

Manual PostGIS 3.3.4dev

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Abstract

PostGIS es una extension del sistema de base de datos relacional **PostgreSQL** que permite almacenar objetos SIG (Sistemas de Información Geografica) en la base de datos. PostGIS incluye soporte de indices de tipos basados en GiST R-Tree, y funciones de análisis y procesado de objetos SIG.



Este es el manual de la version 3.3.4dev



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Chapter 1

Introducción

PostGIS is a spatial extension for the PostgreSQL relational database that was created by Refractions Research Inc, as a spatial database technology research project. Refractions is a GIS and database consulting company in Victoria, British Columbia, Canada, specializing in data integration and custom software development.

PostGIS is now a project of the OSGeo Foundation and is developed and funded by many FOSS4G developers and organizations all over the world that gain great benefit from its functionality and versatility.

The PostGIS project development group plans on supporting and enhancing PostGIS to better support a range of important GIS functionality in the areas of OGC and SQL/MM spatial standards, advanced topological constructs (coverages, surfaces, networks), data source for desktop user interface tools for viewing and editing GIS data, and web-based access tools.

1.1 Comité de Dirección del Proyecto (Project Steering Committee)

El Comité de Dirección del Proyecto PostGIS (PSC por sus siglas en Ingles, Project Steering Committee) coordina la dirección general, ciclos de publicación, documentación, y el alcance de los esfuerzos para el proyecto PostGIS. Además el PSC da soporte general a usuarios, acepta y aprueba los parches de la comunidad general de PostGIS y vota sobre diversos asuntos relacionados con PostGIS como el acceso de nuevos desarrolladores, los nuevos miembros del PSC o cambios importantes en el API.

Raúl Marín Rodríguez MVT support, Bug fixing, Performance and stability improvements, GitHub curation, alignment of PostGIS with PostgreSQL releases

Regina Obe Buildbot Maintenance, Windows production and experimental builds, documentation, alignment of PostGIS with PostgreSQL releases, X3D support, TIGER geocoder support, management functions.

Darafei Praliaskouski Index improvements, bug fixing and geometry/geography function improvements, SFCGAL, raster, GitHub curation, and bot maintenance.

Paul Ramsey (Chair) Co-founder of PostGIS project. General bug fixing, geography support, geography and geometry index support (2D, 3D, nD index and anything spatial index), underlying geometry internal structures, GEOS functionality integration and alignment with GEOS releases, alignment of PostGIS with PostgreSQL releases, loader/dumper, and Shapefile GUI loader.

Sandro Santilli Bug fixes and maintenance, buildbot maintenance, git mirror management, management functions, integration of new GEOS functionality and alignment with GEOS releases, topology support, and raster framework and low level API functions.

1.2 Core Contributors Present

Nicklas Avén Distance function enhancements (including 3D distance and relationship functions) and additions, Tiny WKB (TWKB) output format and general user support

Dan Baston Geometry clustering function additions, other geometry algorithm enhancements, GEOS enhancements and general user support

Martin Davis GEOS enhancements and documentation

Björn Harrtell MapBox Vector Tile and GeoBuf functions. Gogs testing and GitLab experimentation.

Aliaksandr Kalenik Geometry Processing, PostgreSQL gist, general bug fixing

1.3 Core Contributors Past

Bborie Park Prior PSC Member. Raster development, integration with GDAL, raster loader, user support, general bug fixing, testing on various OS (Slackware, Mac, Windows, and more)

Mark Cave-Ayland Prior PSC Member. Coordinated bug fixing and maintenance effort, spatial index selectivity and binding, loader/dumper, and Shapefile GUI Loader, integration of new and new function enhancements.

Jorge Arévalo Desarrollo raster, soporte del driver GDAL, cargador

Olivier Courtin Entrada y salida XML (KML,GML)/Funciones GeoJSON, soporte 3D y corrección de errores.

Chris Hodgson Anterior miembro del PSC. Desarrollo en general, mantenimiento del sitio web y buildbot, gestor de la incubación en el OSGeo

Mateusz Loskot CMake support for PostGIS, built original raster loader in python and low level raster API functions

Kevin Neufeld Prior PSC Member. Documentation and documentation support tools, buildbot maintenance, advanced user support on PostGIS newsgroup, and PostGIS maintenance function enhancements.

Dave Blasby El desarrollado/Cofundador de PostGIS original. Dave escribió el código de los objetos del lado del servidor, enlaces de los índices y muchas otras funciones analíticas del lado del servidor.

Jeff Lounsbury Desarrollo original del cargador/descargador de ficheros Shape. Es el propietario representativo actual del proyecto PostGIS.

Mark Leslie Mantenimiento y desarrollo de funciones básicas. Soporte de la curva de mejora. Cargador de Shapefiles.

Pierre Racine Architect of PostGIS raster implementation. Raster overall architecture, prototyping, programming support

David Zwarg Raster development (mostly map algebra analytic functions)

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Campañas de Crowd Funding Crowd funding campaigns are campaigns we run to get badly wanted features funded that can service a large number of people. Each campaign is specifically focused on a particular feature or set of features. Each sponsor chips in a small fraction of the needed funding and with enough people/organizations contributing, we have the funds to pay for the work that will help many. If you have an idea for a feature you think many others would be willing to co-fund, please post to the [PostGIS newsgroup](#) your thoughts and together we can make it happen.

PostGIS 2.0.0 fue la primer version en la que utilizamos esta estrategia. Utilizamos [PledgeBank](#) y hemos tenido dos campañas con éxito para realizarlas.

[postgistopology](#) - 10 patrocinadores contribuyeron con \$ 250 USD cada uno para construir la función toTopoGeometry y con este apoyo, topología 2.0.0. Sucedió.

[postgistopology](#) - 10 patrocinadores contribuyeron con \$ 250 USD cada uno para construir la función toTopoGeometry y con este apoyo, topología 2.0.0. Sucedió.

Librerías de soporte importantes The [GEOS](#) geometry operations library

The [GDAL](#) Geospatial Data Abstraction Library used to power much of the raster functionality introduced in PostGIS 2. In kind, improvements needed in GDAL to support PostGIS are contributed back to the GDAL project.

The [PROJ](#) cartographic projection library

Por ultimo pero no menos importante, [PostgreSQL DBMS](#), El Gigante sobre el que se apoya PostGIS. Gran parte de la velocidad y la flexibilidad de PostGIS no sería viable sin la extensibilidad, gran planeador de consultas, el índice de GIST, y gran cantidad de funciones SQL que ofrece PostgreSQL.

Chapter 2

Instalación de PostGIS

En este capítulo se detallan los pasos necesarios para instalar PostGIS .

2.1 Versión corta

Para compilar asumiendo que tiene todas las dependencias en su ruta de búsqueda:

```
tar xvfz postgis-3.3.4dev.tar.gz
cd postgis-3.3.4dev
./configure
make
make install
```

Una vez que se instala PostGIS, es necesario habilitarlo en cada base de datos en la que desee utilizarlo.

2.2 Compilación e instalación desde el código fuente

Note

Muchos Sistemas Operativos incluyen ya paquetes precompilados PostgreSQL/PostGIS. En la mayoría de casos no es necesario compilar salvo si quieres las ultimas versiones o haces mantenimiento de paquetes.



Esta sección incluye las instrucciones generales de compilado. Si estas compilando en Windows u otro Sistema Operativo, puedes encontrar información adicional detallada en [PostGIS User contributed compile guides](#) y [PostGIS Dev Wiki](#).

Algunos paquetes precompilados para varios Sistemas Operativos están en [PostGIS Pre-built Packages](#)

Si eres usuario de Windows, puedes obtener versiones estables compiladas via Stackbuilder o el [sitio de descargas de PostGIS para Windows](#) También tenemos [versiones experimentales para Windows](#) que son publicadas normalmente una o dos veces por semana o cuando ocurre algo interesante. Puedes utilizar éstas para experimentar con las versiones de desarrollo de PostGIS

The PostGIS module is an extension to the PostgreSQL backend server. As such, PostGIS 3.3.4dev *requires* full PostgreSQL server headers access in order to compile. It can be built against PostgreSQL versions 11 - 15. Earlier versions of PostgreSQL are *not* supported.

Si todavía no tienes instalado PostgreSQL puedes ir a la guía de instalación en <http://www.postgresql.org> .

Note

Para tener compatibilidad con las funcionalidades GEOS, cuando instales PostgreSQL necesitar hacer un enlace explícito con la librería estándar C++:



```
LDFLAGS=-lstdc++ ./configure [PON TUS OPCIONES AQUÍ]
```

Esta es una solución para falsas excepciones C++ con herramientas de desarrollo antiguas. Prueba este truco si experimentas problemas extraños (backend cerrado inesperadamente o cosas similares). Por supuesto, será necesario volver a compilar PostgreSQL desde cero.

Los siguientes pasos describen la configuración y compilación del código fuente de PostGIS. Están escritas para usuarios Linux y no funcionarán con Windows o Mac.

2.2.1 Obteniendo el código fuente

Retrieve the PostGIS source archive from the downloads website <http://postgis.net/stuff/postgis-3.3.4dev.tar.gz>

```
wget http://postgis.net/stuff/postgis-3.3.4dev.tar.gz
tar -xvzf postgis-3.3.4dev.tar.gz
cd postgis-3.3.4dev
```

Esto creará un directorio llamado `postgis-3.3.4dev` en el directorio de trabajo actual.

De forma alternativa se puede obtener el código fuente del [git](https://git.osgeo.org/gitea/postgis/postgis/) repositorio <https://git.osgeo.org/gitea/postgis/postgis/>.

```
git clone https://git.osgeo.org/gitea/postgis/postgis.git postgis
cd postgis
sh autogen.sh
```

Vaya al nuevo directorio `postgis-3.3.4dev` creado para continuar con la instalación.

```
./configure
```

2.2.2 Install Requirements

PostGIS tiene los siguientes requisitos para compilarlo y usarlo:

Requerido

- PostgreSQL 11 - 15. A complete installation of PostgreSQL (including server headers) is required. PostgreSQL is available from <http://www.postgresql.org>.
- Para conocer las compatibilidades entre versiones de PostgreSQL/PostGIS y PostGIS/GEOS puede ver una matriz de compatibilidades en <http://trac.osgeo.org/postgis/wiki/UsersWikiPostgreSQLPostGIS>
- compilador GNU C (`gcc`). Otros compiladores ANSI C pueden utilizarse para compilar PostGIS, pero encontraremos menos problemas al compilar con `gcc`.
- GNU Make (`gmake` or `make`). Para muchos sistemas, GNU `make` es la versión por defecto de `make`. Para verificar la versión de `make` podemos ejecutar el siguiente comando `make -v`. Otras versiones de `make` pueden no procesar el fichero PostGIS `Makefile` de forma correcta.
- Proj reprojection library. Proj 4.9 or above is required. The Proj library is used to provide coordinate reprojection support within PostGIS. Proj is available for download from <https://proj.org/>.
- GEOS geometry library, version 3.6 or greater, but GEOS 3.11+ is required to take full advantage of all the new functions and features. GEOS is available for download from <https://libgeos.org/>.

- LibXML2, version 2.5.x or higher. LibXML2 is currently used in some imports functions (ST_GeomFromGML and ST_GeomFromKML). LibXML2 is available for download from <https://gitlab.gnome.org/GNOME/libxml2/-/releases>.
- JSON-C, version 0.9 or higher. JSON-C is currently used to import GeoJSON via the function ST_GeomFromGeoJson. JSON-C is available for download from <https://github.com/json-c/json-c/releases/>.
- GDAL, version 2+ is required 3+ is preferred. This is required for raster support. <https://gdal.org/download.html>.
- If compiling with PostgreSQL+JIT, LLVM version >=6 is required <https://trac.osgeo.org/postgis/ticket/4125>.

Opcional

- GDAL (pseudo optional) only if you don't want raster you can leave it out. Also make sure to enable the drivers you want to use as described in Section 3.2.
- GTK (GTK+2.0, 2.8+ requerida) para compilar el cargador de shapefiles shp2pgsql-gui. <http://www.gtk.org/> .
- SFCGAL, version 1.3.1 (or higher), 1.4.1 or higher is recommended. SFCGAL can be used to provide additional 2D and 3D advanced analysis functions to PostGIS cf Section 8.20. And also allow to use SFCGAL rather than GEOS for some 2D functions provided by both backends (like ST_Intersection or ST_Area, for instance). A PostgreSQL configuration variable `postgis.backend` allow end user to control which backend he want to use if SFCGAL is installed (GEOS by default). Nota: SFCGAL 1.2 require at least CGAL 4.3 and Boost 1.54 (cf: <https://oslandia.gitlab.io/SFCGAL/dev.html>) <https://gitlab.com/Oslandia/SFCGAL/>.
- In order to build the Section 14.1 you will also need PCRE <http://www.pcre.org> (which generally is already installed on nix systems). `Regex::Assemble` perl CPAN package is only needed if you want to rebuild the data encoded in `parseaddress-stcity` h. Section 14.1 will automatically be built if it detects a PCRE library, or you pass in a valid `--with-pcre-dir=/path/to/pcre` during configure.
- To enable ST_AsMVT protobuf-c library 1.1.0 or higher (for usage) and the protoc-c compiler (for building) are required. Also, pkg-config is required to verify the correct minimum version of protobuf-c. See [protobuf-c](#). By default, Postgis will use Wagyu to validate MVT polygons faster which requires a c++11 compiler. It will use CXXFLAGS and the same compiler as the PostgreSQL installation. To disable this and use GEOS instead use the `--without-wagyu` during the configure step.
- CUnit (CUnit). Se necesita para hacer test de regresión. <http://cunit.sourceforge.net/>
- DocBook (xsltproc) es necesario para compilar la documentación. Docbook esta disponible en <http://www.docbook.org/> .
- DBLatex (dblatex) necesario para construir la documentación en formato PDF. DBLatex esta disponible en <http://dblatex.sourceforge.net/> .
- ImageMagick (convert) es necesario para generar las imágenes empleadas en la documentación. ImageMagick esta disponible en <http://www.imagemagick.org/> .

2.2.3 Configuración

Como en la gran mayoría de instalaciones Linux, el primer paso es generar el Makefile que se utilizara para compilar el código fuente. Esto se hace ejecutando el script de shell.

`./configure`

Sin parámetros adicionales, este comando intentara localizar los componentes y librerías necesarios para construir el código fuente PostGIS de forma automática en tu sistema. Aunque este es el uso mas común de **`./configure`**, el script acepta varios parámetros para aquellos que han instalado las librerías y programas en lugares no standard.

La siguiente lista muestra los parámetros utilizados mas comunes. Para obtener una lista completa, puedes utilizar los parámetros **`--help`** o **`--help=short`**.

`--with-library-minor-version` Starting with PostGIS 3.0, the library files generated by default will no longer have the minor version as part of the file name. This means all PostGIS 3 libs will end in `postgis-3`. This was done to make `pg_upgrade` easier, with downside that you can only install one version PostGIS 3 series in your server. To get the old behavior of file including the minor version: e.g. `postgis-3.0` add this switch to your configure statement.

--prefix=PREFIX Esta es la localización donde se instalarán las librerías PostGIS y los scripts SQL. Por defecto, esta localización es la misma que la detectada para la instalación PostgreSQL.



Caution

Este parámetro está roto actualmente, ya que el paquete sólo se instalará en el directorio de instalación de PostgreSQL. Para seguir al tanto de este bug visita <http://trac.osgeo.org/postgis/ticket/635>

--with-pgconfig=FILE PostgreSQL tiene una herramienta llamada **pg_config** para activar extensiones como PostGIS o para localizar el directorio de instalación de PostgreSQL. Utiliza este parámetro (**--with-pgconfig=/path/to/pg_config**) para especificar una instalación personalizada de PostgreSQL de forma manual que PostGIS utilizara para compilar.

--with-gdalconfig=FILE GDAL, una biblioteca necesaria, proporciona la funcionalidad necesaria para el soporte de raster **gdal-config** para activar la instalación de software para localizar el directorio de instalación de GDAL. Utilice este parámetro (**- with-gdalconfig = / ruta /a/ gdal config-**) para especificar manualmente una instalación de GDAL personalizada que PostGIS utilizara para compilar.

--with-geosconfig=FILE GEOS, librería de geometrías requerida, tiene una utilidad llamada **geos-config** para activar la localización del directorio de instalación del software GEOS. Utiliza este parámetro (**--with-geosconfig=/path/to/geos-config**) para especificar de forma manual una instalación personalizada de GEOS que PostGIS puede utilizar para compilar.

--with-xml2config=FILE LibXML es una librería necesaria para procesar GeomFromKML/GML. Normalmente encontrará si tienes instalada la librería libxml, pero si no está instalada, o quieres usar una versión específica, necesitarás que PostGIS apunte a un fichero de configuración particular **xml2-config** para localizar un directorio de instalación LibXML para activar la instalación del Software. Utiliza el siguiente parámetro (**>--with-xml2config=/path/to/xml2-config**) para especificar de forma manual una instalación personalizada de LibXML con la que compilar PostGIS.

--with-projdir=DIR Proj4 es una librería de reproyecciones necesaria de PostGIS. Utiliza el siguiente parámetro (**--with-projdir=/path/to/projdir**) para definir manualmente una instalación personalizada de Proj4 para compilar PostGIS.

--with-libiconv=DIR Directorio donde iconv está instalado.

--with-jsondir=DIR **JSON-C** es una librería con licencia MIT-licensed JSON necesaria para dar soporte a PostGIS ST_GeomFromJSON. Utiliza este parámetro (**--with-jsondir=/path/to/jsondir**) para especificar de forma manual el directorio de instalación personalizado de instalación de JSON-C que PostGIS utilizara para compilar.

--with-pcre=DIR **PCRE** is an BSD-licensed Perl Compatible Regular Expression library required by address_standardizer extension. Use this parameter (**--with-pcre=dir/to/pcre**) to manually specify a particular PCRE installation directory that PostGIS will build against.

--with-gui Compilar la GUI de importar datos (necesita GTK+2.0). Esto creará una interfaz gráfica **shp2pgsql-gui** para el comando **shp2pgsql**.

--without-raster Compile without raster support.

--without-topology Disable topology support. There is no corresponding library as all logic needed for topology is in postgis-3.3.4dev library.

--with-gettext=no PostGIS intentará detectar soporte gettext y compilar con él por defecto, de todas formas si existen incompatibilidades que causan errores de carga, se puede desactivar por completo con este comando. Para ver un ejemplo de resolución de problemas configurando en gettext puedes ver el siguiente enlace <http://trac.osgeo.org/postgis/ticket/748>. NOTA: No te pierdes mucho si desactivas esta opción. Se utiliza principalmente para soporte de ayuda/etiquetas internacionales en la GUI de carga, que actualmente no está documentada y sigue siendo experimental.

--with-sfcgal=PATH By default PostGIS will not install with sfcgal support without this switch. PATH is an optional argument that allows to specify an alternate PATH to sfcgal-config.

--without-phony-revision Disable updating postgis_revision.h to match current HEAD of the git repository.

**Note**

If you obtained PostGIS from the [code repository](#), the first step is really to run the script

./autogen.sh

Este Script generara el script **configure** que a su vez se utiliza para personalizar la instalación de PostGIS.

Si, por el contrario, as obtenido PostGIS como tarball, ejecutar **./autogen.sh** no es necesario ya que ya se ha generado **configure**.

2.2.4 Compilando

Una vez generado el Makefile, compilar PostGIS es tan simple como ejecutar

make

La ultima linea de salida del terminal debe ser "PostGIS copilado con éxito. Listo para instalar."

As of PostGIS v1.4.0, all the functions have comments generated from the documentation. If you wish to install these comments into your spatial databases later, run the command which requires docbook. The `postgis_comments.sql` and other package comments files `raster_comments.sql`, `topology_comments.sql` are also packaged in the tar.gz distribution in the doc folder so no need to make comments if installing from the tar ball. Comments are also included as part of the CREATE EXTENSION install.

make comments

Introducido en la version PostGIS 2.0. Esto genera hojas de referencia html para una referencia rápida o para los folletos. Esto requiere xsltproc para compilar y generará 4 ficheros en la carpeta doc `topology_cheatsheet.html`, `tiger_geocoder_cheatsheet.html`, `raster_cheatsheet.html`, `postgis_cheatsheet.html`

Puedes descargar algunos ya compilados en formato html o pdf en [Guías de Estudio PostGIS / PostgreSQL](#)

make cheatsheets

2.2.5 Compilando e Instalando Extensiones de PostGIS

Las extensiones de PosGIS son compiladas e instaladas de forma automatica si estas utilizando la version 9.1+ de PostgreSQL

Si estas compilando desde el repositorio de código fuente, necesitas compilar primero la función descriptions. Si tienes instalado docbook ya esta compilado. También puedes compilarla manualmente con la sentencia:

make comments

Compilar los comentarios no es necesario si estas compilando desde un tar ya que están en el paquete pre-compilados con el tar.

Si estas compilando para PostgreSQL 9.1, la extension debería compilarse de forma automática como parte del proceso del comando `make install`. Si lo necesitas, puedes compilar la extensión desde las carpetas de la extensión o copiar los ficheros en un servidor diferente.

```
cd extensions
cd postgis
make clean
make
export PGUSER=postgres #overwrite psql variables
make check #to test before install
make install
# to test extensions
make check RUNTESTFLAGS=--extension
```

**Note**

`make check` uses psql to run tests and as such can use psql environment variables. Common ones useful to override are PGUSER, PGPORT, and PGHOST. Refer to [psql environment variables](#)

Los ficheros de la extension serán siempre los mismos para la misma versión de PostgreSQL independientemente del Sistema Operativo, así que se pueden copiar los ficheros de la extensión de un Sistema Operativo a otro si ya tienes los binarios de PostGIS ya instalados en tus servidores.

Si quieres instalar la extensión de forma manual en un servidor separado de tu servidor de desarrollo, necesitas copiar los siguientes archivos de la carpeta de la extensión en la carpeta PostgreSQL / share / extension de la instalación de PostgreSQL y los binarios normales para PostGIS si no los tienes instalados en el servidor.

- Estos son los ficheros de control que contienen información como la versión de la extensión a instalar si no lo has especificado. `postgis.control`, `postgis_topology.control`.
- Todos los ficheros en la carpeta `/sql` de la extension. Estos ficheros deben ser copiados en la raíz de PostgreSQL en la carpeta `share/extension extensions/postgis/sql/*.sql, extensions/postgis_topology/sql/*.sql`

Una vez hecho esto deberías ver `postgis`, `postgis_topology` como extensiones disponibles en PgAdmin -> extensiones.

Si estas utilizando `psql`, puedes verificar que las extensiones están instaladas ejecutando la siguiente sentencia:

```
SELECT name, default_version, installed_version
FROM pg_available_extensions WHERE name LIKE 'postgis%' or name LIKE 'address%';
```

name	default_version	installed_version
address_standardizer	3.3.4dev	3.3.4dev
address_standardizer_data_us	3.3.4dev	3.3.4dev
postgis	3.3.4dev	3.3.4dev
postgis_sfcgal	3.3.4dev	
postgis_tiger_geocoder	3.3.4dev	3.3.4dev
postgis_topology	3.3.4dev	

(6 rows)

Si tienes instalada una extension en la base de datos que estas consultando, deberías verla mencionada la columna `installed_version`. Si la consulta no devuelve ningún registro, significa que no tienes la extension PostGIS instalada en el servidor. PgAdmin III 1.14+ muestra esta información en la sección extensiones en el navegador de bases de datos y permite actualizar o instalar haciendo click derecho.

Si la extension esta disponible, puedes instalar la extension `postgis` en la base de datos de tu elección utilizando la interfaz de extensiones de pgAdmin o ejecutando la siguiente sentencia:

```
CREATE EXTENSION postgis;
CREATE EXTENSION postgis_sfcgal;
CREATE EXTENSION fuzzystrmatch; --needed for postgis_tiger_geocoder
--optional used by postgis_tiger_geocoder, or can be used standalone
CREATE EXTENSION address_standardizer;
CREATE EXTENSION address_standardizer_data_us;
CREATE EXTENSION postgis_tiger_geocoder;
CREATE EXTENSION postgis_topology;
```

In `psql` you can use to see what versions you have installed and also what schema they are installed.

```
\connect mygisdb
\x
\dx postgis*
```

```
List of installed extensions
-[ RECORD 1 ]-----
Name          | postgis
Version       | 3.3.4dev
Schema        | public
Description   | PostGIS geometry, geography, and raster spat..
-[ RECORD 2 ]-----
Name          | postgis_raster
```

```

Version      | 3.0.0dev
Schema      | public
Description  | PostGIS raster types and functions
-[ RECORD 3 ]-----
Name        | postgis_tiger_geocoder
Version     | 3.3.4dev
Schema      | tiger
Description  | PostGIS tiger geocoder and reverse geocoder
-[ RECORD 4 ]-----
Name        | postgis_topology
Version     | 3.3.4dev
Schema      | topology
Description  | PostGIS topology spatial types and functions

```

Warning

No se pueden hacer copias de seguridad explícitas de las tablas de las extensiones `spatial_ref_sys`, `layer`, `topology`. Solo se pueden hacer copias de seguridad explícitas cuando se hacen copias de seguridad de sus respectivas extensiones `postgis` or `postgis_topology`, lo que al parecer ocurre cuando haces una copia de seguridad de la base de datos completa. Con PostGIS 2.0.1, solo los `srid` no incluidos en PostGIS son guardados cuando se hace una copia de seguridad de la base de datos, así que no esperes que al cambiar alguno de los `srid` que incluye PostGIS este en tu copia de seguridad. Envía un ticket si encuentras algún problema. La estructura de las tablas de extensiones no se guardan en copias de seguridad si son creadas con `CREATE EXTENSION` y son la misma estructura para una versión dada de una extensión. Estos comportamientos están incorporados en el modelo de extensiones PostgreSQL actual, así que nada podemos hacer al respecto.

If you installed 3.3.4dev, without using our wonderful extension system, you can change it to be extension based by running the below commands to package the functions in their respective extension. Installing using ``unpacked`` was removed in PostgreSQL 13, so you are advised to switch to an extension build before upgrading to PostgreSQL 13.

```

CREATE EXTENSION postgis FROM unpackaged;
CREATE EXTENSION postgis_raster FROM unpackaged;
CREATE EXTENSION postgis_topology FROM unpackaged;
CREATE EXTENSION postgis_tiger_geocoder FROM unpackaged;

```

2.2.6 Tests

Si quieres hacer un test en la compilación de PostGIS, ejecuta

make check

El comando anterior ejecutará varias comprobaciones y tests de regresión utilizando la librería generada para la versión de base de datos PostgreSQL actual.

**Note**

Si has configurado PostGIS con instalaciones de PostgreSQL, GEOS, o Proj4 en directorios personalizados, necesitaras añadir las localizaciones de las librerías personalizadas en la variable de entorno `LD_LIBRARY_PATH`.

**Caution**

Actualmente, el comando **make check** une las variables de entorno `PATH` y `PGPORT` cuando ejecuta las comprobaciones - *no* utiliza la versión de PostgreSQL especificada utilizando el parametro de configuración **--with-pgconfig**. Así que hay que estar seguros de modificar la variable de entorno `PATH` para que apunte a la instalación de PostgreSQL detectada durante la configuración o estar preparado para tener algún que otro dolor de cabeza.

If successful, make check will produce the output of almost 500 tests. The results will look similar to the following (numerous lines omitted below):

```
CUnit - A unit testing framework for C - Version 2.1-3
  http://cunit.sourceforge.net/

  .
  .
  .

Run Summary:   Type  Total    Ran Passed Failed Inactive
               suites    44     44   n/a     0         0
               tests   300    300   300     0         0
               asserts 4215   4215  4215     0        n/a
Elapsed time =    0.229 seconds

  .
  .
  .

Running tests

  .
  .
  .

Run tests: 134
Failed: 0

-- if you build with SFCGAL

  .
  .
  .

Running tests

  .
  .
  .

Run tests: 13
Failed: 0

-- if you built with raster support

  .
  .
  .

Run Summary:   Type  Total    Ran Passed Failed Inactive
               suites    12     12   n/a     0         0
               tests    65     65    65     0         0
               asserts 45896  45896 45896     0        n/a

  .
  .
  .

Running tests
```

```

    .
    .
    .

Run tests: 101
Failed: 0

-- topology regress

.
.
.

Running tests

    .
    .
    .

Run tests: 51
Failed: 0

-- if you built --with-gui, you should see this too

    CUnit - A unit testing framework for C - Version 2.1-2
    http://cunit.sourceforge.net/

    .
    .
    .

Run Summary:
      Type  Total   Ran Passed Failed Inactive
      suites      2     2   n/a     0       0
      tests       4     4     4     0       0
      asserts     4     4     4     0     n/a

```

The `postgis_tiger_geocoder` and `address_standardizer` extensions, currently only support the standard PostgreSQL `installcheck`. To test these use the below. Note: the `make install` is not necessary if you already did `make install` at root of PostGIS code folder.

For `address_standardizer`:

```

cd extensions/address_standardizer
make install
make installcheck

```

Output should look like:

```

===== dropping database "contrib_regression" =====
DROP DATABASE
===== creating database "contrib_regression" =====
CREATE DATABASE
ALTER DATABASE
===== running regression test queries =====
test test-init-extensions      ... ok
test test-parseaddress         ... ok
test test-standardize_address_1 ... ok
test test-standardize_address_2 ... ok

=====
All 4 tests passed.

```

For tiger geocoder, make sure you have postgis and fuzzystrmatch extensions available in your PostgreSQL instance. The address_standardizer tests will also kick in if you built postgis with address_standardizer support:

```
cd extensions/postgis_tiger_geocoder
make install
make installcheck
```

output should look like:

```
===== dropping database "contrib_regression" =====
DROP DATABASE
===== creating database "contrib_regression" =====
CREATE DATABASE
ALTER DATABASE
===== installing fuzzystrmatch =====
CREATE EXTENSION
===== installing postgis =====
CREATE EXTENSION
===== installing postgis_tiger_geocoder =====
CREATE EXTENSION
===== installing address_standardizer =====
CREATE EXTENSION
===== running regression test queries =====
test test-normalize_address ... ok
test test-page_normalize_address ... ok

=====
All 2 tests passed.
=====
```

2.2.7 Instalación

Para instalar PostGIS entre

make install

Esto copiará los ficheros de instalación de PostGIS en el subdirectorio especificado por el parámetro de configuración **--prefix** del comando . En particular:

- Los archivos binarios de carga y dumper estarán instalados en [prefix]/bin.
- Los archivos SQL, tal como postgis.sql, están instalados en [prefix]/share/contrib.
- Las librerías de PostGIS estarán instaladas en [prefix]/lib.

Si has ejecutado el comando **make comments** previamente para generar los ficheros postgis_comments.sql, raster_comments.sql, instala los ficheros sql ejecutando:

make comments-install



Note

postgis_comments.sql, raster_comments.sql, topology_comments.sql han sido separados de la compilación y de la instalación típicos ya que tienen una dependencia extra de la librería **xsltproc**.

2.3 Installing and Using the address standardizer

The `address_standardizer` extension used to be a separate package that required separate download. From PostGIS 2.2 on, it is now bundled in. For more information about the `address_standardize`, what it does, and how to configure it for your needs, refer to Section 14.1.

This standardizer can be used in conjunction with the PostGIS packaged tiger geocoder extension as a replacement for the `Normalize_Address` discussed. To use as replacement refer to Section 2.4.3. You can also use it as a building block for your own geocoder or use it to standardize your addresses for easier compare of addresses.

The address standardizer relies on PCRE which is usually already installed on many Nix systems, but you can download the latest at: <http://www.pcre.org>. If during Section 2.2.3, PCRE is found, then the address standardizer extension will automatically be built. If you have a custom pcre install you want to use instead, pass to configure `--with-pcredir=/path/to/pcre` where `/path/to/pcre` is the root folder for your pcre include and lib directories.

For Windows users, the PostGIS 2.1+ bundle is packaged with the `address_standardizer` already so no need to compile and can move straight to CREATE EXTENSION step.

Once you have installed, you can connect to your database and run the SQL:

```
CREATE EXTENSION address_standardizer;
```

The following test requires no rules, gaz, or lex tables

```
SELECT num, street, city, state, zip
FROM parse_address('1 Devonshire Place PH301, Boston, MA 02109');
```

Output should be

num	street	city	state	zip
1	Devonshire Place PH301	Boston	MA	02109

2.3.1 Installing Regexp::Assemble

Perl Regexp::Assemble is no longer needed for compiling `address_standardizer` extension since the files it generates are part of the source tree. However if you need to edit the `usps-st-city-orig.txt` or `usps-st-city-orig.txt usps-st-city-adc` tx, you need to rebuild `parseaddress-stcities.h` which does require Regexp::Assemble.

```
cpan Regexp::Assemble
```

or if you are on Ubuntu / Debian you might need to do

```
sudo perl -MCPAN -e "install Regexp::Assemble"
```

2.4 Instalar o actualizar el geocodificador Tiger y cargar datos

Extras like Tiger geocoder may not be packaged in your PostGIS distribution. If you are missing the tiger geocoder extension or want a newer version than what your install comes with, then use the `share/extension/postgis_tiger_geocoder.*` files from the packages in [Windows Unreleased Versions](#) section for your version of PostgreSQL. Although these packages are for windows, the `postgis_tiger_geocoder` extension files will work on any OS since the extension is an SQL/plpgsql only extension.

2.4.1 Tiger Geocoder Enabling your PostGIS database: Using Extension

If you are using PostgreSQL 9.1+ and PostGIS 2.1+, you can take advantage of the new extension model for installing tiger geocoder. To do so:

1. First get binaries for PostGIS 2.1+ or compile and install as usual. This should install the necessary extension files as well for tiger geocoder.
2. Connect to your database via psql or pgAdmin or some other tool and run the following SQL commands. Note that if you are installing in a database that already has postgis, you don't need to do the first step. If you have fuzzystmatch extension already installed, you don't need to do the second step either.

```
CREATE EXTENSION postgis;
CREATE EXTENSION fuzzystmatch;
CREATE EXTENSION postgis_tiger_geocoder;
--this one is optional if you want to use the rules based standardizer ( ←
    page_normalize_address)
CREATE EXTENSION address_standardizer;
```

If you already have postgis_tiger_geocoder extension installed, and just want to update to the latest run:

```
ALTER EXTENSION postgis UPDATE;
ALTER EXTENSION postgis_tiger_geocoder UPDATE;
```

If you made custom entries or changes to tiger.loader_platform and tiger.loader_variables you may need to update these.

3. To confirm your install is working correctly, run this sql in your database:

```
SELECT na.address, na.streetname, na.streotypeabbrev, na.zip
      FROM normalize_address('1 Devonshire Place, Boston, MA 02109') AS na;
```

Which should output

address	streetname	streotypeabbrev	zip
1	Devonshire	Pl	02109

4. Create a new record in tiger.loader_platform table with the paths of your executables and server.

So for example to create a profile called debbie that follows sh convention. You would do:

```
INSERT INTO tiger.loader_platform(os, declare_sect, pgbin, wget, unzip_command, psql, ←
    path_sep,
                                loader, environ_set_command, county_process_command)
SELECT 'debbie', declare_sect, pgbin, wget, unzip_command, psql, path_sep,
       loader, environ_set_command, county_process_command
FROM tiger.loader_platform
WHERE os = 'sh';
```

And then edit the paths in the declare_sect column to those that fit Debbie's pg, unzip, shp2pgsql, psql, etc path locations.

If you don't edit this loader_platform table, it will just contain common case locations of items and you'll have to edit the generated script after the script is generated.

5. As of PostGIS 2.4.1 the Zip code-5 digit tabulation area zcta5 load step was revised to load current zcta5 data and is part of the **Loader_Generate_Nation_Script** when enabled. It is turned off by default because it takes quite a bit of time to load (20 to 60 minutes), takes up quite a bit of disk space, and is not used that often.

To enable it, do the following:

```
UPDATE tiger.loader_lookuptables SET load = true WHERE table_name = 'zcta520';
```

If present the **Geocode** function can use it if a boundary filter is added to limit to just zips in that boundary. The **Reverse_Geocode** function uses it if the returned address is missing a zip, which often happens with highway reverse geocoding.

6. Create a folder called `gisdata` on root of server or your local pc if you have a fast network connection to the server. This folder is where the tiger files will be downloaded to and processed. If you are not happy with having the folder on the root of the server, or simply want to change to a different folder for staging, then edit the field `staging_fold` in the `tiger.loader_variables` table.
7. Create a folder called `temp` in the `gisdata` folder or wherever you designated the `staging_fold` to be. This will be the folder where the loader extracts the downloaded tiger data.
8. Then run the **Loader_Generate_Nation_Script** SQL function make sure to use the name of your custom profile and copy the script to a `.sh` or `.bat` file. So for example to build the nation load:

```
psql -c "SELECT Loader_Generate_Nation_Script('debbie')" -d geocoder -tA
> /gisdata/nation_script_load.sh
```

9. Run the generated nation load commandline scripts.

```
cd /gisdata
sh nation_script_load.sh
```

10. After you are done running the nation script, you should have three tables in your `tiger_data` schema and they should be filled with data. Confirm you do by doing the following queries from `psql` or `pgAdmin`

```
SELECT count(*) FROM tiger_data.county_all;
```

```
count
-----
    3233
(1 row)
```

```
SELECT count(*) FROM tiger_data.state_all;
```

```
count
-----
     56
(1 row)
```

11. By default the tables corresponding to `bg`, `tract`, `tabblock` are not loaded. These tables are not used by the geocoder but are used by folks for population statistics. If you wish to load them as part of your state loads, run the following statement to enable them.

```
UPDATE tiger.loader_lookuptables SET load = true WHERE load = false AND lookup_name IN (
    'tract', 'bg', 'tabblock');
```

Alternatively you can load just these tables after loading state data using the **Loader_Generate_Census_Script**

12. For each state you want to load data for, generate a state script **Loader_Generate_Script**.



Warning

DO NOT Generate the state script until you have already loaded the nation data, because the state script utilizes county list loaded by nation script.

13.

```
psql -c "SELECT Loader_Generate_Script(ARRAY['MA'], 'debbie')" -d geocoder -tA
> /gisdata/ma_load.sh
```

14. Run the generated commandline scripts.

```
cd /gisdata
sh ma_load.sh
```

15. After you are done loading all data or at a stopping point, it's a good idea to analyze all the tiger tables to update the stats (include inherited stats)

```
SELECT install_missing_indexes();
vacuum (analyze, verbose) tiger.addr;
vacuum (analyze, verbose) tiger.edges;
vacuum (analyze, verbose) tiger.faces;
vacuum (analyze, verbose) tiger.featnames;
vacuum (analyze, verbose) tiger.place;
vacuum (analyze, verbose) tiger.cousub;
vacuum (analyze, verbose) tiger.county;
vacuum (analyze, verbose) tiger.state;
vacuum (analyze, verbose) tiger.zip_lookup_base;
vacuum (analyze, verbose) tiger.zip_state;
vacuum (analyze, verbose) tiger.zip_state_loc;
```

2.4.1.1 Converting a Tiger Geocoder Regular Install to Extension Model

If you installed the tiger geocoder without using the extension model, you can convert to the extension model as follows:

1. Follow instructions in Section 2.4.5 for the non-extension model upgrade.
2. Connect to your database with psql or pgAdmin and run the following command:

```
CREATE EXTENSION postgis_tiger_geocoder FROM unpackaged;
```

2.4.2 Tiger Geocoder Enabling your PostGIS database: Not Using Extensions

Primero debes instalar PostGIS con las instrucciones anteriores.

If you don't have an extras folder, download <http://postgis.net/stuff/postgis-3.3.4dev.tar.gz>

tar xvfz postgis-3.3.4dev.tar.gz

cd postgis-3.3.4dev/extras/tiger_geocoder

Edit the `tiger_loader_2015.sql` (or latest loader file you find, unless you want to load different year) to the paths of your executables server etc or alternatively you can update the `loader_platform` table once installed. If you don't edit this file or the `loader_platform` table, it will just contain common case locations of items and you'll have to edit the generated script after the fact when you run the **Loader_Generate_Nation_Script** and **Loader_Generate_Script** SQL functions.

If you are installing Tiger geocoder for the first time edit either the `create_geocode.bat` script If you are on windows or the `create_geocode.sh` if you are on Linux/Unix/Mac OSX with your PostgreSQL specific settings and run the corresponding script from the commandline.

Verifica que ahora tienes el esquema `tiger` en tu base de datos y este forma parte de tu variable `search_path` en la base de datos. Si no, añádelo con un comando parecido al siguiente:

```
ALTER DATABASE geocoder SET search_path=public, tiger;
```

La funcionalidad de normalización de direcciones funciona sin datos mas o menos, excepto para direcciones complejas. Ejecuta el siguiente test y verifica si se parece a esto:

```
SELECT pprint_addy(normalize_address('202 East Fremont Street, Las Vegas, Nevada 89101')) ↔
      As pretty_address;
pretty_address
-----
202 E Fremont St, Las Vegas, NV 89101
```

2.4.3 Using Address Standardizer Extension with Tiger geocoder

One of the many complaints of folks is the address normalizer function `Normalize_Address` function that normalizes an address for prepping before geocoding. The normalizer is far from perfect and trying to patch its imperfectness takes a vast amount of resources. As such we have integrated with another project that has a much better address standardizer engine. To use this new `address_standardizer`, you compile the extension as described in Section 2.3 and install as an extension in your database.

Once you install this extension in the same database as you have installed `postgis_tiger_geocoder`, then the `Pagc_Normalize_Address` can be used instead of `Normalize_Address`. This extension is tiger agnostic, so can be used with other data sources such as international addresses. The tiger geocoder extension does come packaged with its own custom versions of `rules table` (`tiger.pagc_rules`), `gaz table` (`tiger.pagc_gaz`), and `lex table` (`tiger.pagc_lex`). These you can add and update to improve your standardizing experience for your own needs.

2.4.4 Cargando datos Tiger

Las instrucciones de carga de datos están disponibles de forma mas detallada en `extras/tiger_geocoder/tiger_2011/README`. Esto solo describe los pasos generales.

El proceso de carga, descarga datos desde el sitio web del censo de las respectivas naciones de los estados pedidos, extrae los ficheros, y carga cada estado en un conjunto separado por estados en su propia tabla. Cada tabla de estado hereda el esquema de tablas definido en `tiger` así que basta con hacer una consulta a estas tablas para acceder a todos los datos de la tabla de estados en cualquier momento utilizando `Drop_State_Tables_Generate_Script` si necesita volver a cargar un estado o si ya no lo necesitas mas.

Para poder cargar los datos necesitarás las siguientes herramientas:

- Una herramienta para descomprimir ficheros zip de la pagina web del censo.
Para sistemas Unix: el ejecutable `unzip` que normalmente esta instalado en la mayoría de sistemas Unix.
Para windows, 7-zip es una herramienta libre de compresión/descompresión que puedes descargar en <http://www.7-zip.org/>
- El comando `shp2pgsql` que se instala por defecto cuando instalas PostGIS.
- `wget` que es una herramienta de captura web, normalmente instalado en los sistemas Unix/Linux.
Si estas en windows, puedes obtener ejecutables precompilados en <http://gnuwin32.sourceforge.net/packages/wget.htm>

If you are upgrading from `tiger_2010`, you'll need to first generate and run `Drop_Nation_Tables_Generate_Script`. Before you load any state data, you need to load the nation wide data which you do with `Loader_Generate_Nation_Script`. Which will generate a loader script for you. `Loader_Generate_Nation_Script` is a one-time step that should be done for upgrading (from 2010) and for new installs.

To load state data refer to `Loader_Generate_Script` to generate a data load script for your platform for the states you desire. Note that you can install these piecemeal. You don't have to load all the states you want all at once. You can load them as you need them.

Una vez que los estados que quieres han sido cargados, asegurare de ejecutar:

```
SELECT install_missing_indexes();
```

como se explica en `Install_Missing_Indexes`.

Para probar que las cosas han funcionado como deberían, intenta ejecutar una geocodificación en una dirección del estado descargado utilizando `Geocode`

2.4.5 Actualizando la instalación del geocodificador Tiger

If you have Tiger Geocoder packaged with 2.0+ already installed, you can upgrade the functions at any time even from an interim tar ball if there are fixes you badly need. This will only work for Tiger geocoder not installed with extensions.

If you don't have an extras folder, download <http://postgis.net/stuff/postgis-3.3.4dev.tar.gz>

```
tar xvfz postgis-3.3.4dev.tar.gz
```

```
cd postgis-3.3.4dev/extras/tiger_geocoder/tiger_2011
```

Locate the `upgrade_geocoder.bat` script If you are on windows or the `upgrade_geocoder.sh` if you are on Linux/Unix/Mac OSX. Edit the file to have your postgis database credentials.

If you are upgrading from 2010 or 2011, make sure to unremark out the loader script line so you get the latest script for loading 2012 data.

Then run th corresponding script from the commandline.

Después, elimina todas las tabals de naciones y carga las nuevas. Genera un script drop con esta sentencia SQL como se detalla en [Drop_Nation_Tables_Generate_Script](#)

```
SELECT drop_nation_tables_generate_script();
```

Ejecuta la sentencia SQL drop

Genera un script de carga de naciones con esta sentencia SELECT como se detalla en [Loader_Generate_Nation_Script](#)

Para windows

```
SELECT loader_generate_nation_script('windows');
```

Para unix/linux

```
SELECT loader_generate_nation_script('sh');
```

Para mas información sobre como ejecutar los scripts generados visita Section [2.4.4](#). Esto solo es necesario hacerlo una vez.



Note

Puedes tener una mezcla de tablas de estados de 2010/2011 y puedes actualizar cada estado por separado. Antes de actualizar un estado a la versión de 2011 debes suprimir las tablas de este estado para 2010 utilizando [Drop_State_Tables_Generate_Script](#).

2.5 Common Problems during installation

Hay varias cosas a comprobar cuando la instalación o actualización no han fusionado como se esperaba.

1. Comprueba que tienes instalado PostgreSQL 11 o posterior, y que estas compilando para esta version de PostgreSQL que estas utilizando. Se pueden producir confusiones cuando tu distribución (Linux)ya tiene instalada PostgreSQL, o has instalado antes PostgreSQL y lo has olvidado. PostGIS solo funcionará con PostgreSQL 11 o superior, y errores inesperados o extraños pueden ocurrir si utilizas una version mas antigua. Para comprobar la version de PostgreSQL que esta instalada y ejecutándose, conectare a la base de datos utilizando psql y ejecuta la siguiente consulta:

```
SELECT version();
```

Si estas ejecutando una version basada en una distribución RPM, puedes comprobar si existen paquetes pre-instalados utilizando el comando **rpm** como sigue: **rpm -qa | grep postgresql**

2. Si tienes errores en la actualización, asegúrate de que estas restaurando tu base de datos en una que tenga instalada PostGIS.

```
SELECT postgis_full_version();
```

Comprueba que tu configuración detecta la ubicación y la version correctas de PostgreSQL, la librería Proj4 y la librería GEOS.

1. La salida de configure se utiliza para generar el fichero `postgis_config.h`. Comprueba que la variables `POSTGIS_PGSQL_V`, `POSTGIS_PROJ_VERSION` y `POSTGIS_GEOS_VERSION`, han sido bien configuradas.

Chapter 3

Administración de PostGIS

3.1 Performance Tuning

Tuning for PostGIS performance is much like tuning for any PostgreSQL workload. The only additional consideration is that geometries and rasters are usually large, so memory-related optimizations generally have more of an impact on PostGIS than other types of PostgreSQL queries.

For general details about optimizing PostgreSQL, refer to [Tuning your PostgreSQL Server](#).

For PostgreSQL 9.4+ configuration can be set at the server level without touching `postgresql.conf` or `postgresql.auto.conf` by using the `ALTER SYSTEM` command.

```
ALTER SYSTEM SET work_mem = '256MB';
-- this forces non-startup configs to take effect for new connections
SELECT pg_reload_conf();
-- show current setting value
-- use SHOW ALL to see all settings
SHOW work_mem;
```

In addition to the Postgres settings, PostGIS has some custom settings which are listed in [Section 8.23](#).

3.1.1 Startup

These settings are configured in `postgresql.conf`:

`constraint_exclusion`

- Default: partition
- This is generally used for table partitioning. The default for this is set to "partition" which is ideal for PostgreSQL 8.4 and above since it will force the planner to only analyze tables for constraint consideration if they are in an inherited hierarchy and not pay the planner penalty otherwise.

`shared_buffers`

- Default: ~128MB in PostgreSQL 9.6
- Set to about 25% to 40% of available RAM. On windows you may not be able to set as high.

`max_worker_processes` This setting is only available for PostgreSQL 9.4+. For PostgreSQL 9.6+ this setting has additional importance in that it controls the max number of processes you can have for parallel queries.

- Default: 8
 - Sets the maximum number of background processes that the system can support. This parameter can only be set at server start.
-

3.1.2 Runtime

work_mem - sets the size of memory used for sort operations and complex queries

- Default: 1-4MB
- Adjust up for large dbs, complex queries, lots of RAM
- Adjust down for many concurrent users or low RAM.
- If you have lots of RAM and few developers:

```
SET work_mem TO '256MB';
```

maintenance_work_mem - the memory size used for VACUUM, CREATE INDEX, etc.

- Default: 16-64MB
- Generally too low - ties up I/O, locks objects while swapping memory
- Recommend 32MB to 1GB on production servers w/lots of RAM, but depends on the # of concurrent users. If you have lots of RAM and few developers:

```
SET maintenance_work_mem TO '1GB';
```

max_parallel_workers_per_gather

This setting is only available for PostgreSQL 9.6+ and will only affect PostGIS 2.3+, since only PostGIS 2.3+ supports parallel queries. If set to higher than 0, then some queries such as those involving relation functions like `ST_Intersects` can use multiple processes and can run more than twice as fast when doing so. If you have a lot of processors to spare, you should change the value of this to as many processors as you have. Also make sure to bump up `max_worker_processes` to at least as high as this number.

- Default: 0
- Sets the maximum number of workers that can be started by a single `Gather` node. Parallel workers are taken from the pool of processes established by `max_worker_processes`. Note that the requested number of workers may not actually be available at run time. If this occurs, the plan will run with fewer workers than expected, which may be inefficient. Setting this value to 0, which is the default, disables parallel query execution.

3.2 Configuring raster support

If you enabled raster support you may want to read below how to properly configure it.

As of PostGIS 2.1.3, out-of-db rasters and all raster drivers are disabled by default. In order to re-enable these, you need to set the following environment variables `POSTGIS_GDAL_ENABLED_DRIVERS` and `POSTGIS_ENABLE_OUTDB_RASTERS` in the server environment. For PostGIS 2.2, you can use the more cross-platform approach of setting the corresponding Section 8.23.

If you want to enable offline raster:

```
POSTGIS_ENABLE_OUTDB_RASTERS=1
```

Any other setting or no setting at all will disable out of db rasters.

In order to enable all GDAL drivers available in your GDAL install, set this environment variable as follows

```
POSTGIS_GDAL_ENABLED_DRIVERS=ENABLE_ALL
```

If you want to only enable specific drivers, set your environment variable as follows:

```
POSTGIS_GDAL_ENABLED_DRIVERS="GTiff PNG JPEG GIF XYZ"
```

**Note**

If you are on windows, do not quote the driver list

Setting environment variables varies depending on OS. For PostgreSQL installed on Ubuntu or Debian via apt-postgresql, the preferred way is to edit `/etc/postgresql/10/main/environment` where 10 refers to version of PostgreSQL and main refers to the cluster.

On windows, if you are running as a service, you can set via System variables which for Windows 7 you can get to by right-clicking on Computer->Properties Advanced System Settings or in explorer navigating to Control Panel\All Control Panel Items\System. Then clicking *Advanced System Settings ->Advanced->Environment Variables* and adding new system variables.

After you set the environment variables, you'll need to restart your PostgreSQL service for the changes to take effect.

3.3 Creating spatial databases

3.3.1 Spatially enable database using EXTENSION

If you are using PostgreSQL 9.1+ and have compiled and installed the extensions/postgis modules, you can turn a database into a spatial one using the EXTENSION mechanism.

Core postgis extension includes geometry, geography, spatial_ref_sys and all the functions and comments. Raster and topology are packaged as a separate extension.

Run the following SQL snippet in the database you want to enable spatially:

```
CREATE EXTENSION IF NOT EXISTS plpgsql;
CREATE EXTENSION postgis;
CREATE EXTENSION postgis_raster; -- OPTIONAL
CREATE EXTENSION postgis_topology; -- OPTIONAL
```

3.3.2 Spatially enable database without using EXTENSION (discouraged)

**Note**

This is generally only needed if you cannot or don't want to get PostGIS installed in the PostgreSQL extension directory (for example during testing, development or in a restricted environment).

Adding PostGIS objects and function definitions into your database is done by loading the various sql files located in `[prefix]/share/contrib` as specified during the build phase.

The core PostGIS objects (geometry and geography types, and their support functions) are in the `postgis.sql` script. Raster objects are in the `rtpostgis.sql` script. Topology objects are in the `topology.sql` script.

For a complete set of EPSG coordinate system definition identifiers, you can also load the `spatial_ref_sys.sql` definitions file and populate the `spatial_ref_sys` table. This will permit you to perform `ST_Transform()` operations on geometries.

If you wish to add comments to the PostGIS functions, you can find them in the `postgis_comments.sql` script. Comments can be viewed by simply typing `\dd [function_name]` from a **psql** terminal window.

Run the following Shell commands in your terminal:


```
DB=[yourdatabase]
SCRIPTSDIR=`pg_config --sharedir`/contrib/postgis-3.2/

# Core objects
psql -d ${DB} -f ${SCRIPTSDIR}/postgis.sql
psql -d ${DB} -f ${SCRIPTSDIR}/spatial_ref_sys.sql
psql -d ${DB} -f ${SCRIPTSDIR}/postgis_comments.sql # OPTIONAL

# Raster support (OPTIONAL)
psql -d ${DB} -f ${SCRIPTSDIR}/rtpostgis.sql
psql -d ${DB} -f ${SCRIPTSDIR}/raster_comments.sql # OPTIONAL

# Topology support (OPTIONAL)
psql -d ${DB} -f ${SCRIPTSDIR}/topology.sql
psql -d ${DB} -f ${SCRIPTSDIR}/topology_comments.sql # OPTIONAL
```

3.3.3 Create a spatially-enabled database from a template

Some packaged distributions of PostGIS (in particular the Win32 installers for PostGIS >= 1.1.5) load the PostGIS functions into a template database called `template_postgis`. If the `template_postgis` database exists in your PostgreSQL installation then it is possible for users and/or applications to create spatially-enabled databases using a single command. Note that in both cases, the database user must have been granted the privilege to create new databases.

From the shell:

```
# createdb -T template_postgis my_spatial_db
```

From SQL:

```
postgres=# CREATE DATABASE my_spatial_db TEMPLATE=template_postgis
```

3.4 Upgrading spatial databases

Upgrading existing spatial databases can be tricky as it requires replacement or introduction of new PostGIS object definitions. Unfortunately not all definitions can be easily replaced in a live database, so sometimes your best bet is a dump/reload process. PostGIS provides a **SOFT UPGRADE** procedure for minor or bugfix releases, and a **HARD UPGRADE** procedure for major releases.

Before attempting to upgrade PostGIS, it is always worth to backup your data. If you use the `-Fc` flag to `pg_dump` you will always be able to restore the dump with a **HARD UPGRADE**.

3.4.1 Soft upgrade

If you installed your database using extensions, you'll need to upgrade using the extension model as well. If you installed using the old sql script way, you are advised to switch your install to extensions because the script way is no longer supported.

3.4.1.1 Soft Upgrade 9.1+ using extensions

If you originally installed PostGIS with extensions, then you need to upgrade using extensions as well. Doing a minor upgrade with extensions, is fairly painless.

If you are running PostGIS 3 or above, then you should use the [PostGIS_Extensions_Upgrade](#) function to upgrade to the latest version you have installed.

```
SELECT postgis_extensions_upgrade();
```

If you are running PostGIS 2.5 or lower, then do the following:

```
ALTER EXTENSION postgis UPDATE;
SELECT postgis_extensions_upgrade();
-- This second call is needed to rebundle postgis_raster extension
SELECT postgis_extensions_upgrade();
```

If you have multiple versions of PostGIS installed, and you don't want to upgrade to the latest, you can explicitly specify the version as follows:

```
ALTER EXTENSION postgis UPDATE TO "3.3.4dev";
ALTER EXTENSION postgis_topology UPDATE TO "3.3.4dev";
```

If you get an error notice something like:

```
No migration path defined for ... to 3.3.4dev
```

Then you'll need to backup your database, create a fresh one as described in Section 3.3.1 and then restore your backup on top of this new database.

If you get a notice message like:

```
Version "3.3.4dev" of extension "postgis" is already installed
```

Then everything is already up to date and you can safely ignore it. **UNLESS** you're attempting to upgrade from an development version to the next (which doesn't get a new version number); in that case you can append "next" to the version string, and next time you'll need to drop the "next" suffix again:

```
ALTER EXTENSION postgis UPDATE TO "3.3.4devnext";
ALTER EXTENSION postgis_topology UPDATE TO "3.3.4devnext";
```



Note

If you installed PostGIS originally without a version specified, you can often skip the reinstallation of postgis extension before restoring since the backup just has `CREATE EXTENSION postgis` and thus picks up the newest latest version during restore.



Note

If you are upgrading PostGIS extension from a version prior to 3.0.0, you will have a new extension *postgis_raster* which you can safely drop, if you don't need raster support. You can drop as follows:

```
DROP EXTENSION postgis_raster;
```

3.4.1.2 Soft Upgrade Pre 9.1+ or without extensions

This section applies only to those who installed PostGIS not using extensions. If you have extensions and try to upgrade with this approach you'll get messages like:

```
can't drop ... because postgis extension depends on it
```

NOTE: if you are moving from PostGIS 1.* to PostGIS 2.* or from PostGIS 2.* prior to r7409, you cannot use this procedure but would rather need to do a **HARD UPGRADE**.

After compiling and installing (make install) you should find a set of `*_upgrade.sql` files in the installation folders. You can list them all with:

```
ls `pg_config --sharedir`/contrib/postgis-3.3.4dev/*_upgrade.sql
```

Load them all in turn, starting from `postgis_upgrade.sql`.

```
psql -f postgis_upgrade.sql -d your_spatial_database
```

The same procedure applies to raster, topology and sfcgal extensions, with upgrade files named `rtpostgis_upgrade.sql`, `topology_upgrade.sql` and `sfcgal_upgrade.sql` respectively. If you need them:

```
psql -f rtpostgis_upgrade.sql -d your_spatial_database
```

```
psql -f topology_upgrade.sql -d your_spatial_database
```

```
psql -f sfcgal_upgrade.sql -d your_spatial_database
```

You are advised to switch to an extension based install by running

```
psql -c "SELECT postgis_extensions_upgrade();" "
```



Note

If you can't find the `postgis_upgrade.sql` specific for upgrading your version you are using a version too early for a soft upgrade and need to do a **HARD UPGRADE**.

The `PostGIS_Full_Version` function should inform you about the need to run this kind of upgrade using a "procs need upgrade" message.

3.4.2 Hard upgrade

By HARD UPGRADE we mean full dump/reload of postgis-enabled databases. You need a HARD UPGRADE when PostGIS objects' internal storage changes or when SOFT UPGRADE is not possible. The [Release Notes](#) appendix reports for each version whether you need a dump/reload (HARD UPGRADE) to upgrade.

The dump/reload process is assisted by the `postgis_restore.pl` script which takes care of skipping from the dump all definitions which belong to PostGIS (including old ones), allowing you to restore your schemas and data into a database with PostGIS installed without getting duplicate symbol errors or bringing forward deprecated objects.

Supplementary instructions for windows users are available at [Windows Hard upgrade](#).

The Procedure is as follows:

1. Create a "custom-format" dump of the database you want to upgrade (let's call it `olddb`) include binary blobs (-b) and verbose (-v) output. The user can be the owner of the db, need not be postgres super account.

```
pg_dump -h localhost -p 5432 -U postgres -Fc -b -v -f "/somepath/olddb.backup" olddb
```

2. Do a fresh install of PostGIS in a new database -- we'll refer to this database as `newdb`. Please refer to [Section 3.3.2](#) and [Section 3.3.1](#) for instructions on how to do this.

The `spatial_ref_sys` entries found in your dump will be restored, but they will not override existing ones in `spatial_ref_sys`. This is to ensure that fixes in the official set will be properly propagated to restored databases. If for any reason you really want your own overrides of standard entries just don't load the `spatial_ref_sys.sql` file when creating the new db.

If your database is really old or you know you've been using long deprecated functions in your views and functions, you might need to load `legacy.sql` for all your functions and views etc. to properly come back. Only do this if `_really_` needed. Consider upgrading your views and functions before dumping instead, if possible. The deprecated functions can be later removed by loading `uninstall_legacy.sql`.

3. Restore your backup into your fresh newdb database using `postgis_restore.pl`. Unexpected errors, if any, will be printed to the standard error stream by `psql`. Keep a log of those.

```
perl utils/postgis_restore.pl "/somepath/olddb.backup" | psql -h localhost -p 5432 -U postgres newdb 2> errors.txt
```

Errors may arise in the following cases:

1. Some of your views or functions make use of deprecated PostGIS objects. In order to fix this you may try loading `legacy.sql` script prior to restore or you'll have to restore to a version of PostGIS which still contains those objects and try a migration again after porting your code. If the `legacy.sql` way works for you, don't forget to fix your code to stop using deprecated functions and drop them loading `uninstall_legacy.sql`.
2. Some custom records of `spatial_ref_sys` in dump file have an invalid SRID value. Valid SRID values are bigger than 0 and smaller than 999000. Values in the 999000.999999 range are reserved for internal use while values > 999999 can't be used at all. All your custom records with invalid SRIDs will be retained, with those > 999999 moved into the reserved range, but the `spatial_ref_sys` table would lose a check constraint guarding for that invariant to hold and possibly also its primary key (when multiple invalid SRIDS get converted to the same reserved SRID value).

In order to fix this you should copy your custom SRS to a SRID with a valid value (maybe in the 910000..910999 range), convert all your tables to the new srid (see [UpdateGeometrySRID](#)), delete the invalid entry from `spatial_ref_sys` and re-construct the check(s) with:

```
ALTER TABLE spatial_ref_sys ADD CONSTRAINT spatial_ref_sys_srid_check check (srid > 0 AND srid < 999000 );
```

```
ALTER TABLE spatial_ref_sys ADD PRIMARY KEY(srid);
```

If you are upgrading an old database containing french **IGN** cartography, you will have probably SRIDs out of range and you will see, when importing your database, issues like this :

```
WARNING: SRID 310642222 converted to 999175 (in reserved zone)
```

In this case, you can try following steps : first throw out completely the IGN from the sql which is resulting from `postgis_restore.pl`. So, after having run :

```
perl utils/postgis_restore.pl "/somepath/olddb.backup" > olddb.sql
```

run this command :

```
grep -v IGNF olddb.sql > olddb-without-IGN.sql
```

Create then your newdb, activate the required Postgis extensions, and insert properly the french system IGN with : [this script](#) After these operations, import your data :

```
psql -h localhost -p 5432 -U postgres -d newdb -f olddb-without-IGN.sql 2> errors.txt
```

Chapter 4

Data Management

4.1 Spatial Data Model

4.1.1 OGC Geometry

The Open Geospatial Consortium (OGC) developed the *Simple Features Access* standard (SFA) to provide a model for geospatial data. It defines the fundamental spatial type of **Geometry**, along with operations which manipulate and transform geometry values to perform spatial analysis tasks. PostGIS implements the OGC Geometry model as the PostgreSQL data types **geometry** and **geography**.

Geometry is an *abstract* type. Geometry values belong to one of its *concrete* subtypes which represent various kinds and dimensions of geometric shapes. These include the **atomic** types **Point**, **LineString**, **LinearRing** and **Polygon**, and the **collection** types **MultiPoint**, **MultiLineString**, **MultiPolygon** and **GeometryCollection**. The *Simple Features Access - Part 1: Common architecture v1.2.1* adds subtypes for the structures **PolyhedralSurface**, **Triangle** and **TIN**.

Geometry models shapes in the 2-dimensional Cartesian plane. The **PolyhedralSurface**, **Triangle**, and **TIN** types can also represent shapes in 3-dimensional space. The size and location of shapes are specified by their **coordinates**. Each coordinate has a X and Y **ordinate** value determining its location in the plane. Shapes are constructed from points or line segments, with points specified by a single coordinate, and line segments by two coordinates.

Coordinates may contain optional Z and M ordinate values. The Z ordinate is often used to represent elevation. The M ordinate contains a measure value, which may represent time or distance. If Z or M values are present in a geometry value, they must be defined for each point in the geometry. If a geometry has Z or M ordinates the **coordinate dimension** is 3D; if it has both Z and M the coordinate dimension is 4D.

Geometry values are associated with a **spatial reference system** indicating the coordinate system in which it is embedded. The spatial reference system is identified by the geometry SRID number. The units of the X and Y axes are determined by the spatial reference system. In **planar** reference systems the X and Y coordinates typically represent easting and northing, while in **geodetic** systems they represent longitude and latitude. SRID 0 represents an infinite Cartesian plane with no units assigned to its axes. See Section 4.5.

The geometry **dimension** is a property of geometry types. Point types have dimension 0, linear types have dimension 1, and polygonal types have dimension 2. Collections have the dimension of the maximum element dimension.

A geometry value may be **empty**. Empty values contain no vertices (for atomic geometry types) or no elements (for collections).

An important property of geometry values is their spatial **extent** or **bounding box**, which the OGC model calls **envelope**. This is the 2 or 3-dimensional box which encloses the coordinates of a geometry. It is an efficient way to represent a geometry's extent in coordinate space and to check whether two geometries interact.

The geometry model allows evaluating topological spatial relationships as described in Section 5.1.1. To support this the concepts of **interior**, **boundary** and **exterior** are defined for each geometry type. Geometries are topologically closed, so they always contain their boundary. The boundary is a geometry of dimension one less than that of the geometry itself.

The OGC geometry model defines validity rules for each geometry type. These rules ensure that geometry values represents realistic situations (e.g. it is possible to specify a polygon with a hole lying outside the shell, but this makes no sense geometrically and is thus invalid). PostGIS also allows storing and manipulating invalid geometry values. This allows detecting and fixing them if needed. See [Section 4.4](#)

4.1.1.1 Point

A Point is a 0-dimensional geometry that represents a single location in coordinate space.

```
POINT (1 2)
POINT Z (1 2 3)
POINT ZM (1 2 3 4)
```

4.1.1.2 LineString

A LineString is a 1-dimensional line formed by a contiguous sequence of line segments. Each line segment is defined by two points, with the end point of one segment forming the start point of the next segment. An OGC-valid LineString has either zero or two or more points, but PostGIS also allows single-point LineStrings. LineStrings may cross themselves (self-intersect). A LineString is **closed** if the start and end points are the same. A LineString is **simple** if it does not self-intersect.

```
LINESTRING (1 2, 3 4, 5 6)
```

4.1.1.3 LinearRing

A LinearRing is a LineString which is both closed and simple. The first and last points must be equal, and the line must not self-intersect.

```
LINEARRING (0 0 0, 4 0 0, 4 4 0, 0 4 0, 0 0 0)
```

4.1.1.4 Polygon

A Polygon is a 2-dimensional planar region, delimited by an exterior boundary (the shell) and zero or more interior boundaries (holes). Each boundary is a [LinearRing](#).

```
POLYGON ((0 0 0, 4 0 0, 4 4 0, 0 4 0, 0 0 0), (1 1 0, 2 1 0, 2 2 0, 1 2 0, 1 1 0))
```

4.1.1.5 MultiPoint

A MultiPoint is a collection of Points.

```
MULTIPOINT ((0 0), (1 2))
```

4.1.1.6 MultiLineString

A MultiLineString is a collection of LineStrings. A MultiLineString is closed if each of its elements is closed.

```
MULTILINESTRING ((0 0, 1 1, 1 2), (2 3, 3 2, 5 4))
```

4.1.1.7 MultiPolygon

A MultiPolygon is a collection of non-overlapping, non-adjacent Polygons. Polygons in the collection may touch only at a finite number of points.

```
MULTIPOLYGON (((1 5, 5 5, 5 1, 1 1, 1 5)), ((6 5, 9 1, 6 1, 6 5)))
```

4.1.1.8 GeometryCollection

A GeometryCollection is a heterogeneous (mixed) collection of geometries.

```
GEOMETRYCOLLECTION ( POINT(2 3), LINESTRING(2 3, 3 4))
```

4.1.1.9 PolyhedralSurface

A PolyhedralSurface is a contiguous collection of patches or facets which share some edges. Each patch is a planar Polygon. If the Polygon coordinates have Z ordinates then the surface is 3-dimensional.

```
POLYHEDRALSURFACE Z (
  ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
  ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)),
  ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
  ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
  ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)),
  ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )
```

4.1.1.10 Triangle

A Triangle is a polygon defined by three distinct non-collinear vertices. Because a Triangle is a polygon it is specified by four coordinates, with the first and fourth being equal.

```
TRIANGLE ((0 0, 0 9, 9 0, 0 0))
```

4.1.1.11 TIN

A TIN is a collection of non-overlapping **Triangles** representing a **Triangulated Irregular Network**.

```
TIN Z ( ((0 0 0, 0 0 1, 0 1 0, 0 0 0)), ((0 0 0, 0 1 0, 1 1 0, 0 0 0)) )
```

4.1.2 SQL/MM Part 3 - Curves

The *ISO/IEC 13249-3 SQL Multimedia - Spatial* standard (SQL/MM) extends the OGC SFA to define Geometry subtypes containing curves with circular arcs. The SQL/MM types support 3DM, 3DZ and 4D coordinates.



Note

Todas las comparaciones de coma flotante en la implementación SQL-MM se desarrollan para una tolerancia específica, normalmente 1E-8.

4.1.2.1 CircularString

CircularString is the basic curve type, similar to a LineString in the linear world. A single arc segment is specified by three points: the start and end points (first and third) and some other point on the arc. To specify a closed circle the start and end points are the same and the middle point is the opposite point on the circle diameter (which is the center of the arc). In a sequence of arcs the end point of the previous arc is the start point of the next arc, just like the segments of a LineString. This means that a CircularString must have an odd number of points greater than 1.

```
CIRCULARSTRING(0 0, 1 1, 1 0)
CIRCULARSTRING(0 0, 4 0, 4 4, 0 4, 0 0)
```

4.1.2.2 CompoundCurve

A CompoundCurve is a single continuous curve that may contain both circular arc segments and linear segments. That means that in addition to having well-formed components, the end point of every component (except the last) must be coincident with the start point of the following component.

```
COMPOUNDCURVE( CIRCULARSTRING(0 0, 1 1, 1 0), (1 0, 0 1))
```

4.1.2.3 CurvePolygon

A CurvePolygon is like a polygon, with an outer ring and zero or more inner rings. The difference is that a ring can be a CircularString or CompoundCurve as well as a LineString.

A partir de PostGIS 1.4, PostGIS soporta curvas compuestas en un polígono curvo.

```
CURVEPOLYGON(
  CIRCULARSTRING(0 0, 4 0, 4 4, 0 4, 0 0),
  (1 1, 3 3, 3 1, 1 1) )
```

Example: A CurvePolygon with the shell defined by a CompoundCurve containing a CircularString and a LineString, and a hole defined by a CircularString

```
CURVEPOLYGON(
  COMPOUNDCURVE( CIRCULARSTRING(0 0, 2 0, 2 1, 2 3, 4 3),
                  (4 3, 4 5, 1 4, 0 0)),
  CIRCULARSTRING(1.7 1, 1.4 0.4, 1.6 0.4, 1.6 0.5, 1.7 1) )
```

4.1.2.4 MultiCurve

A MultiCurve is a collection of curves which can include LineStrings, CircularStrings or CompoundCurves.

```
MULTICURVE( (0 0, 5 5), CIRCULARSTRING(4 0, 4 4, 8 4))
```

4.1.2.5 MultiSurface

A MultiSurface is a collection of surfaces, which can be (linear) Polygons or CurvePolygons.

```
MULTISURFACE(
  CURVEPOLYGON(
    CIRCULARSTRING( 0 0, 4 0, 4 4, 0 4, 0 0),
    (1 1, 3 3, 3 1, 1 1)),
  ((10 10, 14 12, 11 10, 10 10), (11 11, 11.5 11, 11 11.5, 11 11)))
```


4.1.3 WKT and WKB

The OGC SFA specification defines two formats for representing geometry values for external use: Well-Known Text (WKT) and Well-Known Binary (WKB). Both WKT and WKB include information about the type of the object and the coordinates which define it.

Well-Known Text (WKT) provides a standard textual representation of spatial data. Examples of WKT representations of spatial objects are:

- POINT(0 0)
- POINT Z (0 0 0)
- POINT ZM (0 0 0 0)
- POINT EMPTY
- LINESTRING(0 0,1 1,1 2)
- LINESTRING EMPTY
- POLYGON(((0 0,4 0,4 0,4 0,0 0),(1 1, 2 1, 2 2, 1 2,1 1)))
- MULTIPOINT(((0 0),(1 2)))
- MULTIPOINT Z ((0 0 0),(1 2 3))
- MULTIPOINT EMPTY
- MULTILINESTRING(((0 0,1 1,1 2),(2 3,3 2,5 4)))
- MULTIPOLYGON((((0 0,4 0,4 0,4 0,0 0),(1 1,2 1,2 2,1 2,1 1)), ((-1 -1,-1 -2,-2 -2,-2 -1,-1 -1)))
- GEOMETRYCOLLECTION(POINT(2 3),LINESTRING(2 3,3 4))
- GEOMETRYCOLLECTION EMPTY

Input and output of WKT is provided by the functions **ST_AsText** and **ST_GeomFromText**:

```
text WKT = ST_AsText(geometry);
geometry = ST_GeomFromText(text WKT, SRID);
```

For example, a statement to create and insert a spatial object from WKT and a SRID is:

```
INSERT INTO geotable ( geom, name )
VALUES ( ST_GeomFromText('POINT(-126.4 45.32)', 312), 'A Place');
```

Well-Known Binary (WKB) provides a portable, full-precision representation of spatial data as binary data (arrays of bytes). Examples of the WKB representations of spatial objects are:

- WKT: POINT(1 1)
WKB: 010100000000000000000000F03F000000000000F03
- WKT: LINESTRING (2 2, 9 9)
WKB: 010200000002000000000000000000004000000000000000400000000000022400000000000002240

Input and output of WKB is provided by the functions **ST_AsBinary** and **ST_GeomFromWKB**:

```
bytea WKB = ST_AsBinary(geometry);
geometry = ST_GeomFromWKB(bytea WKB, SRID);
```

For example, a statement to create and insert a spatial object from WKB is:

```
INSERT INTO geotable ( geom, name )
VALUES ( ST_GeomFromWKB('\x010100000000000000000000f03f000000000000f03f', 312), 'A Place');
```

4.2 Geometry Data Type

PostGIS implements the OGC Simple Features model by defining a PostgreSQL data type called `geometry`. It represents all of the geometry subtypes by using an internal type code (see [GeometryType](#) and [ST_GeometryType](#)). This allows modelling spatial features as rows of tables defined with a column of type `geometry`.

The `geometry` data type is *opaque*, which means that all access is done via invoking functions on geometry values. Functions allow creating geometry objects, accessing or updating all internal fields, and compute new geometry values. PostGIS supports all the functions specified in the OGC *Simple feature access - Part 2: SQL option* (SFS) specification, as well many others. See [Chapter 8](#) for the full list of functions.



Note

PostGIS follows the SFA standard by prefixing spatial functions with "ST_". This was intended to stand for "Spatial and Temporal", but the temporal part of the standard was never developed. Instead it can be interpreted as "Spatial Type".

The SFA standard specifies that spatial objects include a Spatial Reference System identifier (SRID). The SRID is required when creating spatial objects for insertion into the database (it may be defaulted to 0). See [ST_SRID](#) and [Section 4.5](#)

To make querying geometry efficient PostGIS defines various kinds of spatial indexes, and spatial operators to use them. See [Section 4.9](#) and [Section 5.2](#) for details.

4.2.1 PostGIS EWKB and EWKT

OGC SFA specifications initially supported only 2D geometries, and the geometry SRID is not included in the input/output representations. The OGC SFA specification 1.2.1 (which aligns with the ISO 19125 standard) adds support for 3D (ZYZ) and measured (XYM and XYZM) coordinates, but still does not include the SRID value.

Because of these limitations PostGIS defined extended EWKB and EWKT formats. They provide 3D (XYZ and XYM) and 4D (XYZM) coordinate support and include SRID information. Including all geometry information allows PostGIS to use EWKB as the format of record (e.g. in DUMP files).

EWKB and EWKT are used for the "canonical forms" of PostGIS data objects. For input, the canonical form for binary data is EWKB, and for text data either EWKB or EWKT is accepted. This allows geometry values to be created by casting a text value in either HEXEWKB or EWKT to a geometry value using `::geometry`. For output, the canonical form for binary is EWKB, and for text it is HEXEWKB (hex-encoded EWKB).

For example this statement creates a geometry by casting from an EWKT text value, and outputs it using the canonical form of HEXEWKB:

```
SELECT 'SRID=4;POINT(0 0) '::geometry;
 geometry
-----
0101000020040000000000000000000000000000000000000000000000000000
```

PostGIS EWKT output has a few differences to OGC WKT:

- For 3DZ geometries the Z qualifier is omitted:
OGC: POINT Z (1 2 3)
EWKT: POINT (1 2 3)
- For 3DM geometries the M qualifier is included:
OGC: POINT M (1 2 3)
EWKT: POINTM (1 2 3)

- For 4D geometries the ZM qualifier is omitted:

OGC: POINT ZM (1 2 3 4)

EWKT: POINT (1 2 3 4)

EWKT avoids over-specifying dimensionality and the inconsistencies that can occur with the OGC/ISO format, such as:

- POINT ZM (1 1)
- POINT ZM (1 1 1)
- POINT (1 1 1 1)



Caution

PostGIS extended formats are currently a superset of the OGC ones, so that every valid OGC WKB/WKT is also valid EWKB/EWKT. However, this might vary in the future, if the OGC extends a format in a way that conflicts with the PostGIS definition. Thus you **SHOULD NOT** rely on this compatibility!

Examples of the EWKT text representation of spatial objects are:

- POINT(0 0 0) -- XYZ
- SRID=32632;POINT(0 0) -- XY with SRID
- POINTM(0 0 0) -- XYM
- POINT(0 0 0 0) -- XYZM
- SRID=4326;MULTIPOINTM(0 0 0,1 2 1) -- XYM with SRID
- MULTILINESTRING((0 0 0,1 1 0,1 2 1),(2 3 1,3 2 1,5 4 1))
- POLYGON((0 0 0,4 0 0,4 4 0,0 4 0,0 0 0),(1 1 0,2 1 0,2 2 0,1 2 0,1 1 0))
- MULTIPOLYGON(((0 0 0,4 0 0,4 4 0,0 4 0,0 0 0),(1 1 0,2 1 0,2 2 0,1 2 0,1 1 0)),((-1 -1 0,-1 -2 0,-2 -2 0,-2 -1 0,-1 -1 0)))
- GEOMETRYCOLLECTIONM(POINTM(2 3 9), LINESTRINGM(2 3 4, 3 4 5))
- MULTICURVE((0 0, 5 5), CIRCULARSTRING(4 0, 4 4, 8 4))
- POLYHEDRALSURFACE(((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)), ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)), ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)), ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)))
- TRIANGLE ((0 0, 0 10, 10 0, 0 0))
- TIN(((0 0 0, 0 0 1, 0 1 0, 0 0 0)), ((0 0 0, 0 1 0, 1 1 0, 0 0 0)))

Input and output using these formats is available using the following functions:

```
bytea EWKB = ST_AsEWKB(geometry);
text EWKT = ST_AsEWKT(geometry);
geometry = ST_GeomFromEWKB(bytea EWKB);
geometry = ST_GeomFromEWKT(text EWKT);
```

For example, a statement to create and insert a PostGIS spatial object using EWKT is:

```
INSERT INTO geotable ( geom, name )
VALUES ( ST_GeomFromEWKT('SRID=312;POINTM(-126.4 45.32 15)'), 'A Place' )
```

4.3 Geography Data Type

The PostGIS geography data type provides native support for spatial features represented on "geographic" coordinates (sometimes called "geodetic" coordinates, or "lat/lon", or "lon/lat"). Geographic coordinates are spherical coordinates expressed in angular units (degrees).

The basis for the PostGIS geometry data type is a plane. The shortest path between two points on the plane is a straight line. That means functions on geometries (areas, distances, lengths, intersections, etc) are calculated using straight line vectors and cartesian mathematics. This makes them simpler to implement and faster to execute, but also makes them inaccurate for data on the spheroidal surface of the earth.

The PostGIS geography data type is based on a spherical model. The shortest path between two points on the sphere is a great circle arc. Functions on geographies (areas, distances, lengths, intersections, etc) are calculated using arcs on the sphere. By taking the spheroidal shape of the world into account, the functions provide more accurate results.

Because the underlying mathematics is more complicated, there are fewer functions defined for the geography type than for the geometry type. Over time, as new algorithms are added the capabilities of the geography type will expand. As a workaround one can convert back and forth between geometry and geography types.

Like the geometry data type, geography data is associated with a spatial reference system via a spatial reference system identifier (SRID). Any geodetic (long/lat based) spatial reference system defined in the `spatial_ref_sys` table can be used. (Prior to PostGIS 2.2, the geography type supported only WGS 84 geodetic (SRID:4326)). You can add your own custom geodetic spatial reference system as described in Section 4.5.2.

For all spatial reference systems the units returned by measurement functions (e.g. `ST_Distance`, `ST_Length`, `ST_Perimeter`, `ST_Area`) and for the distance argument of `ST_DWithin` are in meters.

4.3.1 Creating Geography Tables

You can create a table to store geography data using the `CREATE TABLE` SQL statement with a column of type geography. The following example creates a table with a geography column storing 2D LineStrings in the WGS84 geodetic coordinate system (SRID 4326):

```
CREATE TABLE global_points (
    id SERIAL PRIMARY KEY,
    name VARCHAR(64),
    location geography(POINT, 4326)
);
```

The geography type supports two optional type modifiers:

- the spatial type modifier restricts the kind of shapes and dimensions allowed in the column. Values allowed for the spatial type are: POINT, LINESTRING, POLYGON, MULTIPOINT, MULTILINESTRING, MULTIPOLYGON, GEOMETRYCOLLECTION. The geography type does not support curves, TINS, or POLYHEDRALSURFACES. The modifier supports coordinate dimensionality restrictions by adding suffixes: Z, M and ZM. For example, a modifier of 'LINESTRINGM' only allows linestrings with three dimensions, and treats the third dimension as a measure. Similarly, 'POINTZM' requires four dimensional (XYZM) data.
- the SRID modifier restricts the spatial reference system SRID to a particular number. If omitted, the SRID defaults to 4326 (WGS84 geodetic), and all calculations are performed using WGS84.

Examples of creating tables with geography columns:

- Create a table with 2D POINT geography with the default SRID 4326 (WGS84 long/lat):

```
CREATE TABLE ptgeogwgs(gid serial PRIMARY KEY, geog geography(POINT) );
```

- Create a table with 2D POINT geography in NAD83 longlat:

```
CREATE TABLE ptgeognad83(gid serial PRIMARY KEY, geog geography(POINT,4269) );
```

- Create a table with 3D (XYZ) POINTs and an explicit SRID of 4326:

```
CREATE TABLE ptzgeogwgs84(gid serial PRIMARY KEY, geog geography(POINTZ,4326) );
```

- Create a table with 2D LINESTRING geography with the default SRID 4326:

```
CREATE TABLE lgeog(gid serial PRIMARY KEY, geog geography(LINESTRING) );
```

- Create a table with 2D POLYGON geography with the SRID 4267 (NAD 1927 long lat):

```
CREATE TABLE lgeognad27(gid serial PRIMARY KEY, geog geography(POLYGON,4267) );
```

Geography fields are registered in the `geography_columns` system view. You can query the `geography_columns` view and see that the table is listed:

```
SELECT * FROM geography_columns;
```

Creating a spatial index works the same as for geometry columns. PostGIS will note that the column type is `GEOGRAPHY` and create an appropriate sphere-based index instead of the usual planar index used for `GEOMETRY`.

```
-- Index the test table with a spherical index
CREATE INDEX global_points_gix ON global_points USING GIST ( location );
```

4.3.2 Using Geography Tables

You can insert data into geography tables in the same way as geometry. Geometry data will autocast to the geography type if it has SRID 4326. The **EWKT** and **EWKB** formats can also be used to specify geography values.

```
-- Add some data into the test table
INSERT INTO global_points (name, location) VALUES ('Town', 'SRID=4326;POINT(-110 30)');
INSERT INTO global_points (name, location) VALUES ('Forest', 'SRID=4326;POINT(-109 29)');
INSERT INTO global_points (name, location) VALUES ('London', 'SRID=4326;POINT(0 49)');
```

Any geodetic (long/lat) spatial reference system listed in `spatial_ref_sys` table may be specified as a geography SRID. Non-geodetic coordinate systems raise an error if used.

```
-- NAD 83 lon/lat
SELECT 'SRID=4269;POINT(-123 34)::geography;
        geography
-----
0101000020AD100000000000000000C05EC000000000000004140
```

```
-- NAD27 lon/lat
SELECT 'SRID=4267;POINT(-123 34)::geography;
        geography
-----
0101000020AB100000000000000000C05EC000000000000004140
```

```
-- NAD83 UTM zone meters - gives an error since it is a meter-based planar projection
SELECT 'SRID=26910;POINT(-123 34)::geography;
```

```
ERROR: Only lon/lat coordinate systems are supported in geography.
```

Las consultas y las funciones de medidas utilizan metros cho unidad. Asi que los parámetros de distancia deben estar expresados en metros, y los valores devueltos deben estar expresados en metros (o metros cuadrados para áreas)

```
-- A distance query using a 1000km tolerance
SELECT name FROM global_points WHERE ST_DWithin(location, 'SRID=4326;POINT(-110 29):: geography, 1000000);
```

You can see the power of geography in action by calculating how close a plane flying a great circle route from Seattle to London (LINESTRING(-122.33 47.606, 0.0 51.5)) comes to Reykjavik (POINT(-21.96 64.15)) ([map the route](#)).

The geography type calculates the true shortest distance of 122.235 km over the sphere between Reykjavik and the great circle flight path between Seattle and London.

```
-- Distance calculation using GEOGRAPHY
SELECT ST_Distance('LINESTRING(-122.33 47.606, 0.0 51.5)::geography, 'POINT(-21.96 64.15) ←
      '::geography);
      st_distance
-----
122235.23815667
```

The geometry type calculates a meaningless cartesian distance between Reykjavik and the straight line path from Seattle to London plotted on a flat map of the world. The nominal units of the result is "degrees", but the result doesn't correspond to any true angular difference between the points, so even calling them "degrees" is inaccurate.

```
-- Distance calculation using GEOMETRY
SELECT ST_Distance('LINESTRING(-122.33 47.606, 0.0 51.5)::geometry, 'POINT(-21.96 64.15) ←
      '::geometry);
      st_distance
-----
13.342271221453624
```

4.3.3 When to use the Geography data type

The geography data type allows you to store data in longitude/latitude coordinates, but at a cost: there are fewer functions defined on GEOGRAPHY than there are on GEOMETRY; those functions that are defined take more CPU time to execute.

The data type you choose should be determined by the expected working area of the application you are building. Will your data span the globe or a large continental area, or is it local to a state, county or municipality?

- Si tus datos están un área pequeña, la mejor solución sería elegir una proyección adecuada y utilizando GEOMETRY, en términos de rendimiento y funcionalidades disponibles.
- Si tus datos son globales o cubren una región continental, veras que GEOGRAPHY te permite construir un sistema sin tener que preocuparte sobre detalles de proyección. Almacenas tus datos en longitud/latitud, y utilizas las funciones definidas en GEOGRAPHY.
- Si no entiendes las proyecciones, y no quieres aprender sobre ellas, y estas preparado a aceptar las funcionalidades limitadas disponibles en GEOGRAPHY, entonces sera mas fácil para ti, utilizar GEOGRAPHY en lugar de GEOMETRY. Simplemente carga tus datos como longitud/latitud y continua desde allí.

Para tener una comparación entre lo que esta soportado entre Geography y Geometry ve a Section 15.11. Para obtener una lista con la descripción de las funciones Geography ve a Section 15.4

4.3.4 Preguntas frecuentes Avanzadas de Geography

1. ¿Se calcula en la esfera o en el esferoide?

Por defecto, todos los cálculos de distancia y área están hechos sobre el esferoide. Deberías ver que los resultados de los cálculos en áreas locales deberán coincidir con los resultados en coordenadas locales planas con proyecciones locales correctas. En grandes áreas, los cálculos esferoidales serán mas precisas que cualquier calculo realizado en planas. Todas las funciones "geography" tienen la opción de utilizar el calculo sobre la esfera, seleccionando el parámetro final booleano a 'FALSE'. Esto puede acelerar los cálculos, particularmente en casos donde las geometrias son muy simples.

2. *¿Que ocurre con los husos horarios y los polos?*

Todos los cálculos no tienen nociones de husos horarios o polos, las coordenadas son esféricas(longitud/latitud) así que una forma que atraviesa husos horarios no es, desde un punto de vista de los cálculos, a cualquier otra forma.

3. *¿Cual es el arco mas largo que se puede procesar?*

Utilizamos grandes arcos de círculo como la "línea de interpolación" entre dos puntos. Esto significa que actualmente, dos puntos se unen de dos formas, dependiendo de la dirección del viaje sobre el arco. Todo nuestro código asume que los puntos están unidos por el *mas corto* de los dos caminos a través del arco de circunferencia. Como consecuencia, las formas que tienen arcos mayores de 180 grados no serán modeladas correctamente.

4. *¿ Por que es tan lento el calculo del area de Europa / Rusia / añade una región geográfica grande aquí?*

¡Por que el polígono es condenadamente grande! Las grandes áreas son malas por dos razones: Sus límites son grandes, así que el índice tiende a tirar de la función sin importar la consulta que estes ejecutando; el numero de vértices es grande, y los tests (distancia, de contención) tiene que recorrer la lista de vértices al menos una vez y a veces N veces (con N igual al numero de vértices en el otro objeto candidato). As with GEOMETRY, we recommend that when you have very large polygons, but are doing queries in small areas, you "denormalize" your geometric data into smaller chunks so that the index can effectively subquery parts of the object and so queries don't have to pull out the whole object every time. Please consult [ST_Subdivide](#) function documentation. Just because you *can* store all of Europe in one polygon doesn't mean you *should*.

4.4 Geometry Validation

PostGIS is compliant with the Open Geospatial Consortium's (OGC) Simple Features specification. That standard defines the concepts of geometry being *simple* and *valid*. These definitions allow the Simple Features geometry model to represent spatial objects in a consistent and unambiguous way that supports efficient computation. (Note: the OGC SF and SQL/MM have the same definitions for simple and valid.)

4.4.1 Simple Geometry

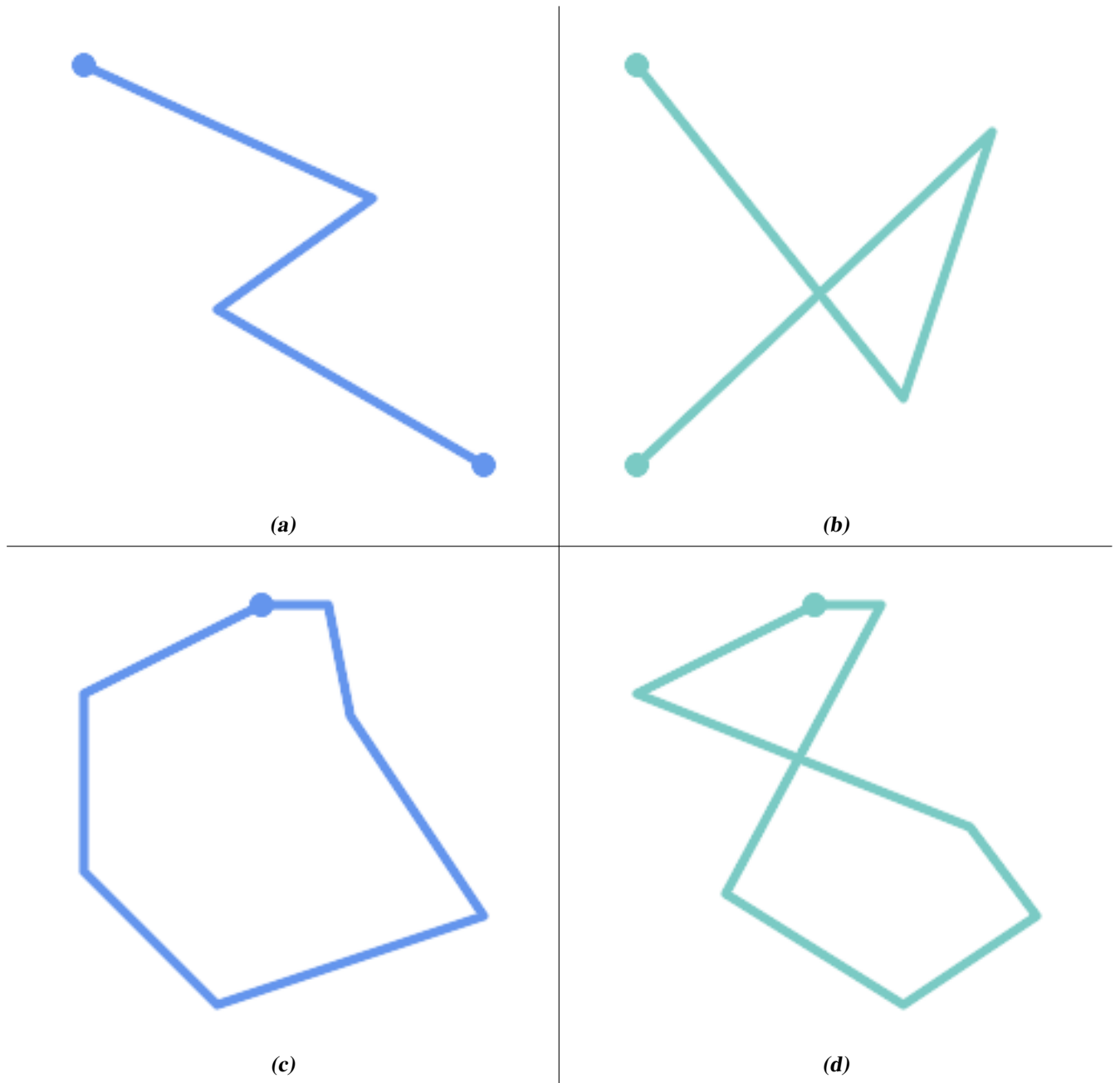
A *simple* geometry is one that has no anomalous geometric points, such as self intersection or self tangency.

A POINT is inherently *simple* as a 0-dimensional geometry object.

MULTIPOINTS son simples *simple* si dos coordenadas (POINTS) no son iguales (tienen valores de coordenadas identicos).

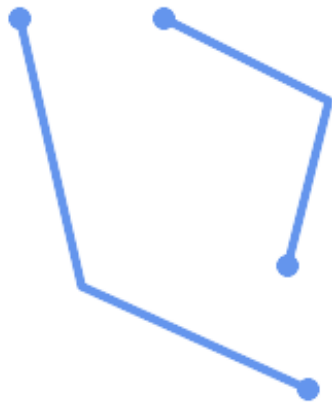
A LINESTRING is *simple* if it does not pass through the same point twice, except for the endpoints. If the endpoints of a simple LineString are identical it is called *closed* and referred to as a Linear Ring.

(a) and (c) are simple LINESTRINGS. (b) and (d) are not simple. (c) is a closed Linear Ring.

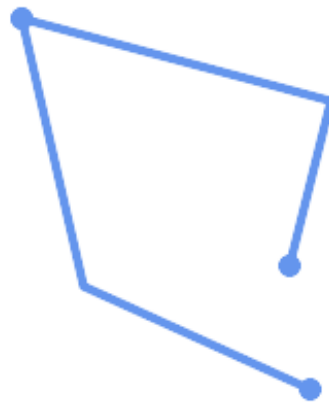


A `MULTILINESTRING` is *simple* only if all of its elements are simple and the only intersection between any two elements occurs at points that are on the boundaries of both elements.

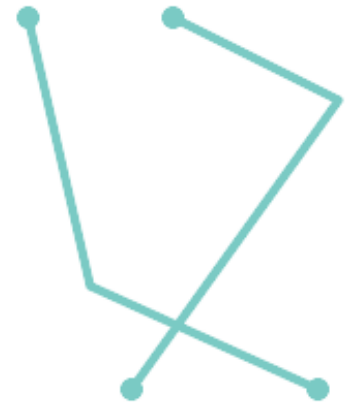
(e) and (f) are simple MULTILINESTRINGS. (g) is not simple.



(e)



(f)



(g)

POLYGONS are formed from linear rings, so valid polygonal geometry is always *simple*.

To test if a geometry is simple use the **ST_IsSimple** function:

```
SELECT
  ST_IsSimple('LINESTRING(0 0, 100 100)') AS straight,
  ST_IsSimple('LINESTRING(0 0, 100 100, 100 0, 0 100)') AS crossing;

straight | crossing
-----+-----
t        | f
```

Generally, PostGIS functions do not require geometric arguments to be simple. Simplicity is primarily used as a basis for defining geometric validity. It is also a requirement for some kinds of spatial data models (for example, linear networks often disallow lines that cross). Multipoint and linear geometry can be made simple using **ST_UnaryUnion**.

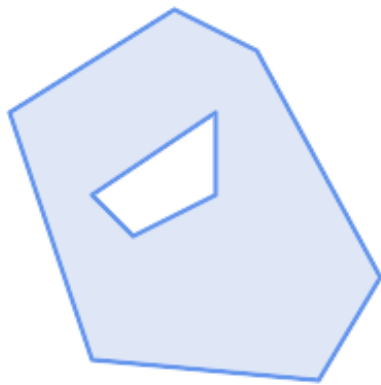
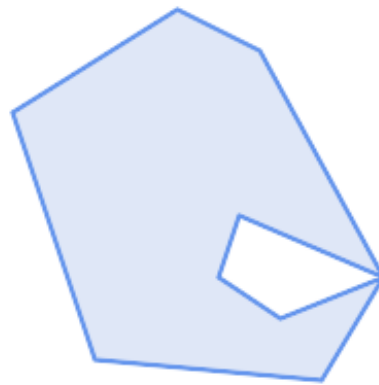
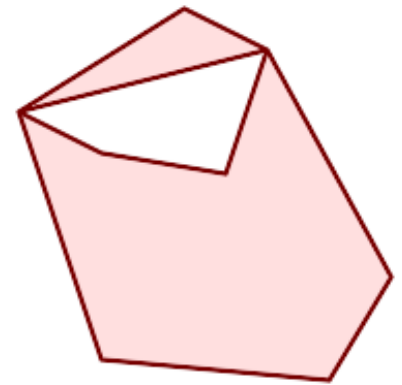
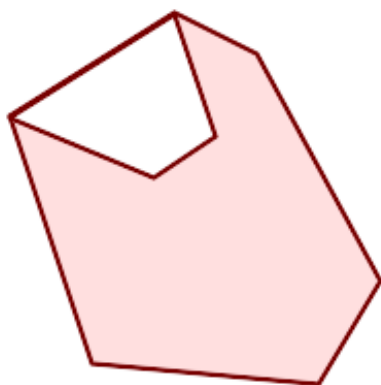
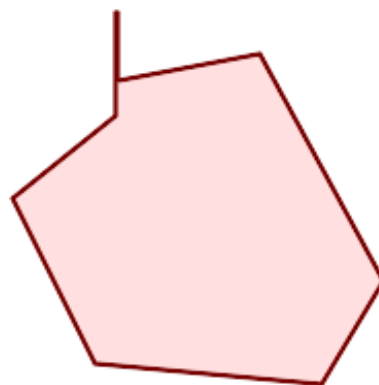
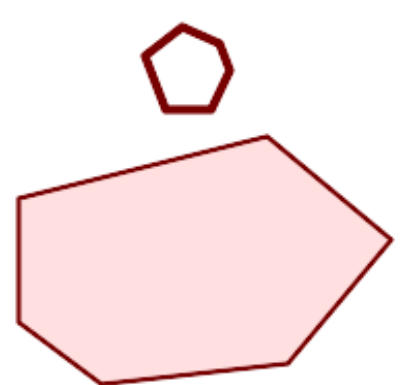
4.4.2 Valid Geometry

Geometry validity primarily applies to 2-dimensional geometries (POLYGONS and MULTIPOLYGONS). Validity is defined by rules that allow polygonal geometry to model planar areas unambiguously.

A POLYGON is *valid* if:

1. the polygon boundary rings (the exterior shell ring and interior hole rings) are *simple* (do not cross or self-touch). Because of this a polygon cannot have cut lines, spikes or loops. This implies that polygon holes must be represented as interior rings, rather than by the exterior ring self-touching (a so-called "inverted hole").
2. boundary rings do not cross
3. boundary rings may touch at points but only as a tangent (i.e. not in a line)
4. interior rings are contained in the exterior ring
5. the polygon interior is simply connected (i.e. the rings must not touch in a way that splits the polygon into more than one part)

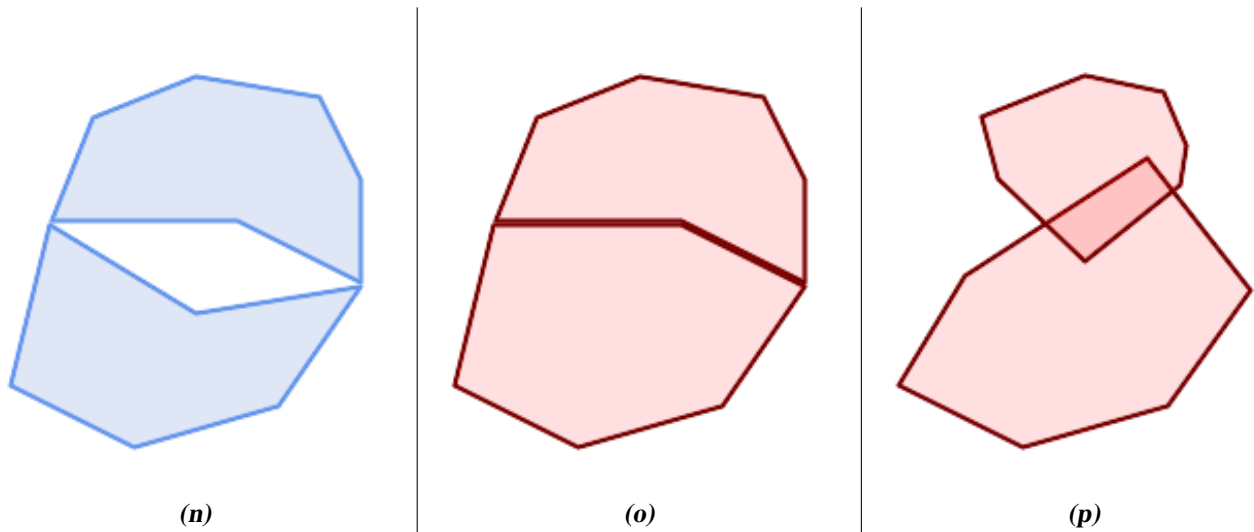
(h) and (i) are valid POLYGONS. (j-m) are invalid. (j) can be represented as a valid MULTIPOLYGON.

**(h)****(i)****(j)****(k)****(l)****(m)**

A MULTIPOLYGON is *valid* if:

1. its element POLYGONS are valid
2. elements do not overlap (i.e. their interiors must not intersect)
3. elements touch only at points (i.e. not along a line)

(n) is a valid MULTIPOLYGON. **(o)** and **(p)** are invalid.



These rules mean that valid polygonal geometry is also *simple*.

For linear geometry the only validity rule is that `LINESTRING`s must have at least two points and have non-zero length (or equivalently, have at least two distinct points.) Note that non-simple (self-intersecting) lines are valid.

```
SELECT
  ST_IsValid('LINESTRING(0 0, 1 1)') AS len_nonzero,
  ST_IsValid('LINESTRING(0 0, 0 0, 0 0)') AS len_zero,
  ST_IsValid('LINESTRING(10 10, 150 150, 180 50, 20 130)') AS self_int;
```

len_nonzero	len_zero	self_int
t	f	t

`POINT` and `MULTIPOINT` geometries have no validity rules.

4.4.3 Managing Validity

PostGIS allows creating and storing both valid and invalid Geometry. This allows invalid geometry to be detected and flagged or fixed. There are also situations where the OGC validity rules are stricter than desired (examples of this are zero-length linestrings and polygons with inverted holes.)

Many of the functions provided by PostGIS rely on the assumption that geometry arguments are valid. For example, it does not make sense to calculate the area of a polygon that has a hole defined outside of the polygon, or to construct a polygon from a non-simple boundary line. Assuming valid geometric inputs allows functions to operate more efficiently, since they do not need to check for topological correctness. (Notable exceptions are that zero-length lines and polygons with inversions are generally handled correctly.) Also, most PostGIS functions produce valid geometry output if the inputs are valid. This allows PostGIS functions to be chained together safely.

If you encounter unexpected error messages when calling PostGIS functions (such as "GEOS Intersection() threw an error!"), you should first confirm that the function arguments are valid. If they are not, then consider using one of the techniques below to ensure the data you are processing is valid.



Note

If a function reports an error with valid inputs, then you may have found an error in either PostGIS or one of the libraries it uses, and you should report this to the PostGIS project. The same is true if a PostGIS function returns an invalid geometry for valid input.

To test if a geometry is valid use the `ST_IsValid` function:

```
SELECT ST_IsValid('POLYGON ((20 180, 180 180, 180 20, 20 20, 20 180))');
-----
t
```

Information about the nature and location of an geometry invalidity are provided by the **ST_IsValidDetail** function:

```
SELECT valid, reason, ST_AsText(location) AS location
FROM ST_IsValidDetail('POLYGON ((20 20, 120 190, 50 190, 170 50, 20 20))') AS t;
```

valid	reason	location
f	Self-intersection	POINT(91.51162790697674 141.56976744186045)

In some situations it is desirable to correct invalid geometry automatically. Use the **ST_MakeValid** function to do this. (**ST_MakeValid** is a case of a spatial function that *does* allow invalid input!)

By default, PostGIS does not check for validity when loading geometry, because validity testing can take a lot of CPU time for complex geometries. If you do not trust your data sources, you can enforce a validity check on your tables by adding a check constraint:

```
ALTER TABLE mytable
ADD CONSTRAINT geometry_valid_check
CHECK (ST_IsValid(geom));
```

4.5 Spatial Reference Systems

A **Spatial Reference System** (SRS) (also called a Coordinate Reference System (CRS)) defines how geometry is referenced to locations on the Earth's surface. There are three types of SRS:

- A **geodetic** SRS uses angular coordinates (longitude and latitude) which map directly to the surface of the earth.
- A **projected** SRS uses a mathematical projection transformation to "flatten" the surface of the spheroidal earth onto a plane. It assigns location coordinates in a way that allows direct measurement of quantities such as distance, area, and angle. The coordinate system is Cartesian, which means it has a defined origin point and two perpendicular axes (usually oriented North and East). Each projected SRS uses a stated length unit (usually metres or feet). A projected SRS may be limited in its area of applicability to avoid distortion and fit within the defined coordinate bounds.
- A **local** SRS is a Cartesian coordinate system which is not referenced to the earth's surface. In PostGIS this is specified by a SRID value of 0.

There are many different spatial reference systems in use. Common SRSEs are standardized in the European Petroleum Survey Group **EPSG database**. For convenience PostGIS (and many other spatial systems) refers to SRS definitions using an integer identifier called a SRID.

A geometry is associated with a Spatial Reference System by its SRID value, which is accessed by **ST_SRID**. The SRID for a geometry can be assigned using **ST_SetSRID**. Some geometry constructor functions allow supplying a SRID (such as **ST_Point** and **ST_MakeEnvelope**). The **EWKT** format supports SRIDs with the **SRID=n;** prefix.

Spatial functions processing pairs of geometries (such as **overlay** and **relationship** functions) require that the input geometries are in the same spatial reference system (have the same SRID). Geometry data can be transformed into a different spatial reference system using **ST_Transform**. Geometry returned from functions has the same SRS as the input geometries.

4.5.1 SPATIAL_REF_SYS Table

The **SPATIAL_REF_SYS** table used by PostGIS is an OGC-compliant database table that defines the available spatial reference systems. It holds the numeric SRIDs and textual descriptions of the coordinate systems.

The **spatial_ref_sys** table definition is:

```
CREATE TABLE spatial_ref_sys (
  srid          INTEGER NOT NULL PRIMARY KEY,
  auth_name     VARCHAR(256),
  auth_srid     INTEGER,
  srtext        VARCHAR(2048),
  proj4text     VARCHAR(2048)
)
```

The columns are:

srid An integer code that uniquely identifies the [Spatial Reference System](#) (SRS) within the database.

auth_name The name of the standard or standards body that is being cited for this reference system. For example, "EPSG" is a valid auth_name.

auth_srid The ID of the Spatial Reference System as defined by the Authority cited in the auth_name. In the case of EPSG, this is the EPSG code.

srtext La representación Well-Known Text del Sistema de Referencia Espacial (SRS). Un ejemplo de representación WKT SRS es:

```
PROJCS["NAD83 / UTM Zone 10N",
  GEOGCS["NAD83",
    DATUM["North_American_Datum_1983",
      SPHEROID["GRS 1980",6378137,298.257222101]
    ],
    PRIMEM["Greenwich",0],
    UNIT["degree",0.0174532925199433]
  ],
  PROJECTION["Transverse_Mercator"],
  PARAMETER["latitude_of_origin",0],
  PARAMETER["central_meridian",-123],
  PARAMETER["scale_factor",0.9996],
  PARAMETER["false_easting",500000],
  PARAMETER["false_northing",0],
  UNIT["metre",1]
]
```

For a discussion of SRS WKT, see the OGC standard [Well-known text representation of coordinate reference systems](#).

proj4text PostGIS uses the PROJ library to provide coordinate transformation capabilities. The proj4text column contains the PROJ coordinate definition string for a particular SRID. For example:

```
+proj=utm +zone=10 +ellps=clrk66 +datum=NAD27 +units=m
```

For more information see the [PROJ web site](#). The spatial_ref_sys.sql file contains both srtext and proj4text definitions for all EPSG projections.

When retrieving spatial reference system definitions for use in transformations, PostGIS uses the following strategy:

- If auth_name and auth_srid are present (non-NULL) use the PROJ SRS based on those entries (if one exists).
- If srtext is present create a SRS using it, if possible.
- If proj4text is present create a SRS using it, if possible.

4.5.2 User-Defined Spatial Reference Systems

The PostGIS `spatial_ref_sys` table contains over 3000 of the most common spatial reference system definitions that are handled by the **PROJ** projection library. But there are many coordinate systems that it does not contain. You can add SRS definitions to the table if you have the required information about the spatial reference system. Or, you can define your own custom spatial reference system if you are familiar with PROJ constructs. Keep in mind that most spatial reference systems are regional and have no meaning when used outside of the bounds they were intended for.

A resource for finding spatial reference systems not defined in the core set is <http://spatialreference.org/>

Some commonly used spatial reference systems are: **4326 - WGS 84 Long Lat**, **4269 - NAD 83 Long Lat**, **3395 - WGS 84 World Mercator**, **2163 - US National Atlas Equal Area**, and the 60 WGS84 UTM zones. UTM zones are one of the most ideal for measurement, but only cover 6-degree regions. (To determine which UTM zone to use for your area of interest, see the **utmzone PostGIS plpgsql helper function**.)

US states use State Plane spatial reference systems (meter or feet based) - usually one or 2 exists per state. Most of the meter-based ones are in the core set, but many of the feet-based ones or ESRI-created ones will need to be copied from spatialreference.org.

You can even define non-Earth-based coordinate systems, such as **Mars 2000**. This Mars coordinate system is non-planar (it's in degrees spheroidal), but you can use it with the `geography` type to obtain length and proximity measurements in meters instead of degrees.

Here is an example of loading a custom coordinate system using an unassigned SRID and the PROJ definition for a US-centric Lambert Conformal projection:

```
INSERT INTO spatial_ref_sys (srid, proj4text)
VALUES ( 990000,
        '+proj=lcc +lon_0=-95 +lat_0=25 +lat_1=25 +lat_2=25 +x_0=0 +y_0=0 +datum=WGS84 +units=m ←
        +no_defs'
);
```

4.6 Spatial Tables

4.6.1 Crear una tabla espacial

You can create a table to store geometry data using the **CREATE TABLE** SQL statement with a column of type `geometry`. The following example creates a table with a geometry column storing 2D (XY) LineStrings in the BC-Albers coordinate system (SRID 3005):

```
CREATE TABLE roads (
    id SERIAL PRIMARY KEY,
    name VARCHAR(64),
    geom geometry(LINESTRING,3005)
);
```

The `geometry` type supports two optional **type modifiers**:

- the **spatial type modifier** restricts the kind of shapes and dimensions allowed in the column. The value can be any of the supported **geometry subtypes** (e.g. POINT, LINESTRING, POLYGON, MULTIPOINT, MULTILINESTRING, MULTIPOLYGON, GEOMETRYCOLLECTION, etc). The modifier supports coordinate dimensionality restrictions by adding suffixes: Z, M and ZM. For example, a modifier of 'LINESTRINGM' allows only linestrings with three dimensions, and treats the third dimension as a measure. Similarly, 'POINTZM' requires four dimensional (XYZM) data.
- the **SRID modifier** restricts the **spatial reference system** SRID to a particular number. If omitted, the SRID defaults to 0.

Examples of creating tables with geometry columns:

- Create a table holding any kind of geometry with the default SRID:

```
CREATE TABLE geoms(gid serial PRIMARY KEY, geom geometry );
```

- Create a table with 2D POINT geometry with the default SRID:

```
CREATE TABLE pts(gid serial PRIMARY KEY, geom geometry(POINT) );
```

- Create a table with 3D (XYZ) POINTs and an explicit SRID of 3005:

```
CREATE TABLE pts(gid serial PRIMARY KEY, geom geometry(POINTZ,3005) );
```

- Create a table with 4D (XYZM) LINESTRING geometry with the default SRID:

```
CREATE TABLE lines(gid serial PRIMARY KEY, geom geometry(LINESTRINGZM) );
```

- Create a table with 2D POLYGON geometry with the SRID 4267 (NAD 1927 long lat):

```
CREATE TABLE polys(gid serial PRIMARY KEY, geom geometry(POLYGON,4267) );
```

It is possible to have more than one geometry column in a table. This can be specified when the table is created, or a column can be added using the **ALTER TABLE** SQL statement. This example adds a column that can hold 3D LineStrings:

```
ALTER TABLE roads ADD COLUMN geom2 geometry(LINESTRINGZ,4326);
```

4.6.2 GEOMETRY_COLUMNS View

The OGC *Simple Features Specification for SQL* defines the `GEOMETRY_COLUMNS` metadata table to describe geometry table structure. In PostGIS `geometry_columns` is a view reading from database system catalog tables. This ensures that the spatial metadata information is always consistent with the currently defined tables and views. The view structure is:

```
\d geometry_columns
```

View "public.geometry_columns"

Column	Type	Modifiers
f_table_catalog	character varying(256)	
f_table_schema	character varying(256)	
f_table_name	character varying(256)	
f_geometry_column	character varying(256)	
coord_dimension	integer	
srid	integer	
type	character varying(30)	

The columns are:

f_table_catalog, f_table_schema, f_table_name The fully qualified name of the feature table containing the geometry column. There is no PostgreSQL analogue of "catalog" so that column is left blank. For "schema" the PostgreSQL schema name is used (public is the default).

f_geometry_column El nombre de la columna de geometrías de la tabla de objetos espaciales.

coord_dimension The coordinate dimension (2, 3 or 4) of the column.

srid The ID of the spatial reference system used for the coordinate geometry in this table. It is a foreign key reference to the `spatial_ref_sys` table (see Section 4.5.1).

type El tipo de objeto espacial. Para restringir la columna espacial a un tipo unico, utiliza uno de: POINT, LINESTRING, POLYGON, MULTIPOINT, MULTILINESTRING, MULTIPOLYGON, GEOMETRYCOLLECTION o su version correspondiente de XYM POINTM, LINESTRINGM, POLYGONM, MULTIPOINTM, MULTILINESTRINGM, MULTIPOLYGONM, GEOMETRYCOLLECTIONM. Para colecciones heterogéneas (tipos mixtos), puedes utilizar "GEOMETRY" como tipo.

4.6.3 Manually Registering Geometry Columns

Two of the cases where you may need this are the case of SQL Views and bulk inserts. For bulk insert case, you can correct the registration in the `geometry_columns` table by constraining the column or doing an alter table. For views, you could expose using a CAST operation. Note, if your column is `typmod` based, the creation process would register it correctly, so no need to do anything. Also views that have no spatial function applied to the geometry will register the same as the underlying table geometry column.

```
-- Lets say you have a view created like this
CREATE VIEW public.vwmytablemercator AS
    SELECT gid, ST_Transform(geom, 3395) As geom, f_name
    FROM public.mytable;

-- For it to register correctly
-- You need to cast the geometry
--
DROP VIEW public.vwmytablemercator;
CREATE VIEW public.vwmytablemercator AS
    SELECT gid, ST_Transform(geom, 3395)::geometry(Geometry, 3395) As geom, f_name
    FROM public.mytable;

-- If you know the geometry type for sure is a 2D POLYGON then you could do
DROP VIEW public.vwmytablemercator;
CREATE VIEW public.vwmytablemercator AS
    SELECT gid, ST_Transform(geom, 3395)::geometry(Polygon, 3395) As geom, f_name
    FROM public.mytable;
```

```
-- Lets say you created a derivative table by doing a bulk insert
SELECT poi.gid, poi.geom, citybounds.city_name
INTO myschema.my_special_pois
FROM poi INNER JOIN citybounds ON ST_Intersects(citybounds.geom, poi.geom);

-- Create 2D index on new table
CREATE INDEX idx_myschema_myspecialpois_geom_gist
ON myschema.my_special_pois USING gist(geom);

-- If your points are 3D points or 3M points,
-- then you might want to create an nd index instead of a 2D index
CREATE INDEX my_special_pois_geom_gist_nd
ON my_special_pois USING gist(geom gist_geometry_ops_nd);

-- To manually register this new table's geometry column in geometry_columns.
-- Note it will also change the underlying structure of the table to
-- to make the column typmod based.
SELECT populate_geometry_columns('myschema.my_special_pois'::regclass);

-- If you are using PostGIS 2.0 and for whatever reason, you
-- you need the constraint based definition behavior
-- (such as case of inherited tables where all children do not have the same type and srid)
-- set optional use_typmod argument to false
SELECT populate_geometry_columns('myschema.my_special_pois'::regclass, false);
```

Although the old-constraint based method is still supported, a constraint-based geometry column used directly in a view, will not register correctly in `geometry_columns`, as will a `typmod` one. In this example we define a column using `typmod` and another using constraints.

```
CREATE TABLE pois_ny(gid SERIAL PRIMARY KEY, poi_name text, cat text, geom geometry(POINT ↵
, 4326));
SELECT AddGeometryColumn('pois_ny', 'geom_2160', 2160, 'POINT', 2, false);
```

Si ejecutamos en `psql`


```
\d pois_ny;
```

Vemos que están definidas de forma diferente -- una es typmod, la otra por restricciones.

```
Table "public.pois_ny"
  Column      |      Type      |      Modifiers
-----+-----+-----
gid           | integer        | not null default nextval('pois_ny_gid_seq'::regclass)
poi_name      | text           |
cat           | character varying(20) |
geom          | geometry(Point,4326) |
geom_2160     | geometry       |
Indexes:
    "pois_ny_pkey" PRIMARY KEY, btree (gid)
Check constraints:
    "enforce_dims_geom_2160" CHECK (st_ndims(geom_2160) = 2)
    "enforce_geotype_geom_2160" CHECK (geometrytype(geom_2160) = 'POINT'::text
    OR geom_2160 IS NULL)
    "enforce_srid_geom_2160" CHECK (st_srid(geom_2160) = 2160)
```

En geometry_columns, ambas se registran de forma correcta

```
SELECT f_table_name, f_geometry_column, srid, type
FROM geometry_columns
WHERE f_table_name = 'pois_ny';
```

```
f_table_name | f_geometry_column | srid | type
-----+-----+-----+-----
pois_ny      | geom              | 4326 | POINT
pois_ny      | geom_2160         | 2160 | POINT
```

De todas formas -- si queremos crear una vista de la siguiente forma

```
CREATE VIEW vw_pois_ny_parks AS
SELECT *
FROM pois_ny
WHERE cat='park';

SELECT f_table_name, f_geometry_column, srid, type
FROM geometry_columns
WHERE f_table_name = 'vw_pois_ny_parks';
```

La columna de la vista basada en typmos se registra de forma correcta, pero la basada en restricciones no.

```
f_table_name | f_geometry_column | srid | type
-----+-----+-----+-----
vw_pois_ny_parks | geom              | 4326 | POINT
vw_pois_ny_parks | geom_2160         | 0    | GEOMETRY
```

This may change in future versions of PostGIS, but for now to force the constraint-based view column to register correctly, you need to do this:

```
DROP VIEW vw_pois_ny_parks;
CREATE VIEW vw_pois_ny_parks AS
SELECT gid, poi_name, cat,
geom,
geom_2160::geometry(POINT,2160) As geom_2160
FROM pois_ny
WHERE cat = 'park';
SELECT f_table_name, f_geometry_column, srid, type
```

```
FROM geometry_columns
WHERE f_table_name = 'vw_pois_ny_parks';
```

f_table_name	f_geometry_column	srid	type
vw_pois_ny_parks	geom	4326	POINT
vw_pois_ny_parks	geom_2160	2160	POINT

4.7 Loading Spatial Data

Once you have created a spatial table, you are ready to upload spatial data to the database. There are two built-in ways to get spatial data into a PostGIS/PostgreSQL database: using formatted SQL statements or using the Shapefile loader.

4.7.1 Using SQL to Load Data

If spatial data can be converted to a text representation (as either WKT or WKB), then using SQL might be the easiest way to get data into PostGIS. Data can be bulk-loaded into PostGIS/PostgreSQL by loading a text file of SQL `INSERT` statements using the `psql` SQL utility.

A SQL load file (`roads.sql` for example) might look like this:

```
BEGIN;
INSERT INTO roads (road_id, roads_geom, road_name)
VALUES (1, 'LINESTRING(191232 243118,191108 243242)', 'Jeff Rd');
INSERT INTO roads (road_id, roads_geom, road_name)
VALUES (2, 'LINESTRING(189141 244158,189265 244817)', 'Geordie Rd');
INSERT INTO roads (road_id, roads_geom, road_name)
VALUES (3, 'LINESTRING(192783 228138,192612 229814)', 'Paul St');
INSERT INTO roads (road_id, roads_geom, road_name)
VALUES (4, 'LINESTRING(189412 252431,189631 259122)', 'Graeme Ave');
INSERT INTO roads (road_id, roads_geom, road_name)
VALUES (5, 'LINESTRING(190131 224148,190871 228134)', 'Phil Tce');
INSERT INTO roads (road_id, roads_geom, road_name)
VALUES (6, 'LINESTRING(198231 263418,198213 268322)', 'Dave Cres');
COMMIT;
```

The SQL file can be loaded into PostgreSQL using `psql`:

```
psql -d [database] -f roads.sql
```

4.7.2 Using the Shapefile Loader

The `shp2pgsql` data loader converts Shapefiles into SQL suitable for insertion into a PostGIS/PostgreSQL database either in geometry or geography format. The loader has several operating modes selected by command line flags.

There is also a `shp2pgsql-gui` graphical interface with most of the options as the command-line loader. This may be easier to use for one-off non-scripted loading or if you are new to PostGIS. It can also be configured as a plugin to PgAdminIII.

(claldp) Estas opciones son exclusivas entre ellas:

- c Creates a new table and populates it from the Shapefile. *This is the default mode.*
- a Appends data from the Shapefile into the database table. Note that to use this option to load multiple files, the files must have the same attributes and same data types.
- d Drops the database table before creating a new table with the data in the Shapefile.

- p** Solo produce el código del comando SQL de creación de la tabla, sin añadir ningún dato. Esto puede utilizarse si necesitas separar completamente los pasos de creación de la tabla y de carga de datos
- ?** Muestra la ayuda en pantalla.
- D** Utiliza el formato "dump" de PostgreSQL en la salida de datos. Esto puede combinarse con -a, -c, y -d. Es mucho mas rápido cargar este fichero "dump" que utilizando en comando SQL "INSERT" por defecto. Utiliza esto ara grandes conjuntos de datos.
- s** [**<FROM_SRID>**]:**<SRID>** Creates and populates the geometry tables with the specified SRID. Optionally specifies that the input shapefile uses the given FROM_SRID, in which case the geometries will be reprojected to the target SRID.
- k** Mantiene las mayúsculas en los identificadores (columnas, esquemas y atributos). Observa que los atributos en los shapefiles están siempre en MAYÚSCULAS.
- i** Fuerza la creación de enteros a enteros estándar de 32-bits, no crea enteros bigint de 64-bits, aunque la firma de la cabecera del DBF parezca que lo garantiza.
- I** Crea un índice GiST de la columna de geometrías.
- m** -m *a_file_name* Especifica un fichero que contiene un conjunto de asignaciones de nombres (largos) de columnas a nombres de columna DBF de 10 caracteres. El contenido del archivo es una o más líneas de dos nombres separados por espacios en blanco y no se arrastra o espacio inicial. Por ejemplo:


```
COLUMNNAME DBFFIELD1
AVERYLONGCOLUMNNAME DBFFIELD2
```
- S** Genera geometrías simples en lugar de MULTI geometrías. Solo funcionará si todas las geometrías son actualmente simples (I.E. un MULTIPOLYGON con una única capa, o un MULTIPOINT con un único vértice).
- t** **<dimensionality>** Fuerza a que la geometría de salida tenga la dimensión especificada. Utiliza las siguientes cadenas para indicar la dimensión: 2D, 3DZ, 3DM, 4D.
Si la entrada tiene menos dimensiones de las especificadas, la salida tendrá estas dimensiones rellenas con ceros. Si la entrada tiene mas dimensiones de las especificadas, las dimensiones no deseadas se eliminarán.
- w** Salida en formato WKT, en vez de WKB. Observa que esto puede introducir derivas en las coordenadas debido a la perdida de precisión.
- e** Ejecuta cada sentencia una por una, sin utilizar una transacción. Esto permite cargar la mayoría de datos correctos cuando existen algunas geometrías no validas que generan errores. Observa que esta opción no se puede utilizar con -D ya que el formato "dump" siempre utiliza transacciones.
- W** **<encoding>** Especifica la codificación de los datos de entrada (fichero dbf). Cuando se utiliza, todos los atributos del fichero dbf son convertidos desde la codificación especificada a UTF8. La salida SQL resultante contendrá un comando SET CLIENT_ENCODING to UTF8, así que el backend sera capaz de reconvertir desde UTF8 a cualquier codificación que este configurada en la base de datos para uso interno.
- N** **<policy>** Políticas de gestión de geometrías NULL (insert*, skip, abort)
- n** -n solo importa los ficheros dbf. Si tus datos no tienen shapefiles correspondientes, se cambiara de forma automática a este modo y se cargara únicamente el dbf. Así que esta opción solo se necesita si lo unifico que quieres cargar son los atributos y no las geometrías.
- G** Utiliza el tipo "geography" en lugar del tipo "geometry" (requiere datos en lon/lat) en WGS84 long lat (SRID=4326)
- T** **<tablespace>** Especifica el "tablespace" para la nueva tabla. Los índices seguirán utilizando el "tablespace" por defecto a menos que el parámetro -X este en uso. La documentación de PostgreSQL tiene una buena descripción de los "tablespaces" personalizados.
- X** **<tablespace>** Especifica el "tablespace" para los índices de la nueva tabla. Esto se aplica a los índices de clave primaria y a los índices espaciales GiST si se usa también la opción -I.

-Z When used, this flag will prevent the generation of ANALYZE statements. Without the -Z flag (default behavior), the ANALYZE statements will be generated.

An example session using the loader to create an input file and loading it might look like this:

```
# shp2pgsql -c -D -s 4269 -i -I shaperoads.shp myschema.roadstable > roads.sql
# psql -d roadsdb -f roads.sql
```

A conversion and load can be done in one step using UNIX pipes:

```
# shp2pgsql shaperoads.shp myschema.roadstable | psql -d roadsdb
```

4.8 Extracting Spatial Data

Spatial data can be extracted from the database using either SQL or the Shapefile dumper. The section on SQL presents some of the functions available to do comparisons and queries on spatial tables.

4.8.1 Using SQL to Extract Data

The most straightforward way of extracting spatial data out of the database is to use a SQL SELECT query to define the data set to be extracted and dump the resulting columns into a parsable text file:

```
db=# SELECT road_id, ST_AsText(road_geom) AS geom, road_name FROM roads;
```

```
road_id | geom | road_name
-----+-----+-----
1 | LINESTRING(191232 243118,191108 243242) | Jeff Rd
2 | LINESTRING(189141 244158,189265 244817) | Geordie Rd
3 | LINESTRING(192783 228138,192612 229814) | Paul St
4 | LINESTRING(189412 252431,189631 259122) | Graeme Ave
5 | LINESTRING(190131 224148,190871 228134) | Phil Tce
6 | LINESTRING(198231 263418,198213 268322) | Dave Cres
7 | LINESTRING(218421 284121,224123 241231) | Chris Way
(6 rows)
```

There will be times when some kind of restriction is necessary to cut down the number of records returned. In the case of attribute-based restrictions, use the same SQL syntax as used with a non-spatial table. In the case of spatial restrictions, the following functions are useful:

ST_Intersects This function tells whether two geometries share any space.

= Este test comprueba si dos geometrías son geoméricamente idénticas. Por ejemplo, si 'POLYGON((0 0,1 1,1 0,0 0))' es la misma que 'POLYGON((0 0,1 1,1 0,0 0))' (si que lo es).

Next, you can use these operators in queries. Note that when specifying geometries and boxes on the SQL command line, you must explicitly turn the string representations into geometries function. The 312 is a fictitious spatial reference system that matches our data. So, for example:

```
SELECT road_id, road_name
FROM roads
WHERE roads_geom='SRID=312;LINESTRING(191232 243118,191108 243242) '::geometry;
```

La consulta anterior deberá devolver el único registro de la tabla "ROADS_GEOM" cuya geometría era igual a este valor.

To check whether some of the roads passes in the area defined by a polygon:

```
SELECT road_id, road_name
FROM roads
WHERE ST_Intersects(roads_geom, 'SRID=312;POLYGON((...))');
```

The most common spatial query will probably be a "frame-based" query, used by client software, like data browsers and web mappers, to grab a "map frame" worth of data for display.

Cuando utilizamos el operador "&&", puedes especificar ya sea un BOX3D como la función de comparación o una GEOMETRY. Cuando se especifica una geometría, sin embargo, se utiliza para la comparación su cuadro delimitador (bounding box).

Using a "BOX3D" object for the frame, such a query looks like this:

```
SELECT ST_AsText(roads_geom) AS geom
FROM roads
WHERE
    roads_geom && ST_MakeEnvelope(191232, 243117, 191232, 243119, 312);
```

Observa el uso del SRID 123, para especificar la proyección de la envolvente.

4.8.2 Using the Shapefile Dumper

The `pgsql2shp` table dumper connects to the database and converts a table (possibly defined by a query) into a shape file. The basic syntax is:

```
pgsql2shp [<options>] <database> [<schema>.]<table>
```

```
pgsql2shp [<options>] <database> <query>
```

Las opciones del comando son:

- f <filename>** Escribe la salida en un fichero con un nombre particular
- h <host>** Especifica el servidor al que conectarse.
- p <port>** Especifica el puerto del servidor de la base de datos al que conectarse.
- P <password>** La contraseña a utilizar en la conexión de la base de datos.
- u <user>** El nombre del usuario a utilizar en la conexión a la base de datos.
- g <geometry column>** En el caso que las tablas tengan varias columnas de geometrías, la columna de geometrías a utilizar cuando se escriba el fichero shape.
- b** Utiliza un cursor binario. Esto hace las operaciones mas rápido, pero no funcionará si algún atributo NO-geométrico de la tabla carece de conversión a texto.
- r** Modo Raw. No suprime el campo `gid`, o omite los nombres de las columnas.
- m filename** Reasignar los identificadores de diez nombres de los personajes. El contenido del archivo son líneas de dos símbolos separados por un único espacio en blanco y sin espacios al final, o al inicio: `VERYLONGSYMBOL SHORTONE ANOTHERVERYLONGSYMBOL SHORTER` etc.

4.9 Spatial Indexes

Spatial indexes make using a spatial database for large data sets possible. Without indexing, a search for features requires a sequential scan of every record in the database. Indexing speeds up searching by organizing the data into a structure which can be quickly traversed to find matching records.

The B-tree index method commonly used for attribute data is not very useful for spatial data, since it only supports storing and querying data in a single dimension. Data such as geometry (which has 2 or more dimensions) requires an index method that supports range query across all the data dimensions. One of the key advantages of PostgreSQL for spatial data handling is that it offers several kinds of index methods which work well for multi-dimensional data: GiST, BRIN and SP-GiST indexes.

- **GiST (Generalized Search Tree)** indexes break up data into "things to one side", "things which overlap", "things which are inside" and can be used on a wide range of data-types, including GIS data. PostGIS uses an R-Tree index implemented on top of GiST to index spatial data. GiST is the most commonly-used and versatile spatial index method, and offers very good query performance.
- **BRIN (Block Range Index)** indexes operate by summarizing the spatial extent of ranges of table records. Search is done via a scan of the ranges. BRIN is only appropriate for use for some kinds of data (spatially sorted, with infrequent or no update). But it provides much faster index create time, and much smaller index size.
- **SP-GiST (Space-Partitioned Generalized Search Tree)** is a generic index method that supports partitioned search trees such as quad-trees, k-d trees, and radix trees (tries).

Spatial indexes store only the bounding box of geometries. Spatial queries use the index as a **primary filter** to quickly determine a set of geometries potentially matching the query condition. Most spatial queries require a **secondary filter** that uses a spatial predicate function to test a more specific spatial condition. For more information on queying with spatial predicates see Section 5.2.

See also the [PostGIS Workshop section on spatial indexes](#), and the [PostgreSQL manual](#).

4.9.1 Indices GiST

GiST stands for "Generalized Search Tree" and is a generic form of indexing for multi-dimensional data. PostGIS uses an R-Tree index implemented on top of GiST to index spatial data. GiST is the most commonly-used and versatile spatial index method, and offers very good query performance. Other implementations of GiST are used to speed up searches on all kinds of irregular data structures (integer arrays, spectral data, etc) which are not amenable to normal B-Tree indexing. For more information see the [PostgreSQL manual](#).

Once a spatial data table exceeds a few thousand rows, you will want to build an index to speed up spatial searches of the data (unless all your searches are based on attributes, in which case you'll want to build a normal index on the attribute fields).

La sintaxis para la creación de un índice GiST en una columna "geometry" es como sigue:

```
CREATE INDEX [indexname] ON [tablename] USING GIST ( [geometryfield] );
```

The above syntax will always build a 2D-index. To get the an n-dimensional index for the geometry type, you can create one using this syntax:

```
CREATE INDEX [indexname] ON [tablename] USING GIST ([geometryfield] gist_geometry_ops_nd);
```

Building a spatial index is a computationally intensive exercise. It also blocks write access to your table for the time it creates, so on a production system you may want to do in in a slower CONCURRENTLY-aware way:

```
CREATE INDEX CONCURRENTLY [indexname] ON [tablename] USING GIST ( [geometryfield] );
```

After building an index, it is sometimes helpful to force PostgreSQL to collect table statistics, which are used to optimize query plans:

```
VACUUM ANALYZE [table_name] [(column_name)];
```

4.9.2 BRIN Indexes

BRIN stands for "Block Range Index". It is a general-purpose index method introduced in PostgreSQL 9.5. BRIN is a *lossy* index method, meaning that a secondary check is required to confirm that a record matches a given search condition (which is the case for all provided spatial indexes). It provides much faster index creation and much smaller index size, with reasonable read performance. Its primary purpose is to support indexing very large tables on columns which have a correlation with their physical location within the table. In addition to spatial indexing, BRIN can speed up searches on various kinds of attribute data structures (integer, arrays etc). For more information see the [PostgreSQL manual](#).

Once a spatial table exceeds a few thousand rows, you will want to build an index to speed up spatial searches of the data. GiST indexes are very performant as long as their size doesn't exceed the amount of RAM available for the database, and as long as you can afford the index storage size, and the cost of index update on write. Otherwise, for very large tables BRIN index can be considered as an alternative.

A BRIN index stores the bounding box enclosing all the geometries contained in the rows in a contiguous set of table blocks, called a *block range*. When executing a query using the index the block ranges are scanned to find the ones that intersect the query extent. This is efficient only if the data is physically ordered so that the bounding boxes for block ranges have minimal overlap (and ideally are mutually exclusive). The resulting index is very small in size, but is typically less performant for read than a GiST index over the same data.

Building a BRIN index is much less CPU-intensive than building a GiST index. It's common to find that a BRIN index is ten times faster to build than a GiST index over the same data. And because a BRIN index stores only one bounding box for each range of table blocks, it's common to use up to a thousand times less disk space than a GiST index.

You can choose the number of blocks to summarize in a range. If you decrease this number, the index will be bigger but will probably provide better performance.

For BRIN to be effective, the table data should be stored in a physical order which minimizes the amount of block extent overlap. It may be that the data is already sorted appropriately (for instance, if it is loaded from another dataset that is already sorted in spatial order). Otherwise, this can be accomplished by sorting the data by a one-dimensional spatial key. One way to do this is to create a new table sorted by the geometry values (which in recent PostGIS versions uses an efficient Hilbert curve ordering):

```
CREATE TABLE table_sorted AS
SELECT * FROM table ORDER BY geom;
```

Alternatively, data can be sorted in-place by using a GeoHash as a (temporary) index, and clustering on that index:

```
CREATE INDEX idx_temp_geohash ON table
USING btree (ST_GeoHash( ST_Transform( geom, 4326 ), 20));
CLUSTER table USING idx_temp_geohash;
```

The syntax for building a BRIN index on a geometry column is:

```
CREATE INDEX [indexname] ON [tablename] USING BRIN ( [geome_col] );
```

The above syntax builds a 2D index. To build a 3D-dimensional index, use this syntax:

```
CREATE INDEX [indexname] ON [tablename]
USING BRIN ([geome_col] brin_geometry_inclusion_ops_3d);
```

You can also get a 4D-dimensional index using the 4D operator class:

```
CREATE INDEX [indexname] ON [tablename]
USING BRIN ([geome_col] brin_geometry_inclusion_ops_4d);
```

The above commands use the default number of blocks in a range, which is 128. To specify the number of blocks to summarise in a range, use this syntax

```
CREATE INDEX [indexname] ON [tablename]
USING BRIN ( [geome_col] ) WITH (pages_per_range = [number]);
```

Keep in mind that a BRIN index only stores one index entry for a large number of rows. If your table stores geometries with a mixed number of dimensions, it's likely that the resulting index will have poor performance. You can avoid this performance penalty by choosing the operator class with the least number of dimensions of the stored geometries

The geography datatype is supported for BRIN indexing. The syntax for building a BRIN index on a geography column is:

```
CREATE INDEX [indexname] ON [tablename] USING BRIN ( [geog_col] );
```

The above syntax builds a 2D-index for geospatial objects on the spheroid.

Currently, only "inclusion support" is provided, meaning that just the `&&`, `~` and `@` operators can be used for the 2D cases (for both geometry and geography), and just the `&&&` operator for 3D geometries. There is currently no support for kNN searches.

An important difference between BRIN and other index types is that the database does not maintain the index dynamically. Changes to spatial data in the table are simply appended to the end of the index. This will cause index search performance to degrade over time. The index can be updated by performing a `VACUUM`, or by using a special function `brin_summarize_new_values`. For this reason BRIN may be most appropriate for use with data that is read-only, or only rarely changing. For more information refer to the [manual](#).

To summarize using BRIN for spatial data:

- Index build time is very fast, and index size is very small.
- Index query time is slower than GiST, but can still be very acceptable.
- Requires table data to be sorted in a spatial ordering.
- Requires manual index maintenance.
- Most appropriate for very large tables, with low or no overlap (e.g. points), which are static or change infrequently.
- More effective for queries which return relatively large numbers of data records.

4.9.3 SP-GiST Indexes

SP-GiST stands for "Space-Partitioned Generalized Search Tree" and is a generic form of indexing for multi-dimensional data types that supports partitioned search trees, such as quad-trees, k-d trees, and radix trees (tries). The common feature of these data structures is that they repeatedly divide the search space into partitions that need not be of equal size. In addition to spatial indexing, SP-GiST is used to speed up searches on many kinds of data, such as phone routing, ip routing, substring search, etc. For more information see the [PostgreSQL manual](#).

As it is the case for GiST indexes, SP-GiST indexes are lossy, in the sense that they store the bounding box enclosing spatial objects. SP-GiST indexes can be considered as an alternative to GiST indexes.

Once a GIS data table exceeds a few thousand rows, an SP-GiST index may be used to speed up spatial searches of the data. The syntax for building an SP-GiST index on a "geometry" column is as follows:

```
CREATE INDEX [indexname] ON [tablename] USING SPGIST ( [geometryfield] );
```

The above syntax will build a 2-dimensional index. A 3-dimensional index for the geometry type can be created using the 3D operator class:

```
CREATE INDEX [indexname] ON [tablename] USING SPGIST ([geometryfield] ↔
    spgist_geometry_ops_3d);
```

Building a spatial index is a computationally intensive operation. It also blocks write access to your table for the time it creates, so on a production system you may want to do in a slower CONCURRENTLY-aware way:

```
CREATE INDEX CONCURRENTLY [indexname] ON [tablename] USING SPGIST ( [geometryfield] );
```

After building an index, it is sometimes helpful to force PostgreSQL to collect table statistics, which are used to optimize query plans:

```
VACUUM ANALYZE [table_name] [(column_name)];
```

An SP-GiST index can accelerate queries involving the following operators:

- `<<`, `&<`, `&>`, `>>`, `<<|`, `&<|`, `|&>`, `|>>`, `&&`, `@>`, `<@`, and `~=`, for 2-dimensional indexes,
- `&/&`, `~==`, `@>>`, and `<<@`, for 3-dimensional indexes.

There is no support for kNN searches at the moment.

4.9.4 Tuning Index Usage

Ordinarily, indexes invisibly speed up data access: once an index is built, the PostgreSQL query planner automatically decides when to use it to improve query performance. But there are some situations where the planner does not choose to use existing indexes, so queries end up using slow sequential scans instead of a spatial index.

If you find your spatial indexes are not being used, there are a few things you can do:

- Examine the query plan and check your query actually computes the thing you need. An erroneous JOIN, either forgotten or to the wrong table, can unexpectedly retrieve table records multiple times. To get the query plan, execute with `EXPLAIN` in front of the query.
- Make sure statistics are gathered about the number and distributions of values in a table, to provide the query planner with better information to make decisions around index usage. `VACUUM ANALYZE` will compute both.

You should regularly vacuum your databases anyways. Many PostgreSQL DBAs run `VACUUM` as an off-peak cron job on a regular basis.

- If vacuuming does not help, you can temporarily force the planner to use the index information by using the command `SET ENABLE_SEQSCAN TO OFF;`. This way you can check whether the planner is at all able to generate an index-accelerated query plan for your query. You should only use this command for debugging; generally speaking, the planner knows better than you do about when to use indexes. Once you have run your query, do not forget to run `SET ENABLE_SEQSCAN TO ON;` so that the planner will operate normally for other queries.
- If `SET ENABLE_SEQSCAN TO OFF;` helps your query to run faster, your Postgres is likely not tuned for your hardware. If you find the planner wrong about the cost of sequential versus index scans try reducing the value of `RANDOM_PAGE_COST` in `postgresql.conf`, or use `SET RANDOM_PAGE_COST TO 1.1;`. The default value for `RANDOM_PAGE_COST` is 4.0. Try setting it to 1.1 (for SSD) or 2.0 (for fast magnetic disks). Decreasing the value makes the planner more likely to use index scans.
- If `SET ENABLE_SEQSCAN TO OFF;` does not help your query, the query may be using a SQL construct that the Postgres planner is not yet able to optimize. It may be possible to rewrite the query in a way that the planner is able to handle. For example, a subquery with an inline SELECT may not produce an efficient plan, but could possibly be rewritten using a LATERAL JOIN.

For more information see the Postgres manual section on [Query Planning](#).

Chapter 5

Consulta Espacial

The *raison d'être* of spatial databases is to perform queries inside the database which would ordinarily require desktop GIS functionality. Using PostGIS effectively requires knowing what spatial functions are available, how to use them in queries, and ensuring that appropriate indexes are in place to provide good performance.

5.1 Determining Spatial Relationships

Spatial relationships indicate how two geometries interact with one another. They are a fundamental capability for querying geometry.

5.1.1 Dimensionally Extended 9-Intersection Model

According to the [OpenGIS Simple Features Implementation Specification for SQL](#), "the basic approach to comparing two geometries is to make pair-wise tests of the intersections between the Interiors, Boundaries and Exteriors of the two geometries and to classify the relationship between the two geometries based on the entries in the resulting 'intersection' matrix."

In the theory of point-set topology, the points in a geometry embedded in 2-dimensional space are categorized into three sets:

Boundary

The boundary of a geometry is the set of geometries of the next lower dimension. For POINTs, which have a dimension of 0, the boundary is the empty set. The boundary of a LINESTRING is the two endpoints. For POLYGONS, the boundary is the linework of the exterior and interior rings.

Interior

The interior of a geometry are those points of a geometry that are not in the boundary. For POINTs, the interior is the point itself. The interior of a LINESTRING is the set of points between the endpoints. For POLYGONS, the interior is the areal surface inside the polygon.

Exterior

The exterior of a geometry is the rest of the space in which the geometry is embedded; in other words, all points not in the interior or on the boundary of the geometry. It is a 2-dimensional non-closed surface.

The [Dimensionally Extended 9-Intersection Model](#) (DE-9IM) describes the spatial relationship between two geometries by specifying the dimensions of the 9 intersections between the above sets for each geometry. The intersection dimensions can be formally represented in a 3x3 **intersection matrix**.

For a geometry g the *Interior*, *Boundary*, and *Exterior* are denoted using the notation $I(g)$, $B(g)$, and $E(g)$. Also, $dim(s)$ denotes the dimension of a set s with the domain of $\{0, 1, 2, F\}$:

- 0 => point

- 1 => line
- 2 => area
- F => empty set

Using this notation, the intersection matrix for two geometries *a* and *b* is:

	Interior	Boundary	Exterior
Interior	$\dim(I(a) \cap I(b))$	$\dim(I(a) \cap B(b))$	$\dim(I(a) \cap E(b))$
Boundary	$\dim(B(a) \cap I(b))$	$\dim(B(a) \cap B(b))$	$\dim(B(a) \cap E(b))$
Exterior	$\dim(E(a) \cap I(b))$	$\dim(E(a) \cap B(b))$	$\dim(E(a) \cap E(b))$

Visually, for two overlapping polygonal geometries, this looks like:





	Interior	Boundary	Exterior
Interior	 $\dim(I(a) \cap I(b)) = 2$	 $\dim(I(a) \cap B(b)) = 1$	 $\dim(I(a) \cap E(b)) = 2$
Boundary	 $\dim(B(a) \cap I(b)) = 1$	 $\dim(B(a) \cap B(b)) = 0$	 $\dim(B(a) \cap E(b)) = 1$
Exterior	 $\dim(E(a) \cap I(b)) = 2$	 $\dim(E(a) \cap B(b)) = 1$	 $\dim(E(a) \cap E(b)) = 2$

Reading from left to right and top to bottom, the intersection matrix is represented as the text string '212101212'.

For more information, refer to:

- [OpenGIS Simple Features Implementation Specification for SQL](#) (version 1.1, section 2.1.13.2)
- [Wikipedia: Dimensionally Extended Nine-Intersection Model \(DE-9IM\)](#)
- [GeoTools: Point Set Theory and the DE-9IM Matrix](#)

5.1.2 Named Spatial Relationships

To make it easy to determine common spatial relationships, the OGC SFS defines a set of *named spatial relationship predicates*. PostGIS provides these as the functions `ST_Contains`, `ST_Crosses`, `ST_Disjoint`, `ST_Equals`, `ST_Intersects`, `ST_Overlaps`, `ST_Touches`, `ST_Within`. It also defines the non-standard relationship predicates `ST_Covers`, `ST_CoveredBy`, and `ST_ContainsProperly`.

Spatial predicates are usually used as conditions in SQL `WHERE` or `JOIN` clauses. The named spatial predicates automatically use a spatial index if one is available, so there is no need to use the bounding box operator `&&` as well. For example:

```
SELECT city.name, state.name, city.geom
FROM city JOIN state ON ST_Intersects(city.geom, state.geom);
```

For more details and illustrations, see the [PostGIS Workshop](#).

5.1.3 General Spatial Relationships

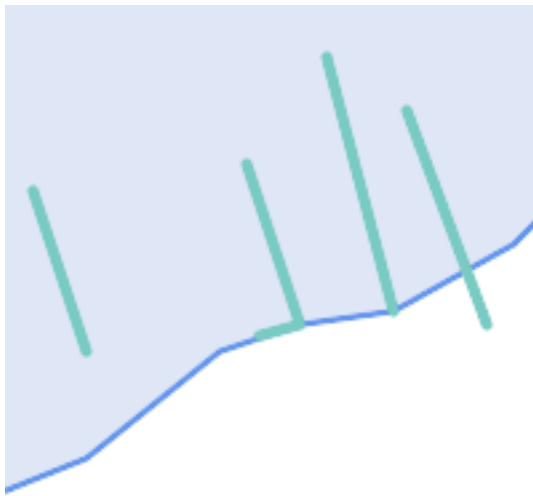
In some cases the named spatial relationships are insufficient to provide a desired spatial filter condition.



For example, consider a linear dataset representing a road network. It may be required to identify all road segments that cross each other, not at a point, but in a line (perhaps to validate some business rule). In this case `ST_Crosses` does not provide the necessary spatial filter, since for linear features it returns `true` only where they cross at a point.

A two-step solution would be to first compute the actual intersection (`ST_Intersection`) of pairs of road lines that spatially intersect (`ST_Intersects`), and then check if the intersection's `ST_GeometryType` is 'LINESTRING' (properly dealing with cases that return `GEOMETRYCOLLECTIONS` of `[MULTI] POINTs`, `[MULTI] LINESTRINGs`, etc.).

Clearly, a simpler and faster solution is desirable.



A second example is locating wharves that intersect a lake's boundary on a line and where one end of the wharf is up on shore. In other words, where a wharf is within but not completely contained by a lake, intersects the boundary of a lake on a line, and where exactly one of the wharf's endpoints is within or on the boundary of the lake. It is possible to use a combination of spatial predicates to find the required features:

- `ST_Contains(lake, wharf) = TRUE`
 - `ST_ContainsProperly(lake, wharf) = FALSE`
 - `ST_GeometryType(ST_Intersection(wharf, lake)) = 'LINESTRING'`
 - `ST_NumGeometries(ST_Multi(ST_Intersection(ST_Boundary(wharf), ST_Boundary(lake)))) = 1`
- ... but needless to say, this is quite complicated.

These requirements can be met by computing the full DE-9IM intersection matrix. PostGIS provides the `ST_Relate` function to do this:

```
SELECT ST_Relate( 'LINESTRING (1 1, 5 5)',
                  'POLYGON ((3 3, 3 7, 7 7, 7 3, 3 3))' );
st_relate
-----
1010F0212
```

To test a particular spatial relationship, an **intersection matrix pattern** is used. This is the matrix representation augmented with the additional symbols {T, *}:

- T => intersection dimension is non-empty; i.e. is in {0, 1, 2}
- * => don't care

Using intersection matrix patterns, specific spatial relationships can be evaluated in a more succinct way. The `ST_Relate` and the `ST_RelateMatch` functions can be used to test intersection matrix patterns. For the first example above, the intersection matrix pattern specifying two lines intersecting in a line is `'1*1***1**'`:

```
-- Find road segments that intersect in a line
SELECT a.id
FROM roads a, roads b
WHERE a.id != b.id
      AND a.geom && b.geom
      AND ST_Relate(a.geom, b.geom, '1*1***1**');
```

For the second example, the intersection matrix pattern specifying a line partly inside and partly outside a polygon is **'102101FF2'**:

```
-- Find wharves partly on a lake's shoreline
SELECT a.lake_id, b.wharf_id
FROM lakes a, wharfs b
WHERE a.geom && b.geom
      AND ST_Relate(a.geom, b.geom, '102101FF2');
```

5.2 Using Spatial Indexes

When constructing queries using spatial conditions, for best performance it is important to ensure that a spatial index is used, if one exists (see Section 4.9). To do this, a spatial operator or index-aware function must be used in a `WHERE` or `ON` clause of the query.

Spatial operators include the bounding box operators (of which the most commonly used is `&&`; see Section 8.10.1 for the full list) and the distance operators used in nearest-neighbor queries (the most common being `<->`; see Section 8.10.2 for the full list.)

Index-aware functions automatically add a bounding box operator to the spatial condition. Index-aware functions include the named spatial relationship predicates `ST_Contains`, `ST_ContainsProperly`, `ST_CoveredBy`, `ST_Covers`, `ST_Crosses`, `ST_Intersects`, `ST_Overlaps`, `ST_Touches`, `ST_Within`, `ST_Within`, and `ST_3DIntersects`, and the distance predicates `ST_DWithin`, `ST_DFullyWithin`, `ST_3DDFullyWithin`, and `ST_3DDWithin`.)

Functions such as `ST_Distance` do *not* use indexes to optimize their operation. For example, the following query would be quite slow on a large table:

```
SELECT geom
FROM geom_table
WHERE ST_Distance( geom, 'SRID=312;POINT(100000 200000)' ) < 100
```

This query selects all the geometries in `geom_table` which are within 100 units of the point (100000, 200000). It will be slow because it is calculating the distance between each point in the table and the specified point, ie. one `ST_Distance()` calculation is computed for **every** row in the table.

The number of rows processed can be reduced substantially by using the index-aware function `ST_DWithin`:

```
SELECT geom
FROM geom_table
WHERE ST_DWithin( geom, 'SRID=312;POINT(100000 200000)', 100 )
```

This query selects the same geometries, but it does it in a more efficient way. This is enabled by `ST_DWithin()` using the `&&` operator internally on an expanded bounding box of the query geometry. If there is a spatial index on `geom`, the query planner will recognize that it can use the index to reduce the number of rows scanned before calculating the distance. The spatial index allows retrieving only records with geometries whose bounding boxes overlap the expanded extent and hence which *might* be within the required distance. The actual distance is then computed to confirm whether to include the record in the result set.

For more information and examples see the [PostGIS Workshop](#).

5.3 Examples of Spatial SQL

The examples in this section make use of a table of linear roads, and a table of polygonal municipality boundaries. The definition of the `bc_roads` table is:

Column	Type	Description
gid	integer	Unique ID
name	character varying	Road Name
geom	geometry	Location Geometry (Linestring)

The definition of the `bc_municipality` table is:

Column	Type	Description
gid	integer	Unique ID
code	integer	Unique ID
name	character varying	City / Town Name
geom	geometry	Location Geometry (Polygon)

1. *What is the total length of all roads, expressed in kilometers?*

You can answer this question with a very simple piece of SQL:

```
SELECT sum(ST_Length(geom))/1000 AS km_roads FROM bc_roads;

km_roads
-----
70842.1243039643
```

2. *How large is the city of Prince George, in hectares?*

This query combines an attribute condition (on the municipality name) with a spatial calculation (of the polygon area):

```
SELECT
  ST_Area(geom)/10000 AS hectares
FROM bc_municipality
WHERE name = 'PRINCE GEORGE';

hectares
-----
32657.9103824927
```

3. *What is the largest municipality in the province, by area?*

This query uses a spatial measurement as an ordering value. There are several ways of approaching this problem, but the most efficient is below:

```
SELECT
  name,
  ST_Area(geom)/10000 AS hectares
FROM bc_municipality
ORDER BY hectares DESC
LIMIT 1;

name          | hectares
-----+-----
TUMBLER RIDGE | 155020.02556131
```

Note that in order to answer this query we have to calculate the area of every polygon. If we were doing this a lot it would make sense to add an area column to the table that could be indexed for performance. By ordering the results in a descending direction, and then using the PostgreSQL "LIMIT" command we can easily select just the largest value without using an aggregate function like `MAX()`.

4. *What is the length of roads fully contained within each municipality?*

This is an example of a "spatial join", which brings together data from two tables (with a join) using a spatial interaction ("contained") as the join condition (rather than the usual relational approach of joining on a common key):

```
SELECT
  m.name,
  sum(ST_Length(r.geom))/1000 as roads_km
FROM bc_roads AS r
JOIN bc_municipality AS m
```



```

    ON ST_Contains(m.geom, r.geom)
GROUP BY m.name
ORDER BY roads_km;

name | roads_km
-----+-----
SURREY | 1539.47553551242
VANCOUVER | 1450.33093486576
LANGLEY DISTRICT | 833.793392535662
BURNABY | 773.769091404338
PRINCE GEORGE | 694.37554369147
...
```

This query takes a while, because every road in the table is summarized into the final result (about 250K roads for the example table). For smaller datasets (several thousand records on several hundred) the response can be very fast.

5. *Create a new table with all the roads within the city of Prince George.*

This is an example of an "overlay", which takes in two tables and outputs a new table that consists of spatially clipped or cut resultants. Unlike the "spatial join" demonstrated above, this query creates new geometries. An overlay is like a turbo-charged spatial join, and is useful for more exact analysis work:

```

CREATE TABLE pg_roads as
SELECT
    ST_Intersection(r.geom, m.geom) AS intersection_geom,
    ST_Length(r.geom) AS rd_orig_length,
    r.*
FROM bc_roads AS r
JOIN bc_municipality AS m
    ON ST_Intersects(r.geom, m.geom)
WHERE
    m.name = 'PRINCE GEORGE';
```

6. *What is the length in kilometers of "Douglas St" in Victoria?*

```

SELECT
    sum(ST_Length(r.geom))/1000 AS kilometers
FROM bc_roads r
JOIN bc_municipality m
    ON ST_Intersects(m.geom, r.geom)
WHERE
    r.name = 'Douglas St'
    AND m.name = 'VICTORIA';

kilometers
-----
4.89151904172838
```

7. *What is the largest municipality polygon that has a hole?*

```

SELECT gid, name, ST_Area(geom) AS area
FROM bc_municipality
WHERE ST_NRings(geom) > 1
ORDER BY area DESC LIMIT 1;

gid | name | area
-----+-----+-----
12 | SPALLUMCHEEN | 257374619.430216
```

Chapter 6

Consejos de rendimiento

6.1 Tablas pequeñas de geometrías grandes

6.1.1 Descripción del problema

Versiones actuales de PostgreSQL (incluyendo la 8.0) tienen algunas debilidades en la optimización de consultas respecto a tablas TOAST. Las tablas TOAST son una especie de "cámara de extensiones" utilizadas para almacenar valores grandes (en sentido de tamaño de datos) que no se pueden mostrar en páginas de datos (como textos largos, imágenes o geometrías complejas con muchos vértices). Para mas información visita [the PostgreSQL Documentation for TOAST](#)

El problema aparece si ocurre que tienes una tabla con geometrías bastante grandes, pero no demasiadas filas de ellas (como una tabla que contiene los límites de todos los países europeos en alta resolución). A continuación, la tabla en sí es pequeña, pero utiliza una gran cantidad de espacio TOAST. En nuestro caso de ejemplo, la tabla en sí tenía alrededor de 80 filas y se utiliza sólo 3 páginas de datos, pero la tabla TOAST utiliza 8225 páginas.

Ahora al emitir una consulta en la que utilizas el operador geométrico `&&` para buscar un límite que coincide sólo unas pocas de esas filas, el optimizador de consultas ve que la tabla sólo tiene 3 páginas y 80 filas. Se estima que un escaneo secuencial en una tabla pequeña de este tipo es mucho más rápida que usando un índice. Y por lo que decide ignorar el índice de GIST. Por lo general, esta estimación es correcta. Pero en nuestro caso, el operador `&&` tiene que buscar en cada geometría del disco la comparación de los límites, y leer todas las páginas TOAST también.

Para comprobar si padeces de este error, utiliza el comando "EXPLAIN ANALYZE" postgresql. Para obtener más información y los detalles técnicos, puedes leer el hilo en la lista de correo de rendimiento postgres: <http://archives.postgresql.org/pgsql-performance/2005-02/msg00030.php>

and newer thread on PostGIS <https://lists.osgeo.org/pipermail/postgis-devel/2017-June/026209.html>

6.1.2 Soluciones provisionales

La gente de PostgreSQL esta intentando resolver este problema haciendo la estimación de la consulta compatible con TOAST. Por el momento, aquí van dos soluciones provisionales:

La primera consiste en forzar la consulta a utilizar índices. Envía "SET enable_seqscan TO off;" al servidor antes de ejecutar la consulta. Esto, básicamente fuerza al planificador de consultas a evitar exploraciones secuenciales siempre que sea posible. Por lo tanto, utiliza el índice GIST como de costumbre. Pero este comando debe ser establecido en cada conexión, y hace que el planeador de consultas cometa errores de estimación en otros casos, por lo que debes enviar al servidor "SET enable_seqscan TO on;" después de la consulta.

La segunda solución es hacer el escaneo secuencia tan rápido como el planificador de consultas cree. Esto, se puede lograr creando una consulta que "cachee" los límites o bbox, y hacer coincidir en contra de esta. En nuestro ejemplo, los comandos son:

```
SELECT AddGeometryColumn('myschema','mytable','bbox','4326','GEOMETRY','2');
UPDATE mytable SET bbox = ST_Envelope(ST_Force_2d(the_geom));
```

Ahora cambia tu consulta para utilizar el operador espacial `&&` con `bbox` en vez de `geom_column`, así:

```
SELECT geom_column
FROM mytable
WHERE bbox && ST_SetSRID('BOX3D(0 0,1 1)::box3d,4326);
```

Por supuesto, si añades o cambias filas de "mutable", tienes que mantener el campo `bbox` sincronizado. La forma mas transparente de hacerlo son los triggers o funciones disparadoras, pero también puedes modificar tu aplicación para mantener la columna `bbox` o ejecutar la consulta `UPDATE` siguiente después de cada modificación.

6.2 CLUSTERing o índices geométricos

Para las tablas que en su mayoría son de sólo lectura, y donde se utiliza un índice único para la mayoría de las consultas, PostgreSQL ofrece el comando `CLUSTER`. Este comando reordena físicamente todas las filas de datos en el mismo orden que los criterios de índice, dando dos ventajas de rendimiento: En primer lugar, para los recorridos de intervalo del índice, el número de búsquedas en la tabla de datos se reduce drásticamente. En segundo lugar, si el conjunto de trabajo se concentra en algunos intervalos pequeños en los índices, tienes un caché más eficiente porque las filas de datos se distribuyen a lo largo de un menor número de páginas de datos. (Te invitamos a leer la documentación de comandos `CLUSTER` del manual de PostgreSQL sobre este tema.)

De todas formas, PostgreSQL no permite el "clustering" en índices GiST de PostGIS por que los índices GiST simplemente ignoran los valores `NULL`, tendrás el siguiente mensaje de error:

```
lwgeom=# CLUSTER my_geom_index ON my_table;
ERROR: cannot cluster when index access method does not handle null values
HINT: You may be able to work around this by marking column "the_geom" NOT NULL.
```

Como sugiere el mensaje de ayuda, podemos evitar esta deficiencia añadiendo una restricción "not null" a la tabla:

```
lwgeom=# ALTER TABLE my_table ALTER COLUMN the_geom SET not null;
ALTER TABLE
```

Por supuesto, esto no funcionará si necesitas valores `NULL` en tu columna de geometrías. Adicionalmente, debes utilizar el método anterior para añadir la restricción, utilizando restricciones `CHECK` como "ALTER TABLE blubb ADD CHECK (geómetra is not nulo);" no funcionara.

6.3 Evitar la conversión de dimensión

A veces, sucede que tienes datos en 3D o 4D en tus tablas pero siempre, al acceder a ella utilizando funciones conformes con OpenGIS como `ST_AsText()` o `ST_AsBinary()`, sólo devuelven geometrías 2D de salida. Esto ocurre por que lo hacen llamando internamente a la función `ST_Force_2d()`, que introduce una sobrecarga significativa para geometrías grandes. Para evitar esta sobrecarga, puede ser factible comprobar la validez de suprimir esas dimensiones adicionales de una vez por todas:

```
UPDATE mytable SET the_geom = ST_Force_2d(the_geom);
VACUUM FULL ANALYZE mytable;
```

Ten en cuenta que si las has añadido a tu columna de geometría utilizando `addGeometryColumn()` habrá una restricción en la dimensión de la geometría. Para pasar la restricción por alto tendrás que quitarla. Recuerda actualizar la entrada en la tabla `geometry_columns` y volver a crear la restricción después.

En el caso de tablas de gran tamaño, puede ser conveniente dividir este `UPDATE` en porciones más pequeñas, restringiendo la actualización de una parte de la tabla a través de una cláusula `WHERE` y su clave primaria o de otros criterios, y la ejecución de un simple "VACUUM"; entre los `UPDATE`. Esto reduce drásticamente la necesidad de espacio de disco temporal. Además, si has mezclado dimensiones de geometrías, que restringen el `UPDATE` con "WHERE dimension(the_geom)>2" salta la reescritura de geometrías que ya están en 2D.

Chapter 7

Usando PostGIS Geometry: Construyendo Aplicaciones

7.1 Usando Mapserver

El Minnesota MapServer es un servidor web de mapas para internet que cumple la especificación OpenGIS Web Mapping Server 'Servidor de Mapas Web'.

- La página principal de MapServer está en <http://mapserver.org>.
- La Especificación de OpenGIS para Mapas Web está en <http://www.opengeospatial.org/standards/wms>.

7.1.1 Uso Básico

Para utilizar PostGIS con MapServer necesitará saber como configurar MapServer, lo cual está fuera del alcance de esta documentación. Esta sección cubrirá cuestiones específicas de PostGIS y detalles de su configuración.

Para usar PostGIS con MapServer, necesitará:

- La versión 0.6 o posterior de PostGIS.
- La versión 3.5 o posterior de MapServer.

MapServer accede a los datos de PostGIS/PostgreSQL como cualquier otro cliente de PostgreSQL -- usando la interfaz libpq. Esto significa que MapServer puede instalarse en cualquier máquina con acceso de red al servidor PostGIS, y usar PostGIS como una fuente de datos. La conexión entre los sistemas será mejor cuanto más rápida sea ésta.

1. Compile e instale MapServer con las opciones que desee, incluyendo la opción de configuración "--with-postgis".
2. En el fichero de mapas de MapServer agregue una capa PostGIS. Por ejemplo:

```
LAYER
  CONNECTIONTYPE postgis
  NAME "widehighways"
  # Conectar a una base de datos espacial remota
  CONNECTION "user=dbuser dbname=gisdatabase host=bigserver"
  PROCESSING "CLOSE_CONNECTION=DEFER"
  # Obtener las filas de la columna 'geom' de la tabla 'roads'
  DATA "geom from roads using srid=4326 using unique gid"
  STATUS ON
  TYPE LINE
  # De las filas, sólo dibujar las autopistas de 4 o más carriles
```

```

FILTER "type = 'highway' and numlanes >= 4"
CLASS
  # Hacer que las superautopistas sean más brillantes y de 2 pixels de grosor
  EXPRESSION ([numlanes] >= 6)
  STYLE
    COLOR 255 22 22
    WIDTH 2
  END
END
CLASS
  # El resto son más oscuras y de sólo 1 pixel de grosor
  EXPRESSION ([numlanes] < 6)
  STYLE
    COLOR 205 92 82
  END
END
END

```

En el ejemplo de arriba, las directivas específicas de PostGIS son:

CONNECTIONTYPE Para las capas PostGIS, es siempre "postgis".

CONNECTION La conexión a la base de datos se rige por una 'cadena de conexión' que se compone de un conjunto estándar de claves y valores como (con los valores por defecto en <>):

user=<username> password=<password> dbname=<username> hostname=<server> port=<5432>

Cualquier par clave/valor puede omitirse, incluso es válida una cadena de conexión vacía. Como mínimo generalmente se proporcionará el nombre de la base de datos y el del usuario con el que conectarse.

DATA Este parámetro toma la forma "<geocolumn> from <tablename> using srid=<srid> using unique <primary key>" donde 'geocolumn' es la columna espacial a representar en el mapa, el 'srid' es el identificador del sistema de referencia utilizado por dicha columna y la 'primary key' es la clave primaria de la tabla (o cualquier otra columna con valores únicos y un índice).

Se pueden omitir las cláusulas "using srid" y "using unique" y MapServer determinará automáticamente los valores correctos si ello es posible, pero al precio de ejecutar unas pocas consultas extra al servidor cada vez que se dibuje el mapa.

PROCESSING Si tenemos múltiples capas, el poner CLOSE_CONNECTION=DEFER hace que se reutilicen conexiones existentes en vez de cerrarlas. Esto mejora la velocidad. Para una explicación más detallada se puede consultar [MapServer PostGIS Performance Tips](#).

FILTER El filtro debe ser una cadena SQL correcta que corresponda a lo que sigue habitualmente a la palabra clave "WHERE" en una consulta SQL. Así que, por ejemplo, para representar solamente carreteras con 6 o más carriles usaremos un filtro con "num_lanes >= 6".

3. Asegúrese de haber generado índices espaciales (GIST) en su base de datos espacial para cualquiera de las capas a ser dibujadas.

```
CREATE INDEX [nombreindice] ON [nombretabla] USING GIST ( [columnageometria] );
```

4. Si va a hacer consultas de las capas usando MapServer necesitará también usar la cláusula "using unique" en el enunciado DATA.

MapServer requiere identificadores únicos para cada registro espacial cuando realiza las consultas, y el módulo PostGIS de MapServer utiliza el valor único especificado para proporcionar esos identificadores únicos. La mejor práctica es el uso de la clave primaria.

7.1.2 Preguntas frecuentes

1. Cuando uso una *EXPRESSION* en mi fichero de mapas, la condición nunca se devuelve como verdadera, aunque sé que los valores existen en mi tabla.

A diferencia de los ficheros 'shape' los nombres de campo en PostGIS tienen que estar referenciados en EXPRESSIONS utilizando *minúsculas*.

```
EXPRESSION ([numlanes] >= 6)
```

2. *El filtro que uso para mis ficheros 'shape' no funciona con mi tabla PostGIS para los mismos datos.*

A diferencia de los ficheros 'shape', los filtros de capas PostGIS usan la sintaxis SQL (se añaden a la instrucción SQL que el conector PostGIS genera para dibujar las capas en MapServer).

```
FILTER "type = 'highway' and numlanes >= 4"
```

3. *Mi capa PostGIS tarda mucho más en dibujarse que mi capa del fichero 'shape'. ¿Es normal?*

En general, cuantos más elementos haya que dibujar en un mapa dado, más probable es que PostGIS sea más lento que los ficheros 'shape'. Para mapas con relativamente pocos elementos (100 ...cientos), PostGIS será seguramente más rápido. Para mapas con una alta densidad de elementos (1000 ...miles), PostGIS será siempre más lento. Si está experimentando sustanciales problemas de ejecución, es posible que no haya generado un índice espacial en su tabla.

```
postgis# CREATE INDEX geotable_gix ON geotable USING GIST ( geocolumn );
postgis# VACUUM ANALYZE;
```

4. *Mi capa PostGIS se dibuja bien, pero las consultas son realmente lentas. ¿Cuál es el problema?*

Para que las consultas sean rápidas, debe tener una clave única para su tabla espacial y un índice sobre esa clave única. Puede especificar qué clave única debe usar MapServer con la cláusula `USING UNIQUE` en la línea `DATA`:

```
DATA "geom FROM geotable USING UNIQUE gid"
```

5. *¿Puedo utilizar las columnas "geography" (nuevas en PostGIS 1.5) como fuente para las capas de MapServer?*

¡Sí! MapServer acepta las columnas 'geography' como si fueran columnas 'geometry', pero si se usa el SRID número 4326. Asegúrese de incluir una cláusula "using srid=4326" en su instrucción `DATA`. Todo funciona igual que con 'geometry'.

```
DATA "geog FROM geogtable USING SRID=4326 USING UNIQUE gid"
```

7.1.3 Uso avanzado

Se usa la cláusula pseudo-SQL `USING` para añadir alguna información que ayude a MapServer a comprender los resultados de consultas más complejas. Más específicamente, cuando se usa bien una vista o una subselección como la tabla origen (lo que está a la derecha de "FROM" en una definición `DATA`) es más difícil para MapServer determinar automáticamente un identificador único para cada fila y también el SRID para la tabla. La cláusula `USING` puede proporcionar a MapServer estas dos piezas de información de la siguiente manera:

```
DATA "geom FROM (
  SELECT
    table1.geom AS geom,
    table1.gid AS gid,
    table2.data AS data
  FROM table1
  LEFT JOIN table2
  ON table1.id = table2.id
) AS new_table USING UNIQUE gid USING SRID=4326"
```

USING UNIQUE <uniqueid> MapServer requiere un identificador único para poder identificar la fila cuando se hacen consultas al mapa. Normalmente identifica la clave primaria de las tablas del sistema. Sin embargo, vistas y subconsultas no tienen automáticamente una columna única conocida. Si quiere usar la funcionalidad de consultas de MapServer debe asegurarse de que la vista o subconsulta incluye una columna de valores únicos, y declararla con `USING UNIQUE`. Por ejemplo, podría seleccionar explícitamente valores de la clave primaria de la tabla para este propósito, o cualquier otra columna que garantice ser única para el conjunto de resultados.

**Note**

"Consultar un mapa" es la acción de hacer click sobre un mapa para obtener información acerca de los elementos del mapa en esa posición. No confundir con "consultas al mapa" con la petición SQL en una definición DATA.

USING SRID=<srid> PostGIS necesita saber qué sistema de referencia espacial están usando las geometrías para poder devolver los datos correctos a MapServer. Normalmente es posible encontrar esta información en la tabla 'geometry_columns' de la base de datos PostGIS, sin embargo esto no es posible con tablas que se crean al vuelo tal como subconsultas y vistas. Así que la opción **USING SRID=** permite indicar el SRID correcto en la definición DATA.

7.1.4 Ejemplos

Comencemos con un ejemplo sencillo. Consideremos la siguiente definición de capa en MapServer:

```
LAYER
  CONNECTIONTYPE postgis
  NAME "roads"
  CONNECTION "user=theuser password=thepass dbname=thedb host=theserver"
  DATA "geom from roads"
  STATUS ON
  TYPE LINE
  CLASS
    STYLE
      COLOR 0 0 0
    END
  END
END
```

Esta capa visualizará todas las geometrías de carreteras de la tabla carreteras 'roads' como líneas negras.

Ahora, digamos que queremos mostrar sólo las autopistas cuando hagamos un zoom al menos de una escala 1:100000. Las siguientes dos capas conseguirán este efecto:

```
LAYER
  CONNECTIONTYPE postgis
  CONNECTION "user=theuser password=thepass dbname=thedb host=theserver"
  PROCESSING "CLOSE_CONNECTION=DEFER"
  DATA "geom from roads"
  MINSCALE 100000
  STATUS ON
  TYPE LINE
  FILTER "road_type = 'highway'"
  CLASS
    COLOR 0 0 0
  END
END

LAYER
  CONNECTIONTYPE postgis
  CONNECTION "user=theuser password=thepass dbname=thedb host=theserver"
  PROCESSING "CLOSE_CONNECTION=DEFER"
  DATA "geom from roads"
  MAXSCALE 100000
  STATUS ON
  TYPE LINE
  CLASSITEM road_type
  CLASS
    EXPRESSION "highway"
    STYLE
      WIDTH 2
      COLOR 255 0 0
    END
  END
```

```

    END
  END
  CLASS
    STYLE
      COLOR 0 0 0
    END
  END
END

```

La primera capa se usa cuando la escala es superior a 1:100000 y muestra sólo las carreteras de tipo "highway" como líneas negras. La opción `FILTER` hace que sólo se visualicen las carreteras de tipo "highway".

La segunda capa se usa cuando la escala es menor de 1:100000 y mostrará las autopistas como líneas rojas de doble grueso, y las otras carreteras como líneas negras de grosor normal.

Así que, hemos hecho un par de cosas interesantes usando sólo la funcionalidad de MapServer, pero nuestra sentencia `SQL DATA` ha seguido siendo sencilla. Supongamos que el nombre de las carreteras está almacenado en otra tabla (por la razón que sea) y necesitamos hacer una unión (join) para obtenerlo y etiquetar nuestras carreteras.

```

LAYER
  CONNECTIONTYPE postgis
  CONNECTION "user=theuser password=thepass dbname=thedb host=theserver"
  DATA "geom FROM (SELECT roads.gid AS gid, roads.geom AS geom,
    road_names.name as name FROM roads LEFT JOIN road_names ON
    roads.road_name_id = road_names.road_name_id)
    AS named_roads USING UNIQUE gid USING SRID=4326"
  MAXSCALE 20000
  STATUS ON
  TYPE ANNOTATION
  LABELITEM name
  CLASS
    LABEL
      ANGLE auto
      SIZE 8
      COLOR 0 192 0
      TYPE truetype
      FONT arial
    END
  END
END

```

Esta capa de anotaciones añade etiquetas verdes a todas las carreteras cuando la escala baje a 1:20000 o menos. También demuestra como usar una unión (join) SQL en una definición `DATA`.

7.2 Clientes Java (JDBC)

Los clientes java pueden acceder a los objetos 'geometry' de PostGIS en la base de datos PostgreSQL bien directamente como representaciones en texto o usando los objetos de extensión JDBC incluidos con PostGIS. Para poder usar los objetos de extensión, el fichero "postgis.jar" debe estar en su `CLASSPATH` así como el paquete controlador JDBC "postgresql.jar".

```

import java.sql.*;
import java.util.*;
import java.lang.*;
import org.postgis.*;

public class JavaGIS {

public static void main(String[] args) {

    java.sql.Connection conn;

```



```

try {
    /*
     * Cargar el controlador JDBC y establecer la conexión.
     */
    Class.forName("org.postgresql.Driver");
    String url = "jdbc:postgresql://localhost:5432/database";
    conn = DriverManager.getConnection(url, "postgres", "");
    /*
     * Agregar los tipos 'geometry' a la conexión. Tenga en cuenta que
     * debe adaptar la conexión a la implementación de la conexión
     * específica pgsq antes de llamar al método addDataType().
     */
    ((org.postgresql.PGConnection)conn).addDataType("geometry", Class.forName("org.postgis. ↵
        PGGeometry"));
    ((org.postgresql.PGConnection)conn).addDataType("box3d", Class.forName("org.postgis. ↵
        PGbox3d"));
    /*
     * Crear una sentencia y ejecutar una consulta 'select'.
     */
    Statement s = conn.createStatement();
    ResultSet r = s.executeQuery("select geom,id from geomtable");
    while( r.next() ) {
        /*
         * Recuperar la geometría como un objeto, luego convertirlo al tipo geometry.
         * Imprimir resultados.
         */
        PGGeometry geom = (PGGeometry)r.getObject(1);
        int id = r.getInt(2);
        System.out.println("Row " + id + ":");
        System.out.println(geom.toString());
    }
    s.close();
    conn.close();
}
catch( Exception e ) {
    e.printStackTrace();
}
}
}

```

El objeto "PGGeometry" es un objeto envoltorio que contiene un objeto geométrico de topología específica (subclase de la clase abstracta "Geometry") dependiendo del tipo: Point, LineString, Polygon, MultiPoint, MultiLineString, MultiPolygon.

```

PGGeometry geom = (PGGeometry)r.getObject(1);
if( geom.getType() == Geometry.POLYGON ) {
    Polygon pl = (Polygon)geom.getGeometry();
    for( int r = 0; r < pl.numRings(); r++ ) {
        LinearRing rng = pl.getRing(r);
        System.out.println("Ring: " + r);
        for( int p = 0; p < rng.numPoints(); p++ ) {
            Point pt = rng.getPoint(p);
            System.out.println("Point: " + p);
            System.out.println(pt.toString());
        }
    }
}
}

```

JavaDoc proporciona una referencia para los objetos extensión para las diferentes funciones de acceso a datos en los objetos geométricos.

7.3 Clientes C (libpq)

...

7.3.1 Cursores de Texto

...

7.3.2 Cursores Binarios

...

Chapter 8

Manual de Referencia PostGIS

Las siguientes funciones son las que probablemente necesite un usuario PostGIS . Existen otras funciones de soporte necesarias para los objetos PostGIS que no se usan por la mayoría de usuarios.



Note
PostGIS ha comenzado una transición de la convención de nomenclatura existente, a una convención SQL-MM-céntrica. Como resultado, la mayoría de las funciones que conoces y adoras han sido renombradas usando el prefijo espacial estándar (ST). Funciones anteriores están todavía disponibles, aunque no se enumeran en este documento donde las funciones actualizadas son equivalentes. Las funciones no st_ no mencionadas en esta documentación están en desuso y se eliminarán en una versión futura de modo que DEJA DE UTILIZARLAS.

8.1 Tipos Geometry/Geography/Box en PostgreSQL PostGIS

8.1.1 box2d

box2d — The type representing a 2-dimensional bounding box.

Descripción

box3d es un tipo de dato espacial usado para representar la caja que contiene una geometría o un grupo de geometrías. ST_3DExtent devuelve un objeto box3d.

The representation contains the values `xmin`, `ymin`, `xmax`, `ymax`. These are the minimum and maximum values of the X and Y extents.

box2d objects have a text representation which looks like `BOX (1 2, 5 6)`.

Comportamiento de la conversión de tipo de dato

Esta sección detalla los cambios de tipo automáticos y explícitos permitidos para este tipo de dato

Convertir a	Comportamiento
box3d	automatic
geometry	automatic

Vea también

Section [15.7](#)

8.1.2 box3d

box3d — The type representing a 3-dimensional bounding box.

Descripción

box3d es un tipo de dato espacial usado para representar la caja que contiene una geometría o un grupo de geometrías. ST_3DExtent devuelve un objeto box3d.

The representation contains the values `xmin`, `ymin`, `zmin`, `xmax`, `ymax`, `zmax`. These are the minimum and maximum values of the X, Y and Z extents.

box3d objects have a text representation which looks like BOX3D (1 2 3,5 6 5).

Comportamiento de la conversión de tipo de dato

Esta sección detalla los cambios de tipo automáticos y explícitos permitidos para este tipo de dato

Convertir a	Comportamiento
box	automatic
box2d	automatic
geometry	automatic

Vea también

Section [15.7](#)

8.1.3 geometry

geometry — geography es un tipo de dato espacial usado para representar una feature en un sistema de coordenadas de Tierra esférica.

Descripción

geometry es un tipo de datos postgis fundamental, usado para representar una feature en un sistema de coordenadas euclidiano.

All spatial operations on geometry use the units of the Spatial Reference System the geometry is in.

Comportamiento de la conversión de tipo de dato

Esta sección detalla los cambios de tipo automáticos y explícitos permitidos para este tipo de dato

Convertir a	Comportamiento
box	automatic
box2d	automatic
box3d	automatic
bytea	automatic
geography	automatic
text	automatic

Vea también

Section 4.1, Section 4.3

8.1.4 geometry_dump

`geometry_dump` — A composite type used to describe the parts of complex geometry.

Descripción

`geometry_dump` is a **composite data type** containing the fields:

- `geom` - a geometry representing a component of the dumped geometry. The geometry type depends on the originating function.
- `path[]` - an integer array that defines the navigation path within the dumped geometry to the `geom` component. The path array is 1-based (i.e. `path[1]` is the first element.)

It is used by the `ST_Dump*` family of functions as an output type to explode a complex geometry into its constituent parts.

Vea también

Section 15.6

8.1.5 geography

`geography` — The type representing spatial features with geodetic (ellipsoidal) coordinate systems.

Descripción

`geography` es un tipo de dato espacial usado para representar una feature en un sistema de coordenadas de Tierra esférica.

Spatial operations on the `geography` type provide more accurate results by taking the ellipsoidal model into account.

Comportamiento de la conversión de tipo de dato

Esta sección detalla los cambios de tipo automáticos y explícitos permitidos para este tipo de dato

Convertir a	Comportamiento
<code>geometry</code>	<code>explicit</code>

Vea también

Section 4.3, Section 4.3

8.2 Funciones de Gestión

8.2.1 AddGeometryColumn

`AddGeometryColumn` — Suprime una columna de geometrías de una tabla espacial.

Synopsis

```
text AddGeometryColumn(varchar table_name, varchar column_name, integer srid, varchar type, integer dimension, boolean use_tpmmod=true);
```

```
text AddGeometryColumn(varchar schema_name, varchar table_name, varchar column_name, integer srid, varchar type, integer dimension, boolean use_tpmmod=true);
```

```
text AddGeometryColumn(varchar catalog_name, varchar schema_name, varchar table_name, varchar column_name, integer srid, varchar type, integer dimension, boolean use_tpmmod=true);
```

Descripción

Añade una columna de geometría a una tabla existente de atributos. `schema_name` es el nombre del esquema de la tabla. `srid` debe ser una referencia de valor entero a una entrada en la tabla `SPATIAL_REF_SYS`. `type` debe ser una cadena que corresponde al tipo de geometría, por ejemplo, 'POLYGON' or 'MULTILINESTRING'. Se lanza un error si no existe el `schemaname` (o no esta visible en el `search_path` actual) o el `SRID`, el tipo de geometría, o la dimensión no son validos.

Note



Cambiado: 2.0.0 Esta función ya no se actualiza desde `geometry_columns` ya que `geometry_columns` es una vista que se lee desde los catálogos del sistema. Por defecto tampoco crea las restricciones, sino que utiliza el modificador de tipo de PostgreSQL. Así que para la construcción de una columna de tipo POINT en wgs84 con esta función ejemplo que hoy es equivalente a: `ALTER TABLE some_table ADD COLUMN geom geometry(Point,4326);`
Cambiado: 2.0.0 Si necesitas el comportamiento antiguo de restricciones, utiliza el valor predeterminado `use_tpmmod`, pero cambiala a `false`.

Note



Cambiado: 2.0.0 Las Vistas ya no pueden ser registradas manualmente en `geometry_columns`, no obstante las vistas se que construyan a partir de geometrías `tpmmod` de las tablas de geometrías y sean utilizadas sin funciones wrapper se registrarán correctamente porque heredan el comportamiento `tpmmod` de su columna de la tabla padre. Las vistas que utilizan funciones de geometría que devuelvan geometrías necesitarán de transformación `cast` a geometrías `tpmmod` para esta columnas de geometrías de la vista y que se registren correctamente en `geometry_columns`. Consulta Section 4.6.3.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Mejorada: 2.0.0 introducción del argumento `use_tpmmod`. El valor predeterminado es crear columnas de geometrías basadas en `tpmmod` en lugar de las basadas en restricciones.

Ejemplos

```
-- Crear esquema para contener datos
CREATE SCHEMA my_schema;
-- Crear una nueva tabla simple PostgreSQL
CREATE TABLE my_schema.my_spatial_table (id serial);

-- La descripción de la tabla muestra una tabla sencilla con una sola columna "id".
postgis=# \d my_schema.my_spatial_table
```

Column	Type	Modifiers
id	serial	

```
id      | integer | not null default nextval('my_schema.my_spatial_table_id_seq'::regclass)

-- Agrega una columna espacial a la tabla
SELECT AddGeometryColumn ('my_schema','my_spatial_table','geom',4326,'POINT',2);

-- Agrega un punto usando el antiguo comportamiento basado en restricciones
SELECT AddGeometryColumn ('my_schema','my_spatial_table','geom_c',4326,'POINT',2, false);

-- Agrega un curvepolygon usando el viejo comportamiento de restricción
SELECT AddGeometryColumn ('my_schema','my_spatial_table','geomcp_c',4326,'CURVEPOLYGON',2, ←
    false);

-- Describe la tabla otra vez revelando la adición de una nueva columna geométrica.
\d my_schema.my_spatial_table
          addgeometrycolumn
-----
my_schema.my_spatial_table.geomcp_c SRID:4326 TYPE:CURVEPOLYGON DIMS:2
(1 row)

Table "my_schema.my_spatial_table"
  Column |          Type          | Modifiers
-----+-----+-----
id       | integer                | not null default nextval('my_schema. ←
my_spatial_table_id_seq'::regclass)
geom     | geometry(Point,4326)   |
geom_c   | geometry               |
geomcp_c | geometry               |
Check constraints:
  "enforce_dims_geom_c" CHECK (st_ndims(geom_c) = 2)
  "enforce_dims_geomcp_c" CHECK (st_ndims(geomcp_c) = 2)
  "enforce_geotype_geom_c" CHECK (geometrytype(geom_c) = 'POINT'::text OR geom_c IS NULL)
  "enforce_geotype_geomcp_c" CHECK (geometrytype(geomcp_c) = 'CURVEPOLYGON'::text OR ←
geomcp_c IS NULL)
  "enforce_srid_geom_c" CHECK (st_srid(geom_c) = 4326)
  "enforce_srid_geomcp_c" CHECK (st_srid(geomcp_c) = 4326)

-- la vista geometry_columns también registra las nuevas columnas --
SELECT f_geometry_column As col_name, type, srid, coord_dimension As ndims
FROM geometry_columns
WHERE f_table_name = 'my_spatial_table' AND f_table_schema = 'my_schema';

col_name |      type      | srid | ndims
-----+-----+-----+-----
geom     | Point          | 4326 | 2
geom_c   | Point          | 4326 | 2
geomcp_c | CurvePolygon   | 4326 | 2
```

También puedes ver

[DropGeometryColumn](#), [DropGeometryTable](#), [Section 4.6.2](#), [Section 4.6.3](#)

8.2.2 DropGeometryColumn

DropGeometryColumn — Suprime una columna de geometrías de una tabla espacial.

Synopsis

```
text DropGeometryColumn(varchar table_name, varchar column_name);
text DropGeometryColumn(varchar schema_name, varchar table_name, varchar column_name);
text DropGeometryColumn(varchar catalog_name, varchar schema_name, varchar table_name, varchar column_name);
```

Descripción

Suprime una columna de geometrías de una tabla espacial. Observa que `schema_name` debe apuntar al campo `f_table_schema` del registro de la tabla `geometry_columns`.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



Note

Cambiado: 2.0.0 Se proporciona esta función para la compatibilidad con versiones anteriores. Ahora que `geometry_columns` es una vista y no un catálogo del sistema, se puede eliminar una columna de geometría como cualquier otra columna de la tabla utilizando `ALTER TABLE`

Ejemplos

```
SELECT DropGeometryColumn ('my_schema','my_spatial_table','geom');
      ----RESULT output ----
                        dropgeometrycolumn
-----
my_schema.my_spatial_table.geom effectively removed.

-- En PostGIS 2.0+ lo anterior también es equivalente al estándar
-- El estándar alterar tabla. Ambos anularán el registro de geometry_columns
ALTER TABLE my_schema.my_spatial_table DROP column geom;
```

También puedes ver

[AddGeometryColumn](#), [DropGeometryTable](#), [Section 4.6.2](#)

8.2.3 DropGeometryTable

`DropGeometryTable` — Borra una tabla y todas sus referencias en la tabla `geómetra_columns`.

Synopsis

```
boolean DropGeometryTable(varchar table_name);
boolean DropGeometryTable(varchar schema_name, varchar table_name);
boolean DropGeometryTable(varchar catalog_name, varchar schema_name, varchar table_name);
```


Descripción

Borra la tabla y todas sus referencias en la tabla `geometra_column`. Nota: utiliza el esquema `current_schema()` de una instalación `pgsql` si el esquema no se especifica.



Note

Cambiado: 2.0.0 Se proporciona esta función para la compatibilidad con versiones anteriores. Ahora que `geometry_columns` es una vista y no un catálogo del sistema, se puede borrar una tabla con columnas de geometría como cualquier otra tabla utilizando `DROP TABLE`

Ejemplos

```
SELECT DropGeometryTable ('my_schema','my_spatial_table');
----RESULT output ---
my_schema.my_spatial_table dropped.

-- Lo anterior es ahora equivalente a --
DROP TABLE my_schema.my_spatial_table;
```

También puedes ver

[AddGeometryColumn](#), [DropGeometryColumn](#), [Section 4.6.2](#)

8.2.4 Find_SRID

`Find_SRID` — Returns the SRID defined for a geometry column.

Synopsis

integer **Find_SRID**(varchar a_schema_name, varchar a_table_name, varchar a_geomfield_name);

Descripción

Returns the integer SRID of the specified geometry column by searching through the `GEOMETRY_COLUMNS` table. If the geometry column has not been properly added (e.g. with the [AddGeometryColumn](#) function), this function will not work.

Ejemplos

```
SELECT Find_SRID('public', 'tiger_us_state_2007', 'geom_4269');
find_srid
-----
4269
```

También puedes ver

[ST_SRID](#)

8.2.5 Populate_Geometry_Columns

`Populate_Geometry_Columns` — Ensures geometry columns are defined with type modifiers or have appropriate spatial constraints.

Synopsis

```
text Populate_Geometry_Columns(boolean use_typmod=true);
int Populate_Geometry_Columns(oid relation_oid, boolean use_typmod=true);
```

Descripción

Asegura que las columnas de geometría se define con modificadores de tipo o tienen restricciones espaciales apropiadas. Esto asegura que se registrarán correctamente en la vista `geometry_columns`. Por defecto se convertirán todas las columnas de geometría sin modificador de tipo a modificadores de tipo. Para conseguir el comportamiento del sistema antiguo selecciona `use_typmod = false`

Para la compatibilidad con versiones anteriores y para necesidades espaciales, como la herencia de tablas, donde cada tabla secundaria puede tener un tipo de geometría diferente, el comportamiento de restricción de comprobación anterior sigue siendo compatible. Si necesita el comportamiento antiguo, debe pasar el nuevo argumento opcional como falso `use_typmod=false`. Cuando se haga esto, las columnas de geometría se crearán sin modificadores de tipo pero tendrán 3 restricciones definidas. En particular, esto significa que cada columna geométrica que pertenezca a una tabla tiene al menos tres restricciones:

- `enforce_dims_the_geom` - asegura que cada geometría posee la misma dimensión (mira en [ST_NDims](#))
- `enforce_geotype_the_geom` - asegura que cada geometría es del mismo tipo (mira en [GeometryType](#))
- `enforce_srid_the_geom` - asegura que cada geometría tiene la misma proyección (mira en [ST_SRID](#))

Si se da una tabla `oid`, esta función trata de determinar el `srid`, la dimensión, y el tipo de geometría de todas las columnas de geometrías en la tabla, añadiendo las restricciones si es necesario. Si no hay errores, una fila apropiada se insertará en la tabla `geometry_columns`, si hay errores, se captura la excepción y se envía un mensaje de error con la descripción del problema.

Si se da una vista `oid`, como en el caso de una tabla `oid`, esta función trata de determinar el `srid`, la dimensión, y el tipo de geometría de todas las columnas de geometrías en la tabla, añadiendo las filas apropiadas a la tabla `geometry_columns`, pero no se ejecuta nada para hacer cumplir las restricciones.

La variante sin parámetros es un simple wrapper de la variante con parámetros que trunca y rellena la tabla `geometry_columns` para cada tabla y vista espacial de la base de datos, añadiendo restricciones espaciales apropiadas a cada tabla. Devuelve un sumario de los numero de columnas de geometrías detectadas en la base de datos y el numero que se insertaron en la tabla `geometry_columns`. La versión con parámetros simplemente devuelve el numero de filas insertado en la tabla `geometry_columns`.

Disponibilidad: 1.4.0

Cambiado: 2.0.0 Por defecto, ahora utiliza modificadores de tipo en lugar de restricciones de tipo check para limitar los tipos de geometría. Puedes seguir utilizando el comportamiento de las restricciones check con el uso de la nueva variable `use_typmod` y estableciéndolo a `false`.

Mejorado: 2.0.0 el argumento opcional `use_typmod` fue introducido y permite controlar si las columnas se crean con modificadores de tipo o con restricciones de tipo check.

Ejemplos

```
CREATE TABLE public.myspatial_table(gid serial, geom geometry);
INSERT INTO myspatial_table(geom) VALUES(ST_GeomFromText('LINESTRING(1 2, 3 4)',4326) );
-- Esto ahora usará modificadores de typ. Para que esto funcione, deben existir datos
SELECT Populate_Geometry_Columns('public.myspatial_table'::regclass);

populate_geometry_columns
-----
1

\d myspatial_table
```

```
Table "public.myspatial_table"
Column |          Type          | Modifiers
-----+-----+-----
gid     | integer                | not null default nextval('myspatial_table_gid_seq'::regclass)
geom     | geometry(LineString,4326) |

-- Esto cambiará las columnas de geometría para usar restricciones si no son typmod o ya ←
-- tienen restricciones..
--Para que esto funcione, deben existir datos
CREATE TABLE public.myspatial_table_cs(gid serial, geom geometry);
INSERT INTO myspatial_table_cs(geom) VALUES(ST_GeomFromText('LINESTRING(1 2, 3 4)',4326) );
SELECT Populate_Geometry_Columns('public.myspatial_table_cs'::regclass, false);
populate_geometry_columns
-----
1
\d myspatial_table_cs

Table "public.myspatial_table_cs"
Column |    Type    | Modifiers
-----+-----+-----
gid     | integer    | not null default nextval('myspatial_table_cs_gid_seq'::regclass)
geom     | geometry   |

Check constraints:
"enforce_dims_geom" CHECK (st_ndims(geom) = 2)
"enforce_geotype_geom" CHECK (geometrytype(geom) = 'LINESTRING'::text OR geom IS NULL)
"enforce_srid_geom" CHECK (st_srid(geom) = 4326)
```

8.2.6 UpdateGeometrySRID



UpdateGeometrySRID — Updates the SRID of all features in a geometry column, and the table metadata.

Synopsis

```
text UpdateGeometrySRID(varchar table_name, varchar column_name, integer srid);
text UpdateGeometrySRID(varchar schema_name, varchar table_name, varchar column_name, integer srid);
text UpdateGeometrySRID(varchar catalog_name, varchar schema_name, varchar table_name, varchar column_name, integer srid);
```

Descripción

Actualiza el SRID de todos los registros de una columna de geometrías, actualizando las restricciones y referencias en geometry_columns. Nota: utiliza current_schema() en instalaciones postgresql que aceptan esquemas, si no se pasa ningún esquema.

-  This function supports 3d and will not drop the z-index.
-  This method supports Circular Strings and Curves

Ejemplos

Insert geometries into roads table with a SRID set already using **EWKT format**:

```
COPY roads (geom) FROM STDIN;
SRID=4326;LINESTRING(0 0, 10 10)
SRID=4326;LINESTRING(10 10, 15 0)
\.
```

Esto cambiará el srid de la tabla de roads a 4326 de lo que era antes

```
SELECT UpdateGeometrySRID('roads','geom',4326);
```

El ejemplo previo es equivalente a esta sentencia DDL

```
ALTER TABLE roads
  ALTER COLUMN geom TYPE geometry(MULTILINESTRING, 4326)
  USING ST_SetSRID(geom,4326);
```

Si se obtuvo la proyección incorrecta (o que se señala como desconocido) en la carga y que quería transformar a mercator web todo en una sola toma, puede hacer esto con DDL pero no hay ninguna función de gestión de PostGIS equivalente para hacerlo de una sola vez.

```
ALTER TABLE roads
  ALTER COLUMN geom TYPE geometry(MULTILINESTRING, 3857) USING ST_Transform(ST_SetSRID(geom ←
    ,4326),3857) ;
```

También puedes ver

[UpdateRasterSRID](#), [ST_SetSRID](#), [ST_Transform](#)

8.3 Constructores Geométricos

8.3.1 ST_GeomCollFromText

ST_GeomCollFromText — Creates a GeometryCollection or Multi* geometry from a set of geometries.

Synopsis

```
geometry ST_MakeLine(geometry set geoms);
geometry ST_MakeLine(geometry geom1, geometry geom2);
geometry ST_MakeLine(geometry[] geoms_array);
```

Descripción

Collects geometries into a geometry collection. The result is either a Multi* or a GeometryCollection, depending on whether the input geometries have the same or different types (homogeneous or heterogeneous). The input geometries are left unchanged within the collection.

Variant 1: accepts two input geometries

Variant 2: accepts an array of geometries

Variant 3: aggregate function accepting a rowset of geometries.



Note

If any of the input geometries are collections (Multi* or GeometryCollection) **ST_Collect** returns a GeometryCollection (since that is the only type which can contain nested collections). To prevent this, use **ST_Dump** in a subquery to expand the input collections to their atomic elements (see example below).

**Note**

ST_Collect and **ST_Union** appear similar, but in fact operate quite differently. ST_Collect aggregates geometries into a collection without changing them in any way. ST_Union geometrically merges geometries where they overlap, and splits linestrings at intersections. It may return single geometries when it dissolves boundaries.

Disponibilidad: 1.4.0 - ST_MakeLine (geomarray) fue introducido. Las Funciones agregadas ST_MakeLine se mejoraron para manejar más puntos más rápido.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos - uso de XLink

Collect 2D points.

```
SELECT ST_AsText( ST_Collect( ST_GeomFromText('POINT(1 2)'),
                          ST_GeomFromText('POINT(-2 3)') ) );
```

```
st_astext
-----
MULTIPOINT((1 2), (-2 3))
```

Collect 3D points.

```
SELECT ST_AsEWKT( ST_Collect( ST_GeomFromEWKT('POINT(1 2 3)'),
                          ST_GeomFromEWKT('POINT(1 2 4)') ) );
```

```
st_asewkt
-----
MULTIPOINT(1 2 3, 1 2 4)
```

Collect curves.

```
SELECT ST_AsText( ST_Collect( 'CIRCULARSTRING(220268 150415,220227 150505,220227 150406)',
                          'CIRCULARSTRING(220227 150406,220227 150407,220227 150406)') );
```

```
st_astext
-----
MULTICURVE(CIRCULARSTRING(220268 150415,220227 150505,220227 150406),
CIRCULARSTRING(220227 150406,220227 150407,220227 150406))
```

Ejemplos: Utilizando la versión Array

Using an array constructor for a subquery.

```
SELECT ST_Collect( ARRAY( SELECT geom FROM sometable ) );
```

Using an array constructor for values.

```
SELECT ST_AsText( ST_Collect(
    ARRAY[ ST_GeomFromText('LINESTRING(1 2, 3 4)'),
          ST_GeomFromText('LINESTRING(3 4, 4 5)') ] ) ) As wktcollect;
```

```
--wkt collect --
MULTILINESTRING((1 2, 3 4), (3 4, 4 5))
```

Ejemplos: Version Agregado Espacial

Creating multiple collections by grouping geometries in a table.

```
SELECT stusps, ST_Collect(f.geom) as geom
      FROM (SELECT stusps, (ST_Dump(geom)).geom As geom
            FROM
              somestatetable ) As f
      GROUP BY stusps
```

Ver también

[ST_Dump](#), [ST_AsBinary](#)

8.3.2 ST_LineFromMultiPoint

ST_LineFromMultiPoint — Crea una LineString desde una geometría MultiPoint.

Synopsis

geometry **ST_LineFromMultiPoint**(geometry aMultiPoint);

Descripción

Crea una LineString desde una geometría MultiPoint.

Use [ST_MakeLine](#) to create lines from Point or LineString inputs.



This function supports 3d and will not drop the z-index.

Ejemplos

Crea una LineString desde una geometría MultiPoint.

```
--Crea una linea 3d desde un multipunto 3d
SELECT ST_AsEWKT(ST_LineFromMultiPoint(ST_GeomFromEWKT('MULTIPOINT(1 2 3, 4 5 6, 7 8 9)')) ←
      ;
--resultado--
LINESTRING(1 2 3,4 5 6,7 8 9)
```

Ver también

[ST_AsEWKT](#), [ST_AsKML](#)

8.3.3 ST_MakeEnvelope

ST_MakeEnvelope — Crea un polígono rectangular formado a partir de los mínimos y máximos especificados. Los valores de entrada deben estar en el SRS especificado en el SRID.

Synopsis

geometry **ST_MakeEnvelope**(double precision xmin, double precision ymin, double precision xmax, double precision ymax, integer srid=unknown);

Descripción

Crea un polígono rectangular formado a partir de los mínimos y máximos de la caja dada. Los valores de entrada deben estar en el SRS especificado por el SRID. Si no se especifica SRID se supone que el sistema de referencia espacial es desconocido.

Disponibilidad: 1.5

Mejorado: 2.0: Se introdujo capacidad de especificar una caja sin especificar un SRID.

Ejemplo: Contruir un poligono correspondiente a la bounding box

```
SELECT ST_AsText(ST_MakeEnvelope(10, 10, 11, 11, 4326));

st_asewkt
-----
POLYGON((10 10, 10 11, 11 11, 11 10, 10 10))
```

Ver también

[ST_MakePoint](#), [ST_MakePoint](#), [ST_Point](#), [ST_SRID](#)

8.3.4 ST_MakeLine

ST_MakeLine — Crea una cadena de línea desde geometrías de punto, multipunto o de línea.

Synopsis

```
geometry ST_MakeLine(geometry set geoms);
geometry ST_MakeLine(geometry geom1, geometry geom2);
geometry ST_MakeLine(geometry[] geoms_array);
```

Descripción

Creates a LineString containing the points of Point, MultiPoint, or LineString geometries. Other geometry types cause an error.

Variant 1: accepts two input geometries

Variant 2: accepts an array of geometries

Variant 3: aggregate function accepting a rowset of geometries. To ensure the order of the input geometries use `ORDER BY` in the function call, or a subquery with an `ORDER BY` clause.

Repeated nodes at the beginning of input LineStrings are collapsed to a single point. Repeated points in Point and MultiPoint inputs are not collapsed. [ST_RemoveRepeatedPoints](#) can be used to collapse repeated points from the output LineString.



This function supports 3d and will not drop the z-index.

Disponibilidad: 2.3.0 - Se introdujo soporte para elementos de entrada multipunto

Disponibilidad: 2.0.0 - Se introdujo el soporte de una cadena lineal como elemento de entrada

Disponibilidad: 1.4.0 - ST_MakeLine (geomarray) fue introducido. Las Funciones agregadas ST_MakeLine se mejoraron para manejar más puntos más rápido.

Ejemplos: Utilizando la versión Array

Create a line composed of two points.

```
SELECT ST_MakeLine(ARRAY(SELECT ST_Centroid(the_geom) FROM visit_locations ORDER BY ↵
    visit_time));

-- Haciendo una linea 3d com 3 puntos 3-d
SELECT ST_AsEWKT(ST_MakeLine(ARRAY[ST_MakePoint(1,2,3),
                                ST_MakePoint(3,4,5), ST_MakePoint(6,6,6)]));

           st_asewkt
-----
LINESTRING(1 2 3,3 4 5,6 6 6)
```

Crea una BOX3D definida por las geometrías puntuales 2 3D dadas.

```
SELECT ST_AsEWKT( ST_MakeLine(ST_MakePoint(1,2,3), ST_MakePoint(3,4,5) ));

           st_asewkt
-----
LINESTRING(1 2 3,3 4 5)
```

Crea una cadena de línea desde geometrías de punto, multipunto o de línea.

```
select ST_AsText( ST_MakeLine( 'LINESTRING(0 0, 1 1)', 'LINESTRING(2 2, 3 3)' ) );

           st_astext
-----
LINESTRING(0 0,1 1,2 2,3 3)
```

Ejemplos: Utilizando la versión Array

Create a line from an array formed by a subquery with ordering.

```
SELECT ST_MakeLine( ARRAY( SELECT ST_Centroid(geom) FROM visit_locations ORDER BY ↵
    visit_time) );
```

Create a 3D line from an array of 3D points

```
SELECT ST_MakeLine(ARRAY(SELECT ST_Centroid(the_geom) FROM visit_locations ORDER BY ↵
    visit_time));

-- Haciendo una linea 3d com 3 puntos 3-d
SELECT ST_AsEWKT(ST_MakeLine(ARRAY[ST_MakePoint(1,2,3),
                                ST_MakePoint(3,4,5), ST_MakePoint(6,6,6)]));

           st_asewkt
-----
LINESTRING(1 2 3,3 4 5,6 6 6)
```

Ejemplos: Version Agregado Espacial

Este ejemplo toma una secuencia de puntos GPS y crea un registro para cada trayecto GPS donde el campo geómetra es una cadena lineal compuesta de los puntos GPS en el orden del trayecto.

Using aggregate ORDER BY provides a correctly-ordered LineString.

```
SELECT gps.track_id, ST_MakeLine(gps.geom ORDER BY gps_time) As geom
FROM gps_points As gps
GROUP BY track_id;
```


Prior to PostgreSQL 9, ordering in a subquery can be used. However, sometimes the query plan may not respect the order of the subquery.

```
SELECT gps.track_id, ST_MakeLine(gps.geom) As geom
      FROM ( SELECT track_id, gps_time, geom
              FROM gps_points ORDER BY track_id, gps_time ) As gps
      GROUP BY track_id;
```

Ver también

[ST_RemoveRepeatedPoints](#), [ST_AsText](#), [ST_GeomFromText](#), [ST_MakePoint](#)

8.3.5 ST_MakePoint

ST_MakePoint — Creates a 2D, 3DZ or 4D Point.

Synopsis

geometry **ST_Point**(float x_lon, float y_lat);

geometry **ST_MakePointM**(float x, float y, float m);

geometry **ST_MakePoint**(double precision x, double precision y, double precision z, double precision m);

Descripción

Crea una BOX2D definida por los puntos de la geometría dada.

Use [ST_MakePointM](#) to make points with XYM coordinates.

While not OGC-compliant, **ST_MakePoint** is faster and more precise than [ST_GeomFromText](#) and [ST_PointFromText](#). It is also easier to use for numeric coordinate values.



Note

For geodetic coordinates, X is longitude and Y is latitude



This function supports 3d and will not drop the z-index.

Ejemplos

```
--Devuelve un punto con un SRID desconocido
SELECT ST_MakePoint(-71.1043443253471, 42.3150676015829);

--Devuelve un punto como WGS 84 long lat
SELECT ST_SetSRID(ST_MakePoint(-71.1043443253471, 42.3150676015829),4326);

--Devuelve un punto 3D (por ejemplo, tiene altitud)
SELECT ST_MakePoint(1, 2,1.5);

--Obtiene z del punto
SELECT ST_Z(ST_MakePoint(1, 2,1.5));
result
-----
1.5
```

Ver también

[ST_GeomFromText](#), [ST_PointFromText](#), [ST_SetSRID](#), [ST_MakePointM](#)

8.3.6 ST_MakePointM

ST_MakePointM — Crea un punto con coordenadas x, y y un valor de medida.

Synopsis

geometry **ST_MakePointM**(float x, float y, float m);

Descripción

Crea un punto con coordenadas x, y y un valor de medida.

Use [ST_MakePoint](#) to make points with XY, XYZ, or XYZM coordinates.

**Note**

For geodetic coordinates, X is longitude and Y is latitude

Ejemplos**Note**

[ST_AsEWKT](#) is used for text output because [ST_AsText](#) does not support M values.

Create point with unknown SRID.

```
SELECT ST_AsEWKT( ST_MakePointM(-71.1043443253471, 42.3150676015829, 10) );

                                st_asewkt
-----
POINTM(-71.1043443253471 42.3150676015829 10)
```

Crea un punto con coordenadas x, y y un valor de medida.

```
SELECT ST_AsEWKT( ST_SetSRID( ST_MakePointM(-71.104, 42.315, 10), 4326) );

                                st_asewkt
-----
SRID=4326;POINTM(-71.104 42.315 10)
```

Get measure of created point.

```
SELECT ST_M( ST_MakePointM(-71.104, 42.315, 10) );

result
-----
10
```

Ver también

[ST_AsEWKT](#), [ST_MakePoint](#), [ST_SetSRID](#)

8.3.7 ST_MakePolygon

ST_MakePolygon — Creates a Polygon from a shell and optional list of holes.

Synopsis

geometry **ST_MakePolygon**(geometry linestring);

geometry **ST_MakePolygon**(geometry outerlinestring, geometry[] interiorlinestrings);

Descripción

Crea un polígono formado por el contorno dado. Las geometrías de entrada deben ser LINESTRINGS cerradas.

Variant 1: Accepts one shell LineString.

Variant 2: Accepts a shell LineString and an array of inner (hole) LineStrings. A geometry array can be constructed using the PostgreSQL array_agg(), ARRAY[] or ARRAY() constructs.



Note

Esta función no acepta una MULTILINESTRING. Utiliza [ST_LineMerge](#) o [ST_Dump](#) para generar una linestring.



This function supports 3d and will not drop the z-index.

Ejemplos: Utilizando la versión Array

Crea un LineString desde una cadena de polilínea codificada.

```
SELECT ST_MLineFromText('MULTILINESTRING((1 2, 3 4), (4 5, 6 7))');
```

Create a Polygon from an open LineString, using [ST_StartPoint](#) and [ST_AddPoint](#) to close it.

```
SELECT ST_MakePolygon( ST_AddPoint(foo.open_line, ST_StartPoint(foo.open_line)) )
FROM (
  SELECT ST_GeomFromText('LINESTRING(75 29,77 29,77 29, 75 29)') As open_line) As foo;
```

Crea un LineString desde una cadena de polilínea codificada.

```
SELECT ST_AsEWKT( ST_MakePolygon( 'LINESTRING(75.15 29.53 1,77 29 1,77.6 29.5 1, 75.15 29.53 1)') );

st_asewkt
-----
POLYGON((75.15 29.53 1,77 29 1,77.6 29.5 1,75.15 29.53 1))
```

Create a Polygon from a LineString with measures

```
SELECT ST_AsEWKT( ST_MakePolygon( 'LINESTRINGM(75.15 29.53 1,77 29 1,77.6 29.5 2, 75.15 29.53 2)' ) );

st_asewkt
-----
POLYGONM((75.15 29.53 1,77 29 1,77.6 29.5 2,75.15 29.53 2))
```

Ejemplos: carcasa exterior con carcadas interiores

Construye un donut con un agujero de hormiga

```
SELECT ST_MakePolygon(
    ST_ExteriorRing(ST_Buffer(foo.line,10)),
    ARRAY[ST_Translate(foo.line,1,1),
          ST_ExteriorRing(ST_Buffer(ST_MakePoint(20,20),1)) ]
)
FROM
    (SELECT ST_ExteriorRing(ST_Buffer(ST_MakePoint(10,10),10,10))
     As line )
     As foo;
```

Create a set of province boundaries with holes representing lakes. The input is a table of province Polygons/MultiPolygons and a table of water linestrings. Lines forming lakes are determined by using **ST_IsClosed**. The province linework is extracted by using **ST_Boundary**. As required by **ST_MakePolygon**, the boundary is forced to be a single LineString by using **ST_LineMerge**. (However, note that if a province has more than one region or has islands this will produce an invalid polygon.) Using a **LEFT JOIN** ensures all provinces are included even if they have no lakes.



Note

El constructor **CASE** se utiliza porque la alimentación de una matriz nula en **ST_MakePolygon** resulta en **NULL**.

```
SELECT p.gid, p.province_name,
       CASE WHEN array_agg(w.geom) IS NULL
            THEN p.geom
            ELSE ST_MakePolygon( ST_LineMerge(ST_Boundary(p.geom)),
                                array_agg(w.geom)) END
FROM
    provinces p LEFT JOIN waterlines w
                ON (ST_Within(w.geom, p.geom) AND ST_IsClosed(w.geom))
GROUP BY p.gid, p.province_name, p.geom;
```

Another technique is to utilize a correlated subquery and the **ARRAY()** constructor that converts a row set to an array.

```
SELECT p.gid, p.province_name,
       CASE WHEN
           ST_Accum(w.the_geom) IS NULL THEN p.the_geom
           ELSE ST_MakePolygon(ST_LineMerge(ST_Boundary(p.the_geom)), ST_Accum(w. ↵
           the_geom)) END
FROM
    provinces p LEFT JOIN waterlines w
                ON (ST_Within(w.the_geom, p.the_geom) AND ST_IsClosed(w.the_geom))
GROUP BY p.gid, p.province_name, p.the_geom;

-- El mismo ejemplo que antes pero utilizando una subconsulta correlada
-- y la función ARRAY() de PostgreSQL, que convierte todo el conjunto de filas en ↵
-- una array

SELECT p.gid, p.province_name, CASE WHEN
    EXISTS(SELECT w.the_geom
           FROM waterlines w
           WHERE ST_Within(w.the_geom, p.the_geom)
           AND ST_IsClosed(w.the_geom))
    THEN
        ST_MakePolygon(ST_LineMerge(ST_Boundary(p.the_geom)),
                        ARRAY(SELECT w.the_geom
                               FROM waterlines w
```

```

WHERE ST_Within(w.the_geom, p.the_geom)
AND ST_IsClosed(w.the_geom))
ELSE p.the_geom END As the_geom
FROM
provinces p;

```

Ver también

[ST_BuildArea](#) [ST_Polygon](#)

8.3.8 ST_Point

ST_Point — Creates a Point with X, Y and SRID values.

Synopsis

geometry **ST_Point**(float x_lon, float y_lat);

geometry **ST_MakePointM**(float x, float y, float m);

Descripción

Returns a Point with the given X and Y coordinate values. This is the SQL-MM equivalent for [ST_MakePoint](#) that takes just X and Y.



Note

For geodetic coordinates, X is longitude and Y is latitude

Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with `ST_SetSRID` to mark the srid on the geometry.



This method implements the SQL/MM specification. SQL-MM 3: 6.1.2

Ejemplos: Geometry

```
SELECT ST_Point( -71.104, 42.315);
```

```
SELECT ST_SetSRID(ST_Point( -71.104, 42.315),4326);
```

New in 3.2.0: With SRID specified

```
SELECT ST_Point( -71.104, 42.315, 4326);
```

Ejemplos: Geography

Pre-PostGIS 3.2 syntax

```
SELECT CAST( ST_SetSRID(ST_Point( -71.104, 42.315), 4326) AS geography);
```

3.2 and on you can include the srid

```
SELECT CAST( ST_Point( -71.104, 42.315, 4326) AS geography);
```

PostgreSQL also provides the :: short-hand for casting

```
SELECT ST_Point( -71.104, 42.315, 4326)::geography;
```

If the point coordinates are not in a geodetic coordinate system (such as WGS84), then they must be reprojected before casting to a geography. In this example a point in Pennsylvania State Plane feet (SRID 2273) is projected to WGS84 (SRID 4326).

```
SELECT CAST(ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326) As geography);
```

Ver también

Section 4.3, [ST_MakePoint](#), [ST_SetSRID](#), [ST_Transform](#), [ST_Point](#), [ST_Point](#), [ST_Point](#)

8.3.9 ST_Point

ST_Point — Creates a Point with X, Y, Z and SRID values.

Synopsis

geometry **ST_MakePoint**(double precision x, double precision y, double precision z, double precision m);

Descripción

Devuelve un **ST_Point** con el valor de coordenadas dado. Es un alias de **ST_MakePoint** del OGC.

Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with **ST_SetSRID** to mark the srid on the geometry.

Ejemplos

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

Ver también

[ST_MakePoint](#), [ST_Point](#), [ST_SetSRID](#), [ST_SRID](#)

8.3.10 ST_Point

ST_Point — Creates a Point with X, Y, M and SRID values.

Synopsis

geometry **ST_PointM**(float x, float y, float m, integer srid=unknown);

Descripción

Devuelve un ST_Point con el valor de coordenadas dado. Es un alias de ST_MakePoint del OGC.

Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with ST_SetSRID to mark the srid on the geometry.

Ejemplos

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

Ver también

[ST_MakePoint](#), [ST_Point](#), [ST_SetSRID](#), [ST_SRID](#)

8.3.11 ST_Point

ST_Point — Creates a Point with X, Y, Z, M and SRID values.

Synopsis

geometry **ST_MakeEnvelope**(double precision xmin, double precision ymin, double precision xmax, double precision ymax, integer srid=unknown);

Descripción

Devuelve un ST_Point con el valor de coordenadas dado. Es un alias de ST_MakePoint del OGC.

Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with ST_SetSRID to mark the srid on the geometry.

Ejemplos

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829), 4326)
```

Ver también

[ST_MakePoint](#), [ST_Point](#), [ST_Point](#), [ST_Point](#), [ST_SetSRID](#)

8.3.12 ST_Polygon

ST_Polygon — Creates a Polygon from a LineString with a specified SRID.

Synopsis

geometry **ST_Polygon**(geometry aLineString, integer srid);

Descripción

Returns a polygon built from the given LineString and sets the spatial reference system from the `srid`.

ST_Polygon is similar to [ST_MakePolygon](#) Variant 1 with the addition of setting the SRID.

, [ST_MakePoint](#), [ST_SetSRID](#)



Note

Esta función no acepta una MULTILINESTRING. Utiliza [ST_LineMerge](#) o [ST_Dump](#) para generar una linestring.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 8.3.2



This function supports 3d and will not drop the z-index.

Ejemplos

Create a 2D polygon.

```
SELECT ST_AsText( ST_Polygon('LINESTRING(75 29, 77 29, 77 29, 75 29)::geometry, 4326) );

-- result --
POLYGON((75 29, 77 29, 77 29, 75 29))
```

Create a 3D polygon.

```
SELECT ST_AsEWKT( ST_Polygon( ST_GeomFromEWKT('LINESTRING(75 29 1, 77 29 2, 77 29 3, 75 29 1)') ), 4326) );

-- result --
SRID=4326;POLYGON((75 29 1, 77 29 2, 77 29 3, 75 29 1))
```

Ver también

[ST_AsEWKT](#), [ST_AsText](#), [ST_GeomFromEWKT](#), [ST_GeomFromText](#), [ST_LineMerge](#), [ST_MakePolygon](#)

8.3.13 ST_MakeEnvelope

ST_MakeEnvelope — Creates a rectangular Polygon in [Web Mercator](#) (SRID:3857) using the [XYZ tile system](#).

Synopsis

geometry **ST_MakePoint**(double precision x, double precision y, double precision z, double precision m);

Descripción

Creates a rectangular Polygon giving the extent of a tile in the **XYZ tile system**. The tile is specified by the zoom level Z and the XY index of the tile in the grid at that level. Can be used to define the tile bounds required by **ST_AsMVTGeom** to convert geometry into the MVT tile coordinate space.

By default, the tile envelope is in the **Web Mercator** coordinate system (SRID:3857) using the standard range of the Web Mercator system (-20037508.342789, 20037508.342789). This is the most common coordinate system used for MVT tiles. The optional **bounds** parameter can be used to generate tiles in any coordinate system. It is a geometry that has the SRID and extent of the "Zoom Level zero" square within which the XYZ tile system is inscribed.

The optional **margin** parameter can be used to expand a tile by the given percentage. E.g. **margin=0.125** expands the tile by 12.5%, which is equivalent to **buffer=512** when the tile extent size is 4096, as used in **ST_AsMVTGeom**. This is useful to create a tile buffer to include data lying outside of the tile's visible area, but whose existence affects the tile rendering. For example, a city name (a point) could be near an edge of a tile, so its label should be rendered on two tiles, even though the point is located in the visible area of just one tile. Using expanded tiles in a query will include the city point in both tiles. Use a negative value to shrink the tile instead. Values less than -0.5 are prohibited because that would eliminate the tile completely. Do not specify a margin when using with **ST_AsMVTGeom**. See the example for **ST_AsMVT**.

Mejorada: 2.0.0 se agregó el parámetro por defecto opcional **srid**.

Disponibilidad: 2.1.0

Ejemplo: Contruir un poligono correspondiente a la bounding box

```
SELECT ST_AsText( ST_TileEnvelope(2, 1, 1) );

st_astext
-----
POLYGON((-10018754.1713945 0,-10018754.1713945 10018754.1713945,0 10018754.1713945,0 ↵
0,-10018754.1713945 0))

SELECT ST_AsText( ST_TileEnvelope(3, 1, 1, ST_MakeEnvelope(-180, -90, 180, 90, 4326) ) );

st_astext
-----
POLYGON((-135 45,-135 67.5,-90 67.5,-90 45,-135 45))
```

Ver también

ST_MakeEnvelope

8.3.14 ST_HexagonGrid

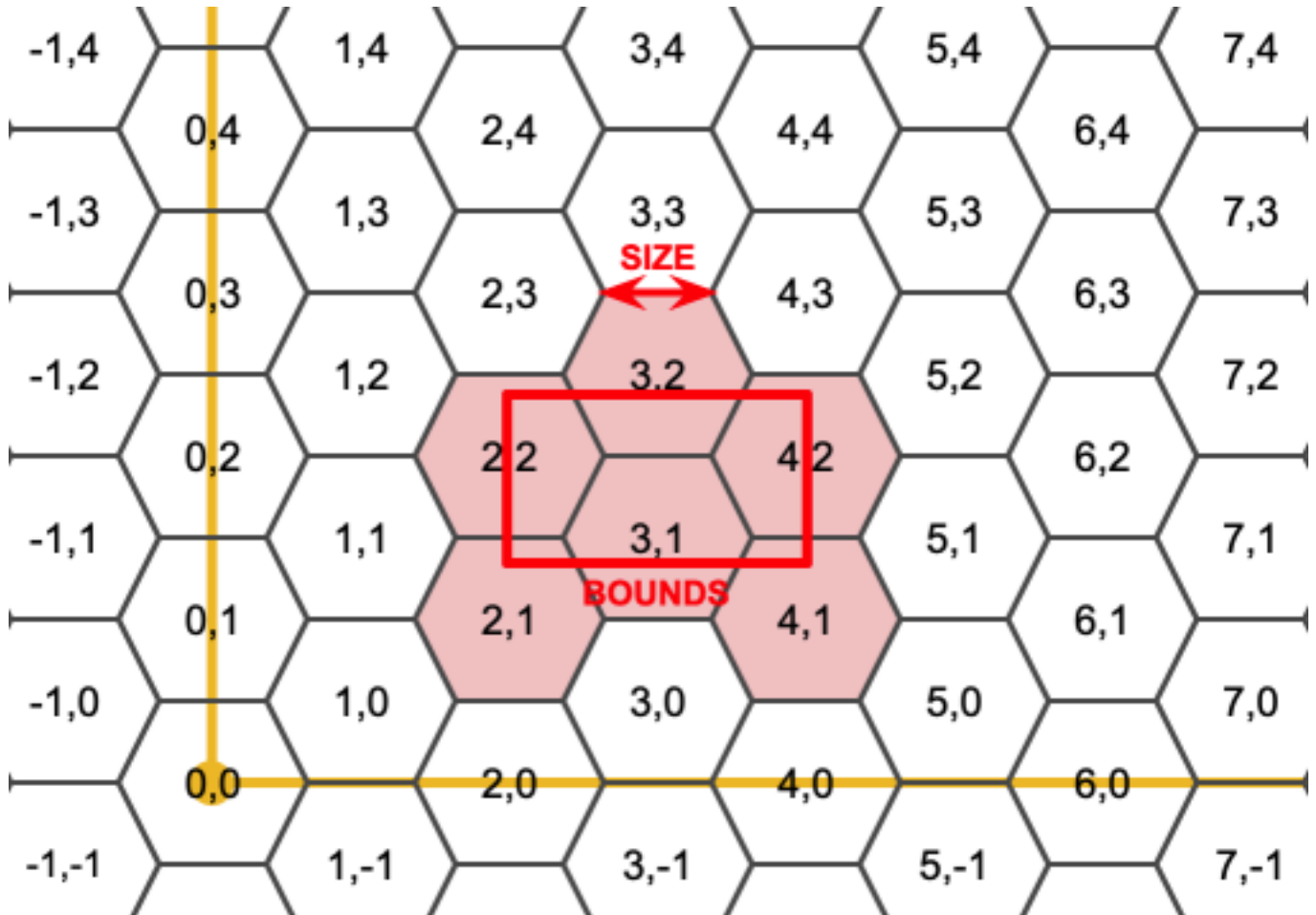
ST_HexagonGrid — Returns a set of hexagons and cell indices that completely cover the bounds of the geometry argument.

Synopsis

geometry **ST_Point**(float x_lon, float y_lat);

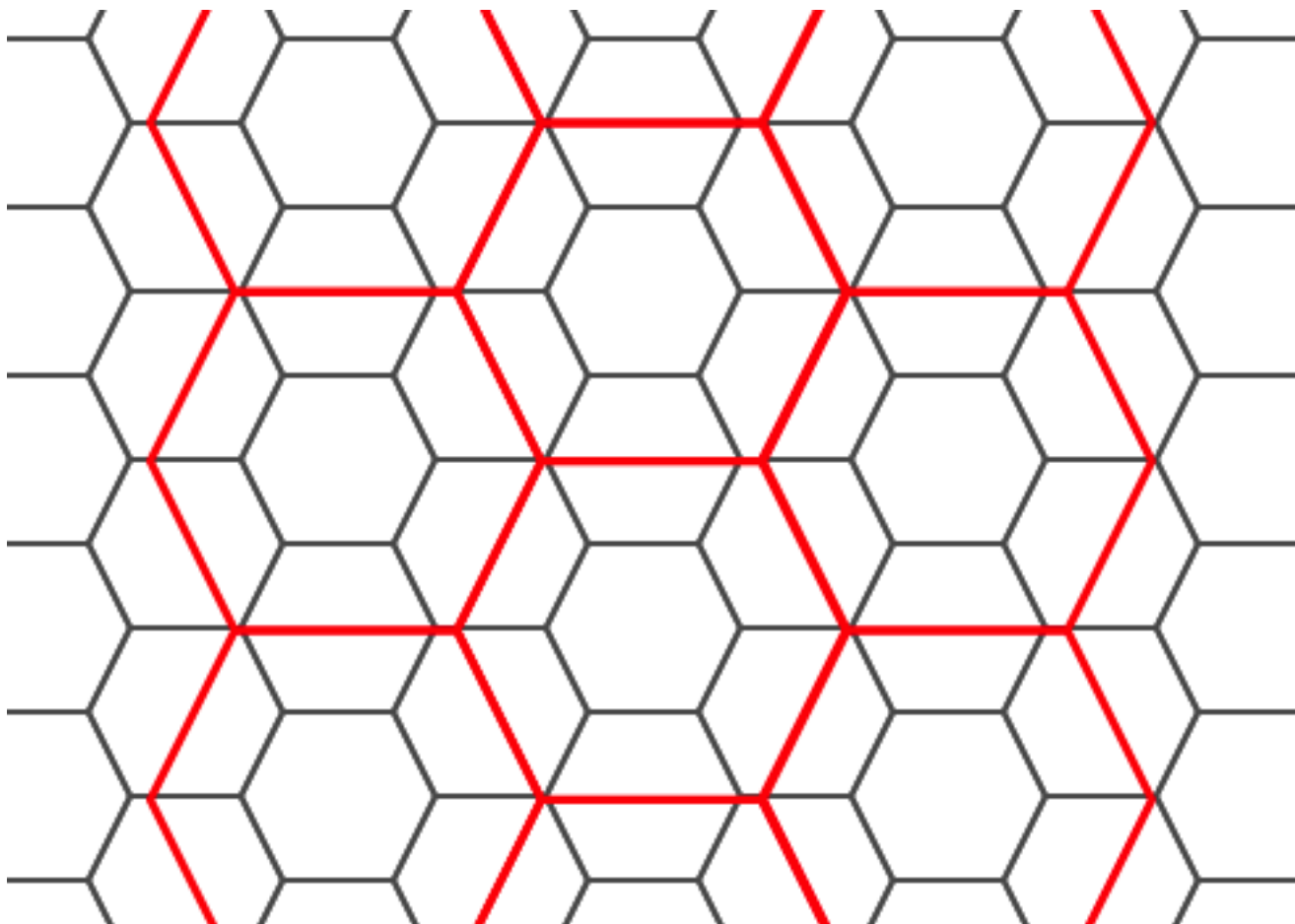
Descripción

Starts with the concept of a hexagon tiling of the plane. (Not a hexagon tiling of the globe, this is not the **H3** tiling scheme.) For a given planar SRS, and a given edge size, starting at the origin of the SRS, there is one unique hexagonal tiling of the plane, `Tiling(SRS, Size)`. This function answers the question: what hexagons in a given `Tiling(SRS, Size)` overlap with a given bounds.



The SRS for the output hexagons is the SRS provided by the bounds geometry.

Doubling or tripling the edge size of the hexagon generates a new parent tiling that fits with the origin tiling. Unfortunately, it is not possible to generate parent hexagon tilings that the child tiles perfectly fit inside.



Disponibilidad: 2.1.0

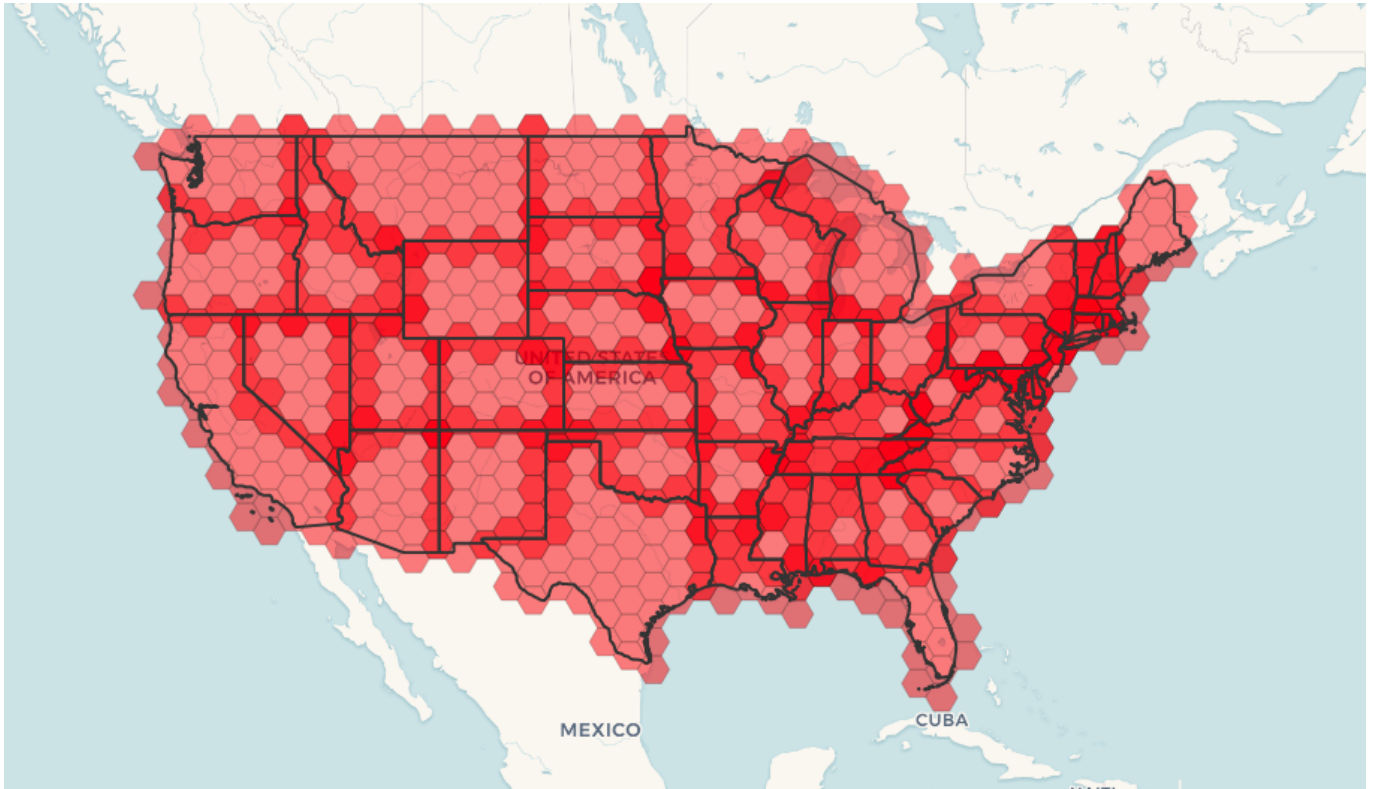
Ejemplos: Utilizando la versión Array

To do a point summary against a hexagonal tiling, generate a hexagon grid using the extent of the points as the bounds, then spatially join to that grid.

```
SELECT COUNT(*), hexes.geom
FROM
  ST_HexagonGrid(
    10000,
    ST_SetSRID(ST_EstimatedExtent('pointtable', 'geom'), 3857)
  ) AS hexes
INNER JOIN
  pointtable AS pts
  ON ST_Intersects(pts.geom, hexes.geom)
GROUP BY hexes.geom;
```

Ejemplo: Contruir un poligono correspondiente a la bounding box

If we generate a set of hexagons for each polygon boundary and filter out those that do not intersect their hexagons, we end up with a tiling for each polygon.



Tiling states results in a hexagon coverage of each state, and multiple hexagons overlapping at the borders between states.

**Note**

The LATERAL keyword is implied for set-returning functions when referring to a prior table in the FROM list. So CROSS JOIN LATERAL, CROSS JOIN, or just plain , are equivalent constructs for this example.

```
SELECT admin1.gid, hex.geom
FROM
  admin1
  CROSS JOIN
  ST_HexagonGrid(100000, admin1.geom) AS hex
WHERE
  adm0_a3 = 'USA'
  AND
  ST_Intersects(admin1.geom, hex.geom)
```

Ver también

[ST_EstimatedExtent](#), [ST_MakePoint](#), [ST_Point](#), [ST_SRID](#)

8.3.15 ST_Hexagon

ST_Hexagon — Returns a single hexagon, using the provided edge size and cell coordinate within the hexagon grid space.

Synopsis

geometry **ST_MakePoint**(double precision x, double precision y, double precision z, double precision m);

Descripción

Uses the same hexagon tiling concept as [ST_HexagonGrid](#), but generates just one hexagon at the desired cell coordinate. Optionally, can adjust origin coordinate of the tiling, the default origin is at 0,0.

Hexagons are generated with no SRID set, so use [ST_SetSRID](#) to set the SRID to the one you expect.

Disponibilidad: 2.1.0

Example: Creating a hexagon at the origin

```
SELECT ST_AsText(ST_SetSRID(ST_Hexagon(1.0, 0, 0), 3857));

POLYGON((-1 0,-0.5
          -0.866025403784439,0.5
          -0.866025403784439,1
          0,0.5
          0.866025403784439,-0.5
          0.866025403784439,-1 0))
```

Ver también

[ST_MakeEnvelope](#), [ST_MakePoint](#), [ST_SetSRID](#)

8.3.16 ST_SquareGrid

ST_SquareGrid — Returns a set of grid squares and cell indices that completely cover the bounds of the geometry argument.

Synopsis

geometry **ST_Point**(float x_lon, float y_lat);

Descripción

Starts with the concept of a square tiling of the plane. For a given planar SRS, and a given edge size, starting at the origin of the SRS, there is one unique square tiling of the plane, `Tiling(SRS, Size)`. This function answers the question: what grids in a given `Tiling(SRS, Size)` overlap with a given bounds.

The SRS for the output squares is the SRS provided by the bounds geometry.

Doubling or edge size of the square generates a new parent tiling that perfectly fits with the original tiling. Standard web map tilings in mercator are just powers-of-two square grids in the mercator plane.

Disponibilidad: 2.1.0

Example: Generating a 1 degree grid for a country

The grid will fill the whole bounds of the country, so if you want just squares that touch the country you will have to filter afterwards with `ST_Intersects`.

```
WITH grid AS (
SELECT (ST_SquareGrid(1, ST_Transform(geom,4326))).*
FROM admin0 WHERE name = 'Canada'
)
SELEcT ST_AsText(geom)
FROM grid
```

Example: Counting points in squares (using single chopped grid)

To do a point summary against a square tiling, generate a square grid using the extent of the points as the bounds, then spatially join to that grid. Note the estimated extent might be off from actual extent, so be cautious and at very least make sure you've analyzed your table.

```
SELECT COUNT(*), squares.geom
FROM
  pointtable AS pts
  INNER JOIN
    ST_SquareGrid(
      1000,
      ST_SetSRID(ST_EstimatedExtent('pointtable', 'geom'), 3857)
    ) AS squares
ON ST_Intersects(pts.geom, squares.geom)
GROUP BY squares.geom
```

Example: Counting points in squares using set of grid per point

This yields the same result as the first example but will be slower for a large number of points

```
SELECT COUNT(*), squares.geom
FROM
  pointtable AS pts
  INNER JOIN
    ST_SquareGrid(
      1000,
      pts.geom
    ) AS squares
ON ST_Intersects(pts.geom, squares.geom)
GROUP BY squares.geom
```

Ver también

[ST_MakeEnvelope](#), [ST_Point](#), [ST_SetSRID](#), [ST_SRID](#)

8.3.17 ST_Square

ST_Square — Returns a single square, using the provided edge size and cell coordinate within the square grid space.

Synopsis

geometry **ST_MakePoint**(double precision x, double precision y, double precision z, double precision m);

Descripción

Uses the same square tiling concept as [ST_SquareGrid](#), but generates just one square at the desired cell coordinate. Optionally, can adjust origin coordinate of the tiling, the default origin is at 0,0.

Squares are generated with no SRID set, so use [ST_SetSRID](#) to set the SRID to the one you expect.

Disponibilidad: 2.1.0

Example: Creating a square at the origin

```
SELECT ST_AsText(ST_MakeEnvelope(10, 10, 11, 11, 4326));

st_asewkt
-----
POLYGON((10 10, 10 11, 11 11, 11 10, 10 10))
```

Ver también

[ST_MakeEnvelope](#), [ST_MakeLine](#), [ST_MakePolygon](#)

8.3.18 ST_Letters

ST_Letters — Returns the input letters rendered as geometry with a default start position at the origin and default text height of 100.

Synopsis

geometry **ST_Letters**(text letters, json font);

Descripción

Uses a built-in font to render out a string as a multipolygon geometry. The default text height is 100.0, the distance from the bottom of a descender to the top of a capital. The default start position places the start of the baseline at the origin. Over-riding the font involves passing in a json map, with a character as the key, and base64 encoded TWKB for the font shape, with the fonts having a height of 1000 units from the bottom of the descenders to the tops of the capitals.

The text is generated at the origin by default, so to reposition and resize the text, first apply the `ST_Scale` function and then apply the `ST_Translate` function.

Disponibilidad: 2.1.0

Ejemplo: Contruir un poligono correspondiente a la bounding box

```
SELECT ST_AsText(ST_Letters('Yo'), 1);
```



Letters generated by ST_Letters

Example: Scaling and moving words

```
SELECT ST_Translate(ST_Scale(ST_Letters('Yo'), 10, 10), 100,100);
```

Ver también

[ST_AsTWKB](#), [ST_Scale](#), [ST_Translate](#)

8.4 Métodos de Acceso a Geometrías

8.4.1 GeometryType

GeometryType — Devuelve el tipo de geometría del valor de ST_Geometry.

Synopsis

```
text GeometryType(geometry geomA);
```

Descripción

Devuelve el tipo de geometría como una cadena de texto. Ej: 'LINESTRING', 'POLYGON', 'MULTIPOINT', etc.

OGC SPEC s2.1.1.1 - Devuelve el nombre del subtipo de la instancia de la geometría de la cual la instancia de la geometría es miembro. El nombre del subtipo de geometría de la instancia se devuelve en forma de cadena de texto.

**Note**

Esta función también indica si la geometría tiene valores de medida, devolviendo una cadena de tipo 'POINTM'.

Mejorado: 2.0.0 se introdujo soporte para superficies poliédricas, Triangulos y TIN.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT GeometryType(ST_GeomFromText('LINESTRING(77.29 29.07,77.42 29.26,77.27 29.31,77.29
29.07)'));
geometrytype
-----
LINESTRING
```



```

SELECT ST_GeometryType(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0
0 0)),
                ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0) ←
                ),
                ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
                ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1) ←
                ) )');
--result
POLYHEDRALSURFACE

```

```

SELECT GeometryType(geom) as result
FROM
  (SELECT
    ST_GeomFromEWKT('TIN (((
      0 0 0,
      0 0 1,
      0 1 0,
      0 0 0
    )), ((
      0 0 0,
      0 1 0,
      1 1 0,
      0 0 0
    ))
  )') AS geom
) AS g;
result
-----
TIN

```

Ver también

[ST_GeometryType](#)

8.4.2 ST_Boundary

ST_Boundary — Devuelve el cierre del limite combinatorio de esta geometría.

Synopsis

geometry **ST_Boundary**(geometry geomA);

Descripción

Devuelve el cierre del limite combinatorio de esta geometría. El limite combinatorio esta definido como se describe en la sección 3.12.3.2 de la especificación OGC. Ya que el resultado de esta función es un cerco, y por lo tanto topológicamente cerrado, el límite resultante puede ser representado utilizando geometrías primitivas como se discute en la especificación OGC en la sección 3.12.2.

Realizado por el módulo de GEOS



Note

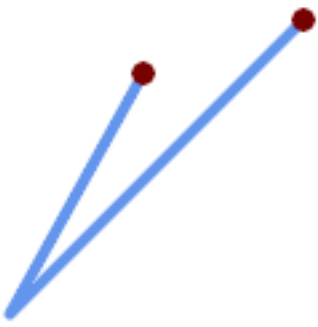
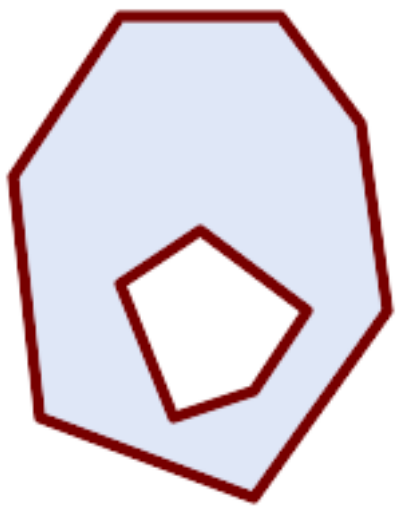
Anterior a la version 2.0.0, esta función lanza una excepción si se utiliza con `GEOMETRYCOLLECTION`. Desde la version 2.0.0 y superiores devolverá `NULL` en lugar de la excepción (entrada no soportada).

- ✓ This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). OGC SPEC s2.1.1.1
- ✓ This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.17
- ✓ This function supports 3d and will not drop the z-index.

Mejorado: 2.1.0 Se ha introducido soporte para Triangle

Changed: 3.2.0 support for TIN, does not use geos, does not linearize curves

Ejemplos

 <p><i>LineString con puntos de límite superpuestos</i></p> <pre>SELECT ST_Boundary(geom) FROM (SELECT 'LINESTRING(100 150,50 60, ↵ 70 80, 160 170)::geometry As geom) As f; -- ST_AsText output MULTIPOINT((100 150),(160 170))</pre>	 <p><i>Agujeros de polígono con límite multilinestring</i></p> <pre>SELECT ST_Boundary(geom) FROM (SELECT 'POLYGON ((10 130, 50 190, 110 190, 140 ↵ 150, 150 80, 100 10, 20 40, 10 130), ↵ (70 40, 100 50, 120 80, 80 110, ↵ 50 90, 70 40))::geometry As geom) As f; -- Salida de ST_AsText MULTILINESTRING((10 130,50 190,110 ↵ 190,140 150,150 80,100 10,20 40,10 130), ↵ (70 40,100 50,120 80,80 110,50 ↵ 90,70 40))</pre>
--	---

```
SELECT ST_AsText(ST_Boundary(ST_GeomFromText('LINESTRING(1 1,0 0, -1 1)')));
st_astext
-----
MULTIPOINT((1 1),(-1 1))

SELECT ST_AsText(ST_Boundary(ST_GeomFromText('POLYGON((1 1,0 0, -1 1, 1 1))')));
st_astext
-----
LINESTRING(1 1,0 0,-1 1,1 1)

--Using a 3d polygon
SELECT ST_AsEWKT(ST_Boundary(ST_GeomFromEWKT('POLYGON((1 1 1,0 0 1, -1 1 1, 1 1 1))')));
```

```

st_asewkt
-----
LINESTRING(1 1 1,0 0 1,-1 1 1,1 1 1)

--Using a 3d multilinestring
SELECT ST_AsEWKT(ST_Boundary(ST_GeomFromEWKT('MULTILINESTRING((1 1 1,0 0 0.5, -1 1 1),(1 1 0.5,0 0 0.5, -1 1 0.5, 1 1 0.5) )')));

st_asewkt
-----
MULTIPOINT((-1 1 1),(1 1 0.75))

```

Ver también

[ST_AsText](#), [ST_ExteriorRing](#), [ST_MakePolygon](#)

8.4.3 ST_BoundingDiagonal

ST_BoundingDiagonal — Devuelve la diagonal del cuadro delimitador de la geometría suministrada.

Synopsis

geometry **ST_BoundingDiagonal**(geometry geom, boolean fits=false);

Descripción

Devuelve la diagonal del cuadro delimitador de la geometría suministrada como una cadena de línea. Si la geometría de entrada está vacía, la línea diagonal también está vacía, de lo contrario es una cadena de línea de 2 puntos con valores mínimos de cada dimensión en su punto de inicio y valores máximos en su punto final.

El parámetro *fits* especifica si se necesita el mejor ajuste. Si es false, se puede aceptar la diagonal de un cuadro delimitador algo más grande (es más rápido para obtener geometrías con muchos vértices). En cualquier caso, el cuadro delimitador de la línea diagonal devuelta siempre cubre la geometría de entrada.

La geometría cadena de línea devuelta siempre conserva SRID y dimensionalidad (z y m presente) de la geometría de entrada.



Note

En los casos degenerados (un solo vértice en la entrada) la cadena de líneas devuelta será topológicamente inválida (no interior). Esto no hace que el retorno sea semánticamente inválido.

Disponibilidad: 2.2.0



This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ejemplos

```
-- Obtener el valor mínimo de x en un área de influencia alrededor de un punto
SELECT ST_X(ST_StartPoint(ST_BoundingDiagonal(
    ST_Buffer(ST_MakePoint(0,0),10)
)));
st_x
-----
-10
```

Ver también

[ST_StartPoint](#), [ST_EndPoint](#), [ST_X](#), [ST_Y](#), [ST_Z](#), [ST_M](#), &&&

8.4.4 ST_CoordDim

ST_CoordDim — Devuelve la dimensión de las coordenadas del valor de ST_Geometry.

Synopsis

integer **ST_CoordDim**(geometry geomA);

Descripción

Devuelve la dimensión de las coordenadas del valor de ST_Geometry.

Es el alias de [ST_NDims](#) conforme a MM



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 5.1.3



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_CoordDim('CIRCULARSTRING(1 2 3, 1 3 4, 5 6 7, 8 9 10, 11 12 13)');
      ---resultado---
      3

      SELECT ST_CoordDim(ST_Point(1,2));
      --resultado--
      2
```

Ver también

[ST_NDims](#)

8.4.5 ST_Dimension

ST_Dimension — Devuelve la dimensión de las coordenadas del valor de ST_Geometry.

Synopsis

integer **ST_Dimension**(geometry g);

Descripción

La dimensión inherente del objeto Geometry, la cual debe ser menor o igual a la dimensión de coordenadas. En la Especificación OGC s2.1.1.1 - devuelve 0 para un POINT, 1 para una LINESTRING, 2 para un POLYGON, y la dimensión mayor de los componentes de una GEOMETRYCOLLECTION. Si es desconocida (geometría vacía) se devuelve null.



This method implements the SQL/MM specification. SQL-MM 3: 5.1.2

Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN. No lanza una excepción si se envía una geometría vacía.



Note

Anterior a la versión 2.0.0, esta función lanzaba una excepción si se enviaba una geometría vacía.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_Dimension('GEOMETRYCOLLECTION(LINESTRING(1 1,0 0),POINT(0 0))');
ST_Dimension
-----
1
```

Ver también

[ST_NDims](#)

8.4.6 ST_Dump

ST_Dump — Returns a set of geometry_dump rows for the components of a geometry.

Synopsis

geometry **ST_Envelope**(geometry g1);

Descripción

A set-returning function (SRF) that extracts the components of a geometry. It returns a set of **geometry_dump** rows, each containing a geometry (*geom* field) and an array of integers (*path* field).

For an atomic geometry type (POINT,LINestring,POLYGON) a single record is returned with an empty *path* array and the input geometry as *geom*. For a collection or multi-geometry a record is returned for each of the collection components, and the *path* denotes the position of the component inside the collection.

ST_Dump is useful for expanding geometries. It is the inverse of a **ST_GeomCollFromText** / GROUP BY, in that it creates new rows. For example it can be use to expand MULTIPOLYGONS into POLYGONS.

Mejorado: 2.0.0 se introdujo soporte para superficies poliédricas, Triangulos y TIN.

Availability: PostGIS 1.0.0RC1. Requires PostgreSQL 7.3 or higher.



Note

Anterior a 1.3.4, esta función daba errores si se utilizaba con geometrias que contenían CURVES. Esto se corrigió en 1.3.4+



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Ejemplos Estándar

```
SELECT sometable.field1, sometable.field1,
       (ST_Dump(sometable.geom)).geom AS geom
FROM sometable;

-- Break a compound curve into its constituent linestrings and circularstrings
SELECT ST_AsEWKT(a.geom), ST_HasArc(a.geom)
FROM ( SELECT (ST_Dump(p_geom)).geom AS geom
        FROM (SELECT ST_GeomFromEWKT('COMPOUNDCURVE(CIRCULARSTRING(0 0, 1 1, 1 0),(1 0, 0 1))') AS p_geom) AS b
      ) AS a;
      st_asewkt          | st_hasarc
-----+-----
CIRCULARSTRING(0 0,1 1,1 0) | t
LINestring(1 0,0 1)       | f
(2 rows)
```

Ejemplos de superficies poliedricas, MDT y triángulos

```
-- Ejemplo de superficie de poliedros
-- Romper una superficie poliédrica en sus caras
SELECT ST_AsEWKT(ST_GeometryN(p_geom,3)) As geom_ewkt
FROM (SELECT ST_GeomFromEWKT('POLYHEDRALSURFACE(
((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)),
((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
```

```

((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)),
((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))
)' AS p_geom ) AS a;

          geom_ewkt
-----
POLYGON((0 0 0,1 0 0,1 0 1,0 0 1,0 0 0))

-- TIN --
SELECT ST_AsEWKT(ST_GeometryN(geom,2)) as wkt
FROM
  (SELECT
    ST_GeomFromEWKT('TIN (((
      0 0 0,
      0 0 1,
      0 1 0,
      0 0 0
    )), ((
      0 0 0,
      0 1 0,
      1 1 0,
      0 0 0
    ))
  )' ) AS geom
  ) AS g;
-- result --

          wkt
-----
TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))

```

Ver también

[geometry_dump](#), [ST_GeomFromEWKT](#), [ST_Dump](#), [ST_GeometryN](#), [ST_NumGeometries](#)

8.4.7 ST_NumPoints

ST_NumPoints — Devuelve un resumen de texto del contenido de la geometría.

Synopsis

geometry **ST_Points**(geometry geom);

Descripción

A set-returning function (SRF) that extracts the coordinates (vertices) of a geometry. It returns a set of [geometry_dump](#) rows, each containing a geometry (*geom* field) and an array of integers (*path* field).

- the *geom* field POINTs represent the coordinates of the supplied geometry.
- the *path* field (an `integer[]`) is an index enumerating the coordinate positions in the elements of the supplied geometry. The indices are 1-based. For example, for a `LINESTRING` the paths are `{i}` where `i` is the `n`th coordinate in the `LINESTRING`. For a `POLYGON` the paths are `{i, j}` where `i` is the ring number (1 is outer; inner rings follow) and `j` is the coordinate position in the ring.

To obtain a single geometry containing the coordinates use **ST_Points**.

Enhanced: 2.1.0 Faster speed. Reimplemented as native-C.

Mejorado: 2.0.0 se introdujo soporte para superficies poliédricas, Triangulos y TIN.

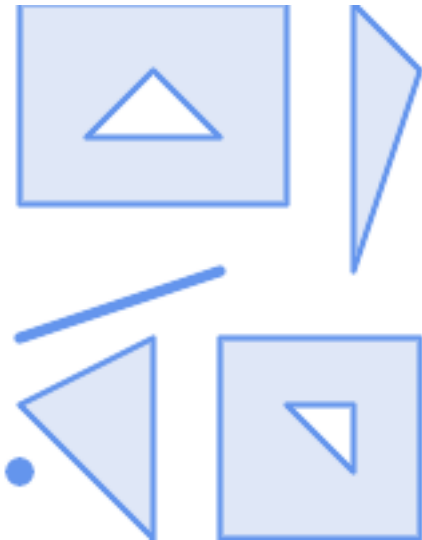
Disponibilidad: 1.2.2

- ✔ This method supports Circular Strings and Curves
- ✔ This function supports Polyhedral surfaces.
- ✔ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).
- ✔ This function supports 3d and will not drop the z-index.

Classic Explode a Table of LineStrings into nodes

```
SELECT edge_id, (dp).path[1] As index, ST_AsText((dp).geom) As wktnode
FROM (SELECT 1 As edge_id
      , ST_DumpPoints(ST_GeomFromText('LINESTRING(1 2, 3 4, 10 10)')) AS dp
      UNION ALL
      SELECT 2 As edge_id
      , ST_DumpPoints(ST_GeomFromText('LINESTRING(3 5, 5 6, 9 10)')) AS dp
      ) As foo;
edge_id | index | wktnode
-----+-----+-----
1 | 1 | POINT(1 2)
1 | 2 | POINT(3 4)
1 | 3 | POINT(10 10)
2 | 1 | POINT(3 5)
2 | 2 | POINT(5 6)
2 | 3 | POINT(9 10)
```

Ejemplos Estándar



```
SELECT path, ST_AsText (geom)
FROM (
  SELECT (ST_DumpPoints(g.geom)) .*
  FROM
```



```

(SELECT
  'GEOMETRYCOLLECTION(
    POINT ( 0 1 ),
    LINESTRING ( 0 3, 3 4 ),
    POLYGON (( 2 0, 2 3, 0 2, 2 0 )),
    POLYGON (( 3 0, 3 3, 6 3, 6 0, 3 0 ),
      ( 5 1, 4 2, 5 2, 5 1 )),
    MULTIPOLYGON (
      (( 0 5, 0 8, 4 8, 4 5, 0 5 )),
      ( 1 6, 3 6, 2 7, 1 6 )),
      (( 5 4, 5 8, 6 7, 5 4 ))
    )
  )::geometry AS geom
) AS g
) j;

```

path	st_astext
{1,1}	POINT(0 1)
{2,1}	POINT(0 3)
{2,2}	POINT(3 4)
{3,1,1}	POINT(2 0)
{3,1,2}	POINT(2 3)
{3,1,3}	POINT(0 2)
{3,1,4}	POINT(2 0)
{4,1,1}	POINT(3 0)
{4,1,2}	POINT(3 3)
{4,1,3}	POINT(6 3)
{4,1,4}	POINT(6 0)
{4,1,5}	POINT(3 0)
{4,2,1}	POINT(5 1)
{4,2,2}	POINT(4 2)
{4,2,3}	POINT(5 2)
{4,2,4}	POINT(5 1)
{5,1,1,1}	POINT(0 5)
{5,1,1,2}	POINT(0 8)
{5,1,1,3}	POINT(4 8)
{5,1,1,4}	POINT(4 5)
{5,1,1,5}	POINT(0 5)
{5,1,2,1}	POINT(1 6)
{5,1,2,2}	POINT(3 6)
{5,1,2,3}	POINT(2 7)
{5,1,2,4}	POINT(1 6)
{5,2,1,1}	POINT(5 4)
{5,2,1,2}	POINT(5 8)
{5,2,1,3}	POINT(6 7)
{5,2,1,4}	POINT(5 4)

(29 rows)

Ejemplos de superficies poliedricas, MDT y triángulos

```

-- Polyhedral surface cube --
SELECT (g.gdump).path, ST_AsEWKT((g.gdump).geom) as wkt
FROM
  (SELECT
    ST_DumpPoints(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 ←
    0)),
    ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
    ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
    ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )' ) AS gdump
  )

```

```

    ) AS g;
-- result --
path      |      wkt
-----+-----
{1,1,1} | POINT(0 0 0)
{1,1,2} | POINT(0 0 1)
{1,1,3} | POINT(0 1 1)
{1,1,4} | POINT(0 1 0)
{1,1,5} | POINT(0 0 0)
{2,1,1} | POINT(0 0 0)
{2,1,2} | POINT(0 1 0)
{2,1,3} | POINT(1 1 0)
{2,1,4} | POINT(1 0 0)
{2,1,5} | POINT(0 0 0)
{3,1,1} | POINT(0 0 0)
{3,1,2} | POINT(1 0 0)
{3,1,3} | POINT(1 0 1)
{3,1,4} | POINT(0 0 1)
{3,1,5} | POINT(0 0 0)
{4,1,1} | POINT(1 1 0)
{4,1,2} | POINT(1 1 1)
{4,1,3} | POINT(1 0 1)
{4,1,4} | POINT(1 0 0)
{4,1,5} | POINT(1 1 0)
{5,1,1} | POINT(0 1 0)
{5,1,2} | POINT(0 1 1)
{5,1,3} | POINT(1 1 1)
{5,1,4} | POINT(1 1 0)
{5,1,5} | POINT(0 1 0)
{6,1,1} | POINT(0 0 1)
{6,1,2} | POINT(1 0 1)
{6,1,3} | POINT(1 1 1)
{6,1,4} | POINT(0 1 1)
{6,1,5} | POINT(0 0 1)
(30 rows)

```

```

-- TIN --
SELECT ST_AsEWKT(ST_GeometryN(geom,2)) as wkt
FROM
  (SELECT
    ST_GeomFromEWKT('TIN (((
      0 0 0,
      0 0 1,
      0 1 0,
      0 0 0
    )), ((
      0 0 0,
      0 1 0,
      1 1 0,
      0 0 0
    ))
  ) AS geom
) AS g;
-- result --
      wkt
-----
TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))

```

```

-- TIN --
SELECT ST_AsEWKT(ST_GeometryN(geom,2)) as wkt
FROM

```

```

(SELECT
  ST_GeomFromEWKT('TIN (((
    0 0 0,
    0 0 1,
    0 1 0,
    0 0 0
  )), ((
    0 0 0,
    0 1 0,
    1 1 0,
    0 0 0
  ))
  ) AS geom
) AS g;
-- result --
          wkt
-----
TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))

```

Ver también

[geometry_dump](#), [ST_GeomFromEWKT](#), [ST_Dump](#), [ST_GeometryN](#), [ST_NumGeometries](#)

8.4.8 ST_NumPoints

ST_NumPoints — Devuelve un resumen de texto del contenido de la geometría.

Synopsis

geometry **ST_Points**(geometry geom);

Descripción

A set-returning function (SRF) that extracts the segments of a geometry. It returns a set of [geometry_dump](#) rows, each containing a geometry (*geom* field) and an array of integers (*path* field).

- Devuelve TRUE si esta LINESTRING es simple y cerrada.
- the *path* field (an `integer[]`) is an index enumerating the segment start point positions in the elements of the supplied geometry. The indices are 1-based. For example, for a LINESTRING the paths are {*i*} where *i* is the *n*th segment start point in the LINESTRING. For a POLYGON the paths are {*i*, *j*} where *i* is the ring number (1 is outer; inner rings follow) and *j* is the segment start point position in the ring.

Disponibilidad: 2.2.0



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Ejemplos Estándar

```

SELECT path, ST_AsText(geom)
FROM (
  SELECT (ST_DumpSegments(g.geom)).*
  FROM (SELECT 'GEOMETRYCOLLECTION(
    LINESTRING(1 1, 3 3, 4 4),
    POLYGON((5 5, 6 6, 7 7, 5 5))
  )'::geometry AS geom
        ) AS g
) j;

```

path	│	st_astext
{1,1}	│	LINESTRING(1 1,3 3)
{1,2}	│	LINESTRING(3 3,4 4)
{2,1,1}	│	LINESTRING(5 5,6 6)
{2,1,2}	│	LINESTRING(6 6,7 7)
{2,1,3}	│	LINESTRING(7 7,5 5)
(5 rows)		

Ejemplos de superficies poliedricas, MDT y triángulos

```

-- TIN --
SELECT ST_AsEWKT(ST_GeometryN(geom,2)) as wkt
FROM
  (SELECT
    ST_GeomFromEWKT('TIN (((
      0 0 0,
      0 0 1,
      0 1 0,
      0 0 0
    )), ((
      0 0 0,
      0 1 0,
      1 1 0,
      0 0 0
    ))
  )') AS geom
) AS g;
-- result --

wkt
-----
TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))

```

```

-- TIN --
SELECT ST_AsEWKT(ST_GeometryN(geom,2)) as wkt
FROM
  (SELECT
    ST_GeomFromEWKT('TIN (((
      0 0 0,
      0 0 1,
      0 1 0,
      0 0 0
    )), ((
      0 0 0,
      0 1 0,
      1 1 0,
      0 0 0
    ))
  )') AS geom
) AS g;

```

```

    ) AS g;
-- result --
          wkt
-----
TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))

```

Ver también

[geometry_dump](#), [ST_GeomCollFromText](#), [ST_Dump](#), [ST_NumInteriorRing](#).

8.4.9 ST_NRings

ST_NRings — Returns a set of `geometry_dump` rows for the exterior and interior rings of a Polygon.

Synopsis

geometry **ST_ExteriorRing**(geometry a_polygon);

Descripción

A set-returning function (SRF) that extracts the rings of a polygon. It returns a set of [geometry_dump](#) rows, each containing a geometry (*geom* field) and an array of integers (*path* field).

The *geom* field contains each ring as a POLYGON. The *path* field is an integer array of length 1 containing the polygon ring index. The exterior ring (shell) has index 0. The interior rings (holes) have indices of 1 and higher.



Note

Esto no funcionara con MULTIPOLYGONS. Para MULTIPOLYGONS utilizaba junto a ST_Dump.

Availability: PostGIS 1.1.3. Requires PostgreSQL 7.3 or higher.



This function supports 3d and will not drop the z-index.

Ejemplos

General form of query.

```

SELECT polyTable.field1, polyTable.field1,
       (ST_DumpRings(polyTable.geom)).geom As geom
FROM polyTable;

```

A polygon with a single hole.

```

SELECT path, ST_AsEWKT(geom) As geom
FROM ST_DumpRings(
    ST_GeomFromEWKT('POLYGON((-8149064 5133092 1,-8149064 5132986 1,-8148996 ↵
        5132839 1,-8148972 5132767 1,-8148958 5132508 1,-8148941 5132466 ↵
        1,-8148924 5132394 1,
        -8148903 5132210 1,-8148930 5131967 1,-8148992 5131978 1,-8149237 5132093 ↵
        1,-8149404 5132211 1,-8149647 5132310 1,-8149757 5132394 1,
        -8150305 5132788 1,-8149064 5133092 1),

```

	(-8149362 5132394 1,-8149446 5132501 1,-8149548 5132597 1,-8149695 5132675 1,-8149362 5132394 1)) ')	↵
) as foo;	
path	geom	

{0}	POLYGON((-8149064 5133092 1,-8149064 5132986 1,-8148996 5132839 1,-8148972 5132767 1,-8148958 5132508 1,	↵
	1,-8148941 5132466 1,-8148924 5132394 1,	
	1,-8148903 5132210 1,-8148930 5131967 1,	
	1,-8148992 5131978 1,-8149237 5132093 1,	
	1,-8149404 5132211 1,-8149647 5132310 1,-8149757 5132394 1,-8150305 5132788 1,-8149064 5133092 1))	↵
{1}	POLYGON((-8149362 5132394 1,-8149446 5132501 1,	
	1,-8149548 5132597 1,-8149695 5132675 1,-8149362 5132394 1))	

Ver también

[geometry_dump](#), [ST_GeomFromEWKT](#), [ST_Dump](#), [ST_GeometryN](#), [ST_NumGeometries](#)

8.4.10 ST_EndPoint

ST_EndPoint — Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.

Synopsis

geometry **ST_Points**(geometry geom);

Descripción

Devuelve el primer punto de una geometría LINESTRING o CIRCULARLINESTRING como un POINT o NULL si el parámetro de entrada no es un LINESTRING o CIRCULARLINESTRING.

- ✓ This method implements the SQL/MM specification. SQL-MM 3: 7.1.4
- ✓ This function supports 3d and will not drop the z-index.
- ✓ This method supports Circular Strings and Curves

Note



Cambiado: 2.0.0 ya no funciona con multilinestrings de geometrías simples. En versiones anteriores de PostGIS -- una linea simple multilinestring funciona sin problemas con esta función y devuelve el punto inicial. En la version 2.0.0 simplemente devuelve NULL como con cualquier multilinestring. La antigua version era una función sin documentar, pero la gente que asumía que tenia sus datos almacenados en LINESTRING pueden experimentar este comportamiento ahora de resultado NULL en la version 2.0.

Ejemplos

End point of a LineString

```
postgis=# SELECT ST_AsText(ST_EndPoint('LINESTRING(1 1, 2 2, 3 3)::geometry));
st_astext
-----
POINT(3 3)
```

End point of a non-LineString is NULL

```
SELECT ST_EndPoint('POINT(1 1)::geometry') IS NULL AS is_null;
   is_null
-----
t
```

End point of a 3D LineString

```
--3d endpoint
SELECT ST_AsEWKT(ST_EndPoint('LINESTRING(1 1 2, 1 2 3, 0 0 5)'));
   st_asewkt
-----
POINT(0 0 5)
```

Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.

```
SELECT ST_AsText(ST_EndPoint('CIRCULARSTRING(5 2,-3 1.999999, -2 1, -4 2, 6 3)::geometry')) ←
;
   st_astext
-----
POINT(6 3)
```

Ver también

[ST_PointN](#), [ST_StartPoint](#)

8.4.11 ST_Envelope

ST_Envelope — Devuelve una geometría que representa la caja en doble precisión (float8) de la geometría dada.

Synopsis

geometry **ST_Envelope**(geometry g1);

Descripción

Devuelve una geometría que representa la caja mínima en doble precisión (float8) de la geometría dada. El polígono definido por las esquinas de la caja ((MINX, MINY), (MINX, MAXY), (MAXX, MAXY), (MAXX, MINY), (MINX, MINY)). (PostGIS añadirá las coordenadas ZMIN/ZMAX también).

Algunos casos particulares (líneas verticales, puntos) devolverán una geometría de dimension menor que POLYGON, por ejemplo POINT o LINESTRING.

Disponibilidad: 1.5.0 comportamiento modificado para devolver doble precisión en vez de float4.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.1



This method implements the SQL/MM specification. SQL-MM 3: 5.1.19

Ejemplos

```
SELECT ST_AsText(ST_Envelope('POINT(1 3)::geometry'));
      st_astext
-----
POINT(1 3)
(1 row)

SELECT ST_AsText(ST_Envelope('LINESTRING(0 0, 1 3)::geometry'));
      st_astext
-----
POLYGON((0 0,0 3,1 3,1 0,0 0))
(1 row)

SELECT ST_AsText(ST_Envelope('POLYGON((0 0, 0 1, 1.0000001 1, 1.0000001 0, 0 0))::geometry' ↵
));
      st_astext
-----
POLYGON((0 0,0 1,1.00000011920929 1,1.00000011920929 0,0 0))
(1 row)
SELECT ST_AsText(ST_Envelope('POLYGON((0 0, 0 1, 1.0000000001 1, 1.0000000001 0, 0 0)):: ↵
geometry'));
      st_astext
-----
POLYGON((0 0,0 1,1.00000011920929 1,1.00000011920929 0,0 0))
(1 row)

SELECT Box3D(geom), Box2D(geom), ST_AsText(ST_Envelope(geom)) As envelopewkt
FROM (SELECT 'POLYGON((0 0, 0 1000012333334.34545678, 1.0000001 1, 1.0000001 0, 0 ↵
0))::geometry As geom) As foo;
```



Envelope of a point and linestring.

```
SELECT ST_AsText(ST_Envelope(
    ST_Collect(
        ST_GeomFromText('LINESTRING(55 75,125 150)'),
        ST_Point(20, 80))
```



```

                                )) As wktenv;
wktenv
-----
POLYGON((20 75,20 150,125 150,125 75,20 75))

```

Ver también

[Box2D](#), [Box3D](#), [ST_OrientedEnvelope](#)

8.4.12 ST_ExteriorRing

ST_ExteriorRing — Devuelva el número de anillos interiores de una geometría poligonal.

Synopsis

geometry **ST_ExteriorRing**(geometry a_polygon);

Descripción

Devuelve una linestring representando el anillo exterior de una geometría tipo POLYGON. Devuelve NULL si la geometría no es un polígono. No funcionará con MULTIPOLYGON



Note

Esto no funcionara con MULTIPOLYGONS. Para MULTIPOLYGONS utilizaba junto a ST_Dump.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). 2.1.5.1



This method implements the SQL/MM specification. SQL-MM 3: 8.2.3, 8.3.3



This function supports 3d and will not drop the z-index.

Ejemplos

```

--Si tienes una tabla de poligonos
SELECT gid, ST_ExteriorRing(the_geom) AS ering
FROM sometable;

--Si tienes una tbla de MULTIPOLYGONos
--y quieres que te devuelva una MULTILINESTRING compuesta por los anillos exteriores de ↵
cada poligono
SELECT gid, ST_Collect(ST_ExteriorRing(the_geom)) AS erings
      FROM (SELECT gid, (ST_Dump(the_geom)).geom As the_geom
            FROM sometable) As foo
GROUP BY gid;

--Ejemplo 3d
SELECT ST_AsEWKT(
  ST_ExteriorRing(
    ST_GeomFromEWKT('POLYGON((0 0 1, 1 1 1, 1 2 1, 1 1 1, 0 0 1))')
  )
);

```

```
st_asewkt
-----
LINESTRING(0 0 1,1 1 1,1 2 1,1 1 1,0 0 1)
```

Ver también

[ST_InteriorRingN](#), [ST_Boundary](#), [ST_NumInteriorRings](#)

8.4.13 ST_GeometryN

ST_GeometryN — Devuelve el tipo de geometría del valor de **ST_Geometry**.

Synopsis

geometry **ST_GeometryN**(geometry geomA, integer n);

Descripción

Devuelve la geometría en la cual se basa si la geometría es una **GEOMETRYCOLLECTION**, un **(MULTI)POINT**, una **(MULTI)LINESTRING**, una **MULTICURVE** o un **(MULTI)POLYGON**, una **POLYHEDRALSURFACE** si no devuelve **NULL**.



Note

El índice es 1-based en la especificación OGC desde la version 0.8.0. Versiones anteriormente implementadas era de tipo 0-based.



Note

Si quieres extraer todas las geometrías de una geometría, **ST_Dump** es mas eficiente y funcionará con geometrías simples.

Mejorado: 2.0.0 se introdujo soporte para superficies poliédricas, Triangulos y TIN.

Cambiado: 2.0.0 Versiones anteriores devuelven **NULL** para geometrías simples. Esto ha sido cambiado para devolver la geometría en el caso de **ST_GeometryN(..,1)**.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 9.1.5



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos Estándar

```
--Extracting a subset of points from a 3d multipoint
SELECT n, ST_AsEWKT(ST_GeometryN(geom, n)) As geomewkt
FROM (
VALUES (ST_GeomFromEWKT('MULTIPOINT((1 2 7), (3 4 7), (5 6 7), (8 9 10))') ),
( ST_GeomFromEWKT('MULTICURVE(CIRCULARSTRING(2.5 2.5,4.5 2.5, 3.5 3.5), (10 11, 12 11))') )
)As foo(geom)
CROSS JOIN generate_series(1,100) n
WHERE n <= ST_NumGeometries(geom);
```

n	geomewkt
1	POINT(1 2 7)
2	POINT(3 4 7)
3	POINT(5 6 7)
4	POINT(8 9 10)
1	CIRCULARSTRING(2.5 2.5,4.5 2.5,3.5 3.5)
2	LINESTRING(10 11,12 11)

```
--Extracting all geometries (useful when you want to assign an id)
SELECT gid, n, ST_GeometryN(geom, n)
FROM sometable CROSS JOIN generate_series(1,100) n
WHERE n <= ST_NumGeometries(geom);
```

Ejemplos de superficies poliedricas, MDT y triángulos

```
-- Ejemplo de superficie de poliedros
-- Romper una superficie poliédrica en sus caras
SELECT ST_AsEWKT(ST_GeometryN(p_geom,3)) As geom_ewkt
FROM (SELECT ST_GeomFromEWKT('POLYHEDRALSURFACE(
((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)),
((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)),
((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))
)') AS p_geom ) AS a;
```

geom_ewkt
POLYGON((0 0 0,1 0 0,1 0 1,0 0 1,0 0 0))

```
-- TIN --
SELECT ST_AsEWKT(ST_GeometryN(geom,2)) as wkt
FROM
(SELECT
ST_GeomFromEWKT('TIN (((
0 0 0,
0 0 1,
0 1 0,
0 0 0
)), ((
0 0 0,
0 1 0,
1 1 0,
0 0 0
)))
```

```

        )') AS geom
    ) AS g;
-- result --
          wkt
-----
TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))

```

Ver también

[ST_Dump](#), [ST_NumGeometries](#)

8.4.14 ST_GeometryType

ST_GeometryType — Devuelve el tipo de geometría del valor de ST_Geometry.

Synopsis

text **ST_GeometryType**(geometry g1);

Descripción

Devuelve el tipo de geometría como una cadena de texto. Por Ejemplo: 'ST_LineString', 'ST_Polygon', 'ST_MultiPolygon' etc. Esta función difiere de GeometryType(geometría) en este caso se devuelve la cadena de texto y ST delante, como el hecho de que no indicará como se mide la geometría.

Mejora: 2.0.0 se introdujo soporte de superficies poliédricas.



This method implements the SQL/MM specification. SQL-MM 3: 5.1.4



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Ejemplos

```

SELECT ST_GeometryType(ST_GeomFromText('LINESTRING(77.29 29.07,77.42 29.26,77.27 29.31,77.29 29.07)'));
--resultado
ST_LineString

```

```

SELECT ST_GeometryType(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))
) )'));
--result
ST_PolyhedralSurface

```

```

SELECT ST_GeometryType(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
    ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
    ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
    ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))
  ) )');
--result
ST_PolyhedralSurface

```

```

SELECT ST_GeometryType(geom) as result
FROM
  (SELECT
    ST_GeomFromEWKT('TIN (((
      0 0 0,
      0 0 1,
      0 1 0,
      0 0 0
    )), ((
      0 0 0,
      0 1 0,
      1 1 0,
      0 0 0
    ))
  )') AS geom
) AS g;
result
-----
ST_Tin

```

Ver también

[GeometryType](#)

8.4.15 ST_HasArc

ST_HasArc — Tests if a geometry contains a circular arc

Synopsis

boolean **ST_IsEmpty**(geometry geomA);

Descripción

Devuelve True si la Geometría es una colección vacía, polígono vacío, punto vacío etc.

Disponibilidad: 1.2.2



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_HasArc(ST_Collect('LINESTRING(1 2, 3 4, 5 6)', 'CIRCULARSTRING(1 1, 2 3, 4 5, 6 6, 7, 5 6)'));
      st_hasarc
      -
      t
```

Ver también

[ST_CurveToLine](#), [ST_PointN](#)

8.4.16 ST_InteriorRingN

ST_InteriorRingN — Devuelva el número de anillos interiores de una geometría poligonal.

Synopsis

geometry **ST_InteriorRingN**(geometry a_polygon, integer n);

Descripción

Devuelve la cadena de texto del anillo interior N del poligono. Devuelve NULL si la geometría no es un polígono o el índice N dado esta fuera de rango.



Note

Esto no funcionara con MULTIPOLYGONS. Para MULTIPOLYGONS utilizaba junto a ST_Dump.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 8.2.6, 8.3.5



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsText(ST_InteriorRingN(the_geom, 1)) As the_geom
FROM (SELECT ST_BuildArea(
        ST_Collect(ST_Buffer(ST_Point(1,2), 20,3),
        ST_Buffer(ST_Point(1, 2), 10,3))) As the_geom
      ) as foo
```

Ver también

[ST_ExteriorRing](#), [ST_M](#), [ST_X](#), [ST_Y](#), [ST_ZMax](#), [ST_ZMin](#)

8.4.17 ST_IsClosed

ST_IsClosed — Devuelve `TRUE` si los puntos de inicio y final de una `LINESTRING` son coincidentes. Para superficies poliedricas si son cerradas (volumetricas).

Synopsis

boolean **ST_IsClosed**(geometry g);

Descripción

Devuelve `TRUE` si los puntos de inicio y final de una `LINESTRING` son coincidentes. Para superficies poliédricas , te dice si las superficies son áreas (abiertas) o si son volumétricas (cerradas).



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 7.1.5, 9.3.3



Note

SQL-MM define que el resultado de `ST_IsClosed(NULL)` debe ser 0, mientras que PostGIS devuelve `NULL`.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Mejora: 2.0.0 se introdujo soporte de superficies poliédricas.



This function supports Polyhedral surfaces.

Ejemplos con líneas y puntos

```
postgis=# SELECT ST_IsClosed('LINESTRING(0 0, 1 1)::geometry');
st_isclosed
-----
f
(1 row)

postgis=# SELECT ST_IsClosed('LINESTRING(0 0, 0 1, 1 1, 0 0)::geometry');
st_isclosed
-----
t
(1 row)

postgis=# SELECT ST_IsClosed('MULTILINESTRING((0 0, 0 1, 1 1, 0 0),(0 0, 1 1))::geometry');
st_isclosed
-----
f
(1 row)

postgis=# SELECT ST_IsClosed('POINT(0 0)::geometry');
st_isclosed
-----
t
```

```
(1 row)

postgis=# SELECT ST_IsClosed('MULTIPOINT((0 0), (1 1))'::geometry);
 st_isclosed
-----
 t
(1 row)
```

Ejemplos con superficies Poliédricas

```
-- Un cubo --
SELECT ST_IsClosed(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 ←
1, 0 1 0, 0 0 0)),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0) ←
),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1) ←
) )''));

 st_isclosed
-----
 t

-- Mismo cubo pero faltando un lado --
SELECT ST_IsClosed(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 ←
0)),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0) ←
),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)) )''));

 st_isclosed
-----
 f
```

Ver también

[ST_IsRing](#)

8.4.18 ST_IsCollection

ST_IsCollection — Devuelve True si la Geometría es una colección vacía, polígono vacío, punto vacío etc.

Synopsis

boolean **ST_IsCollection**(geometry g);

Descripción

Devuelve TRUE si la geometría del argumento es:

- GEOMETRYCOLLECTION

- MULTI{POINT,POLYGON,LINestring,CURVE,SURFACE}
- COMPOUNDCURVE

**Note**

Esta función analiza el tipo de geometría. Esto significa que devolverá `TRUE` en colecciones que estén vacías o que contengan un único elemento.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
postgis=# SELECT ST_IsCollection('LINESTRING(0 0, 1 1)::geometry');
st_iscollection
-----
f
(1 row)

postgis=# SELECT ST_IsCollection('MULTIPOINT EMPTY)::geometry';
st_iscollection
-----
t
(1 row)

postgis=# SELECT ST_IsCollection('MULTIPOINT((0 0))::geometry');
st_iscollection
-----
t
(1 row)

postgis=# SELECT ST_IsCollection('MULTIPOINT((0 0), (42 42))::geometry');
st_iscollection
-----
t
(1 row)

postgis=# SELECT ST_IsCollection('GEOMETRYCOLLECTION(POINT(0 0))::geometry');
st_iscollection
-----
t
(1 row)
```

Ver también

[ST_NumGeometries](#)

8.4.19 ST_IsEmpty

`ST_IsEmpty` — Tests if a geometry is empty.

Synopsis

boolean **ST_IsEmpty**(geometry geomA);

Descripción

Devuelve True si la Geometría es una geometría vacía. Si es cierto, entonces esta Geometría representa una colección de geometrías vacías, polígonos vacíos, puntos vacíos, etc.



Note

SQL-MM define que el resultado de ST_IsEmpty(NULL) debe ser 0, mientras que PostGIS devuelve NULL.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.1



This method implements the SQL/MM specification. SQL-MM 3: 5.1.7



This method supports Circular Strings and Curves



Warning

Cambiado: 2.0.0 En las versiones anteriores de PostGIS ST_GeomFromText('GEOMETRYCOLLECTION(EMPTY)') estaba permitido. Esto no esta permitido ahora en PostGIS 2.0.0 para ajustarse mejor a las normas SQL/MM.

Ejemplos

```
SELECT ST_IsEmpty(ST_GeomFromText('GEOMETRYCOLLECTION EMPTY'));
st_isempty
-----
t
(1 row)

SELECT ST_IsEmpty(ST_GeomFromText('POLYGON EMPTY'));
st_isempty
-----
t
(1 row)

SELECT ST_IsEmpty(ST_GeomFromText('POLYGON((1 2, 3 4, 5 6, 1 2))'));
st_isempty
-----
f
(1 row)

SELECT ST_IsEmpty(ST_GeomFromText('POLYGON((1 2, 3 4, 5 6, 1 2))')) = false;
?column?
-----
t
(1 row)

SELECT ST_IsEmpty(ST_GeomFromText('CIRCULARSTRING EMPTY'));
st_isempty
-----
t
(1 row)
```

8.4.20 ST_IsPolygonCCW

ST_IsPolygonCCW — Devuelve true si todos los aros exteriores están orientados hacia la izquierda y todos los aros interiores están orientados hacia la derecha.

Synopsis

boolean **ST_IsPolygonCCW** (geometry geom);

Descripción

Devuelve true si todos los componentes poligonales de la geometría de entrada utilizan una orientación contraria a las manecillas del reloj para su aro exterior y una dirección en el sentido de las manecillas del reloj para todos los anillos interiores.

Devuelve true si la geometría no tiene componentes poligonales.



Note

Cadenas de líneas cerradas no se consideran componentes poligonales, por lo que aún obtendrá como devolución verdadero por pasar una sola cadena de líneas cerrada sin importar su orientación.



Note

Si una geometría poligonal no utiliza la orientación inversa para los anillos interiores (es decir, si uno o más anillos interiores están orientados en la misma dirección que un anillo exterior), ambos **ST_IsPolygonCW** y **ST_IsPolygonCCW** devolverán false.

Disponibilidad: 2.2.0



This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ver también

ST_ForcePolygonCW , **ST_ForcePolygonCCW** , **ST_IsPolygonCW**

8.4.21 ST_IsPolygonCW

ST_IsPolygonCW — Devuelve true si todos los aros exteriores están orientados hacia la derecha y todos los aros interiores están orientados en sentido contrario a las agujas del reloj.

Synopsis

boolean **ST_IsPolygonCW** (geometry geom);

Descripción

Devuelve true si todos los componentes poligonales de la geometría de entrada utilizan una orientación horaria para su aro exterior y una dirección contraria a las manecillas del reloj para todos los anillos interiores.

Devuelve true si la geometría no tiene componentes poligonales.



Note

Cadenas de líneas cerradas no se consideran componentes poligonales, por lo que aún obtendrá como devolución verdadero por pasar una sola cadena de líneas cerrada sin importar su orientación.



Note

Si una geometría poligonal no utiliza la orientación inversa para los anillos interiores (es decir, si uno o más anillos interiores están orientados en la misma dirección que un anillo exterior), ambos `ST_IsPolygonCW` y `ST_IsPolygonCCW` devolverán false.

Disponibilidad: 2.2.0



This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ver también

`ST_ForcePolygonCW` , `ST_ForcePolygonCCW` , `ST_IsPolygonCW`

8.4.22 ST_IsRing

`ST_IsRing` — Tests if a LineString is closed and simple.

Synopsis

boolean **ST_IsRing**(geometry g);

Descripción

Devuelve TRUE si esta LINESTRING es **ST_IsClosed** (`ST_StartPoint((g)) ~= ST_Endpoint((g))`) y **ST_IsSimple** (no se intersecta con ella misma).



This method implements the **OGC Simple Features Implementation Specification for SQL 1.1**. 2.1.5.1



This method implements the SQL/MM specification. SQL-MM 3: 7.1.6



Note

SQL-MM define que el resultado de `ST_IsRing(NULL)` debe ser 0, mientras que PostGIS devuelve NULL.

Ejemplos

```
SELECT ST_IsRing(the_geom), ST_IsClosed(the_geom), ST_IsSimple(the_geom)
FROM (SELECT 'LINESTRING(0 0, 0 1, 1 1, 1 0, 0 0)::geometry AS the_geom) AS foo;
 st_isring | st_isclosed | st_issimple
-----+-----+-----
t          | t           | t
(1 row)

SELECT ST_IsRing(the_geom), ST_IsClosed(the_geom), ST_IsSimple(the_geom)
FROM (SELECT 'LINESTRING(0 0, 0 1, 1 0, 1 1, 0 0)::geometry AS the_geom) AS foo;
 st_isring | st_isclosed | st_issimple
-----+-----+-----
f          | t           | f
(1 row)
```

Ver también

[ST_IsClosed](#), [ST_IsSimple](#), [ST_StartPoint](#), [ST_EndPoint](#)

8.4.23 ST_IsSimple

ST_IsSimple — Devuelve (TRUE) si la geometría no tiene puntos geométricos anómalos, como auto intersecciones o tangencias.

Synopsis

boolean **ST_IsSimple**(geometry geomA);

Descripción

Devuelve TRUE si la geometría no tiene puntos geométricos anómalos, como auto intersecciones o tangencias. Para mas información sobre la definición del OGC de simplicidad y validez geométrica, visita el enlace ["Ensuring OpenGIS compliancy of geometries"](#)



Note

SQL-MM define que el resultado de **ST_IsSimple**(NULL) debe ser 0, mientras que PostGIS devuelve NULL.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.1



This method implements the SQL/MM specification. SQL-MM 3: 5.1.8



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_IsSimple(ST_GeomFromText('POLYGON((1 2, 3 4, 5 6, 1 2))'));
 st_issimple
-----
t
(1 row)
```

```
SELECT ST_IsSimple(ST_GeomFromText('LINESTRING(1 1,2 2,2 3.5,1 3,1 2,2 1)'));
st_issimple
-----
f
(1 row)
```

Ver también

[ST_IsValid](#)

8.4.24 ST_M

ST_M — Returns the M coordinate of a Point.

Synopsis

float **ST_M**(geometry a_point);

Descripción

Devuelve la coordenada M del punto, o NULL si no seta disponible. La entrada debe ser un punto.



Note

Esto no es (todavía) parte de la especificación OGC, pero esta incluida aquí para completar la lista de extracción de coordenadas de un punto.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification.



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_M(ST_GeomFromEWKT('POINT(1 2 3 4)'));
st_m
-----
4
(1 row)
```

Ver también

[ST_GeomFromEWKT](#), [ST_X](#), [ST_Y](#), [ST_Z](#)

8.4.25 ST_MemSize

ST_MemSize — Devuelve el tipo de geometría del valor de ST_Geometry.

Synopsis

integer **ST_NRings**(geometry geomA);

Descripción

Devuelve el tipo de geometría del valor de ST_Geometry.

This complements the PostgreSQL built-in [database object functions](#) `pg_column_size`, `pg_size_pretty`, `pg_relation_size`, `pg_total_relation_size`.



Note
`pg_relation_size` which gives the byte size of a table may return byte size lower than `ST_MemSize`. This is because `pg_relation_size` does not add toasted table contribution and large geometries are stored in TOAST tables.
`pg_total_relation_size` - includes, the table, the toasted tables, and the indexes.
`pg_column_size` returns how much space a geometry would take in a column considering compression, so may be lower than `ST_MemSize`

- ✔ This function supports 3d and will not drop the z-index.
- ✔ This method supports Circular Strings and Curves
- ✔ This function supports Polyhedral surfaces.
- ✔ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Changed: 2.2.0 name changed to `ST_MemSize` to follow naming convention.

Ejemplos

```
--Return how much byte space Boston takes up in our Mass data set
SELECT pg_size_pretty(SUM(ST_MemSize(geom))) as totgeomsum,
pg_size_pretty(SUM(CASE WHEN town = 'BOSTON' THEN ST_MemSize(geom) ELSE 0 END)) As bossum,
CAST(SUM(CASE WHEN town = 'BOSTON' THEN ST_MemSize(geom) ELSE 0 END)*1.00 /
      SUM(ST_MemSize(geom))*100 As numeric(10,2)) As perbos
FROM towns;

totgeomsum      bossum      perbos
-----
1522 kB          30 kB          1.99

SELECT ST_MemSize(ST_GeomFromText('CIRCULARSTRING(220268 150415,220227 150505,220227 150406)'));

---
73

--What percentage of our table is taken up by just the geometry
SELECT pg_total_relation_size('public.neighborhoods') As fulltable_size, sum(ST_MemSize(geom)) As geomsizes,
sum(ST_MemSize(geom))*1.00/pg_total_relation_size('public.neighborhoods')*100 As pergeom
FROM neighborhoods;
fulltable_size geomsizes pergeom
-----
262144          96238          36.71188354492187500000
```

8.4.26 ST_NDims

ST_NDims — Devuelve la dimensión de las coordenadas del valor de ST_Geometry.

Synopsis

integer **ST_NDims**(geometry g1);

Descripción

Devuelve la dimension de las coordenadas de la geometría. PostGIS soporta 2 - (x,y), 3 - (x,y,z) o 2D con medidas - x,y,m y 4 -3D con medidas en el espacio x,y,z,m.



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_NDims(ST_GeomFromText('POINT(1 1)')) As d2point,
       ST_NDims(ST_GeomFromEWKT('POINT(1 1 2)')) As d3point,
       ST_NDims(ST_GeomFromEWKT('POINTM(1 1 0.5)')) As d2pointm;
```

d2point	d3point	d2pointm
2	3	3

Ver también

[ST_CoordDim](#), [ST_Dimension](#), [ST_GeomFromEWKT](#)

8.4.27 ST_NPoints

ST_NPoints — Devuelve el numero de puntos (vértices) en la geometría.

Synopsis

integer **ST_NPoints**(geometry g1);

Descripción

Devuelve el numero de puntos en la geometría. Funciona con todas las geometrías.

Mejora: 2.0.0 se introdujo soporte de superficies poliédricas.



Note

Anterior a 1.3.4, esta función daba errores si se utilizaba con geometrías que contenían CURVES. Esto se corrigió en 1.3.4+



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_NPoints(ST_GeomFromText('LINESTRING(77.29 29.07,77.42 29.26,77.27 29.31,77.29 29.07)'));
--resultado
4

--Polígono en espacio 3D
SELECT ST_NPoints(ST_GeomFromEWKT('LINESTRING(77.29 29.07 1,77.42 29.26 0,77.27 29.31 -1,77.29 29.07 3)'));
--resultado
4
```

Ver también

[ST_NumPoints](#)

8.4.28 ST_NRings

ST_NRings — Devuelva el número de anillos interiores de una geometría poligonal.

Synopsis

integer **ST_NRings**(geometry geomA);

Descripción

Si la geometria es un polígono o un multi-polígono devuelve el numero de anillos. Al contrario que NumInteriorRings, cuenta el anillo exterior tambien.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_NRings(the_geom) As Nrings, ST_NumInteriorRings(the_geom) As ninterrings
FROM (SELECT ST_GeomFromText('POLYGON((1 2, 3 4, 5 6, 1 2))') As the_geom) As foo;
```

nrings	ninterrings
1	0

(1 row)

Ver también

[ST_NumInteriorRings](#)

8.4.29 ST_NumGeometries

ST_NumGeometries — Devuelve el numero de puntos en la geometría. Funciona con todas las geometrías.

Synopsis

integer **ST_NumGeometries**(geometry geom);

Descripción

Devuelve el numero de geometrías. Si la geometría es una GEOMETRYCOLLECTION (o MULTI*) devuelve el numero de geometrías, para geometrías simples devuelve 1, si no devuelve NULL.

Mejorado: 2.0.0 se introdujo soporte para superficies poliédricas, Triangulos y TIN.

Cambiado: 2.0.0 En versiones anteriores esto devolvería NULL si la geometría no era de tipo collection/MULTI. 2.0.0+ devuelve 1 para geometrías simples, por ejemplo, POLYGON, LINESTRING, POINT.



This method implements the SQL/MM specification. SQL-MM 3: 9.1.4



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
--Prior versions would have returned NULL for this -- in 2.0.0 this returns 1
SELECT ST_NumGeometries(ST_GeomFromText('LINESTRING(77.29 29.07,77.42 29.26,77.27 29.31,77.29 29.07)'));
--result
1

--Geometry Collection Example - multis count as one geom in a collection
SELECT ST_NumGeometries(ST_GeomFromEWKT('GEOMETRYCOLLECTION(MULTIPOINT((-2 3),(-2 2)),
LINESTRING(5 5 ,10 10),
POLYGON((-7 4.2,-7.1 5,-7.1 4.3,-7 4.2)))'));
--result
3
```

Ver también

[ST_GeometryN](#), [ST_Multi](#)

8.4.30 ST_NumInteriorRings

ST_NumInteriorRings — Devuelva el número de anillos interiores de una geometría poligonal.

Synopsis

integer **ST_NumInteriorRings**(geometry a_polygon);

Descripción

Devuelve el número de anillos interiores de una geometría poligonal. Devuelve NULL si la geometría no es un polígono.



This method implements the SQL/MM specification. SQL-MM 3: 8.2.5

Cambiado: 2.0.0 - En versiones anteriores permitiría pasar un multipolígono, devolviendo el número de anillos interiores de primer polígono.

Ejemplos

```
-- Si tiene un polígono regular
SELECT gid, field1, field2, ST_NumInteriorRings(the_geom) AS numholes
FROM sometable;

-- Si tiene multipolígonos.
-- Y quieres saber el número total de anillos interiores en el MULTIPOLYGON
SELECT gid, field1, field2, SUM(ST_NumInteriorRings(the_geom)) AS numholes
FROM (SELECT gid, field1, field2, (ST_Dump(the_geom)).geom As the_geom
      FROM sometable) As foo
GROUP BY gid, field1, field2;
```

Ver también

[ST_NumInteriorRing](#), [ST_PointN](#)

8.4.31 ST_NumInteriorRing

ST_NumInteriorRing — Devuelve el número de anillos interiores de un polígono en la geometría. Sinónimo de **ST_NumInteriorRings**.

Synopsis

integer **ST_NumInteriorRing**(geometry a_polygon);

Ver también

[ST_NumInteriorRings](#), [ST_PointN](#)

8.4.32 ST_NumPatches

ST_NumPatches — Devuelve el número de caras en una superficie poliédrica. Devolverá nulo para geometrías no poliédricas.

Synopsis

integer **ST_NumPatches**(geometry g1);

Descripción

Devuelve el número de caras en una superficie poliédrica. Devolverá nulo para geometrías no poliédricas. Esto es un alias para **ST_NumGeometries** para admitir nombres MM. Más rápido para usar **ST_NumGeometries** si no te importa la convención MM.

Disponibilidad: 2.0.0



This function supports 3d and will not drop the z-index.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3: 8.5



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_NumPatches(ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 ←
    0)),
        ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0) ←
        ),
        ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
        ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1) ←
        ) )');
--result
6
```

Ver también

[ST_GeomFromEWKT](#), [ST_NumGeometries](#)

8.4.33 ST_NumPoints

ST_NumPoints — Devuelve el número de puntos en un valor **ST_LineString** o **ST_CircularString**.

Synopsis

integer **ST_NumPoints**(geometry g1);

Descripción

Devuelve el número de puntos en un valor **ST_LineString** o **ST_CircularString**. Antes de 1.4 sólo funcionaba con cadenas de línea como el estado de especificaciones. A partir de 1.4, esto es un alias para **ST_NPoints** que devuelve el número de vértices para no sólo las cadenas de línea. Considere el uso de **ST_NPoints** en su lugar, que es multiuso y funciona con muchos tipos de geometría.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 7.2.4

Ejemplos

```
SELECT ST_NumPoints(ST_GeomFromText('LINESTRING(77.29 29.07,77.42 29.26,77.27 29.31,77.29 ←
    29.07)'));
--result
4
```

Ver también

[ST_NPoints](#)

8.4.34 ST_PatchN

ST_PatchN — Devuelve el tipo de geometría del valor de **ST_Geometry**.

Synopsis

geometry **ST_PatchN**(geometry geomA, integer n);

Descripción

Devuelve la 1 geometría de base n-ésima (cara) si la geometría es un POLYHEDRALSURFACE, POLYHEDRALSURFACEM. De lo contrario, devuelve NULL. Esto devuelve la misma respuesta que ST_GeometryN para las superficies de poliedros. Usar ST_GeometryN es más rápido.



Note

El índice está basado en 1.



Note

Si desea extraer todas las geometrías, de una geometría, ST_Dump es más eficiente.

Disponibilidad: 2.0.0



This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3: 8.5



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Ejemplos

```
-- Extraer la 2ª cara de la superficie poliédrica
SELECT ST_AsEWKT(ST_PatchN(geom, 2)) As geomewkt
FROM (
VALUES (ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
        ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
        ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
        ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )' ) ) ) ←
        As foo(geom);

        geomewkt
-----+-----
POLYGON((0 0 0,0 1 0,1 1 0,1 0 0,0 0 0))
```

Ver también

[ST_AsEWKT](#), [ST_GeomFromEWKT](#), [ST_Dump](#), [ST_GeometryN](#), [ST_NumGeometries](#)

8.4.35 ST_PointN

ST_PointN — Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.

Synopsis

geometry **ST_PointN**(geometry a_linestring, integer n);

Descripción

Devuelve el punto *n*-ésimo en una sola cadena de línea o cadena de línea circular en la geometría. Los valores negativos se contabilizan hacia atrás desde el final de la cadena de línea, por lo que -1 es el último punto. Devuelve NULL si no hay cadena de línea en la geometría.



Note

El índice se basa en 1 como para las especificaciones OGC desde la versión 0.8.0. La indexación hacia atrás (índice negativo) no se encuentra en versiones anteriores de OGC implementado esto como basado en 0 en su lugar.



Note

Si desea obtener el punto *n*-ésimo de cada cadena de línea en una multiple cadena de línea, utilícelo en conjunción con ST_Dump



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 7.2.5, 7.3.5



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



Note

Cambiado: 2.0.0 ya no funciona con una sola geometría multilinestrings. En versiones antiguas de PostGIS -- una sola línea MultiLineString trabajaría felizmente con esta función y regresaría el punto de inicio. En 2.0.0 sólo devuelve NULL como cualquier otro MultiLineString.

Cambiado: 2.3.0: indexación negativa disponible (-1 es el último punto)

Ejemplos

```
-- Extraer todos los POINTs de un LINESTRING
SELECT ST_AsText(
  ST_PointN(
    column1,
    generate_series(1, ST_NPoints(column1))
  ))
FROM ( VALUES ('LINESTRING(0 0, 1 1, 2 2)::geometry') ) AS foo;

 st_astext
-----
POINT(0 0)
POINT(1 1)
POINT(2 2)
(3 rows)

-- Ejemplo de cadena circular
```

```

SELECT ST_AsText(ST_PointN(ST_GeomFromText('CIRCULARSTRING(1 2, 3 2, 1 2)'),2));

st_astext
-----
POINT(3 2)

SELECT st_astext(f)
FROM ST_GeometryFromtext('LINESTRING(0 0 0, 1 1 1, 2 2 2)') as g
      ,ST_PointN(g, -2) AS f -- 1 based index

st_astext
-----
"POINT Z (1 1 1)"

```

Ver también[ST_NPoints](#)**8.4.36 ST_Points**

ST_Points — Devuelve un MultiPoint que contiene todas las coordenadas de una geometría.

Synopsis

geometry **ST_Points**(geometry geom);

Descripción

Returns a MultiPoint containing all the coordinates of a geometry. Duplicate points are preserved, including the start and end points of ring geometries. (If desired, duplicate points can be removed by calling [ST_RemoveRepeatedPoints](#) on the result).

To obtain information about the position of each coordinate in the parent geometry use [ST_NumPoints](#).

M and Z coordinates are preserved if present.



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.

Disponibilidad: 2.3.0

Ejemplos

```

SELECT ST_AsText(ST_Points('POLYGON Z ((30 10 4,10 30 5,40 40 6, 30 10))'));

--result
MULTIPOINT Z ((30 10 4),(10 30 5),(40 40 6),(30 10 4))

```

Ver también

[ST_RemoveRepeatedPoints](#), [ST_PointN](#)

8.4.37 ST_StartPoint

ST_StartPoint — Returns the first point of a LineString.

Synopsis

geometry **ST_StartPoint**(geometry geomA);

Descripción

Devuelve el primer punto de una geometría `LINESTRING` o `CIRCULARLINESTRING` como un `POINT` o `NULL` si el parámetro de entrada no es un `LINESTRING` o `CIRCULARLINESTRING`.



This method implements the SQL/MM specification. SQL-MM 3: 7.1.3



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Note



Enhanced: 3.2.0 returns a point for all geometries. Prior behavior returns NULLs if input was not a LineString.
Cambiado: 2.0.0 ya no funciona con multilinestrings de geometrías simples. En versiones anteriores de PostGIS -- una linea simple multilinestring funciona sin problemas con esta función y devuelve el punto inicial. En la version 2.0.0 simplemente devuelve NULL como con cualquier multilinestring. La antigua version era una función sin documentar, pero la gente que asumía que tenía sus datos almacenados en `LINESTRING` pueden experimentar este comportamiento ahora de resultado `NULL` en la version 2.0.

Ejemplos

Start point of a LineString

```
SELECT ST_AsText(ST_StartPoint('LINESTRING(0 1, 0 2)::geometry'));
 st_astext
-----
POINT(0 1)
```

Start point of a non-LineString is NULL

```
SELECT ST_StartPoint('POINT(0 1)::geometry') IS NULL AS is_null;
 is_null
-----
t
```

Start point of a 3D LineString

```
SELECT ST_AsEWKT(ST_StartPoint('LINESTRING(0 1 1, 0 2 2)::geometry'));
 st_asewkt
-----
POINT(0 1 1)
```

Devuelve el número de puntos en un valor `ST_LineString` o `ST_CircularString`.

```
SELECT ST_AsText(ST_StartPoint('CIRCULARSTRING(5 2,-3 1.999999, -2 1, -4 2, 6 3)::geometry' ←
));
 st_astext
-----
POINT(5 2)
```


Ver también[ST_EndPoint](#), [ST_PointN](#)**8.4.38 ST_Summary**

ST_Summary — Devuelve un resumen de texto del contenido de la geometría.

Synopsis

```
text ST_Summary(geometry g);
text ST_Summary(geography g);
```

Descripción

Devuelve un resumen de texto del contenido de la geometría.

Las banderas que se muestran entre corchetes después del tipo de geometría tienen el siguiente significado:

- M: tiene ordenada M
- Z: tiene ordenada Z
- B: Tiene un cuadro de delimitación en caché
- G: es geodésico (geography)
- S: tiene un sistema de referencia espacial



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Disponibilidad: 1.2.2

Mejorado: 2.0.0 agregó soporte para geography

Mejorada: 2.1.0 Indicador S para señalar si tiene un sistema de referencia espacial conocido

Mejorado: 2.2.0 agregó soporte para TIN y curvas

Ejemplos

```
=# SELECT ST_Summary(ST_GeomFromText('LINESTRING(0 0, 1 1)')) as geom,
          ST_Summary(ST_GeogFromText('POLYGON((0 0, 1 1, 1 2, 1 1, 0 0))')) geog;
          geom                |                geog
-----+-----
  LineString[B] with 2 points | Polygon[BGS] with 1 rings
                               | ring 0 has 5 points
                               :
(1 row)

=# SELECT ST_Summary(ST_GeogFromText('LINESTRING(0 0 1, 1 1 1)')) As geog_line,
          ST_Summary(ST_GeomFromText('SRID=4326;POLYGON((0 0 1, 1 1 2, 1 2 3, 1 1 1, 0 0 1)) ←
          ')) As geom_poly;
```

```
;  
-----  
|  
| geog_line | geom_poly |  
|-----+-----|  
| LineString[ZBGS] with 2 points | Polygon[ZBS] with 1 rings |  
| : ring 0 has 5 points |  
| : |  
| : |  
|-----+-----|  
(1 row)
```

Ver también

[PostGIS_DropBBox](#), [PostGIS_AddBBox](#), [ST_Force3DM](#), [ST_Force3DZ](#), [ST_Force2D](#), [geography](#)
[ST_IsValid](#), [ST_IsValid](#), [ST_IsValidReason](#), [ST_IsValidDetail](#)

8.4.39 ST_X

ST_X — Returns the X coordinate of a Point.

Synopsis

float **ST_X**(geometry a_point);

Descripción

Devuelve la coordenada X del punto, o NULL si no está disponible. La entrada debe ser un punto.



Note

To get the minimum and maximum X value of geometry coordinates use the functions [ST_XMin](#) and [ST_XMax](#).



This method implements the SQL/MM specification. SQL-MM 3: 6.1.3



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_X(ST_GeomFromEWKT('POINT(1 2 3 4)'));  
st_x  
-----  
1  
(1 row)  
  
SELECT ST_Y(ST_Centroid(ST_GeomFromEWKT('LINESTRING(1 2 3 4, 1 1 1 1)')));  
st_y  
-----  
1.5  
(1 row)
```

Ver también

[ST_Centroid](#), [ST_GeomFromEWKT](#), [ST_M](#), [ST_XMax](#), [ST_XMin](#), [ST_Y](#), [ST_Z](#)

8.4.40 ST_Y

ST_Y — Returns the Y coordinate of a Point.

Synopsis

```
float ST_Y(geometry a_point);
```

Descripción

Devuelve la coordenada Y del punto, o NULL si no está disponible. La entrada debe ser un punto.

**Note**

To get the minimum and maximum Y value of geometry coordinates use the functions [ST_YMin](#) and [ST_YMax](#).



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 6.1.4



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_Y(ST_GeomFromEWKT('POINT(1 2 3 4)'));
 st_y
-----
      2
(1 row)

SELECT ST_Y(ST_Centroid(ST_GeomFromEWKT('LINESTRING(1 2 3 4, 1 1 1 1)')));
 st_y
-----
   1.5
(1 row)
```

Ver también

[ST_Centroid](#), [ST_GeomFromEWKT](#), [ST_M](#), [ST_X](#), [ST_YMax](#), [ST_YMin](#), [ST_Z](#)

8.4.41 ST_Z

ST_Z — Returns the Z coordinate of a Point.

Synopsis

float **ST_Z**(geometry a_point);

Descripción

Devuelve la coordenada Z del punto, o NULL si no está disponible. La entrada debe ser un punto.



Note

To get the minimum and maximum Z value of geometry coordinates use the functions **ST_ZMin** and **ST_ZMax**.



This method implements the SQL/MM specification.



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_Z(ST_GeomFromEWKT('POINT(1 2 3 4)'));
 st_z
-----
      3
(1 row)
```

Ver también

ST_GeomFromEWKT, **ST_M**, **ST_X**, **ST_Y**, **ST_ZMax**, **ST_ZMin**

8.4.42 ST_Zmflag

ST_Zmflag — Devuelve la dimensión de las coordenadas del valor de ST_Geometry.

Synopsis

smallint **ST_Zmflag**(geometry geomA);

Descripción

Devuelve la dimensión de las coordenadas del valor de ST_Geometry.

Values are: 0 = 2D, 1 = 3D-M, 2 = 3D-Z, 3 = 4D.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_Zmflag(ST_GeomFromEWKT('LINESTRING(1 2, 3 4)'));
st_zmflag
-----
0

SELECT ST_Zmflag(ST_GeomFromEWKT('LINESTRINGM(1 2 3, 3 4 3)'));
st_zmflag
-----
1

SELECT ST_Zmflag(ST_GeomFromEWKT('CIRCULARSTRING(1 2 3, 3 4 3, 5 6 3)'));
st_zmflag
-----
2

SELECT ST_Zmflag(ST_GeomFromEWKT('POINT(1 2 3 4)'));
st_zmflag
-----
3
```

Ver también

[ST_CoordDim](#), [ST_NDims](#), [ST_Dimension](#)

8.5 Editores de Geometría

8.5.1 ST_AddPoint

ST_AddPoint — Añade un punto a una cadena de línea.

Synopsis

geometry **ST_AddPoint**(geometry linestring, geometry point);
 geometry **ST_AddPoint**(geometry linestring, geometry point, integer position = -1);

Descripción

Adds a point to a LineString before the index *position* (using a 0-based index). If the *position* parameter is omitted or is -1 the point is appended to the end of the LineString.

Disponibilidad: 1.1.0



This function supports 3d and will not drop the z-index.

Ejemplos

Add a point to the end of a 3D line

```
SELECT ST_AsEWKT(ST_AddPoint('LINESTRING(0 0 1, 1 1 1)', ST_MakePoint(1, 2, 3)));

st_asewkt
-----
LINESTRING(0 0 1,1 1 1,1 2 3)
```

Guarantee all lines in a table are closed by adding the start point of each line to the end of the line only for those that are not closed.

```
UPDATE sometable
SET geom = ST_AddPoint(geom, ST_StartPoint(geom))
FROM sometable
WHERE ST_IsClosed(geom) = false;
```

Ver también

[ST_RemovePoint](#), [ST_SetPoint](#)

8.5.2 ST_CollectionExtract

ST_CollectionExtract — Given a geometry collection, returns a multi-geometry containing only elements of a specified type.

Synopsis

```
geometry ST_CollectionExtract(geometry collection);
geometry ST_CollectionExtract(geometry collection, integer type);
```

Descripción

Given a geometry collection, returns a homogeneous multi-geometry.

If the *type* is not specified, returns a multi-geometry containing only geometries of the highest dimension. So polygons are preferred over lines, which are preferred over points.

If the *type* is specified, returns a multi-geometry containing only that type. If there are no sub-geometries of the right type, an EMPTY geometry is returned. Only points, lines and polygons are supported. The type numbers are:

- 1 == POINT
- 2 == LINESTRING
- 3 == POLYGON

For atomic geometry inputs, the geometry is returned unchanged if the input type matches the requested type. Otherwise, the result is an EMPTY geometry of the specified type. If required, these can be converted to multi-geometries using [ST_Multi](#).



Warning

MultiPolygon results are not checked for validity. If the polygon components are adjacent or overlapping the result will be invalid. (For example, this can occur when applying this function to an [ST_Split](#) result.) This situation can be checked with [ST_IsValid](#) and repaired with [ST_MakeValid](#).

Disponibilidad: 1.5.0



Note

Prior to 1.5.3 this function returned atomic inputs unchanged, no matter type. In 1.5.3 non-matching single geometries returned a NULL result. In 2.0.0 non-matching single geometries return an EMPTY result of the requested type.

Ejemplos

Extract highest-dimension type:

```
SELECT ST_AsText(ST_CollectionExtract(
    'GEOMETRYCOLLECTION( POINT(0 0), LINESTRING(1 1, 2 2) )');
    st_astext
    -----
MULTILINESTRING((1 1, 2 2))
```

Extract points (type 1 == POINT):

```
SELECT ST_AsText(ST_CollectionExtract(
    'GEOMETRYCOLLECTION(GEOMETRYCOLLECTION(POINT(0 0)))',
    1 ));
    st_astext
    -----
MULTIPOINT((0 0))
```

Extract lines (type 2 == LINESTRING):

```
SELECT ST_AsText(ST_CollectionExtract(
    'GEOMETRYCOLLECTION(GEOMETRYCOLLECTION(LINESTRING(0 0, 1 1)),LINESTRING(2 2, 3 3)) ←
    ',
    2 ));
    st_astext
    -----
MULTILINESTRING((0 0, 1 1), (2 2, 3 3))
```

Ver también

[ST_CollectionHomogenize](#), [ST_Multi](#), [ST_IsValid](#), [ST_MakeValid](#)

8.5.3 ST_CollectionHomogenize

ST_CollectionHomogenize — Returns the simplest representation of a geometry collection.

Synopsis

geometry **ST_CollectionHomogenize**(geometry collection);

Descripción

Given a geometry collection, returns the "simplest" representation of the contents.

- Homogeneous (uniform) collections are returned as the appropriate multi-geometry.
- Heterogeneous (mixed) collections are flattened into a single GeometryCollection.
- Collections containing a single atomic element are returned as that element.
- Atomic geometries are returned unchanged. If required, these can be converted to a multi-geometry using [ST_Multi](#).



Warning

This function does not ensure that the result is valid. In particular, a collection containing adjacent or overlapping Polygons will create an invalid MultiPolygon. This situation can be checked with [ST_IsValid](#) and repaired with [ST_MakeValid](#).

Disponibilidad: 2.0.0

Ejemplos

Single-element collection converted to an atomic geometry

```
SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION(POINT(0 0))'));

st_astext
-----
POINT(0 0)
```

Nested single-element collection converted to an atomic geometry:

```
SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION(MULTIPOINT((0 0)))'));

st_astext
-----
POINT(0 0)
```

Collection converted to a multi-geometry:

```
SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION(POINT(0 0),POINT(1 1))'));

st_astext
-----
MULTIPOINT((0 0),(1 1))
```

Nested heterogeneous collection flattened to a GeometryCollection:

```
SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION(POINT(0 0), GEOMETRYCOLLECTION ↵
( LINESTRING(1 1, 2 2))'))');

st_astext
-----
GEOMETRYCOLLECTION(POINT(0 0),LINESTRING(1 1,2 2))
```

Collection of Polygons converted to an (invalid) MultiPolygon:

```
SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION (POLYGON ((10 50, 50 50, 50 ↵
10, 10 10, 10 50)), POLYGON ((90 50, 90 10, 50 10, 50 50, 90 50)))'));

st_astext
-----
MULTIPOLYGON(((10 50,50 50,50 10,10 10,10 50)),((90 50,90 10,50 10,50 50,90 50)))
```

Ver también

[ST_CollectionExtract](#), [ST_Multi](#), [ST_IsValid](#), [ST_MakeValid](#)

8.5.4 ST_CurveToLine

ST_CurveToLine — Converts a geometry containing curves to a linear geometry.

Synopsis

geometry **ST_CurveToLine**(geometry curveGeom, float tolerance, integer tolerance_type, integer flags);

Descripción

Converts a CIRCULAR STRING to regular LINESTRING or CURVEPOLYGON to POLYGON or MULTISURFACE to MULTIPOLYGON. Useful for outputting to devices that can't support CIRCULARSTRING geometry types

Converts a given geometry to a linear geometry. Each curved geometry or segment is converted into a linear approximation using the given `tolerance` and options (32 segments per quadrant and no options by default).

The `tolerance_type` argument determines interpretation of the `tolerance` argument. It can take the following values:

- 0 (default): Tolerance is max segments per quadrant.
- 1: Tolerance is max-deviation of line from curve, in source units.
- 2: Tolerance is max-angle, in radians, between generating radii.

The `flags` argument is a bitfield. 0 by default. Supported bits are:

- 1: Symmetric (orientation independent) output.
- 2: Retain angle, avoids reducing angles (segment lengths) when producing symmetric output. Has no effect when Symmetric flag is off.

Availability: 1.3.0

Enhanced: 2.4.0 added support for max-deviation and max-angle tolerance, and for symmetric output.

Enhanced: 3.0.0 implemented a minimum number of segments per linearized arc to prevent topological collapse.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 7.1.7



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_AsText(ST_CurveToLine(ST_GeomFromText('CIRCULARSTRING(220268 150415,220227 150505,220227 150406)')));

--Result --
LINESTRING(220268 150415,220269.95064912 150416.539364228,220271.823415575 150418.17258804,220273.613787707 150419.895736857,
220275.317452352 150421.704659462,220276.930305234 150423.594998003,220278.448460847 150425.562198489,
220279.868261823 150427.60152176,220281.186287736 150429.708054909,220282.399363347 150431.876723113,
220283.50456625 150434.10230186,220284.499233914 150436.379429536,220285.380970099 150438.702620341,220286.147650624 150441.066277505,
220286.797428488 150443.464706771,220287.328738321 150445.892130112,220287.740300149 150448.342699654,
220288.031122486 150450.810511759,220288.200504713 150453.289621251,220288.248038775 150455.77405574,
220288.173610157 150458.257830005,220287.977398166 150460.734960415,220287.659875492 150463.199479347,
220287.221807076 150465.64544956,220286.664248262 150468.066978495,220285.988542259 150470.458232479,220285.196316903 150472.81345077,
220284.289480732 150475.126959442,220283.270218395 150477.39318505,220282.140985384 150479.606668057,
```

```

220280.90450212 150481.762075989,220279.5637474 150483.85421628,220278.12195122 ↵
150485.87804878,
220276.582586992 150487.828697901,220274.949363179 150489.701464356,220273.226214362 ↵
150491.491836488,
220271.417291757 150493.195501133,220269.526953216 150494.808354014,220267.559752731 ↵
150496.326509628,
220265.520429459 150497.746310603,220263.41389631 150499.064336517,220261.245228106 ↵
150500.277412127,
220259.019649359 150501.38261503,220256.742521683 150502.377282695,220254.419330878 ↵
150503.259018879,
220252.055673714 150504.025699404,220249.657244448 150504.675477269,220247.229821107 ↵
150505.206787101,
220244.779251566 150505.61834893,220242.311439461 150505.909171266,220239.832329968 ↵
150506.078553494,
220237.347895479 150506.126087555,220234.864121215 150506.051658938,220232.386990804 ↵
150505.855446946,
220229.922471872 150505.537924272,220227.47650166 150505.099855856,220225.054972724 ↵
150504.542297043,
220222.663718741 150503.86659104,220220.308500449 150503.074365683,
220217.994991777 150502.167529512,220215.72876617 150501.148267175,
220213.515283163 150500.019034164,220211.35987523 150498.7825509,
220209.267734939 150497.441796181,220207.243902439 150496,
220205.293253319 150494.460635772,220203.420486864 150492.82741196,220201.630114732 ↵
150491.104263143,
220199.926450087 150489.295340538,220198.313597205 150487.405001997,220196.795441592 ↵
150485.437801511,
220195.375640616 150483.39847824,220194.057614703 150481.291945091,220192.844539092 ↵
150479.123276887,220191.739336189 150476.89769814,
220190.744668525 150474.620570464,220189.86293234 150472.297379659,220189.096251815 ↵
150469.933722495,
220188.446473951 150467.535293229,220187.915164118 150465.107869888,220187.50360229 ↵
150462.657300346,
220187.212779953 150460.189488241,220187.043397726 150457.710378749,220186.995863664 ↵
150455.22594426,
220187.070292282 150452.742169995,220187.266504273 150450.265039585,220187.584026947 ↵
150447.800520653,
220188.022095363 150445.35455044,220188.579654177 150442.933021505,220189.25536018 ↵
150440.541767521,
220190.047585536 150438.18654923,220190.954421707 150435.873040558,220191.973684044 ↵
150433.60681495,
220193.102917055 150431.393331943,220194.339400319 150429.237924011,220195.680155039 ↵
150427.14578372,220197.12195122 150425.12195122,
220198.661315447 150423.171302099,220200.29453926 150421.298535644,220202.017688077 ↵
150419.508163512,220203.826610682 150417.804498867,
220205.716949223 150416.191645986,220207.684149708 150414.673490372,220209.72347298 ↵
150413.253689397,220211.830006129 150411.935663483,
220213.998674333 150410.722587873,220216.22425308 150409.61738497,220218.501380756 ↵
150408.622717305,220220.824571561 150407.740981121,
220223.188228725 150406.974300596,220225.586657991 150406.324522731,220227 150406)

--3d example
SELECT ST_AsEWKT(ST_CurveToLine(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 ↵
150505 2,220227 150406 3)')));
Output
-----
LINESTRING(220268 150415 1,220269.95064912 150416.539364228 1.0181172856673,
220271.823415575 150418.17258804 1.03623457133459,220273.613787707 150419.895736857 ↵
1.05435185700189,...AD INFINITUM ....
220225.586657991 150406.324522731 1.32611114201132,220227 150406 3)

--use only 2 segments to approximate quarter circle

```

```

SELECT ST_AsText(ST_CurveToLine(ST_GeomFromText('CIRCULARSTRING(220268 150415,220227 ↔
    150505,220227 150406)'),2));
st_astext
-----
LINESTRING(220268 150415,220287.740300149 150448.342699654,220278.12195122 ↔
    150485.87804878,
220244.779251566 150505.61834893,220207.243902439 150496,220187.50360229 150462.657300346,
220197.12195122 150425.12195122,220227 150406)

-- Ensure approximated line is no further than 20 units away from
-- original curve, and make the result direction-neutral
SELECT ST_AsText(ST_CurveToLine(
    'CIRCULARSTRING(0 0,100 -100,200 0)::geometry,
    20, -- Tolerance
    1, -- Above is max distance between curve and line
    1 -- Symmetric flag
));
st_astext
-----
LINESTRING(0 0,50 -86.6025403784438,150 -86.6025403784439,200 -1.1331077795296e-13,200 0)

```

Ver también

[ST_LineToCurve](#)

8.5.5 ST_Scroll

ST_Scroll — Change start point of a closed LineString.

Synopsis

geometry **ST_Scroll**(geometry linestring, geometry point);

Descripción

Changes the start/end point of a closed LineString to the given vertex *point*.

Availability: 3.2.0



This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ejemplos

Make e closed line start at its 3rd vertex

```

SELECT ST_AsEWKT(ST_Scroll('SRID=4326;LINESTRING(0 0 0 1, 10 0 2 0, 5 5 4 2,0 0 0 1)', ' ↔
    POINT(5 5 4 2)'));
st_asewkt
-----
SRID=4326;LINESTRING(5 5 4 2,0 0 0 1,10 0 2 0,5 5 4 2)

```

Ver también

[ST_Normalize](#)

8.5.6 ST_FlipCoordinates

ST_FlipCoordinates — Returns a version of a geometry with X and Y axis flipped.

Synopsis

geometry **ST_FlipCoordinates**(geometry geom);

Descripción

Returns a version of the given geometry with X and Y axis flipped. Useful for fixing geometries which contain coordinates expressed as latitude/longitude (Y,X).

Disponibilidad: 2.0.0



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.



This function supports M coordinates.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplo

```
SELECT ST_AsEWKT(ST_FlipCoordinates(GeomFromEWKT('POINT(1 2)')));
 st_asewkt
-----
POINT(2 1)
```

Ver también

[ST_SwapOrdinates](#)

8.5.7 ST_Force2D

ST_Force2D — Forzar las geometrías en un "modo de 2 dimensiones".

Synopsis

geometry **ST_Force2D**(geometry geomA);

Descripción

Forzar las geometrías en un "modo de 2 dimensiones" para que todas las representaciones de salida sólo tengan las coordenadas X e Y. Esto es útil para forzar la salida compatible con OGC (ya que OGC sólo especifica geometría 2D).

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_2D.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsEWKT(ST_Force2D(ST_GeomFromEWKT('CIRCULARSTRING(1 1 2, 2 3 2, 4 5 2, 6 7 2, 5 6 2)')));
          st_asewkt
-----
CIRCULARSTRING(1 1,2 3,4 5,6 7,5 6)

SELECT ST_AsEWKT(ST_Force2D('POLYGON((0 0 2,0 5 2,5 0 2,0 0 2),(1 1 2,3 1 2,1 3 2,1 1 2))'));
          st_asewkt
-----
POLYGON((0 0,0 5,5 0,0 0),(1 1,3 1,1 3,1 1))
```

Ver también

[ST_Force3D](#)

8.5.8 ST_Force3D

ST_Force3D — Forzar las geometrías en modo XYZ. Este es un alias para ST_Force3DZ.

Synopsis

geometry **ST_Force3D**(geometry geomA, float Zvalue = 0.0);

Descripción

Forces the geometries into XYZ mode. This is an alias for ST_Force3DZ. If a geometry has no Z component, then a *Zvalue* Z coordinate is tacked on.

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_3D.

Changed: 3.1.0. Added support for supplying a non-zero Z value.



This function supports Polyhedral surfaces.



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.

Ejemplos

```
--Nada le pasa a una geometría que ya es 3D
SELECT ST_AsEWKT(ST_Force3D(ST_GeomFromEWKT('CIRCULARSTRING(1 1 2, 2 3 2, 4 5 2, 6 7 2, 5 6 2)')));
          st_asewkt
-----
CIRCULARSTRING(1 1 2,2 3 2,4 5 2,6 7 2,5 6 2)

SELECT  ST_AsEWKT(ST_Force3D('POLYGON((0 0,0 5,5 0,0 0),(1 1,3 1,1 3,1 1))'));
                                st_asewkt
-----
POLYGON((0 0 0,0 5 0,5 0 0,0 0 0),(1 1 0,3 1 0,1 3 0,1 1 0))
```

Ver también

[ST_AsEWKT](#), [ST_Force2D](#), [ST_Force3DM](#), [ST_Force3DZ](#)

8.5.9 ST_Force3DZ

ST_Force3DZ — Fuerza las geometrías en modo XYZ.

Synopsis

geometry **ST_Force3DZ**(geometry geomA, float Zvalue = 0.0);

Descripción

Forces the geometries into XYZ mode. If a geometry has no Z component, then a *Zvalue* Z coordinate is tacked on.

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_3DZ.

Changed: 3.1.0. Added support for supplying a non-zero Z value.



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
--Nada le pasa a una geometría que ya es 3D
SELECT ST_AsEWKT(ST_Force3DZ(ST_GeomFromEWKT('CIRCULARSTRING(1 1 2, 2 3 2, 4 5 2, 6 7 2, 5 6 2)')));
          st_asewkt
-----
CIRCULARSTRING(1 1 2,2 3 2,4 5 2,6 7 2,5 6 2)

SELECT  ST_AsEWKT(ST_Force3DZ('POLYGON((0 0,0 5,5 0,0 0),(1 1,3 1,1 3,1 1))'));
                                st_asewkt
-----
POLYGON((0 0 0,0 5 0,5 0 0,0 0 0),(1 1 0,3 1 0,1 3 0,1 1 0))
```

```

-----st_asewkt-----
POLYGON((0 0 0,0 5 0,5 0 0,0 0 0),(1 1 0,3 1 0,1 3 0,1 1 0))

```

Ver también

[ST_AsEWKT](#), [ST_Force2D](#), [ST_Force3DM](#), [ST_Force3D](#)

8.5.10 ST_Force3DM

ST_Force3DM — Fuerza las geometrías en modo XYM.

Synopsis

geometry **ST_Force3DM**(geometry geomA, float Mvalue = 0.0);

Descripción

Forces the geometries into XYM mode. If a geometry has no M component, then a *Mvalue* M coordinate is tacked on. If it has a Z component, then Z is removed

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_3DM.

Changed: 3.1.0. Added support for supplying a non-zero M value.



This method supports Circular Strings and Curves

Ejemplos

```

--Nada le pasa a una geometría que ya es 3D
SELECT ST_AsEWKT(ST_Force3DM(ST_GeomFromEWKT('CIRCULARSTRING(1 1 2, 2 3 2, 4 5 2, 6 7 2, 5 6 2)')));
-----st_asewkt-----
CIRCULARSTRINGM(1 1 0,2 3 0,4 5 0,6 7 0,5 6 0)

SELECT ST_AsEWKT(ST_Force3DM('POLYGON((0 0 1,0 5 1,5 0 1,0 0 1),(1 1 1,3 1 1,1 3 1,1 1 1))'));
-----st_asewkt-----
POLYGONM((0 0 0,0 5 0,5 0 0,0 0 0),(1 1 0,3 1 0,1 3 0,1 1 0))

```

Ver también

[ST_AsEWKT](#), [ST_Force2D](#), [ST_Force3DM](#), [ST_Force3D](#), [ST_GeomFromEWKT](#)

8.5.11 ST_Force4D

ST_Force4D — Fuerza las geometrías en modo XYZM.

Synopsis

geometry **ST_Force4D**(geometry geomA, float Zvalue = 0.0, float Mvalue = 0.0);

Descripción

Forces the geometries into XYZM mode. *Zvalue* and *Mvalue* is tacked on for missing Z and M dimensions, respectively.

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_4D.

Changed: 3.1.0. Added support for supplying non-zero Z and M values.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
--Nada le pasa a una geometría que ya es 3D
SELECT ST_AsEWKT(ST_Force4D(ST_GeomFromEWKT('CIRCULARSTRING(1 1 2, 2 3 2, 4 5 2, 6 7 2, 5 6 2)')));
```

	st_asewkt
	CIRCULARSTRING(1 1 2 0,2 3 2 0,4 5 2 0,6 7 2 0,5 6 2 0)

```
SELECT ST_AsEWKT(ST_Force4D('MULTILINESTRINGM((0 0 1,0 5 2,5 0 3,0 0 4),(1 1 1,3 1 1,1 3 1,1 1 1))'));
```

	st_asewkt
	MULTILINESTRING((0 0 0 1,0 5 0 2,5 0 0 3,0 0 0 4),(1 1 0 1,3 1 0 1,1 3 0 1,1 1 0 1))

Ver también

[ST_AsEWKT](#), [ST_Force2D](#), [ST_Force3DM](#), [ST_Force3D](#)

8.5.12 ST_ForcePolygonCCW

ST_ForcePolygonCCW — Orienta todos los aros exteriores en sentido contrario a las agujas del reloj y todos los aros interiores en sentido horario.

Synopsis

geometry **ST_ForcePolygonCCW** (geometry geom);

Descripción

Fuerza (Multi)polígonos a utilizar una orientación en sentido contrario a las manecillas del reloj para su anillo exterior, y una orientación en el sentido de las agujas del reloj para sus anillos interiores. Las geometrías no poligonales se devuelven sin cambios.

Availability: 2.4.0



This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ver también

ST_ForcePolygonCW , ST_IsPolygonCCW , ST_IsPolygonCW

8.5.13 ST_ForceCollection

ST_ForceCollection — Convertir la geometría en una GEOMETRYCOLLECTION.

Synopsis

```
geometry ST_ForceCollection(geometry geomA);
```

Descripción

Convierte la geometría en una GEOMETRYCOLLECTION. Esto es útil para simplificar la representación WKB.

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.

Disponibilidad: 1.2.2, antes de 1.3.4 esta función se bloqueará con curvas. Esto se fija en 1.3.4 +

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_Collection.



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_AsEWKT(ST_ForceCollection('POLYGON((0 0 1,0 5 1,5 0 1,0 0 1),(1 1 1,3 1 1,1 3 1,1 1 1))'));
----- st_asewkt -----
GEOMETRYCOLLECTION(POLYGON((0 0 1,0 5 1,5 0 1,0 0 1),(1 1 1,3 1 1,1 3 1,1 1 1)))

SELECT ST_AsText(ST_ForceCollection('CIRCULARSTRING(220227 150406,2220227 150407,220227 150406)'));
----- st_astext -----
GEOMETRYCOLLECTION(CIRCULARSTRING(220227 150406,2220227 150407,220227 150406))
(1 row)
```

```
-- Ejemplo POLYHEDRAL --
SELECT ST_AsEWKT(ST_ForceCollection('POLYHEDRALSURFACE(((0 0 0,0 0 1,0 1 1,0 1 0,0 0 0)),
((0 0 0,0 1 0,1 1 0,1 0 0,0 0 0)),
((0 0 0,1 0 0,1 0 1,0 0 1,0 0 0)),
((1 1 0,1 1 1,1 0 1,1 0 0,1 1 0)),
((0 1 0,0 1 1,1 1 1,1 1 1,0 0 1 0))),

```

```
((0 0 1,1 0 1,1 1 1,0 1 1,0 0 1)))')')
-----
st_asewkt
-----
GEOMETRYCOLLECTION(
  POLYGON((0 0 0,0 0 1,0 1 1,0 1 0,0 0 0)),
  POLYGON((0 0 0,0 1 0,1 1 0,1 0 0,0 0 0)),
  POLYGON((0 0 0,1 0 0,1 0 1,0 0 1,0 0 0)),
  POLYGON((1 1 0,1 1 1,1 0 1,1 0 0,1 1 0)),
  POLYGON((0 1 0,0 1 1,1 1 1,1 1 0,0 1 0)),
  POLYGON((0 0 1,1 0 1,1 1 1,0 1 1,0 0 1))
)
```

Ver también

[ST_AsEWKT](#), [ST_Force2D](#), [ST_Force3DM](#), [ST_Force3D](#), [ST_GeomFromEWKT](#)

8.5.14 ST_ForcePolygonCW

ST_ForcePolygonCW — Orienta todos los anillos exteriores en el sentido de las agujas del reloj y todos los anillos interiores en sentido contrario a las agujas del reloj.

Synopsis

geometry **ST_ForcePolygonCW** (geometry geom);

Descripción

Fuerza (Multi)Polígonos a utilizar una orientación en el sentido de las agujas del reloj para su anillo exterior, y una orientación en sentido contrario a las agujas del reloj para sus anillos interiores. Las geometrías no poligonales se devuelven sin cambios.

Availability: 2.4.0



This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ver también

[ST_ForcePolygonCCW](#) , [ST_IsPolygonCCW](#) , [ST_IsPolygonCW](#)

8.5.15 ST_ForceSFS

ST_ForceSFS — Fuerza las geometrías para usar sólo los tipos de geometría SFS 1.1.

Synopsis

geometry **ST_ForceSFS**(geometry geomA);
 geometry **ST_ForceSFS**(geometry geomA, text version);

Descripción

This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.

8.5.16 ST_ForceRHR

ST_ForceRHR — Fuerza la orientación de los vértices en un polígono para seguir la regla de la mano derecha.

Synopsis

geometry **ST_ForceRHR**(geometry g);

Descripción

Fuerce la orientación de los vértices en un polígono para seguir la regla de la mano derecha, en el cual, el área que está delimitada por el polígono está a la derecha del límite. En particular, el anillo exterior está orientado en el sentido de las agujas del reloj y el interior está orientado en sentido contrario a las agujas del reloj. Esta función es sinónimo de **ST_ForcePolygonCW**

**Note**

La definición anterior de la regla de la derecha entra en conflicto con definiciones utilizadas en otros contextos. Para evitar la confusión, se recomienda utilizar ST_ForcePolygonCW.

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_AsEWKT (
  ST_ForceRHR (
    'POLYGON((0 0 2, 5 0 2, 0 5 2, 0 0 2),(1 1 2, 1 3 2, 3 1 2, 1 1 2))'
  )
);
```

	st_asewkt
	POLYGON((0 0 2,0 5 2,5 0 2,0 0 2),(1 1 2,3 1 2,1 3 2,1 1 2))

(1 row)

Ver también

ST_ForcePolygonCCW , **ST_ForcePolygonCW** , **ST_IsPolygonCCW** , **ST_IsPolygonCW** , **ST_BuildArea**, **ST_Polygonize**, **ST_Reverse**

8.5.17 ST_ForceCurve

ST_ForceCurve — Relanzar una geometría en su tipo curvo, si corresponde.

Synopsis

geometry **ST_ForceCurve**(geometry g);

Descripción

Convierte una geometría en su representación curvada, si corresponde: las líneas se convierten en curvas compuestas, las multi-líneas se convierten en polígonos multicurvos se convierten en polígonos de curvas los multipolígonos se convierten en multisuperficies. Si la entrada de geometría es ya una representación curvada regresa igual que la entrada.

Disponibilidad: 2.2.0



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_AsText (
  ST_ForceCurve (
    'POLYGON((0 0 2, 5 0 2, 0 5 2, 0 0 2),(1 1 2, 1 3 2, 3 1 2, 1 1 2))'::geometry
  )
);
```

	st_astext
	CURVEPOLYGON Z ((0 0 2,5 0 2,0 5 2,0 0 2),(1 1 2,1 3 2,3 1 2,1 1 2))
(1 row)	

Ver también

[ST_LineToCurve](#)

8.5.18 ST_LineToCurve

ST_LineToCurve — Converts a linear geometry to a curved geometry.

Synopsis

geometry **ST_LineToCurve**(geometry geomANoncircular);

Descripción

Converts plain LINESTRING/POLYGON to CIRCULAR STRINGs and Curved Polygons. Note much fewer points are needed to describe the curved equivalent.



Note

If the input LINESTRING/POLYGON is not curved enough to clearly represent a curve, the function will return the same input geometry.

Availability: 1.3.0



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
-- 2D Example
SELECT ST_AsText(ST_LineToCurve(foo.geom)) As curvedastext, ST_AsText(foo.geom) As
  non_curvedastext
FROM (SELECT ST_Buffer('POINT(1 3)::geometry', 3) As geom) As foo;
```

curvedastext	non_curvedastext
CURVEPOLYGON(CIRCULARSTRING(4 3,3.12132034355964 0.878679656440359, POLYGON((4	POLYGON((4
3,3.94235584120969 2.41472903395162,3.77163859753386 1.85194970290473,	3,3.94235584120969 2.41472903395162,3.77163859753386 1.85194970290473,
1 0,-1.12132034355965 5.12132034355963,4 3))	1 0,-1.12132034355965 5.12132034355963,4 3))
1.33328930094119,3.12132034355964 0.878679656440359,	1.33328930094119,3.12132034355964 0.878679656440359,
	3.49440883690764
	2.66671069905881
	0.505591163092366,2.14805029
	0.228361402466141,
	1.58527096604839
	0.0576441587903094,1
	0,
	0.414729033951621
	0.0576441587903077,-0.14805029
	0.228361402466137,
	-0.666710699058802
	0.505591163092361,-1.12132034
	0.878679656440353,
	-1.49440883690763
	1.33328930094119,-1.77163859
	1.85194970290472
	--ETC--
	,3.94235584120969
	3.58527096604839,4
	3))

```
--3D example
SELECT ST_AsText(ST_LineToCurve(geom)) As curved, ST_AsText(geom) AS not_curved
FROM (SELECT ST_Translate(ST_Force3D(ST_Boundary(ST_Buffer(ST_Point(1,3), 2,2))),0,0,3) AS
  geom) AS foo;
```

curved	not_curved
CIRCULARSTRING Z (3 3 3,-1 2.99999999999999 3,3 3 3)	LINESTRING Z (3 3 3,2.4142135623731
1.58578643762691 3,1 1 3,	-0.414213562373092 1.5857864376269
	3,-1 2.99999999999999 3,
	-0.414213562373101 4.41421356237309
	3,
	0.999999999999991 5
	3,2.41421356237309 4.4142135623731
	3,3 3 3)

(1 row)

Ver también

[ST_CurveToLine](#)

8.5.19 ST_Multi

ST_Multi — Devuelve la geometría como una geometría MULTI*.

Synopsis

geometry **ST_Multi**(geometry geom);

Descripción

Returns the geometry as a MULTI* geometry collection. If the geometry is already a collection, it is returned unchanged.

Ejemplos

```
SELECT ST_AsText(ST_Multi('POLYGON ((10 30, 30 30, 30 10, 10 10, 10 30))'));
           st_astext
-----
MULTIPOLYGON(((10 30,30 30,30 10,10 10,10 30)))
```

Ver también

[ST_AsText](#)

8.5.20 ST_Normalize

ST_Normalize — Devuelve la geometría en su forma canónica.

Synopsis

geometry **ST_Normalize**(geometry geom);

Descripción

Devuelve la geometría en su forma normalizada/canónica. Puede reordenar vértices en anillos poligonales, anillos en un polígono, elementos en un complejo de geometría múltiple.

Principalmente útil sólo para propósitos de prueba (comparando los resultados esperados y los obtenidos).

Disponibilidad: 2.3.0

Ejemplos

```
SELECT ST_AsText(ST_Normalize(ST_GeomFromText(
  'GEOMETRYCOLLECTION(
    POINT(2 3),
    MULTILINESTRING((0 0, 1 1),(2 2, 3 3)),
    POLYGON(
      (0 10,0 0,10 0,10 10,0 10),
      (4 2,2 2,2 4,4 4,4 2),
      (6 8,8 8,8 6,6 6,6 8)
    )
  )'
)))
```

st_astext

```
GEOMETRYCOLLECTION(POLYGON((0 0,0 10,10 10,10 0,0 0),(6 6,8 6,8 8,6 8,6 6),(2 2,4 2,4 4,2 4,2 2)),MULTILINESTRING((2 2,3 3),(0 0,1 1)),POINT(2 3))
(1 row)
```

Ver también

[ST_Equals](#),

8.5.21 ST_QuantizeCoordinates

ST_QuantizeCoordinates — Sets least significant bits of coordinates to zero

Synopsis

geometry **ST_QuantizeCoordinates** (geometry g , int prec_x , int prec_y , int prec_z , int prec_m);

Descripción

`ST_QuantizeCoordinates` determines the number of bits (N) required to represent a coordinate value with a specified number of digits after the decimal point, and then sets all but the N most significant bits to zero. The resulting coordinate value will still round to the original value, but will have improved compressibility. This can result in a significant disk usage reduction provided that the geometry column is using a [compressible storage type](#). The function allows specification of a different number of digits after the decimal point in each dimension; unspecified dimensions are assumed to have the precision of the x dimension. Negative digits are interpreted to refer digits to the left of the decimal point, (i.e., `prec_x=-2` will preserve coordinate values to the nearest 100).

The coordinates produced by `ST_QuantizeCoordinates` are independent of the geometry that contains those coordinates and the relative position of those coordinates within the geometry. As a result, existing topological relationships between geometries are unaffected by use of this function. The function may produce invalid geometry when it is called with a number of digits lower than the intrinsic precision of the geometry.

Availability: 2.5.0

Technical Background

PostGIS stores all coordinate values as double-precision floating point integers, which can reliably represent 15 significant digits. However, PostGIS may be used to manage data that intrinsically has fewer than 15 significant digits. An example is TIGER data, which is provided as geographic coordinates with six digits of precision after the decimal point (thus requiring only nine significant digits of longitude and eight significant digits of latitude.)

When 15 significant digits are available, there are many possible representations of a number with 9 significant digits. A double precision floating point number uses 52 explicit bits to represent the significand (mantissa) of the coordinate. Only 30 bits are needed to represent a mantissa with 9 significant digits, leaving 22 insignificant bits; we can set their value to anything we like and still end up with a number that rounds to our input value. For example, the value 100.123456 can be represented by the floating point numbers closest to 100.123456000000, 100.123456000001, and 100.123456432199. All are equally valid, in that `ST_AsText (geom, 6)` will return the same result with any of these inputs. As we can set these bits to any value, `ST_QuantizeCoordinates` sets the 22 insignificant bits to zero. For a long coordinate sequence this creates a pattern of blocks of consecutive zeros that is compressed by PostgreSQL more efficiently.



Note Only the on-disk size of the geometry is potentially affected by `ST_QuantizeCoordinates`. `ST_MemSize`, which reports the in-memory usage of the geometry, will return the the same value regardless of the disk space used by a geometry.

Ejemplos

```
SELECT ST_AsText(ST_QuantizeCoordinates('POINT (100.123456 0)::geometry, 4));
st_astext
-----
POINT(100.123455047607 0)
```

```
WITH test AS (SELECT 'POINT (123.456789123456 123.456789123456)::geometry AS geom)
SELECT
  digits,
  encode(ST_QuantizeCoordinates(geom, digits), 'hex'),
  ST_AsText(ST_QuantizeCoordinates(geom, digits))
FROM test, generate_series(15, -15, -1) AS digits;
```

digits	encode	st_astext
15	01010000005f9a72083cdd5e405f9a72083cdd5e40	POINT(123.456789123456 123.456789123456) ↩
14	01010000005f9a72083cdd5e405f9a72083cdd5e40	POINT(123.456789123456 123.456789123456) ↩
13	01010000005f9a72083cdd5e405f9a72083cdd5e40	POINT(123.456789123456 123.456789123456) ↩
12	01010000005c9a72083cdd5e405c9a72083cdd5e40	POINT(123.456789123456 123.456789123456) ↩
11	0101000000409a72083cdd5e40409a72083cdd5e40	POINT(123.456789123456 123.456789123456) ↩
10	0101000000009a72083cdd5e40009a72083cdd5e40	POINT(123.456789123455 123.456789123455) ↩
9	0101000000009072083cdd5e40009072083cdd5e40	POINT(123.456789123418 123.456789123418) ↩
8	0101000000008072083cdd5e40008072083cdd5e40	POINT(123.45678912336 123.45678912336) ↩
7	0101000000000070083cdd5e40000070083cdd5e40	POINT(123.456789121032 123.456789121032) ↩
6	0101000000000040083cdd5e40000040083cdd5e40	POINT(123.456789076328 123.456789076328) ↩
5	0101000000000000083cdd5e40000000083cdd5e40	POINT(123.456789016724 123.456789016724) ↩
4	0101000000000000003cdd5e40000000003cdd5e40	POINT(123.456787109375 123.456787109375) ↩
3	01010000000000000003cdd5e40000000003cdd5e40	POINT(123.456787109375 123.456787109375) ↩


```

2      | 010100000000000000000038dd5e400000000038dd5e40 | POINT(123.45654296875 123.45654296875) ←
1      | 0101000000000000000000dd5e4000000000dd5e40 | POINT(123.453125 123.453125)
0      | 0101000000000000000000dc5e4000000000dc5e40 | POINT(123.4375 123.4375)
-1     | 0101000000000000000000c05e4000000000c05e40 | POINT(123 123)
-2     | 010100000000000000000005e400000000000005e40 | POINT(120 120)
-3     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-4     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-5     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-6     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-7     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-8     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-9     | 0101000000000000000000058400000000000005840 | POINT(96 96)
-10    | 0101000000000000000000058400000000000005840 | POINT(96 96)
-11    | 0101000000000000000000058400000000000005840 | POINT(96 96)
-12    | 0101000000000000000000058400000000000005840 | POINT(96 96)
-13    | 0101000000000000000000058400000000000005840 | POINT(96 96)
-14    | 0101000000000000000000058400000000000005840 | POINT(96 96)
-15    | 0101000000000000000000058400000000000005840 | POINT(96 96)

```

Ver también

[ST_SnapToGrid](#)

8.5.22 ST_RemovePoint

ST_RemovePoint — Remove a point from a linestring.

Synopsis

geometry **ST_RemovePoint**(geometry linestring, integer offset);

Descripción

Removes a point from a LineString, given its index (0-based). Useful for turning a closed line (ring) into an open linestring.

Enhanced: 3.2.0

Disponibilidad: 1.1.0



This function supports 3d and will not drop the z-index.

Ejemplos

Guarantees no lines are closed by removing the end point of closed lines (rings). Assumes geom is of type LINESTRING

```

UPDATE sometable
   SET geom = ST_RemovePoint(geom, ST_NPoints(geom) - 1)
FROM sometable
WHERE ST_IsClosed(geom);

```

Ver también

[ST_AddPoint](#), [ST_NPoints](#), [ST_NumPoints](#)

8.5.23 ST_RemoveRepeatedPoints

ST_RemoveRepeatedPoints — Returns a version of a geometry with duplicate points removed.

Synopsis

geometry **ST_RemoveRepeatedPoints**(geometry geom, float8 tolerance);

Descripción

Returns a version of the given geometry with duplicate consecutive points removed. The function processes only (Multi)LineStrings, (Multi)Polygons and MultiPoints but it can be called with any kind of geometry. Elements of GeometryCollections are processed individually. The endpoints of LineStrings are preserved.

If the *tolerance* parameter is provided, vertices within the tolerance distance of one another are considered to be duplicates.

Enhanced: 3.2.0

Disponibilidad: 2.2.0



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsText( ST_RemoveRepeatedPoints( 'MULTIPOINT ((1 1), (2 2), (3 3), (2 2))' ));
-----
MULTIPOINT(1 1,2 2,3 3)
```

```
SELECT ST_AsText( ST_RemoveRepeatedPoints( 'LINESTRING (0 0, 0 0, 1 1, 0 0, 1 1, 2 2)' ));
-----
LINESTRING(0 0,1 1,0 0,1 1,2 2)
```

Example: Collection elements are processed individually.

```
SELECT ST_AsText( ST_RemoveRepeatedPoints( 'GEOMETRYCOLLECTION (LINESTRING (1 1, 2 2, 2 2, 3 3), POINT (4 4), POINT (4 4), POINT (5 5))' ));
-----
GEOMETRYCOLLECTION(LINESTRING(1 1,2 2,3 3),POINT(4 4),POINT(4 4),POINT(5 5))
```

Example: Repeated point removal with a distance tolerance.

```
SELECT ST_AsText( ST_RemoveRepeatedPoints( 'LINESTRING (0 0, 0 0, 1 1, 5 5, 1 1, 2 2)', 2) )
;
-----
LINESTRING(0 0,5 5,2 2)
```

Ver también

[ST_Simplify](#)

8.5.24 ST_Reverse

ST_Reverse — Devuelve la geometría con el orden de vértice invertido.

Synopsis

geometry **ST_Reverse**(geometry g1);

Descripción

Se puede utilizar en cualquier geometría e invierte el orden de los vértices.

Mejorada: 2.4.0 se introdujo el soporte para curvas.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_AsText(geom) as line, ST_AsText(ST_Reverse(geom)) As reverseline
FROM
(SELECT ST_MakeLine(ST_Point(1,2),
                    ST_Point(1,10)) As geom) as foo;
--result
          line          |          reverseline
-----+-----
LINESTRING(1 2,1 10) | LINESTRING(1 10,1 2)
```

8.5.25 ST_Segmentize

ST_Segmentize — Devuelve una geometry/geography modificada que no tenga un segmento mayor que la distancia dada.

Synopsis

geometry **ST_Segmentize**(geometry geom, float max_segment_length);

geography **ST_Segmentize**(geography geog, float max_segment_length);

Descripción

Devuelve una geometría modificada que no tiene ningún segmento más largo que el `max_segment_length` dado. El cálculo de distancia se realiza en 2d solamente. Para geometry, las unidades de longitud están en unidades de referencia espacial. Para geography, las unidades están en metros.

Disponibilidad: 1.2.2

Enhanced: 3.0.0 Segmentize geometry now uses equal length segments

Mejorada: 2.3.0 Segmentize geography ahora utiliza segmentos de igual longitud

Mejorada: 2.1.0 se introdujo el soporte para geography.

Cambiado: 2.1.0 como resultado de la introducción del soporte a geography: la construcción `SELECT ST_Segmentize('LINESTRING(1 2, 3 4)', 0.5);` producirá un error de función ambigua. Debe tener un objeto correctamente tecleado, por ejemplo, una columna geometry/geography, utilice `ST_GeomFromText`, `ST_GeogFromText` o `SELECT ST_Segmentize('LINESTRING(1 2, 3 4)'::geometry, 0.5);`



Note

Esto sólo aumentará los segmentos. No alargará segmentos más cortos que la longitud máxima

Ejemplos

```
SELECT ST_AsText(ST_Segmentize(
ST_GeomFromText('MULTILINESTRING((-29 -27,-30 -29.7,-36 -31,-45 -33), (-45 -33,-46 -32))')
, 5)
);
st_astext
-----
MULTILINESTRING((-29 -27,-30 -29.7,-34.886615700134 -30.758766735029,-36 -31,
-40.8809353009198 -32.0846522890933,-45 -33),
(-45 -33,-46 -32))
(1 row)

SELECT ST_AsText(ST_Segmentize(ST_GeomFromText('POLYGON((-29 28, -30 40, -29 28))'),10));
st_astext
-----
POLYGON((-29 28,-29.8304547985374 37.9654575824488,-30 40,-29.1695452014626 30.0345424175512,-29 28))
(1 row)
```

Ver también

[ST_LineSubstring](#)

8.5.26 ST_SetPoint

ST_SetPoint — Reemplace el punto de una cadena de línea con un punto dado.

Synopsis

geometry **ST_SetPoint**(geometry linestring, integer zerobasedposition, geometry point);

Descripción

Reemplace el punto N de una cadena de línea con el punto dado. El índice comienza en 0. El índice negativo se cuenta hacia atrás, por lo que -1 es el último punto. Esto es especialmente útil en los disparadores cuando se trata de mantener la relación de las articulaciones cuando un vértice se mueve.

Disponibilidad: 1.1.0

Actualizado 2.3.0: indexación negativa



This function supports 3d and will not drop the z-index.

Ejemplos

```
--Change first point in line string from -1 3 to -1 1
SELECT ST_AsText(ST_SetPoint('LINESTRING(-1 2,-1 3)', 0, 'POINT(-1 1)'));
st_astext
-----
LINESTRING(-1 1,-1 3)

---Change last point in a line string (lets play with 3d linestring this time)
```

```

SELECT ST_AsEWKT(ST_SetPoint(foo.geom, ST_NumPoints(foo.geom) - 1, ST_GeomFromEWKT('POINT ↵
  (-1 1 3)'))))
FROM (SELECT ST_GeomFromEWKT('LINESTRING(-1 2 3,-1 3 4, 5 6 7)') As geom) As foo;
      st_asewkt
-----
LINESTRING(-1 2 3,-1 3 4,-1 1 3)

SELECT ST_AsText(ST_SetPoint(g, -3, p))
FROM ST_GeomFromText('LINESTRING(0 0, 1 1, 2 2, 3 3, 4 4)') AS g
      , ST_PointN(g,1) as p;
      st_astext
-----
LINESTRING(0 0,1 1,0 0,3 3,4 4)

```

Ver también

[ST_AddPoint](#), [ST_NPoints](#), [ST_NumPoints](#), [ST_PointN](#), [ST_RemovePoint](#)

8.5.27 ST_ShiftLongitude

ST_ShiftLongitude — Shifts the longitude coordinates of a geometry between -180..180 and 0..360.

Synopsis

geometry **ST_ShiftLongitude**(geometry geom);

Descripción

Reads every point/vertex in a geometry, and shifts its longitude coordinate from -180..0 to 180..360 and vice versa if between these ranges. This function is symmetrical so the result is a 0..360 representation of a -180..180 data and a -180..180 representation of a 0..360 data.



Note

This is only useful for data with coordinates in longitude/latitude; e.g. SRID 4326 (WGS 84 geographic)



Warning

Pre-1.3.4 bug prevented this from working for MULTIPOINT. 1.3.4+ works with MULTIPOINT as well.



This function supports 3d and will not drop the z-index.

Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN.

NOTE: this function was renamed from "ST_Shift_Longitude" in 2.2.0



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
--single point forward transformation
SELECT ST_AsText(ST_ShiftLongitude('SRID=4326;POINT(270 0)::geometry'))

st_astext
-----
POINT(-90 0)

--single point reverse transformation
SELECT ST_AsText(ST_ShiftLongitude('SRID=4326;POINT(-90 0)::geometry'))

st_astext
-----
POINT(270 0)

--for linestrings the functions affects only to the sufficient coordinates
SELECT ST_AsText(ST_ShiftLongitude('SRID=4326;LINESTRING(174 12, 182 13)::geometry'))

st_astext
-----
LINESTRING(174 12,-178 13)
```

Ver también

[ST_WrapX](#)

8.5.28 ST_WrapX

ST_WrapX — Wrap a geometry around an X value.

Synopsis

geometry **ST_WrapX**(geometry geom, float8 wrap, float8 move);

Descripción

This function splits the input geometries and then moves every resulting component falling on the right (for negative 'move') or on the left (for positive 'move') of given 'wrap' line in the direction specified by the 'move' parameter, finally re-unioning the pieces together.



Note

This is useful to "recenter" long-lat input to have features of interest not spawned from one side to the other.

Availability: 2.3.0 requires GEOS



This function supports 3d and will not drop the z-index.

Ejemplos

```
-- Move all components of the given geometries whose bounding box
-- falls completely on the left of x=0 to +360
select ST_WrapX(geom, 0, 360);

-- Move all components of the given geometries whose bounding box
-- falls completely on the left of x=-30 to +360
select ST_WrapX(geom, -30, 360);
```

Ver también

[ST_ShiftLongitude](#)

8.5.29 ST_SnapToGrid

ST_SnapToGrid — Ajusta todos los puntos de la geometría de entrada a una cuadrícula regular.

Synopsis

```
geometry ST_SnapToGrid(geometry geomA, float originX, float originY, float sizeX, float sizeY);
geometry ST_SnapToGrid(geometry geomA, float sizeX, float sizeY);
geometry ST_SnapToGrid(geometry geomA, float size);
geometry ST_SnapToGrid(geometry geomA, geometry pointOrigin, float sizeX, float sizeY, float sizeZ, float sizeM);
```

Descripción

Variante 1, 2, 3: ajusta todos los puntos de la geometría de entrada a la cuadrícula definida por su origen y tamaño de celda. Elimina los puntos consecutivos que caen en la misma celda, eventualmente devuelve NULL si los puntos de salida no son suficientes para definir una geometría del tipo dado. Las geometrías contraídas de una colección se despojan de ella. Útil para reducir la precisión.

Variante 4: introducido 1.1.0 - Ajusta todos los puntos de la geometría de entrada a la cuadrícula definida por su origen (el segundo argumento, debe ser un punto) y tamaños de celda. Especifique 0 como tamaño para cualquier dimensión que no desee ajustar a una cuadrícula.



Note

La geometría devuelta podría perder su simplicidad (ver [ST_IsSimple](#)).



Note

Antes del lanzamiento 1.1.0 esta función siempre devolvió una geometría 2d. A partir de 1.1.0 la geometría devuelta tendrá la misma dimensionalidad que la entrada con valores de dimensión más altos sin tocar. Utilice la versión que toma un segundo argumento de geometría para definir todas las dimensiones de cuadrícula.

Disponibilidad: 1.0.0RC1

Disponibilidad: 1.1.0 - soporte de Z y M



This function supports 3d and will not drop the z-index.

Ejemplos

```
--Snap your geometries to a precision grid of 10^-3
UPDATE mytable
  SET geom = ST_SnapToGrid(geom, 0.001);

SELECT ST_AsText(ST_SnapToGrid(
    ST_GeomFromText('LINESTRING(1.1115678 2.123, 4.111111 3.2374897, ↵
    4.11112 3.23748667)'),
    0.001)
    );
          st_astext
-----
LINESTRING(1.112 2.123,4.111 3.237)
--Snap a 4d geometry
SELECT ST_AsEWKT(ST_SnapToGrid(
    ST_GeomFromEWKT('LINESTRING(-1.1115678 2.123 2.3456 1.1111,
    4.111111 3.2374897 3.1234 1.1111, -1.11111112 2.123 2.3456 1.111112)'),
    ST_GeomFromEWKT('POINT(1.12 2.22 3.2 4.4444)'),
    0.1, 0.1, 0.1, 0.01) );
                                st_asewkt
-----
LINESTRING(-1.08 2.12 2.3 1.1144,4.12 3.22 3.1 1.1144,-1.08 2.12 2.3 1.1144)

--With a 4d geometry - the ST_SnapToGrid(geom,size) only touches x and y coords but keeps m ↵
and z the same
SELECT ST_AsEWKT(ST_SnapToGrid(ST_GeomFromEWKT('LINESTRING(-1.1115678 2.123 3 2.3456,
    4.111111 3.2374897 3.1234 1.1111)'),
    0.01)
    );
                                st_asewkt
-----
LINESTRING(-1.11 2.12 3 2.3456,4.11 3.24 3.1234 1.1111)
```

Ver también

[ST_Snap](#), [ST_AsEWKT](#), [ST_AsText](#), [ST_GeomFromText](#), [ST_GeomFromEWKT](#), [ST_Simplify](#)

8.5.30 ST_Snap

ST_Snap — Ajusta segmentos y vértices de la geometría de entrada a vértices de una geometría de referencia.

Synopsis

geometry **ST_Snap**(geometry input, geometry reference, float tolerance);

Descripción

Snaps the vertices and segments of a geometry to another Geometry's vertices. A snap distance tolerance is used to control where snapping is performed. The result geometry is the input geometry with the vertices snapped. If no snapping occurs then the input geometry is returned unchanged.

El ajustar una geometría a otra puede mejorar la robustez de las operaciones de superposición eliminando los bordes casi coincidentes (que causan problemas durante el cálculo de noding y de intersección).

Un ajuste excesivo puede resultar en la creación de una topología no válida, por lo que el número y la ubicación de los vértices ajustados se deciden usando heurísticas para determinar cuándo es seguro ajustar. Sin embargo, esto puede resultar en que algunos potenciales ajustes se omitan.

**Note**

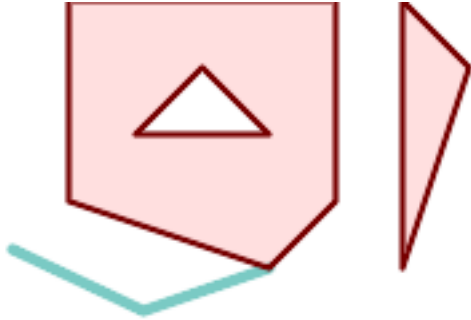
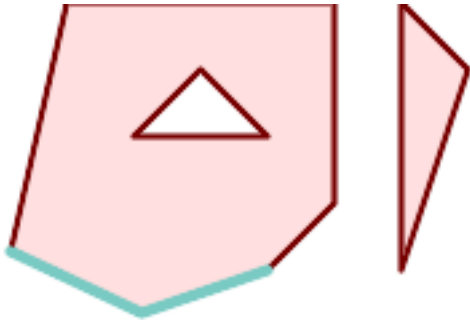
La geometría devuelta puede perder su simplicidad (ver [ST_IsSimple](#)) y su validez (ver [ST_IsValid](#)).

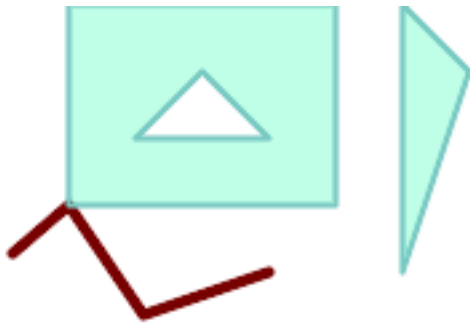
Realizado por el módulo GEOS.

Disponibilidad: 2.0.0

Ejemplos

Un multipolígono mostrado con una cadena de líneas (antes de cualquier ajuste)

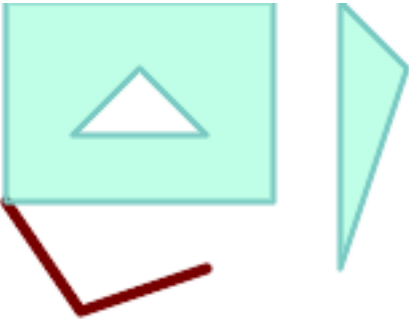
	
<p><i>Un multipolígono se ajustó a una cadena de línea a la tolerancia: 1,01 de distancia. El nuevo multipolígono se muestra en referencia a la cadena de línea</i></p> <pre>SELECT ST_AsText(ST_Snap(poly,line, ↵ ST_Distance(poly,line)*1.01)) AS polysnapped FROM (SELECT ST_GeomFromText('MULTIPOLYGON(((26 125, 26 200, 126 200, 126 125, ↵ 26 125), (51 150, 101 150, 76 175, 51 150) ↵), ((151 100, 151 200, 176 175, 151 ↵ 100)))') As poly, ST_GeomFromText('LINESTRING (5 ↵ 107, 54 84, 101 100)') As line) As foo;</pre> <p>polysnapped</p>	<p><i>Un multipolígono se ajustó a una cadena de línea a la tolerancia: 1,25 de distancia. El nuevo multipolígono se muestra en referencia a la cadena de línea</i></p> <pre>SELECT ST_AsText (ST_Snap(poly,line, ST_Distance(poly, ↵ line)*1.25)) AS polysnapped FROM (SELECT ST_GeomFromText('MULTIPOLYGON(((26 125, 26 200, 126 200, 126 125, ↵ 26 125), (51 150, 101 150, 76 175, 51 150) ↵), ((151 100, 151 200, 176 175, 151 ↵ 100)))') As poly, ST_GeomFromText('LINESTRING (5 ↵ 107, 54 84, 101 100)') As line) As foo;</pre> <p>polysnapped</p>
<pre>MULTIPOLYGON(((26 125,26 200,126 200,126 ↵ 125,101 100,26 125), (51 150,101 150,76 175,51 150)),((151 ↵ 100,151 200,176 175,151 100)))</pre>	<pre>MULTIPOLYGON(((5 107,26 200,126 200,126 ↵ 125,101 100,54 84,5 107), (51 150,101 150,76 175,51 150)),((151 ↵ 100,151 200,176 175,151 100)))</pre>



La cadena de línea se ajustó al multipolígono original a la tolerancia 1,01 de distancia. La nueva cadena de línea se muestra con referencia al multipolígono

```
SELECT ST_AsText (
  ST_Snap(line, poly, ST_Distance(poly, ↵
    line)*1.01)
) AS linesnapped
FROM (SELECT
  ST_GeomFromText ('MULTIPOLYGON (
    ((26 125, 26 200, 126 200, 126 125, ↵
    26 125),
    (51 150, 101 150, 76 175, 51 150 )) ↵
  '
    ((151 100, 151 200, 176 175, 151 ↵
    100)))') As poly,
  ST_GeomFromText ('LINESTRING (5 ↵
    107, 54 84, 101 100)') As line
  ) As foo;

          linesnapped
-----
LINESTRING(5 107,26 125,54 84,101 100)
```



La cadena de línea se ajustó al multipolígono original a la tolerancia 1,25 de distancia. La nueva cadena de línea se muestra con referencia al multipolígono

```
SELECT ST_AsText (
  ST_Snap(line, poly, ST_Distance(poly, ↵
    line)*1.25)
) AS linesnapped
FROM (SELECT
  ST_GeomFromText ('MULTIPOLYGON (
    (( 26 125, 26 200, 126 200, 126 125, ↵
    26 125 ),
    (51 150, 101 150, 76 175, 51 150 )) ↵
  '
    ((151 100, 151 200, 176 175, 151 ↵
    100 )))') As poly,
  ST_GeomFromText ('LINESTRING (5 ↵
    107, 54 84, 101 100)') As line
  ) As foo;

          linesnapped
-----
LINESTRING(26 125,54 84,101 100)
```

Ver también

[ST_SnapToGrid](#)

8.5.31 ST_SwapOrdinates

ST_SwapOrdinates — Returns a version of the given geometry with given ordinate values swapped.

Synopsis

geometry **ST_SwapOrdinates**(geometry geom, cstring ords);

Descripción

Returns a version of the given geometry with given ordinates swapped.

The `ords` parameter is a 2-characters string naming the ordinates to swap. Valid names are: x,y,z and m.

Disponibilidad: 2.2.0



This method supports Circular Strings and Curves



This function supports 3d and will not drop the z-index.



This function supports M coordinates.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplo

```
-- Scale M value by 2
SELECT ST_AsText(
  ST_SwapOrdinates(
    ST_Scale(
      ST_SwapOrdinates(g, 'xm'),
      2, 1
    ),
    'xm'
  )
) FROM ( SELECT 'POINT ZM (0 0 0 2)::geometry g ) foo;
      st_astext
-----
POINT ZM (0 0 0 4)
```

Ver también

[ST_FlipCoordinates](#)

8.6 Geometry Validation

8.6.1 ST_IsValid

`ST_IsValid` — Tests if a geometry is well-formed in 2D.

Synopsis

```
boolean ST_IsValid(geometry g);
boolean ST_IsValid(geometry g, integer flags);
```

Description

Tests if an `ST_Geometry` value is well-formed and valid in 2D according to the OGC rules. For geometries with 3 and 4 dimensions, the validity is still only tested in 2 dimensions. For geometries that are invalid, a PostgreSQL NOTICE is emitted providing details of why it is not valid.

For the version with the `flags` parameter, supported values are documented in [ST_IsValidDetail](#). This version does not print a NOTICE explaining invalidity.

For more information on the definition of geometry validity, refer to [Section 4.4](#).



Note

SQL-MM defines the result of `ST_IsValid(NULL)` to be 0, while PostGIS returns NULL.

Performed by the GEOS module.

The version accepting flags is available starting with 2.0.0.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 5.1.9



Note

Neither OGC-SFS nor SQL-MM specifications include a flag argument for `ST_IsValid`. The flag is a PostGIS extension.

Examples

```
SELECT ST_IsValid(ST_GeomFromText('LINESTRING(0 0, 1 1)')) As good_line,
       ST_IsValid(ST_GeomFromText('POLYGON((0 0, 1 1, 1 2, 1 1, 0 0))')) As bad_poly
--results
NOTICE: Self-intersection at or near point 0 0
good_line | bad_poly
-----+-----
t         | f
```

See Also

[ST_IsSimple](#), [ST_IsValidReason](#), [ST_IsValidDetail](#),

8.6.2 ST_IsValidDetail

`ST_IsValidDetail` — Returns a `valid_detail` row stating if a geometry is valid or if not a reason and a location.

Synopsis

`valid_detail` **ST_IsValidDetail**(geometry geom, integer flags);

Description

Returns a `valid_detail` row, containing a boolean (`valid`) stating if a geometry is valid, a varchar (`reason`) stating a reason why it is invalid and a geometry (`location`) pointing out where it is invalid.

Useful to improve on the combination of `ST_IsValid` and `ST_IsValidReason` to generate a detailed report of invalid geometries.

The optional `flags` parameter is a bitfield. It can have the following values:

- 0: Use usual OGC SFS validity semantics.
- 1: Consider certain kinds of self-touching rings (inverted shells and exverted holes) as valid. This is also known as "the ESRI flag", since this is the validity model used by those tools. Note that this is invalid under the OGC model.

Performed by the GEOS module.

Availability: 2.0.0

Examples

```
--First 3 Rejects from a successful quintuplet experiment
SELECT gid, reason(ST_IsValidDetail(geom)), ST_AsText(location(ST_IsValidDetail(geom))) as ←
       location
FROM
  (SELECT ST_MakePolygon(ST_ExteriorRing(e.buff), array_agg(f.line)) As geom, gid
   FROM (SELECT ST_Buffer(ST_Point(x1*10,y1), z1) As buff, x1*10 + y1*100 + z1*1000 As gid
        FROM generate_series(-4,6) x1
        CROSS JOIN generate_series(2,5) y1
        CROSS JOIN generate_series(1,8) z1
        WHERE x1 > y1*0.5 AND z1 < x1*y1) As e
        INNER JOIN (SELECT ST_Translate(ST_ExteriorRing(ST_Buffer(ST_Point(x1*10,y1), z1)), ←
              y1*1, z1*2) As line
        FROM generate_series(-3,6) x1
        CROSS JOIN generate_series(2,5) y1
        CROSS JOIN generate_series(1,10) z1
        WHERE x1 > y1*0.75 AND z1 < x1*y1) As f
   ON (ST_Area(e.buff) > 78 AND ST_Contains(e.buff, f.line))
  GROUP BY gid, e.buff) As quintuplet_experiment
WHERE ST_IsValid(geom) = false
ORDER BY gid
LIMIT 3;
```

gid	reason	location
5330	Self-intersection	POINT(32 5)
5340	Self-intersection	POINT(42 5)
5350	Self-intersection	POINT(52 5)

```
--simple example
SELECT * FROM ST_IsValidDetail('LINESTRING(220227 150406,220227 150407,22020 150410)');
```

valid	reason	location
t		

See Also

[ST_IsValid](#), [ST_IsValidReason](#)

8.6.3 ST_IsValidReason

ST_IsValidReason — Returns text stating if a geometry is valid, or a reason for invalidity.

Synopsis

```
text ST_IsValidReason(geometry geomA);
text ST_IsValidReason(geometry geomA, integer flags);
```

Description

Returns text stating if a geometry is valid, or if invalid a reason why.

Useful in combination with **ST_IsValid** to generate a detailed report of invalid geometries and reasons.

Allowed flags are documented in **ST_IsValidDetail**.

Performed by the GEOS module.

Availability: 1.4

Availability: 2.0 version taking flags.

Examples

```
-- invalid bow-tie polygon
SELECT ST_IsValidReason(
    'POLYGON ((100 200, 100 100, 200 200,
        200 100, 100 200))'::geometry) as validity_info;
validity_info
-----
Self-intersection[150 150]
```

```
--First 3 Rejects from a successful quintuplet experiment
SELECT gid, ST_IsValidReason(geom) as validity_info
FROM
  (SELECT ST_MakePolygon(ST_ExteriorRing(e.buff), array_agg(f.line)) As geom, gid
  FROM (SELECT ST_Buffer(ST_Point(x1*10,y1), z1) As buff, x1*10 + y1*100 + z1*1000 As gid
        FROM generate_series(-4,6) x1
        CROSS JOIN generate_series(2,5) y1
        CROSS JOIN generate_series(1,8) z1
        WHERE x1 > y1*0.5 AND z1 < x1*y1) As e
        INNER JOIN (SELECT ST_Translate(ST_ExteriorRing(ST_Buffer(ST_Point(x1*10,y1), z1)),
            y1*1, z1*2) As line
        FROM generate_series(-3,6) x1
        CROSS JOIN generate_series(2,5) y1
        CROSS JOIN generate_series(1,10) z1
        WHERE x1 > y1*0.75 AND z1 < x1*y1) As f
  ON (ST_Area(e.buff) > 78 AND ST_Contains(e.buff, f.line))
  GROUP BY gid, e.buff) As quintuplet_experiment
WHERE ST_IsValid(geom) = false
ORDER BY gid
LIMIT 3;

gid |      validity_info
-----+-----
5330 | Self-intersection [32 5]
5340 | Self-intersection [42 5]
5350 | Self-intersection [52 5]
```

```
--simple example
SELECT ST_IsValidReason('LINESTRING(220227 150406,220227 150407,22020 150410)');

st_isvalidreason
-----
Valid Geometry
```

See Also

[ST_IsValid](#), [ST_Summary](#)

8.6.4 ST_MakeValid

ST_MakeValid — Attempts to make an invalid geometry valid without losing vertices.

Synopsis

```
geometry ST_MakeValid(geometry input);
geometry ST_MakeValid(geometry input, text params);
```

Description

The function attempts to create a valid representation of a given invalid geometry without losing any of the input vertices. Valid geometries are returned unchanged.

Supported inputs are: POINTS, MULTIPOINTS, LINESTRINGS, MULTILINESTRINGS, POLYGONS, MULTIPOLYGONS and GEOMETRYCOLLECTIONS containing any mix of them.

In case of full or partial dimensional collapses, the output geometry may be a collection of lower-to-equal dimension geometries, or a geometry of lower dimension.

Single polygons may become multi-geometries in case of self-intersections.

The `params` argument can be used to supply an options string to select the method to use for building valid geometry. The options string is in the format "method=linework|structure keepcollapsed=true|false".

The "method" key has two values.

- "linework" is the original algorithm, and builds valid geometries by first extracting all lines, noding that linework together, then building a value output from the linework.
- "structure" is an algorithm that distinguishes between interior and exterior rings, building new geometry by unioning exterior rings, and then differencing all interior rings.

The "keepcollapsed" key is only valid for the "structure" algorithm, and takes a value of "true" or "false". When set to "false", geometry components that collapse to a lower dimensionality, for example a one-point linestring would be dropped.

Performed by the GEOS module.

Availability: 2.0.0

Enhanced: 2.0.1, speed improvements

Enhanced: 2.1.0, added support for GEOMETRYCOLLECTION and MULTIPOINT.

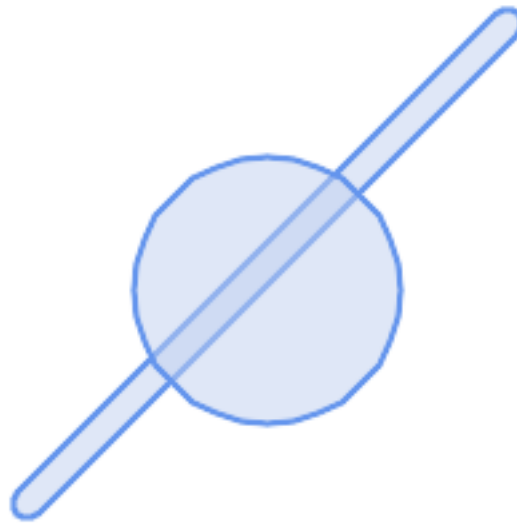
Enhanced: 3.1.0, added removal of Coordinates with NaN values.

Enhanced: 3.2.0, added algorithm options, 'linework' and 'structure' which requires GEOS >= 3.10.0.

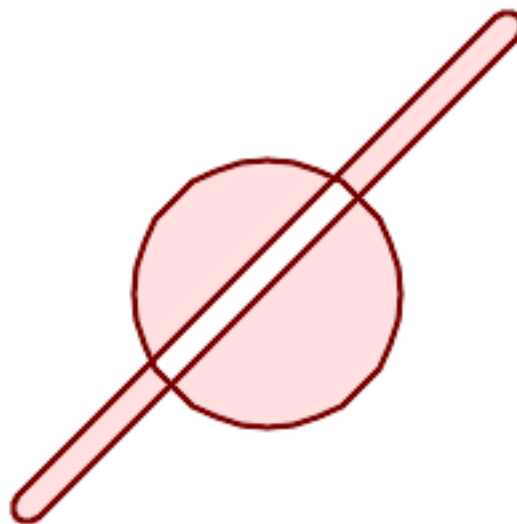


This function supports 3d and will not drop the z-index.

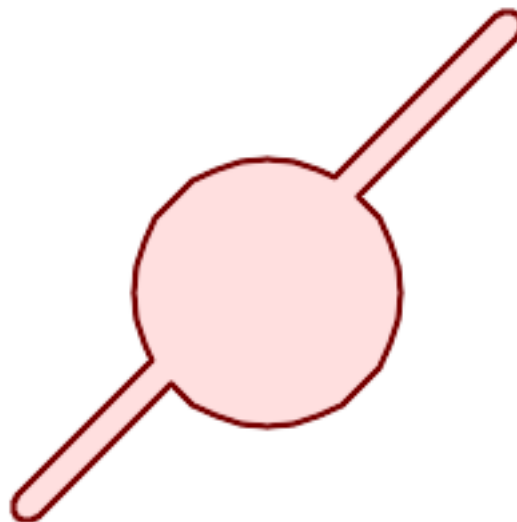
Examples



before_geom: MULTIPOLYGON of 2 overlapping polygons

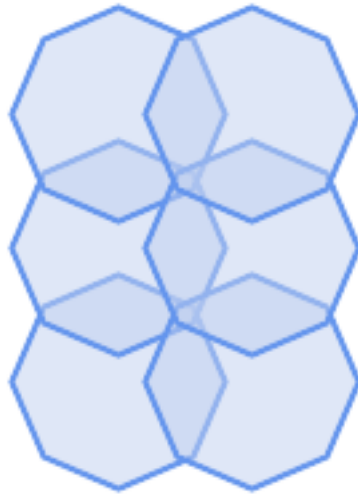


after_geom: MULTIPOLYGON of 4 non-overlapping polygons

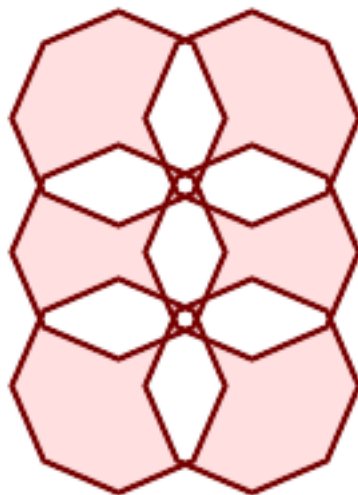


after_geom_structure: MULTIPOLYGON of 1 non-overlapping polygon

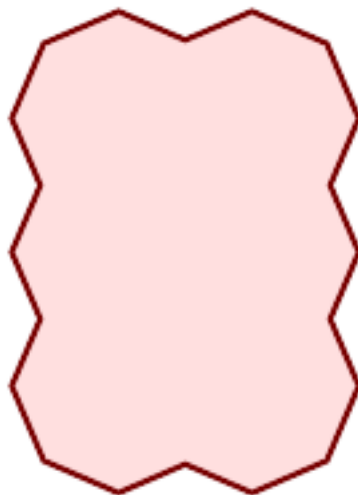
```
SELECT f.geom AS before_geom, ST_MakeValid(f.geom) AS after_geom, ST_MakeValid(f.geom, ←
    'method=structure') AS after_geom_structure
FROM (SELECT 'MULTIPOLYGON(((186 194,187 194,188 195,189 195,190 195,
191 195 192 195 193 194 194 194 194 193 195 192 195 191
```



before_geom: MULTIPOLYGON of 6 overlapping polygons



after_geom: MULTIPOLYGON of 14 Non-overlapping polygons



after_geom_structure: MULTIPOLYGON of 1 Non-overlapping polygon

```
SELECT c.geom AS before_geom,
       ST_MakeValid(c.geom) AS after_geom,
       ST_MakeValid(c.geom, 'method=structure') AS after_geom_structure
FROM (SELECT 'MULTIPOLYGON(((91 50,79 22,51 10,23 22,11 50,23 78,51 90,79 78,91 ↵
```

Examples

```
SELECT ST_AsText(ST_MakeValid(
    'LINESTRING(0 0, 0 0)',
    'method=structure keepcollapsed=true'
));

st_astext
-----
POINT(0 0)

SELECT ST_AsText(ST_MakeValid(
    'LINESTRING(0 0, 0 0)',
    'method=structure keepcollapsed=false'
));

st_astext
-----
LINESTRING EMPTY
```

See Also

[ST_IsValid](#), [ST_GeomCollFromText](#), [ST_CollectionExtract](#)

8.7 Spatial Reference System Functions

8.7.1 ST_SetSRID

ST_SetSRID — Set the SRID on a geometry.

Synopsis

geometry **ST_SetSRID**(geometry geom, integer srid);

Description

Sets the SRID on a geometry to a particular integer value. Useful in constructing bounding boxes for queries.



Note

This function does not transform the geometry coordinates in any way - it simply sets the meta data defining the spatial reference system the geometry is assumed to be in. Use [ST_Transform](#) if you want to transform the geometry into a new projection.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method supports Circular Strings and Curves

Examples

-- Mark a point as WGS 84 long lat --

```
SELECT ST_SetSRID(ST_Point(-123.365556, 48.428611),4326) As wgs84long_lat;  
-- the ewkt representation (wrap with ST_AsEWKT) -  
SRID=4326;POINT(-123.365556 48.428611)
```

-- Mark a point as WGS 84 long lat and then transform to web mercator (Spherical Mercator) --

```
SELECT ST_Transform(ST_SetSRID(ST_Point(-123.365556, 48.428611),4326),3785) As spere_merc;  
-- the ewkt representation (wrap with ST_AsEWKT) -  
SRID=3785;POINT(-13732990.8753491 6178458.96425423)
```

See Also

Section [4.5](#), [ST_SRID](#), [ST_Transform](#), [UpdateGeometrySRID](#)

8.7.2 ST_SRID

ST_SRID — Returns the spatial reference identifier for a geometry.

Synopsis

integer **ST_SRID**(geometry g1);

Description

Returns the spatial reference identifier for the ST_Geometry as defined in spatial_ref_sys table. Section [4.5](#)



Note

spatial_ref_sys table is a table that catalogs all spatial reference systems known to PostGIS and is used for transformations from one spatial reference system to another. So verifying you have the right spatial reference system identifier is important if you plan to ever transform your geometries.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.1



This method implements the SQL/MM specification. SQL-MM 3: 5.1.5



This method supports Circular Strings and Curves

Examples

```
SELECT ST_SRID(ST_GeomFromText('POINT(-71.1043 42.315)',4326));  
--result  
4326
```

See Also

Section [4.5](#), [ST_SetSRID](#), [ST_Transform](#), [ST_SRID](#), [ST_SRID](#)

8.7.3 ST_Transform

ST_Transform — Return a new geometry with coordinates transformed to a different spatial reference system.

Synopsis

```
geometry ST_Transform(geometry g1, integer srid);  
geometry ST_Transform(geometry geom, text to_proj);  
geometry ST_Transform(geometry geom, text from_proj, text to_proj);  
geometry ST_Transform(geometry geom, text from_proj, integer to_srid);
```

Description

Returns a new geometry with its coordinates transformed to a different spatial reference system. The destination spatial reference `to_srid` may be identified by a valid SRID integer parameter (i.e. it must exist in the `spatial_ref_sys` table). Alternatively, a spatial reference defined as a PROJ.4 string can be used for `to_proj` and/or `from_proj`, however these methods are not optimized. If the destination spatial reference system is expressed with a PROJ.4 string instead of an SRID, the SRID of the output geometry will be set to zero. With the exception of functions with `from_proj`, input geometries must have a defined SRID.

`ST_Transform` is often confused with `ST_SetSRID`. `ST_Transform` actually changes the coordinates of a geometry from one spatial reference system to another, while `ST_SetSRID()` simply changes the SRID identifier of the geometry.

**Note**

Requires PostGIS be compiled with PROJ support. Use `PostGIS_Full_Version` to confirm you have PROJ support compiled in.

**Note**

If using more than one transformation, it is useful to have a functional index on the commonly used transformations to take advantage of index usage.

**Note**

Prior to 1.3.4, this function crashes if used with geometries that contain CURVES. This is fixed in 1.3.4+

Enhanced: 2.0.0 support for Polyhedral surfaces was introduced.

Enhanced: 2.3.0 support for direct PROJ.4 text was introduced.



This method implements the SQL/MM specification. SQL-MM 3: 5.1.6



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Examples

Change Massachusetts state plane US feet geometry to WGS 84 long lat

```

SELECT ST_AsText(ST_Transform(ST_GeomFromText('POLYGON((743238 2967416,743238 2967450,
      743265 2967450,743265.625 2967416,743238 2967416))',2249),4326)) As wgs_geom;

wgs_geom
-----
POLYGON((-71.1776848522251 42.3902896512902,-71.1776843766326 42.3903829478009,
-71.1775844305465 42.3903826677917,-71.1775825927231 42.3902893647987,-71.177684
8522251 42.3902896512902));
(1 row)

--3D Circular String example
SELECT ST_AsEWKT(ST_Transform(ST_GeomFromEWKT('SRID=2249;CIRCULARSTRING(743238 2967416 ↵
      1,743238 2967450 2,743265 2967450 3,743265.625 2967416 3,743238 2967416 4)'),4326));

st_asewkt
-----
SRID=4326;CIRCULARSTRING(-71.1776848522251 42.3902896512902 1,-71.1776843766326 ↵
      42.3903829478009 2,
-71.1775844305465 42.3903826677917 3,
-71.1775825927231 42.3902893647987 3,-71.1776848522251 42.3902896512902 4)

```

Example of creating a partial functional index. For tables where you are not sure all the geometries will be filled in, its best to use a partial index that leaves out null geometries which will both conserve space and make your index smaller and more efficient.

```

CREATE INDEX idx_geom_26986_parcel
ON parcels
USING gist
(ST_Transform(geom, 26986))
WHERE geom IS NOT NULL;

```

Examples of using PROJ.4 text to transform with custom spatial references.

```

-- Find intersection of two polygons near the North pole, using a custom Gnomonic projection
-- See http://boundlessgeo.com/2012/02/flattening-the-peel/
WITH data AS (
  SELECT
    ST_GeomFromText('POLYGON((170 50,170 72,-130 72,-130 50,170 50))', 4326) AS p1,
    ST_GeomFromText('POLYGON((-170 68,-170 90,-141 90,-141 68,-170 68))', 4326) AS p2,
    '+proj=gnom +ellps=WGS84 +lat_0=70 +lon_0=-160 +no_defs'::text AS gnom
)
SELECT ST_AsText(
  ST_Transform(
    ST_Intersection(ST_Transform(p1, gnom), ST_Transform(p2, gnom)),
    gnom, 4326))
FROM data;

st_astext
-----
POLYGON((-170 74.053793645338,-141 73.4268621378904,-141 68,-170 68,-170 74.053793645338) ↵
)

```

Configuring transformation behavior

Sometimes coordinate transformation involving a grid-shift can fail, for example if PROJ.4 has not been built with grid-shift files or the coordinate does not lie within the range for which the grid shift is defined. By default, PostGIS will throw an error if a grid shift file is not present, but this behavior can be configured on a per-SRID basis either by testing different `to_proj` values of PROJ.4 text, or altering the `proj4text` value within the `spatial_ref_sys` table.

For example, the `proj4text` parameter `+datum=NAD83` is a shorthand form for the following `+nadgrids` parameter:


```
+nadgrids=@conus,@alaska,@ntv2_0.gsb,@ntv1_can.dat
```

The @ prefix means no error is reported if the files are not present, but if the end of the list is reached with no file having been appropriate (ie. found and overlapping) then an error is issued.

If, conversely, you wanted to ensure that at least the standard files were present, but that if all files were scanned without a hit a null transformation is applied you could use:

```
+nadgrids=@conus,@alaska,@ntv2_0.gsb,@ntv1_can.dat,null
```

The null grid shift file is a valid grid shift file covering the whole world and applying no shift. So for a complete example, if you wanted to alter PostGIS so that transformations to SRID 4267 that didn't lie within the correct range did not throw an ERROR, you would use the following:

```
UPDATE spatial_ref_sys SET proj4text = '+proj=longlat +ellps=clrk66 +nadgrids=@conus, ↵
    @alaska,@ntv2_0.gsb,@ntv1_can.dat,null +no_defs' WHERE srid = 4267;
```

See Also

Section [4.5](#), [ST_SetSRID](#), [ST_SRID](#), [UpdateGeometrySRID](#)

8.8 Geometry Input

8.8.1 Well-Known Text (WKT)

8.8.1.1 ST_BdPolyFromText

ST_BdPolyFromText — Construye un polígono dando una colección arbitraria de cadenas de líneas cerradas como representación "MultiLineString" de texto "Well-Known".

Synopsis

geometry **ST_BdPolyFromText**(text WKT, integer srid);

Descripción

Construye un polígono dando una colección arbitraria de cadenas de líneas cerradas como representación "MultiLineString" de texto "Well-Known".



Note

Envía un error si la cadena WKT no representa una MULTILINESTRING. Envía un error si la salida es un MULTIPOLYGON; en este caso puedes utilizar **ST_BdMPolyFromText**, o mira **ST_BuildArea()** para un enfoque mas específico de postgis.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2

Realizado por el módulo GEOS.

Disponibilidad: 1.1.0

Ver también

[ST_BuildArea](#), [ST_BdMPolyFromText](#)

8.8.1.2 ST_BdMPolyFromText

ST_BdMPolyFromText — Construye un multipolígono dando una colección arbitraria de cadenas de líneas cerradas como representación "MultiLineString" de texto "Well-Known".

Synopsis

geometry **ST_BdMPolyFromText**(text WKT, integer srid);

Descripción

Construye un Polígono dando una colección arbitraria de cadenas de líneas cerradas, polígonos, "MultiLineString" en formato de texto "Well-Known".



Note

Envía un error si el WKT no es una MULTILINESTRING. Fuerza una salida MULTIPOLYGON aunque el resultado este compuesto por un único POLYGON; puedes utilizar **ST_BdPolyFromText** si estas seguro que un único POLYGON será el resultado de la operación, o ver **ST_BuildArea()** para un enfoque mas especifico de postgis.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2

Realizado por el módulo GEOS.

Disponibilidad: 1.1.0

Ver también

ST_BuildArea, **ST_BdPolyFromText**

8.8.1.3 ST_GeogFromText

ST_GeogFromText — Devuelve un valor especifico "geography" desde una representación "Well-Known Text" (WKT) o extendida.

Synopsis

geography **ST_GeogFromText**(text EWKT);

Descripción

Devuelve un objeto geográfico del texto bien conocido o de la representación bien conocida extendida. Se asume SRID 4326 si no se especifica. Este es un alias para ST_GeographyFromText. Los puntos se expresan siempre en forma latitud longitud.

Ejemplos

```
--- convertir coordenadas latitud longitud a geográficas
ALTER TABLE sometable ADD COLUMN geog geography(POINT,4326);
UPDATE sometable SET geog = ST_GeogFromText('SRID=4326;POINT(' || lon || ' ' || lat || ')') ←
;

--- Especificar un punto geográfico usando EPSG:4267, NAD27
SELECT ST_AsEWKT(ST_GeogFromText('SRID=4267;POINT(-77.0092 38.889588)'));
```

Ver también

[ST_AsText](#), [ST_GeographyFromText](#)

8.8.1.4 ST_GeographyFromText

`ST_GeographyFromText` — Devuelve un valor específico "geography" desde una representación "Well-Known Text" (WKT) o extendida.

Synopsis

```
geography ST_GeographyFromText(text EWKT);
```

Descripción

Devuelve un objeto geográfico de la representación bien conocida de texto. Se supone SRID 4326 si no se especifica.

Ver también

[ST_GeogFromText](#), [ST_AsText](#)

8.8.1.5 ST_GeomCollFromText

`ST_GeomCollFromText` — Hace una colección Geometry de la colección WKT con el SRID dado. Si no se da SRID, el valor predeterminado es 0.

Synopsis

```
geometry ST_GeomCollFromText(text WKT, integer srid);
geometry ST_GeomCollFromText(text WKT);
```

Descripción

Hace una colección Geometry de la representación de texto conocido (WKT) con el SRID dado. Si no se da SRID, el valor predeterminado es 0.

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad

Devuelve null si el WKT no es una GEOMETRYCOLLECTION

**Note**

Si estas completamente seguro que todas tus geometrias WKT son colecciones, no utilices esta función. Es mas lenta que `ST_GeomFromText` ya que añade pasos de validación adicionales.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification.

Ejemplos

```
SELECT ST_GeomCollFromText('GEOMETRYCOLLECTION(POINT(1 2),LINESTRING(1 2, 3 4))');
```

Ver también

[ST_GeomFromText](#), [ST_SRID](#)

8.8.1.6 ST_GeomFromEWKT

ST_GeomFromEWKT — Devuelve un valor especificado ST_Geometry desde una representación "Extended Well-Known Text" (EWKT).

Synopsis

geometry **ST_GeomFromEWKT**(text EWKT);

Descripción

Construye un objeto PostGIS ST_Geometry desde una representación OGC "Extended Well-Known text" (EWKT).



Note

El formato EWKT no es un estándar OGC, sino un formato específico PostGIS que incluye el identificador del sistema de referencia espacial (SRID).

Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_GeomFromEWKT('SRID=4269;LINESTRING(-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932)');
SELECT ST_GeomFromEWKT('SRID=4269;MULTILINESTRING((-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932))');

SELECT ST_GeomFromEWKT('SRID=4269;POINT(-71.064544 42.28787)');

SELECT ST_GeomFromEWKT('SRID=4269;POLYGON((-71.1776585052917 42.3902909739571,-71.1776820268866 42.3903701743239,-71.1776063012595 42.3903825660754,-71.1775826583081 42.3903033653531,-71.1776585052917 42.3902909739571))');

SELECT ST_GeomFromEWKT('SRID=4269;MULTIPOLYGON((( -71.1031880899493 42.3152774590236,-71.1031627617667 42.3152960829043,-71.102923838298 42.3149156848307,-71.1023097974109 42.3151969047397,-71.1019285062273 42.3147384934248,-71.102505233663 42.3144722937587,-71.10277487471 42.3141658254797,-71.103113945163 42.3142739188902,-71.10324876416 42.31402489987,-71.1033002961013 42.3140393340215,-71.1033488797549 42.3139495090772,-71.103396240451 42.3138632439557,-71.1041521907712 42.3141153348029,-71.1041411411543 42.3141545014533,-71.1041287795912 42.3142114839058,-71.1041188134329 42.3142693656241,-71.1041112482575 42.3143272556118,
```

```
-71.1041072845732 42.3143851580048,-71.1041057218871 42.3144430686681,
-71.1041065602059 42.3145009876017,-71.1041097995362 42.3145589148055,
-71.1041166403905 42.3146168544148,-71.1041258822717 42.3146748022936,
-71.1041375307579 42.3147318674446,-71.1041492906949 42.3147711126569,
-71.1041598612795 42.314808571739,-71.1042515013869 42.3151287620809,
-71.1041173835118 42.3150739481917,-71.1040809891419 42.3151344119048,
-71.1040438678912 42.3151191367447,-71.1040194562988 42.3151832057859,
-71.1038734225584 42.3151140942995,-71.1038446938243 42.3151006300338,
-71.1038315271889 42.315094347535,-71.1037393329282 42.315054824985,
-71.1035447555574 42.3152608696313,-71.1033436658644 42.3151648370544,
-71.1032580383161 42.3152269126061,-71.103223066939 42.3152517403219,
-71.1031880899493 42.3152774590236)),
((-71.1043632495873 42.315113108546,-71.1043583974082 42.3151211109857,
-71.1043443253471 42.3150676015829,-71.1043850704575 42.3150793250568,-71.1043632495873  ←
  42.315113108546)))');
```

```
-- Cadena circular 3d
SELECT ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227 150406 3)');
```

```
-- Ejemplo de superficie de poliedros
SELECT ST_GeomFromEWKT('POLYHEDRALSURFACE(
  ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
  ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)),
  ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
  ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
  ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)),
  ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))
)');
```

Ver también

[ST_AsEWKT](#), [ST_GeomFromText](#), [ST_GeomFromEWKT](#)

8.8.1.7 ST_GeomFromMARC21

ST_GeomFromMARC21 — Takes MARC21/XML geographic data as input and returns a PostGIS geometry object.

Synopsis

geometry **ST_GeomFromMARC21** (text marxml);

Descripción

This function creates a PostGIS geometry from a MARC21/XML record, which can contain a `POINT` or a `POLYGON`. In case of multiple geographic data entries in the same MARC21/XML record, a `MULTIPOINT` or `MULTIPOLYGON` will be returned. If the record contains mixed geometry types, a `GEOMETRYCOLLECTION` will be returned. It returns `NULL` if the MARC21/XML record does not contain any geographic data (datafield:034).

LOC MARC21/XML versions supported:

- [MARC21/XML 1.1](#)

Availability: 3.3.0, requires libxml2 2.6+

**Note**

The MARC21/XML Coded Cartographic Mathematical Data currently does not provide any means to describe the Spatial Reference System of the encoded coordinates, so this function will always return a geometry with SRID 0.

**Note**

Returned POLYGON geometries will always be clockwise oriented.

Ejemplos

Converting MARC21/XML geographic data containing a single POINT encoded as hddd.dddd

```
SELECT
    ST_AsText (
        ST_GeomFromMARC21 ('
            <record xmlns="http://www.loc.gov/MARC21/slim">
                <leader>00000nz a2200000nc 4500</leader>
                <controlfield tag="001">040277569</controlfield>
                <datafield tag="034" ind1=" " ind2=" ">
                    <subfield code="d">W004.500000</subfield>
                    <subfield code="e">W004.500000</subfield>
                    <subfield code="f">N054.250000</subfield>
                    <subfield code="g">N054.250000</subfield>
                </datafield>
            </record>') );

    st_astext
    -----
POINT(-4.5 54.25)
(1 row)
```

Converting MARC21/XML geographic data containing a single POLYGON encoded as hdddmms

```
SELECT
    ST_AsText (
        ST_GeomFromMARC21 ('
            <record xmlns="http://www.loc.gov/MARC21/slim">
                <leader>01062cem a2200241 a 4500</leader>
                <controlfield tag="001"> 84696781 </controlfield>
                <datafield tag="034" ind1="1" ind2=" ">
                    <subfield code="a">a</subfield>
                    <subfield code="b">50000</subfield>
                    <subfield code="d">E0130600</subfield>
                    <subfield code="e">E0133100</subfield>
                    <subfield code="f">N0523900</subfield>
                    <subfield code="g">N0522300</subfield>
                </datafield>
            </record>') );

    st_astext
    -----

POLYGON((13.1 52.65,13.516666666666667 52.65,13.516666666666667  ←
        52.38333333333333,13.1 52.38333333333333,13.1 52.65))
(1 row)
```

Converting MARC21/XML geographic data containing a POLYGON and a POINT:

```
SELECT
    ST_AsText (
        ST_GeomFromMARC21 ( '
<record xmlns="http://www.loc.gov/MARC21/slim">
  <datafield tag="034" ind1="1" ind2=" ">
    <subfield code="a">a</subfield>
    <subfield code="b">50000</subfield>
    <subfield code="d">E0130600</subfield>
    <subfield code="e">E0133100</subfield>
    <subfield code="f">N0523900</subfield>
    <subfield code="g">N0522300</subfield>
  </datafield>
  <datafield tag="034" ind1=" " ind2=" ">
    <subfield code="d">W004.500000</subfield>
    <subfield code="e">W004.500000</subfield>
    <subfield code="f">N054.250000</subfield>
    <subfield code="g">N054.250000</subfield>
  </datafield>
</record>' ) );
-----
GEOMETRYCOLLECTION (POLYGON ( (13.1 52.65,13.516666666666667  ↵
    52.65,13.516666666666667 52.38333333333333,13.1 52.38333333333333,13.1  ↵
    52.65) ), POINT (-4.5 54.25) )
(1 row)
```

Ver también

[ST_AsMARC21](#)

8.8.1.8 ST_GeometryFromText

ST_GeometryFromText — Devuelve un valor específico de ST_Geometry desde una representación "Well-Known Text" (WKT). Es un alias para ST_GeomFromText

Synopsis

```
geometry ST_GeometryFromText(text WKT);
geometry ST_GeometryFromText(text WKT, integer srid);
```

Descripción



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 5.1.40

Ver también

[ST_GeomFromText](#)

8.8.1.9 ST_GeomFromText

ST_GeomFromText — Devuelve un valor específico de ST_Geometry desde una representación "Extended Well-Known Binary" (EWKB).

Synopsis

```
geometry ST_GeomFromText(text WKT);
geometry ST_GeomFromText(text WKT, integer srid);
```

Descripción

Construye un objeto ST_Geometry de PostGIS desde una representación OGC "Well-Known Text" (WKT).



Note

Hay dos variantes de la función ST_GeomFromText. El primero no toma SRID y devuelve una geometría sin sistema de referencia espacial definido (SRID = 0). La segunda toma un SRID como segundo argumento y devuelve una geometría que incluye esta SRID como parte de sus metadatos.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2 - la opción SRID es de la suite de conformidad.



This method implements the SQL/MM specification. SQL-MM 3: 5.1.40



This method supports Circular Strings and Curves



Note

While not OGC-compliant, [ST_MakePoint](#) is faster than ST_GeomFromText and ST_PointFromText. It is also easier to use for numeric coordinate values. [ST_Point](#) is another option similar in speed to [ST_MakePoint](#) and is OGC-compliant, but doesn't support anything but 2D points.



Warning

Cambiado: 2.0.0 En las versiones anteriores de PostGIS ST_GeomFromText('GEOMETRYCOLLECTION(EMPTY)') estaba permitido. Esto no está permitido ahora en PostGIS 2.0.0 para ajustarse mejor a las normas SQL/MM. Esto debería ser escrito como ST_GeomFromText('GEOMETRYCOLLECTION EMPTY')

Ejemplos

```
SELECT ST_GeomFromText('LINESTRING(-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932)');
SELECT ST_GeomFromText('LINESTRING(-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932)',4269);

SELECT ST_GeomFromText('MULTILINESTRING((-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932))');

SELECT ST_GeomFromText('POINT(-71.064544 42.28787)');

SELECT ST_GeomFromText('POLYGON((-71.1776585052917 42.3902909739571,-71.1776820268866 42.3903701743239,
```



```

-71.1776063012595 42.3903825660754,-71.1775826583081 42.3903033653531,-71.1776585052917 ↵
  42.3902909739571)) ');

SELECT ST_GeomFromText('MULTIPOLYGON((( (-71.1031880899493 42.3152774590236,
-71.1031627617667 42.3152960829043,-71.102923838298 42.3149156848307,
-71.1023097974109 42.3151969047397,-71.1019285062273 42.3147384934248,
-71.102505233663 42.3144722937587,-71.10277487471 42.3141658254797,
-71.103113945163 42.3142739188902,-71.10324876416 42.31402489987,
-71.1033002961013 42.3140393340215,-71.1033488797549 42.3139495090772,
-71.103396240451 42.3138632439557,-71.1041521907712 42.3141153348029,
-71.1041411411543 42.3141545014533,-71.1041287795912 42.3142114839058,
-71.1041188134329 42.3142693656241,-71.1041112482575 42.3143272556118,
-71.1041072845732 42.3143851580048,-71.1041057218871 42.3144430686681,
-71.1041065602059 42.3145009876017,-71.1041097995362 42.3145589148055,
-71.1041166403905 42.3146168544148,-71.1041258822717 42.3146748022936,
-71.1041375307579 42.3147318674446,-71.1041492906949 42.3147711126569,
-71.1041598612795 42.314808571739,-71.1042515013869 42.3151287620809,
-71.1041173835118 42.3150739481917,-71.1040809891419 42.3151344119048,
-71.1040438678912 42.3151191367447,-71.1040194562988 42.3151832057859,
-71.1038734225584 42.3151140942995,-71.1038446938243 42.3151006300338,
-71.1038315271889 42.315094347535,-71.1037393329282 42.315054824985,
-71.1035447555574 42.3152608696313,-71.1033436658644 42.3151648370544,
-71.1032580383161 42.3152269126061,-71.103223066939 42.3152517403219,
-71.1031880899493 42.3152774590236))),
((-71.1043632495873 42.315113108546,-71.1043583974082 42.3151211109857,
-71.1043443253471 42.3150676015829,-71.1043850704575 42.3150793250568,-71.1043632495873 ↵
  42.315113108546))) ', 4326);

SELECT ST_GeomFromText('CIRCULARSTRING(220268 150415,220227 150505,220227 150406)');

```

Ver también

[ST_GeomFromEWKT](#), [ST_GeomFromWKB](#), [ST_SRID](#)

8.8.1.10 ST_LineFromText

ST_LineFromText — Hace una geometría de la representación WKT con el SRID dado. Si SRID no se da, el valor predeterminado es 0.

Synopsis

```

geometry ST_LineFromText(text WKT);
geometry ST_LineFromText(text WKT, integer srid);

```

Descripción

Hace una Geometry desde un WKT con el SRID dado. Si no se da un SRID, el valor predeterminado es 0. Si el WKT pasado no es un LINestring, se devuelve null.



Note

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad

**Note**

Si sabes que todas tus geometrías son LINESTRING, es mas eficiente el uso de ST_GeomFromText. Esto llama únicamente a ST_GeomFromText y añade validaciones adicionales que devuelven un linestring.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 7.2.8

Ejemplos

```
SELECT ST_LineFromText('LINESTRING(1 2, 3 4)') AS aline, ST_LineFromText('POINT(1 2)') AS ↵
       null_return;
aline                                | null_return
-----|-----
01020000000200000000000000000000F ... | t
```

Ver también

[ST_GeomFromText](#)

8.8.1.11 ST_MLineFromText

ST_MLineFromText — Devuelve un valor especificado ST_MultiLineString desde una representación WKT.

Synopsis

```
geometry ST_MLineFromText(text WKT, integer srid);
geometry ST_MLineFromText(text WKT);
```

Descripción

Hace una Geometry desde el texto bien conocido (WKT) con el SRID dado. Si no se da un SRID, el valor predeterminado es 0.

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad

Devuelve NULL si el WKT no es un MULTILINESTRING

**Note**

Si estas completamente seguro que todas tus geometrías WKT son puntos, no utilices esta función. Es mas lenta que ST_GeomFromText ya que añade algunos pasos de validación.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 9.4.4

Ejemplos

```
SELECT ST_MLineFromText('MULTILINESTRING((1 2, 3 4), (4 5, 6 7))');
```

Ver también

[ST_GeomFromText](#)

8.8.1.12 ST_MPointFromText

ST_MPointFromText — Hace una geometría desde un WKT con el SRID dado. Si no se da un SRID, el valor predeterminado es 0.

Synopsis

```
geometry ST_MPointFromText(text WKT, integer srid);  
geometry ST_MPointFromText(text WKT);
```

Descripción

Hace una geometría desde un WKT con el SRID dado. Si no se da un SRID, el valor predeterminado es 0.

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad

Devuelve NULL si el WKT no es un MULTIPUNTO



Note

Si estas completamente seguro que todas tus geometrias WKT son puntos, no utilices esta función. Es mas lenta que ST_GeomFromText ya que añade algunos pasos de validación.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). 3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 9.2.4

Ejemplos

```
SELECT ST_MPointFromText('MULTIPOINT((1 2),(3 4))');  
SELECT ST_MPointFromText('MULTIPOINT((-70.9590 42.1180),(-70.9611 42.1223))', 4326);
```

Ver también

[ST_GeomFromText](#)

8.8.1.13 ST_MPolyFromText

ST_MPolyFromText — Hace una Geometría MultiPolygon desde un WKT con el SRID dado. Si no se da SRID, el valor predeterminado es 0.

Synopsis

```
geometry ST_MPolyFromText(text WKT, integer srid);  
geometry ST_MPolyFromText(text WKT);
```

Descripción

Hace un MultiPolygon desde un WKT con el SRID dado. Si no se da SRID, el valor predeterminado es 0.

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad

Devuelve un error si el WKT no es un MULTIPOLYGON



Note

Si estas completamente seguro que todas tus geometrías WKT son multipolygon, no utilices esta función. Es mas lenta que ST_GeomFromText ya que añade algunos pasos de validación adicionales.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 9.6.4

Ejemplos

```
SELECT ST_MPolyFromText('MULTIPOLYGON(((0 0 1,20 0 1,20 20 1,0 20 1,0 0 1),(5 5 3,5 7 3,7 7 3,7 5 3,5 5 3)))');
SELECT ST_MPolyFromText('MULTIPOLYGON((-70.916 42.1002,-70.9468 42.0946,-70.9765 42.0872,-70.9754 42.0875,-70.9749 42.0879,-70.9752 42.0881,-70.9754 42.0891,-70.9758 42.0894,-70.9759 42.0897,-70.9759 42.0899,-70.9754 42.0902,-70.9756 42.0906,-70.9753 42.0907,-70.9753 42.0917,-70.9757 42.0924,-70.9755 42.0928,-70.9755 42.0942,-70.9751 42.0948,-70.9755 42.0953,-70.9751 42.0958,-70.9751 42.0962,-70.9759 42.0983,-70.9767 42.0987,-70.9768 42.0991,-70.9771 42.0997,-70.9771 42.1003,-70.9768 42.1005,-70.977 42.1011,-70.9766 42.1019,-70.9768 42.1026,-70.9769 42.1033,-70.9775 42.1042,-70.9773 42.1043,-70.9776 42.1043,-70.9778 42.1048,-70.9773 42.1058,-70.9774 42.1061,-70.9779 42.1065,-70.9782 42.1078,-70.9788 42.1085,-70.9798 42.1087,-70.9806 42.109,-70.9807 42.1093,-70.9806 42.1099,-70.9809 42.1109,-70.9808 42.1112,-70.9798 42.1116,-70.9792 42.1127,-70.979 42.1129,-70.9787 42.1134,-70.979 42.1139,-70.9791 42.1141,-70.9987 42.1116,-71.0022 42.1273,-70.9408 42.1513,-70.9315 42.1165,-70.916 42.1002)))',4326);
```

Ver también

[ST_GeomFromText](#), [ST_SRID](#)

8.8.1.14 ST_PointFromText

ST_PointFromText — Crea una geometría puntual desde un WKT con el SRID dado. Si no se especifica el SRID por defecto será unknown.

Synopsis

```
geometry ST_PointFromText(text WKT);
geometry ST_PointFromText(text WKT, integer srid);
```

Descripción

Construye un objeto de punto de PostGIS ST_GEOMETRY de la representación bien conocida del texto de OGC. Si no se da SRID, se omite a desconocido (actualmente 0). Si la geometría no es una representación de punto WKT, devuelve null. Si WKT es totalmente inválido, entonces lanza un error.

**Note**

Hay 2 variantes de la función `ST_PointFromText`, la primera no toma SRID y devuelve una geometría sin sistema de referencia espacial definido. La segunda toma un id de un sistema de referencia como segundo argumento y devuelve una `ST_Geometry` que incluye este srid como parte de sus metadatos. El srid debe estar definido en la tabla `spatial_ref_sys`.

**Note**

Si estas completamente seguro que todas tus geometrias WKT son puntos, no utilices esta función. Es mas lenta que `ST_GeomFromText` ya que añade algunos pasos de validación. Si estas construyendo puntos desde coordenadas long lat y te interesan mas el rendimiento y la precisión que la conformidad con OGC, utiliza `ST_MakePoint` o el alias conforme al OGC `ST_Point`.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2 - la opción SRID es de la suite de conformidad.



This method implements the SQL/MM specification. SQL-MM 3: 6.1.8

Ejemplos

```
SELECT ST_PointFromText('POINT(-71.064544 42.28787)');
SELECT ST_PointFromText('POINT(-71.064544 42.28787)', 4326);
```

Ver también

[ST_GeomFromText](#), [ST_MakePoint](#), [ST_Point](#), [ST_SRID](#)

8.8.1.15 ST_PolygonFromText

`ST_PolygonFromText` — Hace una geometría desde un WKT con el SRID dado. Si no se da un SRID, el valor predeterminado es 0.

Synopsis

```
geometry ST_PolygonFromText(text WKT);
geometry ST_PolygonFromText(text WKT, integer srid);
```

Descripción

Hace una geometría desde WKT con el SRID dado. Si no se da SRID, el valor predeterminado es 0. Devuelve null si WKT no es un polígono.

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad

**Note**

Si estas completamente seguro que todas tus geometrías WKT son poligonos, no utilices esta función. Es mas lenta que `ST_GeomFromText` ya que añade algunos pasos de validación adicionales.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 8.3.6

Ejemplos

```
SELECT ST_PolygonFromText('POLYGON((-71.1776585052917 42.3902909739571,-71.1776820268866 ↵
    42.3903701743239,
-71.1776063012595 42.3903825660754,-71.1775826583081 42.3903033653531,-71.1776585052917 ↵
    42.3902909739571))');
st_polygonfromtext
-----
010300000001000000050000006...
```

```
SELECT ST_PolygonFromText('POINT(1 2)') IS NULL as point_is_notpoly;
point_is_not_poly
-----
t
```

Ver también

[ST_GeomFromText](#)

8.8.1.16 ST_WKTTToSQL

ST_WKTTToSQL — Devuelve un valor específico de ST_Geometry desde una representación "Well-Known Text" (WKT). Es un alias para ST_GeomFromText

Synopsis

geometry **ST_WKTTToSQL**(text WKT);

Descripción



This method implements the SQL/MM specification. SQL-MM 3: 5.1.34

Ver también

[ST_GeomFromText](#)

8.8.2 Well-Known Binary (WKB)

8.8.2.1 ST_GeogFromWKB

ST_GeogFromWKB — Crea una instancia "geography" desde la representación de una geometría en "Well-Known Binary" (WKB) o "Extended Well-Known Binary" (EWKB).

Synopsis

geography **ST_GeogFromWKB**(bytea wkb);

Descripción

La función `ST_GeogFromWKB`, toma una representación de una geometría en "Well-Known Binary" (WKB) o la versión extendida de PostGIS y crea la instancia apropiada de tipo "geography". Esta función juega el rol de "Geometry Factory" en SQL.

Si no se define un SRID, por defecto es 4326 (WGS 84 long lat).



This method supports Circular Strings and Curves

Ejemplos

```
--Aunque bytes rep contiene solo \, esto se necesita para escapar caracteres cuando se e ↵
insertan en una tabla
SELECT ST_AsText(
ST_GeogFromWKB(E'\\001\\002\\000\\000\\000\\002\\000\\000\\000\\037\\205\\353Q ↵
\\270~\\\\\\\\300\\323Mb\\020X\\231C@\\020X9\\264\\310~\\\\\\\\300)\\\\\\\\217\\302\\365\\230 ↵
C@')
);
                                st_astext
-----
LINESTRING(-113.98 39.198,-113.981 39.195)
(1 row)
```

Ver también

[ST_GeogFromText](#), [ST_AsBinary](#)

8.8.2.2 ST_GeomFromEWKB

`ST_GeomFromEWKB` — Devuelve un valor específico de `ST_Geometry` desde una representación "Extended Well-Known Binary" (EWKB).

Synopsis

geometry **ST_GeomFromEWKB**(bytea EWKB);

Descripción

Construye un objeto `ST_Geometry` de PostGIS desde un formato OGC "Extended Well-Known Binary" (EWKB).



Note

El formato EWKB no es un estándar del OGC, sino un formato específico de PostGIS que incluye el identificador del sistema de referencia espacial (SRID)

Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

Representación binaria de LINESTRING(-71.160281 42.258729,-71.160837 42.259113,-71.161144 42.25932) en NAD 83 long lat (4269).



Note

Nota: Aunque los arrays de bits están delimitados por \ y deben tener ', necesitaremos escapar ambos con \ y " si el valor de standard_conforming_strings es off. Así que esto puede no ser exactamente como la representación AsEWKB.

```
SELECT ST_GeomFromEWKB(E'\001\002\000\000 \255\020\000\000\003\000\000\000\344 ←
J=
\013B\312Q\300n\303(\010\036!E@'\277E'K
\312Q\300\366{b\235*!E@\225|\354.P\312Q
\300p\231\323e1!E@');
```



Note

En PostgreSQL 9.1 +-standard_conforming_strings se establece en on de forma predeterminada, donde como en versiones anteriores se estableció en off. Puede cambiar los valores predeterminados según sea necesario para una sola consulta o a nivel de base de datos o de servidor. A continuación se muestra cómo lo haría con standard_conforming_strings = on. En este caso nos escapamos del ' with standard ansi ', pero las barras no se escapan

```
set standard_conforming_strings = on;
SELECT ST_GeomFromEWKB('\001\002\000\000 \255\020\000\000\003\000\000\000\344J=\012\013B
\312Q\300n\303(\010\036!E@'\277E'K\012\312Q\300\366{b\235*!E@\225|\354.P\312Q\012\300 ←
p\231\323e1')
```

Ver también

[ST_AsBinary](#), [ST_AsEWKB](#), [ST_GeomFromWKB](#)

8.8.2.3 ST_GeomFromWKB

ST_GeomFromWKB — Crea una instancia de geometría desde la representación de una geometría en "Well-Known Binary" (WKB) y un SRID opcional.

Synopsis

```
geometry ST_GeomFromWKB(bytea geom);
geometry ST_GeomFromWKB(bytea geom, integer srid);
```

Descripción

La función **ST_GeomFromWKB**, toma una representación binaria "well-known" de una geometría y un ID de un Sistema de Referencia Espacial (SRID) y crea una instancia del tipo de geometría adecuado. Esta función juega un rol de "Geometry Factory" en SQL. Es un nombre alternativo para **ST_WKBToSQL**.

Si no se especifica SRID, el valor predeterminado es 0 (desconocido).



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.7.2 - El SRID opcional es para el paquete de conformidad



This method implements the SQL/MM specification. SQL-MM 3: 5.1.41



This method supports Circular Strings and Curves

Ejemplos

```
-- Aunque bytea rep contiene single \, estos deben ser escapados al insertar en una tabla
-- a menos que standard_conforming_strings esté establecido en on.
SELECT ST_AsEWKT(
ST_GeomFromWKB(E'\\001\\002\\000\\000\\000\\002\\000\\000\\000\\037\\205\\353Q ↵
\\270~\\\\\\\\300\\323Mb\\020X\\231C@\\020X9\\264\\310~\\\\\\\\300)\\\\\\\\217\\302\\365\\230 ↵
C@',4326)
);

```

st_asewkt
SRID=4326;LINESTRING(-113.98 39.198,-113.981 39.195)

```
(1 row)

SELECT
  ST_AsText(
    ST_GeomFromWKB(
      ST_AsEWKB('POINT(2 5)::geometry')
    )
  );

```

st_astext
POINT(2 5)

```
(1 row)
```

Ver también

[ST_WKBToSQL](#), [ST_AsBinary](#), [ST_GeomFromEWKB](#)

8.8.2.4 ST_LineFromWKB

ST_LineFromWKB — Crea un `LINESTRING` desde un `WKB` con el `SRID` dado

Synopsis

geometry **ST_LineFromWKB**(bytea WKB);
 geometry **ST_LineFromWKB**(bytea WKB, integer srid);

Descripción

La función `ST_GeomFromWKB`, toma una representación binaria "well-known" de una geometría y un ID de un Sistema de Referencia Espacial (`SRID`) y crea una instancia del tipo de geometría adecuado - en este caso una geometría `LINESTRING`. Esta función juega un rol de "Geometry Factory" en `SQL`.

Si no se especifica un `SRID`, el valor predeterminado es 0. `NULL` se devuelve si la entrada `bytea` no representa un `LINESTRING`.



Note

OGC SPEC 3.2.6.2 - La opción `SRID` es del paquete de conformidad



Note

Si sabes que todas tus geometrías son `LINESTRING`, es mas eficiente el uso de [ST_GeomFromWKB](#). Esta función simplemente llama a [ST_GeomFromWKB](#) y añade validaciones adicionales y devuelve una `linestring`.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 7.2.9

Ejemplos

```
SELECT ST_LineFromWKB(ST_AsBinary(ST_GeomFromText('LINESTRING(1 2, 3 4)'))) AS aline,
       ST_LineFromWKB(ST_AsBinary(ST_GeomFromText('POINT(1 2)'))) IS NULL AS ←
       null_return;
aline                                     | null_return
-----+-----
01020000000200000000000000000000F ... | t
```

Ver también

[ST_GeomFromWKB](#), [ST_LinestringFromWKB](#)

8.8.2.5 ST_LinestringFromWKB

ST_LinestringFromWKB — Crea una geometría desde un WKB con el SRID dado.

Synopsis

geometry **ST_LinestringFromWKB**(bytea WKB);
 geometry **ST_LinestringFromWKB**(bytea WKB, integer srid);

Descripción

La función **ST_LinestringFromWKB**, toma una representación de una geometría en "well-known binary" y un ID de un Sistema de Referencia Espacial (SRID) y crea una instancia del tipo apropiado de geometría - en este caso, una geometría **LINESTRING**. Esta función juega un rol de "Geometry Factory" en SQL.

Si no se especifica un SRID, el valor predeterminado es 0.NULL se devuelve si la entrada *bytea* no representa una geometría **LINESTRING**. Esto es un alias para [ST_LineFromWKB](#).



Note

OGC SPEC 3.2.6.2 - La opción SRID es del paquete de conformidad



Note

Si sabes que todas tus geometrías son **LINESTRING**, es mas eficiente el uso de [ST_GeomFromWKB](#). Esta función simplemente llama a [ST_GeomFromWKB](#) y añade validaciones adicionales y devuelve una **LINESTRING**.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.6.2



This method implements the SQL/MM specification. SQL-MM 3: 7.2.9

Ejemplos

```
SELECT
  ST_LineStringFromWKB(
    ST_AsBinary(ST_GeomFromText('LINESTRING(1 2, 3 4)'))
  ) AS aline,
  ST_LineStringFromWKB(
    ST_AsBinary(ST_GeomFromText('POINT(1 2)'))
  ) IS NULL AS null_return;
  aline                                | null_return
-----
01020000000200000000000000000000F ... | t
```

Ver también

[ST_GeomFromWKB](#), [ST_LineFromWKB](#)

8.8.2.6 ST_PointFromWKB

ST_PointFromWKB — Crea una geometría desde un WKB con el SRID dado.

Synopsis

geometry **ST_GeomFromWKB**(bytea geom);
 geometry **ST_GeomFromWKB**(bytea geom, integer srid);

Descripción

La función **ST_PointFromWKB**, toma una representación binaria "well-known" de una geometría y un ID de un Sistema de Referencia Espacial (SRID) y crea una instancia del tipo de geometría adecuado - en este caso una geometría **POINT**. Esta función juega un rol de "Geometry Factory" en SQL.

Si no se especifica un SRID, el valor predeterminado es 0. **NULL** se devuelve si la entrada **bytea** no representa una geometría de **POINT**.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.7.2



This method implements the SQL/MM specification. SQL-MM 3: 6.1.9



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT
  ST_AsText (
    ST_PointFromWKB (
      ST_AsEWKB ('POINT(2 5) '::geometry)
    )
  );
  st_astext
-----
POINT(2 5)
(1 row)
```

```

SELECT
  ST_AsText (
    ST_PointFromWKB (
      ST_AsEWKB ('LINESTRING(2 5, 2 6)::geometry)
    )
  );
 st_astext
-----
(1 row)

```

Ver también

[ST_GeomFromWKB](#), [ST_LineFromWKB](#)

8.8.2.7 ST_WKBToSQL

ST_WKBToSQL — Devuelve un valor específico de **ST_Geometry** desde una representación "Well-Known Binary" (WKB). Es un alias para **ST_GeomFromWKB** que no toma srid

Synopsis

geometry **ST_WKBToSQL**(bytea WKB);

Descripción

This method implements the SQL/MM specification. SQL-MM 3: 5.1.36

Ver también

[ST_GeomFromWKB](#)

8.8.3 Other Formats**8.8.3.1 ST_Box2dFromGeoHash**

ST_Box2dFromGeoHash — Devuelve un BOX2D de una cadena de GeoHash.

Synopsis

box2d **ST_Box2dFromGeoHash**(text geohash, integer precision=full_precision_of_geohash);

Descripción

Devuelve un BOX2D de una cadena de GeoHash.

If no `precision` is specified **ST_Box2dFromGeoHash** returns a BOX2D based on full precision of the input GeoHash string.

Si es especificada la `precisión` **ST_Box2dFromGeoHash** utilizará muchos caracteres del GeoHash para crear el BOX2D. Los valores de precisión más bajos resultan en BOX2Ds más grandes y los valores más grandes aumentan la precisión.

Disponibilidad: 2.1.0

Ejemplos

```
SELECT ST_Box2dFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0');

          st_geomfromgeohash
-----
BOX(-115.172816 36.114646,-115.172816 36.114646)

SELECT ST_Box2dFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0', 0);

          st_box2dfromgeohash
-----
BOX(-180 -90,180 90)

SELECT ST_Box2dFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0', 10);

          st_box2dfromgeohash
-----
BOX(-115.17282128334 36.1146408319473,-115.172810554504 36.1146461963654)
```

Ver también

[ST_GeoHash](#), [ST_GeomFromGeoHash](#), [ST_PointFromGeoHash](#)

8.8.3.2 ST_GeomFromGeoHash

ST_GeomFromGeoHash — Devuelve una geometría de una cadena de GeoHash.

Synopsis

geometry **ST_GeomFromGeoHash**(text geohash, integer precision=full_precision_of_geohash);

Descripción

Devuelve una geometría de una cadena de GeoHash. La geometría será un polígono que representa los límites de GeoHash.

Si no se especifica ninguna *precisión*, ST_GeomFromGeoHash devuelve un polígono basándose en la precisión completa de la cadena de GeoHash de entrada.

Si se especifica la *precisión*, ST_GeomFromGeoHash utilizará muchos caracteres del GeoHash para crear el polígono.

Disponibilidad: 2.1.0

Ejemplos

```
SELECT ST_AsText(ST_GeomFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0'));

          st_astext
-----
POLYGON((-115.172816 36.114646,-115.172816 36.114646,-115.172816 36.114646,-115.172816 36.114646,-115.172816 36.114646))

SELECT ST_AsText(ST_GeomFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0', 4));

          st_astext
-----
POLYGON((-115.3125 36.03515625,-115.3125 36.2109375,-114.9609375 36.2109375,-114.9609375 36.03515625,-115.3125 36.03515625))
```

```
SELECT ST_AsText(ST_GeomFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0', 10));
```

st_astext ↩

```
POLYGON((-115.17282128334 36.1146408319473,-115.17282128334 ↩
 36.1146461963654,-115.172810554504 36.1146461963654,-115.172810554504 ↩
 36.1146408319473,-115.17282128334 36.1146408319473))
```

Ver también

[ST_GeoHash](#), [ST_Box2dFromGeoHash](#), [ST_PointFromGeoHash](#)

8.8.3.3 ST_GeomFromGML

ST_GeomFromGML — Toma una representación GML como entrada de una geometría y extrae un objeto geométrico PostGIS

Synopsis

```
geometry ST_GeomFromGML(text geomgml);
geometry ST_GeomFromGML(text geomgml, integer srid);
```

Descripción

Construye un objeto ST_Geometry de PostGIS desde una representación OGC GML.

ST_GeomFromGML funciona solamente para fragmentos geométricos GML. Lanza un error si intentas utilizar un documento GML completo.

Versiones OGC GML soportadas:

- GML 3.2.1 Namespace
- GML 3.1.1 Simple Features profile SF-2 (con GML 3.1.0 y 3.0.0 compatibilidad para versiones anteriores)
- GML 2.1.2

OGC GML standards, cf: <http://www.opengeospatial.org/standards/gml>:

Disponibilidad: 1.5, requiere libxml2 1.6+

Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN.

Mejorada: 2.0.0 se agregó el parámetro por defecto opcional srid.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

GML permite dimensiones mixtas (2D y 3D dentro de la misma MultiGeometry, por ejemplo). Como las geometrías PostGIS no lo hacen, ST_GeomFromGML convierte todas las geometrías a 2D si se encuentra una dimensión Z que falta.

GML soporta SRS diferentes en la misma MultiGeometry. Como las geometrías de PostGIS no lo hacen, ST_GeomFromGML, en este caso, reproyecta todas las subgeometrías al SRS del nodo padre. Si no esta disponible el atributo srsName en el nodo padre del GML, la función lanza un error.

La función ST_GeomFromGML no es muy estricta con los namespaces explícitos de un GML. Puedes evitar mencionarlos explícitamente para usos comunes. Pero lo necesitas si deseas utilizar la función XLink dentro del GML.

**Note**

La función ST_GeomFromGML no soporta geometrias curvas SQL/MM.

Ejemplos - Una geometría simple con srsName

```
SELECT ST_GeomFromGML('
    <gml:LineString srsName="EPSG:4269">
      <gml:coordinates>
        -71.16028,42.258729 -71.160837,42.259112 ↔
        -71.161143,42.25932
      </gml:coordinates>
    </gml:LineString
>');
```

Ejemplos - uso de XLink

```
SELECT ST_GeomFromGML('
    <gml:LineString xmlns:gml="http://www.opengis.net/gml"
                    xmlns:xlink="http://www.w3.org/1999/xlink"
                    srsName="urn:ogc:def:crs:EPSG::4269">
      <gml:pointProperty>
        <gml:Point gml:id="p1"
><gml:pos
>42.258729 -71.16028</gml:pos
></gml:Point>
        </gml:pointProperty>
        <gml:pos
>42.259112 -71.160837</gml:pos>
        <gml:pointProperty>
          <gml:Point xlink:type="simple" xlink:href="#p1"/>
        </gml:pointProperty>
      </gml:LineString
>'));
```

Ejemplos - Superficie polihédrica

```
SELECT ST_AsEWKT(ST_GeomFromGML('
<gml:PolyhedralSurface>
<gml:polygonPatches>
  <gml:PolygonPatch>
    <gml:exterior>
      <gml:LinearRing
><gml:posList srsDimension="3"
>0 0 0 0 1 0 1 1 0 1 0 0 0 0</gml:posList
></gml:LinearRing>
      </gml:exterior>
    </gml:PolygonPatch>
    <gml:PolygonPatch>
      <gml:exterior>
        <gml:LinearRing
><gml:posList srsDimension="3"
>0 0 0 0 1 0 1 1 0 1 0 0 0 0</gml:posList
></gml:LinearRing>
      </gml:exterior>
    </gml:PolygonPatch>
  </gml:polygonPatches>
</gml:PolyhedralSurface>
');
```

```

    <gml:PolygonPatch>
      <gml:exterior>
        <gml:LinearRing>
><gml:posList srsDimension="3"
>0 0 0 1 0 0 1 0 1 0 0 1 0 0 0</gml:posList
></gml:LinearRing>
        </gml:exterior>
      </gml:PolygonPatch>
      <gml:PolygonPatch>
        <gml:exterior>
          <gml:LinearRing>
><gml:posList srsDimension="3"
>1 1 0 1 1 1 1 0 1 1 0 0 1 1 0</gml:posList
></gml:LinearRing>
          </gml:exterior>
        </gml:PolygonPatch>
      <gml:PolygonPatch>
        <gml:exterior>
          <gml:LinearRing>
><gml:posList srsDimension="3"
>0 1 0 0 1 1 1 1 1 1 0 0 1 0</gml:posList
></gml:LinearRing>
          </gml:exterior>
        </gml:PolygonPatch>
      <gml:PolygonPatch>
        <gml:exterior>
          <gml:LinearRing>
><gml:posList srsDimension="3"
>0 0 1 1 0 1 1 1 1 0 1 1 0 0 1</gml:posList
></gml:LinearRing>
          </gml:exterior>
        </gml:PolygonPatch>
    </gml:polygonPatches>
  </gml:PolyhedralSurface
>'))';

-- result --
POLYHEDRALSURFACE(((0 0 0,0 0 1,0 1 1,0 1 0,0 0 0)),
((0 0 0,0 1 0,1 1 0,1 0 0,0 0 0)),
((0 0 0,1 0 0,1 0 1,0 0 1,0 0 0)),
((1 1 0,1 1 1,1 0 1,1 0 0,1 1 0)),
((0 1 0,0 1 1,1 1 1,1 1 0,0 1 0)),
((0 0 1,1 0 1,1 1 1,0 1 1,0 0 1)))

```

Ver también

Section [2.2.3](#), [ST_AsGML](#), [ST_GMLToSQL](#)

8.8.3.4 ST_GeomFromGeoJSON

ST_GeomFromGeoJSON — Toma como entrada una representación geojson de una geometría y devuelve un objeto geométrico PostGIS

Synopsis

```

geometry ST_GeomFromGeoJSON(text geomjson);
geometry ST_GeomFromGeoJSON(json geomjson);
geometry ST_GeomFromGeoJSON(jsonb geomjson);

```


Descripción

Construye un objeto geométrico PostGIS desde una representación GeoJSON.

ST_GeomFromGeoJSON solo funciona con fragmentos geométricos JSON. Devolverá un error si intentas utilizar un documento JSON completo.

Enhanced: 3.0.0 parsed geometry defaults to SRID=4326 if not specified otherwise.

Enhanced: 2.5.0 can now accept json and jsonb as inputs.

Disponibilidad: 2.0.0 necesita de - JSON-C >= 0.9

**Note**

Si no tienes activado el soporte de JSON-C, tendrás un mensaje error en vez de ver la salida. Para activar el soporte JSON-C, ejecuta `configure --with-jsondir=/path/to/json-c`. Para mas detalles ve a Section [2.2.3](#).



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsText(ST_GeomFromGeoJSON('{"type":"Point","coordinates":[-48.23456,20.12345]}')) ←
      As wkt;
-----
POINT(-48.23456 20.12345)
```

```
-- un linestring 3D
SELECT ST_AsText(ST_GeomFromGeoJSON('{"type":"LineString","coordinates ←
      ":[ [1,2,3], [4,5,6], [7,8,9] ]}')) As wkt;
wkt
-----
LINESTRING(1 2,4 5,7 8)
```

Ver también

[ST_AsText](#), [ST_AsGeoJSON](#), Section [2.2.3](#)

8.8.3.5 ST_GeomFromKML

ST_GeomFromKML — Toma una representación de una geometría KML de entrada y devuelve un objeto geométrico PostGIS

Synopsis

geometry **ST_GeomFromKML**(text geomkml);

Descripción

Construye un objeto ST_Geometry de PostGIS desde una representación OGC KML.

ST_GeomFromKML solo funciona con fragmentos geométricos KML. Devuelve un error si intentas utilizar un documento KML completo.

Versiones soportadas OGC KML:

- KML 2.2.0 Namespace

OGC KML standards, cf: <http://www.opengeospatial.org/standards/kml>:

Availability: 1.5, requires libxml2 2.6+



This function supports 3d and will not drop the z-index.



Note

ST_GeomFromKML no soporta geometrías curvas SQL/MM.

Ejemplos - Una geometría simple con srsName

```
SELECT ST_GeomFromKML('
    <LineString>
      <coordinates>
>-71.1663,42.2614
                                -71.1667,42.2616</coordinates>
      </LineString>
>');
```

Ver también

Section 2.2.3, [ST_AsKML](#)

8.8.3.6 ST_GeomFromTWKB

ST_GeomFromTWKB — Crea una instancia de geometría de una representación geométrica TWKB ("Tiny Well-Known Binary").

Synopsis

geometry **ST_GeomFromTWKB**(bytea twkb);

Descripción

La función ST_GeomFromTWKB toma un TWKB ("Tiny Well-Known Binary") a una representación geométrica (WKB) y crea una instancia apropiada de un tipo de geometría.

Ejemplos

```
SELECT ST_AsText(ST_GeomFromTWKB(ST_AstWKB('LINESTRING(126 34, 127 35)::geometry')));

      st_astext
-----
LINESTRING(126 34, 127 35)
(1 row)

SELECT ST_AsEWKT(
  ST_GeomFromTWKB(E'\x620002f7f40dbce4040105')
);
```

```
----- st_asewkt -----
```

```
LINESTRING(-113.98 39.198,-113.981 39.195)
(1 row)
```

Ver también

[ST_AsTWKB](#)

8.8.3.7 ST_GMLToSQL

ST_GMLToSQL — Devuelve un valor específico ST_Geometry desde una representación GML. Esto es un alias de [ST_GeomFromGML](#).

Synopsis

```
geometry ST_GMLToSQL(text geomgml);
geometry ST_GMLToSQL(text geomgml, integer srid);
```

Descripción



This method implements the SQL/MM specification. SQL-MM 3: 5.1.50 (excepto para soporte de curvas).

Disponibilidad: 1.5, requiere libxml2 1.6+

Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN.

Mejorada: 2.0.0 se agregó el parámetro por defecto opcional srid.

Ver también

Section [2.2.3](#), [ST_GeomFromGML](#), [ST_AsGML](#)

8.8.3.8 ST_LineFromEncodedPolyline

ST_LineFromEncodedPolyline — Crea un LineString desde una polilínea codificada.

Synopsis

```
geometry ST_LineFromEncodedPolyline(text polyline, integer precision=5);
```

Descripción

Crea un LineString desde una cadena de polilínea codificada.

Optional `precision` specifies how many decimal places will be preserved in Encoded Polyline. Value should be the same on encoding and decoding, or coordinates will be incorrect.

Ver <http://developers.google.com/maps/documentation/utilities/polylinealgorithm>

Disponibilidad: 2.2.0

Ejemplos

```
-- Create a line string from a polyline
SELECT ST_AsEWKT(ST_LineFromEncodedPolyline('_p~iF~ps|U_ulLnnqC_mqNvxq`@'));
-- result --
SRID=4326;LINESTRING(-120.2 38.5,-120.95 40.7,-126.453 43.252)

-- Select different precision that was used for polyline encoding
SELECT ST_AsEWKT(ST_LineFromEncodedPolyline('_p~iF~ps|U_ulLnnqC_mqNvxq`@',6));
-- result --
SRID=4326;LINESTRING(-12.02 3.85,-12.095 4.07,-12.6453 4.3252)
```

Ver también

[ST_AsEncodedPolyline](#)

8.8.3.9 ST_PointFromGeoHash

ST_PointFromGeoHash — Devuelve un punto de una cadena de GeoHash.

Synopsis

point **ST_PointFromGeoHash**(text geohash, integer precision=full_precision_of_geohash);

Descripción

Devuelve un punto de una cadena de GeoHash. El punto representa el punto central del GeoHash.

Si no se especifica ninguna *precisión*, **ST_PointFromGeoHash** devuelve un punto basándose en la precisión completa de la cadena de GeoHash de entrada.

Si *precision* es especificado **ST_PointFromGeoHash** utilizará muchos caracteres de GeoHash para crear el punto.

Disponibilidad: 2.1.0

Ejemplos

```
SELECT ST_AsText(ST_PointFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0'));
          st_astext
-----
POINT(-115.172816 36.114646)

SELECT ST_AsText(ST_PointFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0', 4));
          st_astext
-----
POINT(-115.13671875 36.123046875)

SELECT ST_AsText(ST_PointFromGeoHash('9qqj7nmxnccgyy4d0dbxqz0', 10));
          st_astext
-----
POINT(-115.172815918922 36.1146435141563)
```

Ver también

[ST_GeoHash](#), [ST_Box2dFromGeoHash](#), [ST_GeomFromGeoHash](#)

8.8.3.10 ST_FromFlatGeobufToTable

ST_FromFlatGeobufToTable — Creates a table based on the structure of FlatGeobuf data.

Synopsis

geometry **ST_BdPolyFromText**(text WKT, integer srid);

Descripción

Creates a table based on the structure of FlatGeobuf data. (<http://flatgeobuf.org>).

`schema` Schema name.

`table` Table name.

`data` Input FlatGeobuf data.

Availability: 3.2.0

8.8.3.11 ST_FromFlatGeobuf

ST_FromFlatGeobuf — Reads FlatGeobuf data.

Synopsis

setof anyelement **ST_FromFlatGeobuf**(anyelement Table reference, bytea FlatGeobuf input data);

Descripción

Reads FlatGeobuf data (<http://flatgeobuf.org>). NOTE: PostgreSQL bytea cannot exceed 1GB.

`tabletype` reference to a table type.

`data` input FlatGeobuf data.

Availability: 3.2.0

8.9 Geometry Output

8.9.1 Well-Known Text (WKT)

8.9.1.1 ST_AsEWKT

ST_AsEWKT — Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.

Synopsis

text **ST_AsEWKT**(geometry g1);

text **ST_AsEWKT**(geometry g1, integer maxdecimaldigits=15);

text **ST_AsEWKT**(geography g1);

text **ST_AsEWKT**(geography g1, integer maxdecimaldigits=15);

Descripción

Returns the Well-Known Text representation of the geometry prefixed with the SRID. The optional *maxdecimaldigits* argument may be used to reduce the maximum number of decimal digits after floating point used in output (defaults to 15).

To perform the inverse conversion of EWKT representation to PostGIS geometry use [ST_GeomFromEWKT](#).



Warning

Using the *maxdecimaldigits* parameter can cause output geometry to become invalid. To avoid this use [ST_ReducePrecision](#) with a suitable gridsize first.



Note

The WKT spec does not include the SRID. To get the OGC WKT format use [ST_AsText](#).



Warning

WKT format does not maintain precision so to prevent floating truncation, use [ST_AsBinary](#) or [ST_AsEWKB](#) format for transport.

Enhanced: 3.1.0 support for optional precision parameter.

Enhanced: 2.0.0 support for Geography, Polyhedral surfaces, Triangles and TIN was introduced.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_AsEWKT('0103000020E61000000100000005000000000000
                0000000000000000000000000000000000000000
                F03F000000000000F03F000000000000F03F000000000000F03
                F0000000000000000000000000000000000000000'::geometry);

                st_asewkt
-----
SRID=4326;POLYGON((0 0,0 1,1 1,1 0,0 0))
(1 row)

SELECT ST_AsEWKT('01080000800300000000000000000060 ↵
                E30A4100000000785C0241000000000000F03F0000000018
E20A4100000000485F024100000000000000400000000018
E20A4100000000305C024100000000000000840')

--st_asewkt---
CIRCULARSTRING(220268 150415 1,220227 150505 2,220227 150406 3)
```

Ver también

[ST_AsBinary](#), [ST_AsEWKB](#), [ST_AsText](#), [ST_GeomFromEWKT](#)

8.9.1.2 ST_AsText

ST_AsText — Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.

Synopsis

```
text ST_AsText(geometry g1);
text ST_AsText(geometry g1, integer maxdecimaldigits = 15);
text ST_AsText(geography g1);
text ST_AsText(geography g1, integer maxdecimaldigits = 15);
```

Descripción

Returns the OGC **Well-Known Text** (WKT) representation of the geometry/geography. The optional *maxdecimaldigits* argument may be used to limit the number of digits after the decimal point in output ordinates (defaults to 15).

To perform the inverse conversion of WKT representation to PostGIS geometry use [ST_GeomFromText](#).

**Note**

The standard OGC WKT representation does not include the SRID. To include the SRID as part of the output representation, use the non-standard PostGIS function [ST_AsEWKT](#)

**Warning**

The textual representation of numbers in WKT may not maintain full floating-point precision. To ensure full accuracy for data storage or transport it is best to use **Well-Known Binary** (WKB) format (see [ST_AsBinary](#) and *maxdecimaldigits*).

**Warning**

Using the *maxdecimaldigits* parameter can cause output geometry to become invalid. To avoid this use [ST_ReducePrecision](#) with a suitable gridsize first.

Availability: 1.5 - support for geography was introduced.

Enhanced: 2.5 - optional parameter precision introduced.



This method implements the **OGC Simple Features Implementation Specification for SQL 1.1**, s2.1.1.1



This method implements the SQL/MM specification, SQL-MM 3: 5.1.25



This method supports Circular Strings and Curves



Note

The default behavior in PostgreSQL 9.0 has been changed to output bytea in hex encoding. If your GUI tools require the old behavior, then SET bytea_output='escape' in your database.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Enhanced: 2.0.0 support for higher coordinate dimensions was introduced.

Enhanced: 2.0.0 support for specifying endian with geography was introduced.

Availability: 1.5.0 geography support was introduced.

Changed: 2.0.0 Inputs to this function can not be unknown -- must be geometry. Constructs such as `ST_AsBinary('POINT(1 2)')` are no longer valid and you will get an `n_st_asbinary(unknown) is not unique` error. Code like that needs to be changed to `ST_AsBinary('POINT(1 2)'::geometry);`. If that is not possible, then install `legacy.sql`.



This method implements the **OGC Simple Features Implementation Specification for SQL 1.1**. s2.1.1.1



This method implements the SQL/MM specification. SQL-MM 3: 5.1.37



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Ejemplos

[illegible][illegible]

Ver también

ST_GeomFromWKB, ST_AsEWKB, ST_AsTWKB, ST_AsText,

8.9.2.2 ST AsEWKB

ST_AsEWKB — Return the Extended Well-Known Binary (EWKB) representation of the geometry with SRID meta data.

Synopsis

```
text ST_AsHEXEWKB(geometry g1, text NDRorXDR);
text ST_AsHEXEWKB(geometry g1);
```

Descripción

Returns a Geometry in HEXEWKB format (as text) using either little-endian (NDR) or big-endian (XDR) encoding. If no encoding is specified, then NDR is used.



Note

Disponibilidad: 1.2.2



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_AsHEXEWKB(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326));
      which gives same answer as

SELECT ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326)::text;

st_ashexewkb
-----
0103000020E6100000010000000500
000000000000000000000000000000
000000000000000000000000000000F03F
000000000000000000000000000000F03F
F0000000000000000000000000000000000000000000000000000000000000000000
```

8.9.3 Other Formats

8.9.3.1 ST_AsEncodedPolyline

ST_AsEncodedPolyline — Returns an Encoded Polyline from a LineString geometry.

Synopsis

```
text ST_AsEncodedPolyline(geometry geom, integer precision=5);
```

Descripción

Returns the geometry as an Encoded Polyline. This format is used by Google Maps with precision=5 and by Open Source Routing Machine with precision=5 and 6.

Optional `precision` specifies how many decimal places will be preserved in Encoded Polyline. Value should be the same on encoding and decoding, or coordinates will be incorrect.

Disponibilidad: 2.2.0

Ejemplos

Basic

```
SELECT ST_AsEncodedPolyline(GeomFromEWKT('SRID=4326;LINESTRING(-120.2 38.5,-120.95 40.7,-126.453 43.252)'));
--result--
|_p~iF~ps|U_ulLnnqC_mqNvxq`@
```

Use in conjunction with geography linestring and geography segmentize, and put on google maps

```
-- the SQL for Boston to San Francisco, segments every 100 KM
SELECT ST_AsEncodedPolyline(
    ST_Segmentize(
        ST_GeogFromText('LINESTRING(-71.0519 42.4935,-122.4483 37.64)'),
        100000)::geometry) As encodedFlightPath;
```

javascript will look something like this where \$ variable you replace with query result

```
<script type="text/javascript" src="http://maps.googleapis.com/maps/api/js?libraries=geometry"></script>
<script type="text/javascript">
    flightPath = new google.maps.Polyline({
        path: google.maps.geometry.encoding.decodePath("$encodedFlightPath"),
        map: map,
        strokeColor: '#0000CC',
        strokeOpacity: 1.0,
        strokeWeight: 4
    });
</script>
```

Ver también

[ST_LineFromEncodedPolyline](#), [ST_Segmentize](#)

8.9.3.2 ST_AsFlatGeobuf

ST_AsFlatGeobuf — Return a FlatGeobuf representation of a set of rows.

Synopsis

```
bytea ST_AsFlatGeobuf(anyelement set row);
bytea ST_AsFlatGeobuf(anyelement row, bool index);
bytea ST_AsFlatGeobuf(anyelement row, bool index, text geom_name);
```

Descripción

Return a FlatGeobuf representation (<http://flatgeobuf.org>) of a set of rows corresponding to a FeatureCollection. NOTE: PostgreSQL bytea cannot exceed 1GB.

row row data with at least a geometry column.

index toggle spatial index creation. Default is false.

geom_name is the name of the geometry column in the row data. If NULL it will default to the first found geometry column.

Availability: 3.2.0

8.9.3.3 ST_AsGeobuf

ST_AsGeobuf — Return a Geobuf representation of a set of rows.

Synopsis

bytea **ST_AsGeobuf**(anyelement set row);
 bytea **ST_AsGeobuf**(anyelement row, text geom_name);

Descripción

Return a Geobuf representation (<https://github.com/mapbox/geobuf>) of a set of rows corresponding to a FeatureCollection. Every input geometry is analyzed to determine maximum precision for optimal storage. Note that Geobuf in its current form cannot be streamed so the full output will be assembled in memory.

row row data with at least a geometry column.

geom_name is the name of the geometry column in the row data. If NULL it will default to the first found geometry column.

Availability: 2.4.0

Ejemplos

```
SELECT encode(ST_AsGeobuf(q, 'geom'), 'base64')
  FROM (SELECT ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))') AS geom) AS q;
 st_asgeobuf
-----
GAAiEAoOCgwIBBoIAAAAAgIAAAE=
```

8.9.3.4 ST_AsGeoJSON

ST_AsGeoJSON — Return a geometry as a GeoJSON element.

Synopsis

text **ST_AsGeoJSON**(record feature, text geomcolumnname, integer maxdecimaldigits=9, boolean pretty_bool=false);
 text **ST_AsGeoJSON**(geometry geom, integer maxdecimaldigits=9, integer options=8);
 text **ST_AsGeoJSON**(geography geog, integer maxdecimaldigits=9, integer options=0);

Descripción

Returns a geometry as a GeoJSON "geometry", or a row as a GeoJSON "feature". (See the [GeoJSON specifications RFC 7946](#)). 2D and 3D Geometries are both supported. GeoJSON only support SFS 1.1 geometry types (no curve support for example).

The `maxdecimaldigits` argument may be used to reduce the maximum number of decimal places used in output (defaults to 9). If you are using EPSG:4326 and are outputting the geometry only for display, `maxdecimaldigits=6` can be a good choice for many maps.



Warning

Using the `maxdecimaldigits` parameter can cause output geometry to become invalid. To avoid this use **ST_ReducePrecision** with a suitable gridsize first.

The `options` argument can be used to add BBOX or CRS in GeoJSON output:

- 0: means no option
- 1: GeoJSON BBOX
- 2: GeoJSON Short CRS (e.g EPSG:4326)
- 4: GeoJSON Long CRS (e.g `urn:ogc:def:crs:EPSG::4326`)
- 8: GeoJSON Short CRS if not EPSG:4326 (default)

The GeoJSON specification states that polygons are oriented using the Right-Hand Rule, and some clients require this orientation. This can be ensured by using `ST_ForcePolygonCCW`. The specification also requires that geometry be in the WGS84 coordinate system (SRID = 4326). If necessary geometry can be projected into WGS84 using `ST_Transform`: `ST_Transform(geom, 4326)`.

GeoJSON can be tested and viewed online at geojson.io and geojsonlint.com. It is widely supported by web mapping frameworks:

- [OpenLayers GeoJSON Example](#)
- [Leaflet GeoJSON Example](#)
- [Mapbox GL GeoJSON Example](#)

Disponibilidad: 1.3.4

Availability: 1.5.0 geography support was introduced.

Changed: 2.0.0 support default args and named args.

Changed: 3.0.0 support records as input

Changed: 3.0.0 output SRID if not EPSG:4326.



This function supports 3d and will not drop the z-index.

Ejemplos

Generate a FeatureCollection:

```
SELECT json_build_object(
    'type', 'FeatureCollection',
    'features', json_agg(ST_AsGeoJSON(t.*)::json)
)
FROM ( VALUES (1, 'one', 'POINT(1 1)::geometry),
               (2, 'two', 'POINT(2 2)'),
               (3, 'three', 'POINT(3 3)')
      ) as t(id, name, geom);
```

```
{"type" : "FeatureCollection", "features" : [{"type": "Feature", "geometry": {"type": "Point", "coordinates": [1,1]}, "properties": {"id": 1, "name": "one"}}, {"type": "Feature", "geometry": {"type": "Point", "coordinates": [2,2]}, "properties": {"id": 2, "name": "two"}}, {"type": "Feature", "geometry": {"type": "Point", "coordinates": [3,3]}, "properties": {"id": 3, "name": "three"}}]}
```

Generate a Feature:

```
SELECT ST_AsGeoJSON(t.*)
FROM (VALUES (1, 'one', 'POINT(1 1)::geometry)) AS t(id, name, geom);
```

```
st_asgeojson
```

```
{ "type": "Feature", "geometry": { "type": "Point", "coordinates": [1,1] }, "properties": { "id": 1, "name": "one" } }
```

An alternate way to generate Features with an id property is to use JSONB functions and operators:

```
SELECT jsonb_build_object(
  'type',      'Feature',
  'id',        id,
  'geometry',  ST_AsGeoJSON(geom)::jsonb,
  'properties', to_jsonb( t.* ) - 'id' - 'geom'
) AS json
FROM (VALUES (1, 'one', 'POINT(1 1)::geometry)) AS t(id, name, geom);
```

```
json
```

```
{ "id": 1, "type": "Feature", "geometry": { "type": "Point", "coordinates": [1, 1] }, "properties": { "name": "one" } }
```

Don't forget to transform your data to WGS84 longitude, latitude to conform with the GeoJSON specification:

```
SELECT ST_AsGeoJSON(ST_Transform(geom,4326)) from fe_edges limit 1;
```

```
st_asgeojson
```

```
{ "type": "MultiLineString", "coordinates": [[ [-89.734634999999997, 31.492072000000000], [-89.734955999999997, 31.492237999999997] ] ] }
```

3D geometries are supported:

```
SELECT ST_AsGeoJSON('LINESTRING(1 2 3, 4 5 6)');
```

```
{ "type": "LineString", "coordinates": [[1,2,3], [4,5,6]] }
```

Ver también

[ST_GeomFromGeoJSON](#), [ST_ForcePolygonCCW](#), [ST_Transform](#)

8.9.3.5 ST_AsGML

ST_AsGML — Return the geometry as a GML version 2 or 3 element.

Synopsis

```
text ST_AsGML(geometry geom, integer maxdecimaldigits=15, integer options=0);
text ST_AsGML(geography geog, integer maxdecimaldigits=15, integer options=0, text nprefix=null, text id=null);
text ST_AsGML(integer version, geometry geom, integer maxdecimaldigits=15, integer options=0, text nprefix=null, text id=null);
text ST_AsGML(integer version, geography geog, integer maxdecimaldigits=15, integer options=0, text nprefix=null, text id=null);
```

Descripción

Return the geometry as a Geography Markup Language (GML) element. The version parameter, if specified, may be either 2 or 3. If no version parameter is specified then the default is assumed to be 2. The `maxdecimaldigits` argument may be used to reduce the maximum number of decimal places used in output (defaults to 15).



Warning

Using the `maxdecimaldigits` parameter can cause output geometry to become invalid. To avoid this use `ST_ReducePrecision` with a suitable gridsize first.

GML 2 refer to 2.1.2 version, GML 3 to 3.1.1 version

The 'options' argument is a bitfield. It could be used to define CRS output type in GML output, and to declare data as lat/lon:

- 0: GML Short CRS (e.g EPSG:4326), default value
- 1: GML Long CRS (e.g urn:ogc:def:crs:EPSG::4326)
- 2: For GML 3 only, remove srsDimension attribute from output.
- 4: For GML 3 only, use <LineString> rather than <Curve> tag for lines.
- 16: Declare that datas are lat/lon (e.g srid=4326). Default is to assume that data are planars. This option is useful for GML 3.1.1 output only, related to axis order. So if you set it, it will swap the coordinates so order is lat lon instead of database lon lat.
- 32: Output the box of the geometry (envelope).

The 'namespace prefix' argument may be used to specify a custom namespace prefix or no prefix (if empty). If null or omitted 'gml' prefix is used

Disponibilidad: 1.3.2

Availability: 1.5.0 geography support was introduced.

Enhanced: 2.0.0 prefix support was introduced. Option 4 for GML3 was introduced to allow using LineString instead of Curve tag for lines. GML3 Support for Polyhedral surfaces and TINS was introduced. Option 32 was introduced to output the box.

Changed: 2.0.0 use default named args

Enhanced: 2.1.0 id support was introduced, for GML 3.



Note

Only version 3+ of ST_AsGML supports Polyhedral Surfaces and TINS.



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 17.2



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos: Versión 2

```
SELECT ST_AsGML(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326));
      st_asgml
-----
<gml:Polygon srsName="EPSG:4326"><gml:outerBoundaryIs><gml:LinearRing><gml:↵
  coordinates>0,0 0,1 1,1 1,0 0,0</gml:coordinates></gml:LinearRing></gml:↵
  outerBoundaryIs></gml:Polygon>
```

Ejemplos: Versión 3

```
-- Flip coordinates and output extended EPSG (16 | 1)--
SELECT ST_AsGML(3, ST_GeomFromText('POINT(5.234234233242 6.34534534534)',4326), 5, 17);
      st_asgml
-----
<gml:Point srsName="urn:ogc:def:crs:EPSG::4326"><gml:pos>6.34535 5.23423</↵
  gml:pos></gml:Point>
```

```
-- Output the envelope (32) --
SELECT ST_AsGML(3, ST_GeomFromText('LINESTRING(1 2, 3 4, 10 20)',4326), 5, 32);
      st_asgml
-----
<gml:Envelope srsName="EPSG:4326">
  <gml:lowerCorner>1 2</gml:lowerCorner>
  <gml:upperCorner>10 20</gml:upperCorner>
</gml:Envelope>
```

```
-- Output the envelope (32) , reverse (lat lon instead of lon lat) (16), long srs (1)= 32 | ↵
16 | 1 = 49 --
SELECT ST_AsGML(3, ST_GeomFromText('LINESTRING(1 2, 3 4, 10 20)',4326), 5, 49);
      st_asgml
-----
<gml:Envelope srsName="urn:ogc:def:crs:EPSG::4326">
  <gml:lowerCorner>2 1</gml:lowerCorner>
  <gml:upperCorner>20 10</gml:upperCorner>
</gml:Envelope>
```

```
-- Polyhedral Example --
SELECT ST_AsGML(3, ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0) ↵
),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )');
      st_asgml
-----
<gml:PolyhedralSurface>
<gml:polygons>
  <gml:PolygonPatch>
    <gml:exterior>
      <gml:LinearRing>
        <gml:posList srsDimension="3">0 0 0 0 1 0 1 1 0 1 0 0 ↵
          0 0</gml:posList>
      </gml:LinearRing>
    </gml:exterior>
  </gml:PolygonPatch>
  <gml:PolygonPatch>
    <gml:exterior>
      <gml:LinearRing>
```

```
<gml:posList srsDimension="3">0 0 0 0 1 0 1 1 0 1 0 0 0 ↵  
    0 0</gml:posList>  
    </gml:LinearRing>  
  </gml:exterior>  
</gml:PolygonPatch>  
<gml:PolygonPatch>  
  <gml:exterior>  
    <gml:LinearRing>  
      <gml:posList srsDimension="3">0 0 0 1 0 0 1 0 1 0 0 1 0 ↵  
        0 0</gml:posList>  
    </gml:LinearRing>  
  </gml:exterior>  
</gml:PolygonPatch>  
<gml:PolygonPatch>  
  <gml:exterior>  
    <gml:LinearRing>  
      <gml:posList srsDimension="3">1 1 0 1 1 1 1 0 1 1 0 0 1 ↵  
        1 0</gml:posList>  
    </gml:LinearRing>  
  </gml:exterior>  
</gml:PolygonPatch>  
<gml:PolygonPatch>  
  <gml:exterior>  
    <gml:LinearRing>  
      <gml:posList srsDimension="3">0 1 0 0 1 1 1 1 1 1 0 0 ↵  
        1 0</gml:posList>  
    </gml:LinearRing>  
  </gml:exterior>  
</gml:PolygonPatch>  
<gml:PolygonPatch>  
  <gml:exterior>  
    <gml:LinearRing>  
      <gml:posList srsDimension="3">0 0 1 1 0 1 1 1 1 0 1 1 0 ↵  
        0 1</gml:posList>  
    </gml:LinearRing>  
  </gml:exterior>  
</gml:PolygonPatch>  
</gml:polygonPatches>  
</gml:PolyhedralSurface>
```

Ver también

ST_GeomFromGML

8.9.3.6 ST AsKML

ST_AsKML — Return the geometry as a KML element.

Synopsis

```
text ST_AsKML(geometry geom, integer maxdecimaldigits=15, text nprefix=NULL);
text ST_AsKML(geography geog, integer maxdecimaldigits=15, text nprefix=NULL);
```

Descripción

Return the geometry as a Keyhole Markup Language (KML) element. default maximum number of decimal places is 15, default namespace is no prefix.

**Warning**

Using the *maxdecimaldigits* parameter can cause output geometry to become invalid. To avoid this use **ST_ReducePrecision** with a suitable gridsize first.

**Note**

Requiere que PostGIS sea compilado con soporte de Proj. Utilice **PostGIS_Full_Version** para confirmar que ha compilado el soporte de proyectos.

**Note**

Availability: 1.2.2 - later variants that include version param came in 1.3.2

**Note**

Enhanced: 2.0.0 - Add prefix namespace, use default and named args

**Note**

Changed: 3.0.0 - Removed the "versioned" variant signature

**Note**

AsKML output will not work with geometries that do not have an SRID



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsKML(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326));

      st_askml
      -----
<Polygon><outerBoundaryIs><LinearRing><coordinates>0,0 0,1 1,1 1,0 0,0</ ←
      coordinates></LinearRing></outerBoundaryIs></Polygon>

--3d linestring
SELECT ST_AsKML('SRID=4326;LINESTRING(1 2 3, 4 5 6)');
<LineString><coordinates>1,2,3 4,5,6</coordinates></LineString>
```

Ver también

ST_AsSVG, **ST_AsGML**

8.9.3.7 ST_AsLatLonText

ST_AsLatLonText — Return the Degrees, Minutes, Seconds representation of the given point.

Synopsis

text **ST_AsLatLonText**(geometry pt, text format=');

Descripción

Returns the Degrees, Minutes, Seconds representation of the point.



Note

It is assumed the point is in a lat/lon projection. The X (lon) and Y (lat) coordinates are normalized in the output to the "normal" range (-180 to +180 for lon, -90 to +90 for lat).

The text parameter is a format string containing the format for the resulting text, similar to a date format string. Valid tokens are "D" for degrees, "M" for minutes, "S" for seconds, and "C" for cardinal direction (NSEW). DMS tokens may be repeated to indicate desired width and precision ("SSS.SSSS" means "1.0023").

"M", "S", and "C" are optional. If "C" is omitted, degrees are shown with a "-" sign if south or west. If "S" is omitted, minutes will be shown as decimal with as many digits of precision as you specify. If "M" is also omitted, degrees are shown as decimal with as many digits precision as you specify.

If the format string is omitted (or zero-length) a default format will be used.

Disponibilidad: 2.0

Ejemplos

Default format.

```
SELECT (ST_AsLatLonText('POINT (-3.2342342 -2.32498)'));
      st_aslatlontext
-----
2\textdegree{}19'29.928"S 3\textdegree{}14'3.243"W
```

Providing a format (same as the default).

```
SELECT (ST_AsLatLonText('POINT (-3.2342342 -2.32498)', 'D\textdegree{}M'S.SSS"C'));
      st_aslatlontext
-----
2\textdegree{}19'29.928"S 3\textdegree{}14'3.243"W
```

Characters other than D, M, S, C and . are just passed through.

```
SELECT (ST_AsLatLonText('POINT (-3.2342342 -2.32498)', 'D degrees, M minutes, S seconds to the C'));
      st_aslatlontext
-----
2 degrees, 19 minutes, 30 seconds to the S 3 degrees, 14 minutes, 3 seconds to the W
```

Signed degrees instead of cardinal directions.

```
SELECT (ST_AsLatLonText('POINT (-3.2342342 -2.32498)', 'D\textdegree{}M'S.SSS"'));
      st_aslatlontext
-----
-2\textdegree{}19'29.928" -3\textdegree{}14'3.243"
```

Decimal degrees.

```
SELECT (ST_AsLatLonText('POINT (-3.2342342 -2.32498)', 'D.DDDD degrees C'));
      st_aslatlonTEXT
-----
2.3250 degrees S 3.2342 degrees W
```

Excessively large values are normalized.

```
SELECT (ST_AsLatLonText('POINT (-302.2342342 -792.32498)'));
      st_aslatlonTEXT
-----
72\textdegree{}19'29.928"S 57\textdegree{}45'56.757"E
```

8.9.3.8 ST_AsMARC21

ST_AsMARC21 — Returns geometry as a MARC21/XML record with a geographic datafield (034).

Synopsis

text **ST_AsMARC21** (geometry geom , text format='hddmmss');

Descripción

This function returns a MARC21/XML record with **Coded Cartographic Mathematical Data** representing the bounding box of a given geometry. The *format* parameter allows to encode the coordinates in subfields \$d,\$e,\$f and \$g in all formats supported by the MARC21/XML standard. Valid formats are:

- cardinal direction, degrees, minutes and seconds (default): hddmmss
- decimal degrees with cardinal direction: hddd.dddddd
- decimal degrees without cardinal direction: ddd.dddddd
- decimal minutes with cardinal direction: hdddm.mmm
- decimal minutes without cardinal direction: dddm.mmm
- decimal seconds with cardinal direction: hddmmss.sss

The decimal sign may be also a comma, e.g. hdddm,mmm.

The precision of decimal formats can be limited by the number of characters after the decimal sign, e.g. hdddm.mm for decimal minutes with a precision of two decimals.

This function ignores the Z and M dimensions.

LOC MARC21/XML versions supported:

- **MARC21/XML 1.1**

Availability: 3.3.0



Note

This function does not support non lon/lat geometries, as they are not supported by the MARC21/XML standard (Coded Cartographic Mathematical Data).



Note

The MARC21/XML Standard does not provide any means to annotate the spatial reference system for Coded Cartographic Mathematical Data, which means that this information will be lost after conversion to MARC21/XML.

Ejemplos

Converting a POINT to MARC21/XML formatted as hdddmss (default)

```
SELECT ST_AsMARC21('SRID=4326;POINT(-4.504289 54.253312)::geometry');

          st_asmarc21
-----
<record xmlns="http://www.loc.gov/MARC21/slim">
  <datafield tag="034" ind1="1" ind2=" ">
    <subfield code="a">a</subfield>
    <subfield code="d">W0043015</subfield>
    <subfield code="e">W0043015</subfield>
    <subfield code="f">N0541512</subfield>
    <subfield code="g">N0541512</subfield>
  </datafield>
</record>
```

Converting a POLYGON to MARC21/XML formatted in decimal degrees

```
SELECT ST_AsMARC21('SRID=4326;POLYGON((-4.5792388916015625 ↔
54.18172660239091,-4.56756591796875 ↔
54.196993557130355,-4.546623229980469 ↔
54.18313300502024,-4.5792388916015625 54.18172660239091))::geometry,' ↔
hddd.dddd');

          st_asmarc21
-----
<record xmlns="http://www.loc.gov/MARC21/slim">
  <datafield tag="034" ind1="1" ind2=" ">
    <subfield code="a">a</subfield>
    <subfield code="d">W004.5792</subfield>
    <subfield code="e">W004.5466</subfield>
    <subfield code="f">N054.1970</subfield>
    <subfield code="g">N054.1817</subfield>
  </datafield>
</record>
```

Converting a GEOMETRYCOLLECTION to MARC21/XML formatted in decimal minutes. The geometries order in the MARC21/XML output correspond to their order in the collection.

```
SELECT ST_AsMARC21('SRID=4326;GEOMETRYCOLLECTION(POLYGON((13.1 ↔
52.65,13.516666666666667 52.65,13.516666666666667 52.38333333333333,13.1 ↔
52.38333333333333,13.1 52.65)),POINT(-4.5 54.25))::geometry,'hdddm. ↔
mmmm');

          st_asmarc21
-----
<record xmlns="http://www.loc.gov/MARC21/slim">
  <datafield tag="034" ind1="1" ind2=" ">
    <subfield code="a">a</subfield>
    <subfield code="d">E01307.0000</subfield>
    <subfield code="e">E01331.0000</subfield>
    <subfield code="f">N05240.0000</subfield>
    <subfield code="g">N05224.0000</subfield>
  </datafield>
  <datafield tag="034" ind1="1" ind2=" ">
```

```

        <subfield code="a">a</subfield>
        <subfield code="d">W00430.0000</subfield>
        <subfield code="e">W00430.0000</subfield>
        <subfield code="f">N05415.0000</subfield>
        <subfield code="g">N05415.0000</subfield>
    </datafield>
</record>

```

Ver también

[ST_GeomFromMARC21](#)

8.9.3.9 ST_AsMVTGeom

ST_AsMVTGeom — Transforms a geometry into the coordinate space of a MVT tile.

Synopsis

geometry **ST_AsMVTGeom**(geometry geom, box2d bounds, integer extent=4096, integer buffer=256, boolean clip_geom=true);

Descripción

Transforms a geometry into the coordinate space of a MVT ([Mapbox Vector Tile](#)) tile, clipping it to the tile bounds if required. The geometry must be in the coordinate system of the target map (using [ST_Transform](#) if needed). Commonly this is [Web Mercator](#) (SRID:3857).

The function attempts to preserve geometry validity, and corrects it if needed. This may cause the result geometry to collapse to a lower dimension.

The rectangular bounds of the tile in the target map coordinate space must be provided, so the geometry can be transformed, and clipped if required. The bounds can be generated using [ST_MakeEnvelope](#).

This function is used to convert geometry into the tile coordinate space required by [ST_AsMVT](#).

geom is the geometry to transform, in the coordinate system of the target map.

bounds is the rectangular bounds of the tile in map coordinate space, with no buffer.

extent is the tile extent size in tile coordinate space as defined by the [MVT specification](#). Defaults to 4096.

buffer is the buffer size in tile coordinate space for geometry clipping. Defaults to 256.

clip_geom is a boolean to control if geometries are clipped or encoded as-is. Defaults to true.

Availability: 2.4.0



Note

From 3.0, Wagyu can be chosen at configure time to clip and validate MVT polygons. This library is faster and produces more correct results than the GEOS default, but it might drop small polygons.

Ejemplos

```
SELECT ST_AsText(ST_AsMVTGeom(
    ST_GeomFromText('POLYGON ((0 0, 10 0, 10 5, 0 -5, 0 0))'),
    ST_MakeBox2D(ST_Point(0, 0), ST_Point(4096, 4096)),
    4096, 0, false));
           st_astext
-----
MULTIPOLYGON(((5 4096,10 4091,10 4096,5 4096)),((5 4096,0 4101,0 4096,5 4096)))
```

Canonical example for a Web Mercator tile using a computed tile bounds to query and clip geometry.

```
SELECT ST_AsMVTGeom(
    ST_Transform( geom, 3857 ),
    ST_TileEnvelope(12, 513, 412), extent => 4096, buffer => 64) AS geom
FROM data
WHERE geom && ST_TileEnvelope(12, 513, 412, margin => (64.0 / 4096))
```

Ver también

[ST_AsMVT](#), [ST_MakeEnvelope](#), [PostGIS_Wagyu_Version](#)

8.9.3.10 ST_AsMVT

ST_AsMVT — Aggregate function returning a MVT representation of a set of rows.

Synopsis

```
bytea ST_AsMVT(anyelement set row);
bytea ST_AsMVT(anyelement row, text name);
bytea ST_AsMVT(anyelement row, text name, integer extent);
bytea ST_AsMVT(anyelement row, text name, integer extent, text geom_name);
bytea ST_AsMVT(anyelement row, text name, integer extent, text geom_name, text feature_id_name);
```

Descripción

An aggregate function which returns a binary **Mapbox Vector Tile** representation of a set of rows corresponding to a tile layer. The rows must contain a geometry column which will be encoded as a feature geometry. The geometry must be in tile coordinate space and valid as per the **MVT specification**. **ST_AsMVTGeom** can be used to transform geometry into tile coordinate space. Other row columns are encoded as feature attributes.

The **Mapbox Vector Tile** format can store features with varying sets of attributes. To use this capability supply a JSONB column in the row data containing Json objects one level deep. The keys and values in the JSONB values will be encoded as feature attributes.

Tiles with multiple layers can be created by concatenating multiple calls to this function using `||` or `STRING_AGG`.



Important

Do not call with a `GEOMETRYCOLLECTION` as an element in the row. However you can use **ST_AsMVTGeom** to prepare a geometry collection for inclusion.

`row` row data with at least a geometry column.

`name` is the name of the layer. Default is the string "default".

`extent` is the tile extent in screen space as defined by the specification. Default is 4096.

`geom_name` is the name of the geometry column in the row data. Default is the first geometry column. Note that PostgreSQL by default automatically **folds unquoted identifiers to lower case**, which means that unless the geometry column is quoted, e.g. "MyMVTGeom", this parameter must be provided as lowercase.

`feature_id_name` is the name of the Feature ID column in the row data. If NULL or negative the Feature ID is not set. The first column matching name and valid type (smallint, integer, bigint) will be used as Feature ID, and any subsequent column will be added as a property. JSON properties are not supported.

Enhanced: 3.0 - added support for Feature ID.

Enhanced: 2.5.0 - added support parallel query.

Availability: 2.4.0

Ejemplos

```
WITH mvtgeom AS
(
  SELECT ST_AsMVTGeom(geom, ST_TileEnvelope(12, 513, 412), extent => 4096, buffer => 64) AS ←
    geom, name, description
  FROM points_of_interest
  WHERE geom && ST_TileEnvelope(12, 513, 412, margin => (64.0 / 4096))
)
SELECT ST_AsMVT(mvtgeom.*)
FROM mvtgeom;
```

Ver también

[ST_AsMVTGeom](#), [ST_MakeEnvelope](#)

8.9.3.11 ST_AsSVG

`ST_AsSVG` — Returns SVG path data for a geometry.

Synopsis

text `ST_AsSVG`(geometry geom, integer rel=0, integer maxdecimaldigits=15);

text `ST_AsSVG`(geography geog, integer rel=0, integer maxdecimaldigits=15);

Descripción

Return the geometry as Scalar Vector Graphics (SVG) path data. Use 1 as second argument to have the path data implemented in terms of relative moves, the default (or 0) uses absolute moves. Third argument may be used to reduce the maximum number of decimal digits used in output (defaults to 15). Point geometries will be rendered as cx/cy when 'rel' arg is 0, x/y when 'rel' is 1. Multipoint geometries are delimited by commas (","), GeometryCollection geometries are delimited by semicolons (";").



Note

Availability: 1.2.2. Availability: 1.4.0 Changed in PostGIS 1.4.0 to include L command in absolute path to conform to <http://www.w3.org/TR/SVG/paths.html#PathDataBNF>

Changed: 2.0.0 to use default args and support named args

Ejemplos

```
SELECT ST_AsSVG('POLYGON((0 0,0 1,1 1,1 0,0 0))');

      st_assvg
      -
M 0 0 L 0 -1 1 -1 1 0 Z
```

8.9.3.12 ST_AsTWKB

ST_AsTWKB — Returns the geometry as TWKB, aka "Tiny Well-Known Binary"

Synopsis

bytea **ST_AsTWKB**(geometry g1, integer decimaldigits_xy=0, integer decimaldigits_z=0, integer decimaldigits_m=0, boolean include_sizes=false, boolean include_bounding_boxes=false);

bytea **ST_AsTWKB**(geometry[] geometries, bigint[] unique_ids, integer decimaldigits_xy=0, integer decimaldigits_z=0, integer decimaldigits_m=0, boolean include_sizes=false, boolean include_bounding_boxes=false);

Descripción

Returns the geometry in TWKB (Tiny Well-Known Binary) format. TWKB is a **compressed binary format** with a focus on minimizing the size of the output.

The decimal digits parameters control how much precision is stored in the output. By default, values are rounded to the nearest unit before encoding. If you want to transfer more precision, increase the number. For example, a value of 1 implies that the first digit to the right of the decimal point will be preserved.

The sizes and bounding boxes parameters control whether optional information about the encoded length of the object and the bounds of the object are included in the output. By default they are not. Do not turn them on unless your client software has a use for them, as they just use up space (and saving space is the point of TWKB).

The array-input form of the function is used to convert a collection of geometries and unique identifiers into a TWKB collection that preserves the identifiers. This is useful for clients that expect to unpack a collection and then access further information about the objects inside. You can create the arrays using the **array_agg** function. The other parameters operate the same as for the simple form of the function.



Note

The format specification is available online at <https://github.com/TWKB/Specification>, and code for building a JavaScript client can be found at <https://github.com/TWKB/twkb.js>.

Enhanced: 2.4.0 memory and speed improvements.

Disponibilidad: 2.2.0

Ejemplos

```
SELECT ST_AsTWKB('LINESTRING(1 1,5 5)::geometry');

      st_astwkb
      -
\x020000202020808
```

To create an aggregate TWKB object including identifiers aggregate the desired geometries and objects first, using "array_agg()", then call the appropriate TWKB function.

```
SELECT ST_AsTWKB(array_agg(geom), array_agg(gid)) FROM mytable;
           st_astwkb
-----
\x040402020400000202
```

Ver también

[ST_GeomFromTWKB](#), [ST_AsBinary](#), [ST_AsEWKB](#), [ST_AsEWKT](#), [ST_GeomFromText](#)

8.9.3.13 ST_AsX3D

ST_AsX3D — Returns a Geometry in X3D xml node element format: ISO-IEC-19776-1.2-X3DEncodings-XML

Synopsis

text **ST_AsX3D**(geometry g1, integer maxdecimaldigits=15, integer options=0);

Descripción

Returns a geometry as an X3D xml formatted node element <http://www.web3d.org/standards/number/19776-1>. If maxdecimaldigit (precision) is not specified then defaults to 15.

Note



There are various options for translating PostGIS geometries to X3D since X3D geometry types don't map directly to PostGIS geometry types and some newer X3D types that might be better mappings we have avoided since most rendering tools don't currently support them. These are the mappings we have settled on. Feel free to post a bug ticket if you have thoughts on the idea or ways we can allow people to denote their preferred mappings. Below is how we currently map PostGIS 2D/3D types to X3D types

The 'options' argument is a bitfield. For PostGIS 2.2+, this is used to denote whether to represent coordinates with X3D GeoCoordinates Geospatial node and also whether to flip the x/y axis. By default, **ST_AsX3D** outputs in database form (long,lat or X,Y), but X3D default of lat/lon, y/x may be preferred.

- 0: X/Y in database order (e.g. long/lat = X,Y is standard database order), default value, and non-spatial coordinates (just regular old Coordinate tag).
- 1: Flip X and Y. If used in conjunction with the GeoCoordinate option switch, then output will be default "latitude_first" and coordinates will be flipped as well.
- 2: Output coordinates in GeoSpatial GeoCoordinates. This option will throw an error if geometries are not in WGS 84 long lat (srid: 4326). This is currently the only GeoCoordinate type supported. [Refer to X3D specs specifying a spatial reference system](#). Default output will be GeoCoordinate geoSystem=' "GD" "WE" "longitude_first" '. If you prefer the X3D default of GeoCoordinate geoSystem=' "GD" "WE" "latitude_first" ' use (2 + 1) = 3

PostGIS Type	2D X3D Type	3D X3D Type
LINestring	not yet implemented - will be PolyLine2D	LineSet
MULTILINEstring	not yet implemented - will be PolyLine2D	IndexedLineSet
MULTIPOINT	Polypoint2D	PointSet
POINT	outputs the space delimited coordinates	outputs the space delimited coordinates
(MULTI) POLYGON, POLYHEDRALSURFACE	Invalid X3D markup	IndexedFaceSet (inner rings currently output as another faceset)
TIN	TriangleSet2D (Not Yet Implemented)	IndexedTriangleSet

**Note**

2D geometry support not yet complete. Inner rings currently just drawn as separate polygons. We are working on these.

Lots of advancements happening in 3D space particularly with [X3D Integration with HTML5](#)

There is also a nice open source X3D viewer you can use to view rendered geometries. Free Wrl <http://freewrl.sourceforge.net/> binaries available for Mac, Linux, and Windows. Use the FreeWRL_Launcher packaged to view the geometries.

Also check out [PostGIS minimalist X3D viewer](#) that utilizes this function and [x3dDom html/js open source toolkit](#).

Availability: 2.0.0: ISO-IEC-19776-1.2-X3DEncodings-XML

Enhanced: 2.2.0: Support for GeoCoordinates and axis (x/y, long/lat) flipping. Look at options for details.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Example: Create a fully functional X3D document - This will generate a cube that is viewable in FreeWrl and other X3D viewers.

```
SELECT '<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN" "http://www.web3d.org/specifications/x3d ←
-3.0.dtd">
<X3D>
  <Scene>
    <Transform>
      <Shape>
        <Appearance>
          <Material emissiveColor='0 0 1' />
        </Appearance> ' ||
        ST_AsX3D( ST_GeomFromEWKT('POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )' ) ) ||
        ' </Shape>
      </Transform>
    </Scene>
  </X3D>' As x3ddoc;

          x3ddoc
          -----
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE X3D PUBLIC "ISO//Web3D//DTD X3D 3.0//EN" "http://www.web3d.org/specifications/x3d ←
-3.0.dtd">
<X3D>
  <Scene>
    <Transform>
      <Shape>
        <Appearance>
          <Material emissiveColor='0 0 1' />
        </Appearance>
        <IndexedFaceSet coordIndex='0 1 2 3 -1 4 5 6 7 -1 8 9 10 11 -1 12 13 14 15 -1 16 17 ←
18 19 -1 20 21 22 23'>
          <Coordinate point='0 0 0 0 0 1 0 1 1 0 1 0 0 0 0 0 1 0 1 1 0 1 0 0 0 0 0 1 0 0 ←
1 0 1 0 0 1 1 1 0 1 1 1 0 1 1 0 0 0 1 0 0 1 1 1 1 1 1 1 0 0 0 1 1 0 1 1 1 ←
1 0 1 1' />
        </IndexedFaceSet>
      </Shape>
    </Transform>
  </Scene>
</X3D>
```

```

    </IndexedFaceSet>
  </Shape>
</Transform>
</Scene>
</X3D>

```

PostGIS buildings

Copy and paste the output of this query to [x3d scene viewer](#) and click Show

```

SELECT string_agg('<Shape>' || ST_AsX3D(ST_Extrude(geom, 0,0, i*0.5)) ||
  '<Appearance>'
    <Material diffuseColor="" || (0.01*i)::text || ' 0.8 0.2" specularColor="" || ↵
      (0.05*i)::text || ' 0 0.5"/>
    </Appearance>
  </Shape>', '')
FROM ST_Subdivide(ST_Letters('PostGIS'),20) WITH ORDINALITY AS f(geom,i);

```



Buildings formed by subdividing PostGIS and extrusion

Example: An Octagon elevated 3 Units and decimal precision of 6

```

SELECT ST_AsX3D(
ST_Translate(
  ST_Force_3d(
    ST_Buffer(ST_Point(10,10),5, 'quad_segs=2')), 0,0,
    3)
  ,6) As x3dfrag;

x3dfrag
-----
<IndexedFaceSet coordIndex="0 1 2 3 4 5 6 7">
  <Coordinate point="15 10 3 13.535534 6.464466 3 10 5 3 6.464466 6.464466 3 5 10 3 ↵
    6.464466 13.535534 3 10 15 3 13.535534 13.535534 3 " />
</IndexedFaceSet>

```

Ejemplo: TIN

```

SELECT ST_AsX3D(ST_GeomFromEWKT('TIN (((
    0 0 0,
    0 0 1,
    0 1 0,
    0 0 0
  )), ((
    0 0 0,

```


Ejemplos

```
SELECT ST_GeoHash(ST_SetSRID(ST_Point(-126,48),4326));

      st_geohash
-----
c0w3hf1s70w3hf1s70w3

SELECT ST_GeoHash(ST_SetSRID(ST_Point(-126,48),4326),5);

      st_geohash
-----
c0w3h
```

Ver también

[ST_GeomFromGeoHash](#)

8.10 Operadores

8.10.1 Bounding Box Operators

8.10.1.1 &&

&& — Returns `TRUE` if A's 2D bounding box intersects B's 2D bounding box.

Synopsis

```
boolean &&( geometry A , geometry B );
boolean &&( geography A , geography B );
```

Descripción

The **&&** operator returns `TRUE` if the 2D bounding box of geometry A intersects the 2D bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.

Availability: 1.5.0 support for geography was introduced.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 && tbl2.column2 AS overlaps
FROM ( VALUES
      (1, 'LINESTRING(0 0, 3 3)::geometry),
      (2, 'LINESTRING(0 1, 0 5)::geometry)) AS tbl1,
( VALUES
      (3, 'LINESTRING(1 2, 4 6)::geometry)) AS tbl2;

 column1 | column1 | overlaps
-----+-----+-----
          1 |          3 | t
          2 |          3 | f
(2 rows)
```

Ver también

[ST_Intersects](#), [ST_Extent](#), [|&>](#), [&>](#), [&<|](#), [&<](#), [~](#), [@](#)

8.10.1.2 &&(geometry,box2df)

&&(geometry,box2df) — Returns `TRUE` if a geometry's (cached) 2D bounding box intersects a 2D float precision bounding box (BOX2DF).

Synopsis

boolean **&&**(geometry A , box2df B);

Descripción

The **&&** operator returns `TRUE` if the cached 2D bounding box of geometry A intersects the 2D bounding box B, using float precision. This means that if B is a (double precision) box2d, it will be internally converted to a float precision 2D bounding box (BOX2DF)



Note

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_Point(1,1) && ST_MakeBox2D(ST_Point(0,0), ST_Point(2,2)) AS overlaps;

 overlaps
-----
 t
(1 row)
```


Ver también

[&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,geometry\)](#), [~\(box2df,box2df\)](#), [@\(geometry,box2df\)](#), [@\(box2df,geometry\)](#), [@\(box2df,box2df\)](#)

8.10.1.3 &&(box2df,geometry)

`&&(box2df,geometry)` — Returns `TRUE` if a 2D float precision bounding box (BOX2DF) intersects a geometry's (cached) 2D bounding box.

Synopsis

boolean `&&(box2df A , geometry B);`

Descripción

The `&&` operator returns `TRUE` if the 2D bounding box A intersects the cached 2D bounding box of geometry B, using float precision. This means that if A is a (double precision) `box2d`, it will be internally converted to a float precision 2D bounding box (BOX2DF)

**Note**

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_MakeBox2D(ST_Point(0,0), ST_Point(2,2)) && ST_Point(1,1) AS overlaps;

overlaps
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,geometry\)](#), [~\(box2df,box2df\)](#), [@\(geometry,box2df\)](#), [@\(box2df,geometry\)](#), [@\(box2df,box2df\)](#)

8.10.1.4 &&(box2df,box2df)

`&&(box2df,box2df)` — Returns `TRUE` if two 2D float precision bounding boxes (BOX2DF) intersect each other.

Synopsis

boolean `&&(box2df A , box2df B);`

Descripción

The `&&` operator returns `TRUE` if two 2D bounding boxes A and B intersect each other, using float precision. This means that if A (or B) is a (double precision) `box2d`, it will be internally converted to a float precision 2D bounding box (`BOX2DF`)



Note

This operator is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdices (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_MakeBox2D(ST_Point(0,0), ST_Point(2,2)) && ST_MakeBox2D(ST_Point(1,1), ST_Point(3,3)) AS overlaps;

overlaps
-----
t
(1 row)
```

Ver también

`&&(geometry,box2df)`, `&&(box2df,geometry)`, `~(geometry,box2df)`, `~(box2df,geometry)`, `~(box2df,box2df)`, `@(geometry,box2df)`, `@(box2df,geometry)`, `@(box2df,box2df)`

8.10.1.5 &&&

`&&&` — Returns `TRUE` if A's n-D bounding box intersects B's n-D bounding box.

Synopsis

boolean `&&&(geometry A , geometry B);`

Descripción

The `&&&` operator returns `TRUE` if the n-D bounding box of geometry A intersects the n-D bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Disponibilidad: 2.0.0



This method supports Circular Strings and Curves

- ✔ This function supports Polyhedral surfaces.
- ✔ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).
- ✔ This function supports 3d and will not drop the z-index.

Examples: 3D LineStrings

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 &&& tbl2.column2 AS overlaps_3d,
      tbl1.column2 && tbl2.column2 AS overlaps_2d
FROM ( VALUES
      (1, 'LINESTRING Z(0 0 1, 3 3 2)::geometry),
      (2, 'LINESTRING Z(1 2 0, 0 5 -1)::geometry)) AS tbl1,
( VALUES
      (3, 'LINESTRING Z(1 2 1, 4 6 1)::geometry)) AS tbl2;
```

column1	column1	overlaps_3d	overlaps_2d
1	3	t	t
2	3	f	t

Examples: 3M LineStrings

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 &&& tbl2.column2 AS overlaps_3zm,
      tbl1.column2 && tbl2.column2 AS overlaps_2d
FROM ( VALUES
      (1, 'LINESTRING M(0 0 1, 3 3 2)::geometry),
      (2, 'LINESTRING M(1 2 0, 0 5 -1)::geometry)) AS tbl1,
( VALUES
      (3, 'LINESTRING M(1 2 1, 4 6 1)::geometry)) AS tbl2;
```

column1	column1	overlaps_3zm	overlaps_2d
1	3	t	t
2	3	f	t

Ver también

&&

8.10.1.6 &&&(geometry,gidx)

&&&(geometry,gidx) — Returns TRUE if a geometry’s (cached) n-D bounding box intersects a n-D float precision bounding box (GIDX).

Synopsis

boolean **&&&**(geometry A , gidx B);

Descripción

The `&&&` operator returns `TRUE` if the cached n-D bounding box of geometry A intersects the n-D bounding box B, using float precision. This means that if B is a (double precision) `box3d`, it will be internally converted to a float precision 3D bounding box (GIDX)



Note

This operator is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_MakePoint(1,1,1) &&& ST_3DMakeBox(ST_MakePoint(0,0,0), ST_MakePoint(2,2,2)) AS overlaps;

overlaps
-----
t
(1 row)
```

Ver también

[`&&&\(gidx,geometry\), &&&\(gidx,gidx\)`](#)

8.10.1.7 `&&&(gidx,geometry)`

`&&&(gidx,geometry)` — Returns `TRUE` if a n-D float precision bounding box (GIDX) intersects a geometry's (cached) n-D bounding box.

Synopsis

boolean `&&&(gidx A , geometry B);`

Descripción

The `&&&` operator returns `TRUE` if the n-D bounding box A intersects the cached n-D bounding box of geometry B, using float precision. This means that if A is a (double precision) `box3d`, it will be internally converted to a float precision 3D bounding box (GIDX)



Note

This operator is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_3DMakeBox(ST_MakePoint(0,0,0), ST_MakePoint(2,2,2)) &&& ST_MakePoint(1,1,1) AS overlaps;
overlaps
-----
t
(1 row)
```

Ver también

[&&&\(geometry,gidx\), &&&\(gidx,gidx\)](#)

8.10.1.8 &&&(gidx,gidx)

[&&&\(gidx,gidx\)](#) — Returns `TRUE` if two n-D float precision bounding boxes (GIDX) intersect each other.

Synopsis

boolean **&&&**(gidx A , gidx B);

Descripción

The **&&&** operator returns `TRUE` if two n-D bounding boxes A and B intersect each other, using float precision. This means that if A (or B) is a (double precision) box3d, it will be internally converted to a float precision 3D bounding box (GIDX)



Note

This operator is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_3DMakeBox(ST_MakePoint(0,0,0), ST_MakePoint(2,2,2)) &&& ST_3DMakeBox(ST_MakePoint(1,1,1), ST_MakePoint(3,3,3)) AS overlaps;

overlaps
-----
t
(1 row)
```

Ver también

[&&&\(geometry,gidx\), &&&\(gidx,geometry\)](#)

8.10.1.9 &<

&< — Returns TRUE if A's bounding box overlaps or is to the left of B's.

Synopsis

boolean **&<**(geometry A , geometry B);

Descripción

The &< operator returns TRUE if the bounding box of geometry A overlaps or is to the left of the bounding box of geometry B, or more accurately, overlaps or is NOT to the right of the bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 &< tbl2.column2 AS overleft
FROM
  ( VALUES
    (1, 'LINESTRING(1 2, 4 6)::geometry) ) AS tbl1,
  ( VALUES
    (2, 'LINESTRING(0 0, 3 3)::geometry),
    (3, 'LINESTRING(0 1, 0 5)::geometry),
    (4, 'LINESTRING(6 0, 6 1)::geometry) ) AS tbl2;

column1 | column1 | overleft
-----+-----+-----
          1 |          2 | f
          1 |          3 | f
          1 |          4 | t
(3 rows)
```

Ver también

[&&, |&>, &>, &<|](#)

8.10.1.10 &<|



&<| — Returns TRUE if A’s bounding box overlaps or is below B’s.

Synopsis

boolean &<|(geometry A , geometry B);

Descripción

The &<| operator returns TRUE if the bounding box of geometry A overlaps or is below of the bounding box of geometry B, or more accurately, overlaps or is NOT above the bounding box of geometry B.

-  This method supports Circular Strings and Curves
-  This function supports Polyhedral surfaces.



Note

This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 &<| tbl2.column2 AS overbelow
FROM
  ( VALUES
    (1, 'LINESTRING(6 0, 6 4)::geometry) AS tbl1,
  ( VALUES
    (2, 'LINESTRING(0 0, 3 3)::geometry),
    (3, 'LINESTRING(0 1, 0 5)::geometry),
    (4, 'LINESTRING(1 2, 4 6)::geometry) AS tbl2;

column1 | column1 | overbelow
-----+-----+-----
        1 |         2 | f
        1 |         3 | t
        1 |         4 | t
(3 rows)
```

Ver también

[&&](#), [|&>](#), [&>](#), [&<](#)

8.10.1.11 &>

&> — Returns TRUE if A’ bounding box overlaps or is to the right of B’s.

Synopsis

boolean &>(geometry A , geometry B);

Descripción

The `&>` operator returns `TRUE` if the bounding box of geometry A overlaps or is to the right of the bounding box of geometry B, or more accurately, overlaps or is NOT to the left of the bounding box of geometry B.



Note
This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 &> tbl2.column2 AS overright
FROM
  ( VALUES
    (1, 'LINESTRING(1 2, 4 6)::geometry) AS tbl1,
  ( VALUES
    (2, 'LINESTRING(0 0, 3 3)::geometry),
    (3, 'LINESTRING(0 1, 0 5)::geometry),
    (4, 'LINESTRING(6 0, 6 1)::geometry) AS tbl2;

column1 | column1 | overright
-----+-----+-----
          1 |          2 | t
          1 |          3 | t
          1 |          4 | f
(3 rows)
```

Ver también

`&&`, `|&>`, `&<|`, `&<`

8.10.1.12 <<

`<<` — Returns `TRUE` if A's bounding box is strictly to the left of B's.

Synopsis

boolean `<<`(geometry A , geometry B);

Descripción

The `<<` operator returns `TRUE` if the bounding box of geometry A is strictly to the left of the bounding box of geometry B.



Note
This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 << tbl2.column2 AS left
FROM
  ( VALUES
    (1, 'LINESTRING (1 2, 1 5)::geometry)) AS tbl1,
  ( VALUES
    (2, 'LINESTRING (0 0, 4 3)::geometry),
    (3, 'LINESTRING (6 0, 6 5)::geometry),
    (4, 'LINESTRING (2 2, 5 6)::geometry)) AS tbl2;

column1 | column1 | left
-----+-----+-----
          1 |          2 | f
          1 |          3 | t
          1 |          4 | t
(3 rows)
```

Ver también

>>, |>>, <<|

8.10.1.13 <<|

<<| — Returns TRUE if A’s bounding box is strictly below B’s.

Synopsis

boolean <<|(geometry A , geometry B);

Descripción

The <<| operator returns TRUE if the bounding box of geometry A is strictly below the bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 <<| tbl2.column2 AS below
FROM
  ( VALUES
    (1, 'LINESTRING (0 0, 4 3)::geometry)) AS tbl1,
  ( VALUES
    (2, 'LINESTRING (1 4, 1 7)::geometry),
    (3, 'LINESTRING (6 1, 6 5)::geometry),
    (4, 'LINESTRING (2 3, 5 6)::geometry)) AS tbl2;

column1 | column1 | below
-----+-----+-----
          1 |          2 | t
          1 |          3 | f
          1 |          4 | f
(3 rows)
```

Ver también

<<, >>, |>>

8.10.1.14 =

= — Returns `TRUE` if the coordinates and coordinate order geometry/geography A are the same as the coordinates and coordinate order of geometry/geography B.

Synopsis

```
boolean =( geometry A , geometry B );
boolean =( geography A , geography B );
```

Descripción

The = operator returns `TRUE` if the coordinates and coordinate order geometry/geography A are the same as the coordinates and coordinate order of geometry/geography B. PostgreSQL uses the =, <, and > operators defined for geometries to perform internal orderings and comparison of geometries (ie. in a `GROUP BY` or `ORDER BY` clause).

**Note**

Only geometry/geography that are exactly equal in all respects, with the same coordinates, in the same order, are considered equal by this operator. For "spatial equality", that ignores things like coordinate order, and can detect features that cover the same spatial area with different representations, use [ST_OrderingEquals](#) or [ST_Equals](#)

**Caution**

This operand will NOT make use of any indexes that may be available on the geometries. For an index assisted exact equality test, combine = with &&.

Changed: 2.4.0, in prior versions this was bounding box equality not a geometric equality. If you need bounding box equality, use `~=` instead.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT 'LINESTRING(0 0, 0 1, 1 0)::geometry = 'LINESTRING(1 1, 0 0)::geometry;
?column?
-----
f
(1 row)

SELECT ST_AsText(column1)
FROM ( VALUES
      ('LINESTRING(0 0, 1 1)::geometry',
       ('LINESTRING(1 1, 0 0)::geometry')) AS foo,
      st_astext
-----
LINESTRING(0 0,1 1)
LINESTRING(1 1,0 0)
```

```
(2 rows)

-- Note: the GROUP BY uses the "=" to compare for geometry equivalency.
SELECT ST_AsText(column1)
FROM ( VALUES
      ('LINESTRING(0 0, 1 1)::geometry),
      ('LINESTRING(1 1, 0 0)::geometry)) AS foo
GROUP BY column1;
      st_astext
-----
LINESTRING(0 0,1 1)
LINESTRING(1 1,0 0)
(2 rows)

-- In versions prior to 2.0, this used to return true --
SELECT ST_GeomFromText('POINT(1707296.37 4820536.77)') =
       ST_GeomFromText('POINT(1707296.27 4820536.87)') As pt_intersect;

--pt_intersect --
f
```

Ver también

[ST_Equals](#), [ST_OrderingEquals](#), [~=](#)

8.10.1.15 >>

>> — Returns TRUE if A's bounding box is strictly to the right of B's.

Synopsis

boolean >>(geometry A , geometry B);

Descripción

The >> operator returns TRUE if the bounding box of geometry A is strictly to the right of the bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 >> tbl2.column2 AS right
FROM
  ( VALUES
    (1, 'LINESTRING (2 3, 5 6)::geometry)) AS tbl1,
  ( VALUES
    (2, 'LINESTRING (1 4, 1 7)::geometry),
    (3, 'LINESTRING (6 1, 6 5)::geometry),
    (4, 'LINESTRING (0 0, 4 3)::geometry)) AS tbl2;

column1 | column1 | right
-----+-----+-----
```

```

      1 |      2 | t
      1 |      3 | f
      1 |      4 | f
(3 rows)
```

Ver también

<<, >>, <<|

8.10.1.16 @

@ — Returns TRUE if A’s bounding box is contained by B’s.

Synopsis

boolean @(geometry A , geometry B);

Descripción

The @ operator returns TRUE if the bounding box of geometry A is completely contained by the bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 @ tbl2.column2 AS contained
FROM
  ( VALUES
    (1, 'LINESTRING (1 1, 3 3)::geometry') AS tbl1,
    ( VALUES
      (2, 'LINESTRING (0 0, 4 4)::geometry),
      (3, 'LINESTRING (2 2, 4 4)::geometry),
      (4, 'LINESTRING (1 1, 3 3)::geometry') AS tbl2;
```

```

column1 | column1 | contained
-----+-----+-----
      1 |      2 | t
      1 |      3 | f
      1 |      4 | t
(3 rows)
```

Ver también

~, &&

8.10.1.17 @(geometry,box2df)

@(geometry,box2df) — Returns TRUE if a geometry’s 2D bounding box is contained into a 2D float precision bounding box (BOX2DF).

Synopsis

boolean @(geometry A , box2df B);

Descripción

The @ operator returns TRUE if the A geometry's 2D bounding box is contained the 2D bounding box B, using float precision. This means that if B is a (double precision) box2d, it will be internally converted to a float precision 2D bounding box (BOX2DF)



Note

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdices (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_Buffer(ST_GeomFromText('POINT(2 2)'), 1) @ ST_MakeBox2D(ST_Point(0,0), ST_Point(5,5)) AS is_contained;
```

```
is_contained
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,geometry\)](#), [~\(box2df,box2df\)](#), [@ \(box2df,geometry\)](#), [@ \(box2df,box2df\)](#)

8.10.1.18 @(box2df,geometry)

@(box2df,geometry) — Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into a geometry's 2D bounding box.

Synopsis

boolean @(box2df A , geometry B);

Descripción

The @ operator returns TRUE if the 2D bounding box A is contained into the B geometry's 2D bounding box, using float precision. This means that if B is a (double precision) box2d, it will be internally converted to a float precision 2D bounding box (BOX2DF)



Note

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdices (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_MakeBox2D(ST_Point(2,2), ST_Point(3,3)) @ ST_Buffer(ST_GeomFromText('POINT(1 1)') ←
, 10) AS is_contained;
```

```
is_contained
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,geometry\)](#), [~\(box2df,box2df\)](#), [@\(geometry,box2df\)](#), [@\(box2df,box2df\)](#)

8.10.1.19 @(box2df,box2df)

@(box2df,box2df) — Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into another 2D float precision bounding box.

Synopsis

boolean @(box2df A , box2df B);

Descripción

The @ operator returns TRUE if the 2D bounding box A is contained into the 2D bounding box B, using float precision. This means that if A (or B) is a (double precision) box2d, it will be internally converted to a float precision 2D bounding box (BOX2DF)



Note

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdices (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_MakeBox2D(ST_Point(2,2), ST_Point(3,3)) @ ST_MakeBox2D(ST_Point(0,0), ST_Point ←
(5,5)) AS is_contained;
```

```
is_contained
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,geometry\)](#), [~\(box2df,box2df\)](#), [@\(geometry,box2df\)](#), [@\(box2df,geometry\)](#)

8.10.1.20 |&>

|&> — Returns TRUE if A’s bounding box overlaps or is above B’s.

Synopsis

boolean |&>(geometry A , geometry B);

Descripción

The |&> operator returns TRUE if the bounding box of geometry A overlaps or is above the bounding box of geometry B, or more accurately, overlaps or is NOT below the bounding box of geometry B.



Note

This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 |&> tbl2.column2 AS overabove
FROM
  ( VALUES
    (1, 'LINESTRING(6 0, 6 4)::geometry)) AS tbl1,
  ( VALUES
    (2, 'LINESTRING(0 0, 3 3)::geometry),
    (3, 'LINESTRING(0 1, 0 5)::geometry),
    (4, 'LINESTRING(1 2, 4 6)::geometry)) AS tbl2;
```

column1	column1	overabove
1	2	t
1	3	f
1	4	f

(3 rows)

Ver también

[&&](#), [&>](#), [&<|](#), [&<](#)

8.10.1.21 |>>

|>> — Returns TRUE if A’s bounding box is strictly above B’s.

Synopsis

boolean |>>(geometry A , geometry B);

Descripción

The `|>>` operator returns `TRUE` if the bounding box of geometry A is strictly above the bounding box of geometry B.



Note
This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 |>> tbl2.column2 AS above
FROM
  ( VALUES
    (1, 'LINESTRING (1 4, 1 7)::geometry') AS tbl1,
  ( VALUES
    (2, 'LINESTRING (0 0, 4 2)::geometry'),
    (3, 'LINESTRING (6 1, 6 5)::geometry'),
    (4, 'LINESTRING (2 3, 5 6)::geometry') AS tbl2;

column1 | column1 | above
-----+-----+-----
          1 |          2 | t
          1 |          3 | f
          1 |          4 | f
(3 rows)
```

Ver también

<<, >>, <<|

8.10.1.22 ~

~ — Returns `TRUE` if A's bounding box contains B's.

Synopsis

boolean `~(geometry A , geometry B);`

Descripción

The `~` operator returns `TRUE` if the bounding box of geometry A completely contains the bounding box of geometry B.



Note
This operand will make use of any indexes that may be available on the geometries.

Ejemplos

```
SELECT tbl1.column1, tbl2.column1, tbl1.column2 ~ tbl2.column2 AS contains
FROM
  ( VALUES
    (1, 'LINESTRING (0 0, 3 3)::geometry)) AS tbl1,
  ( VALUES
    (2, 'LINESTRING (0 0, 4 4)::geometry),
    (3, 'LINESTRING (1 1, 2 2)::geometry),
    (4, 'LINESTRING (0 0, 3 3)::geometry)) AS tbl2;

column1 | column1 | contains
-----+-----+-----
        1 |          2 | f
        1 |          3 | t
        1 |          4 | t
(3 rows)
```

Ver también

@, &&

8.10.1.23 ~(geometry,box2df)

~(geometry,box2df) — Returns TRUE if a geometry’s 2D bonding box contains a 2D float precision bounding box (GIDX).

Synopsis

boolean ~(geometry A , box2df B);

Descripción

The ~ operator returns TRUE if the 2D bounding box of a geometry A contains the 2D bounding box B, using float precision. This means that if B is a (double precision) box2d, it will be internally converted to a float precision 2D bounding box (BOX2DF)



Note
This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.

- ✔ This method supports Circular Strings and Curves
- ✔ This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_Buffer(ST_GeomFromText('POINT(1 1)'), 10) ~ ST_MakeBox2D(ST_Point(0,0), ST_Point(←
  (2,2)) AS contains;

contains
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(box2df,geometry\)](#), [~\(box2df,box2df\)](#), [@\(geometry,box2df\)](#), [@\(box2df,geometry\)](#), [@\(box2df,box2df\)](#)

8.10.1.24 ~(box2df,geometry)

`~(box2df,geometry)` — Returns `TRUE` if a 2D float precision bounding box (BOX2DF) contains a geometry's 2D bonding box.

Synopsis

boolean `~(box2df A , geometry B);`

Descripción

The `~` operator returns `TRUE` if the 2D bounding box A contains the B geometry's bounding box, using float precision. This means that if A is a (double precision) box2d, it will be internally converted to a float precision 2D bounding box (BOX2DF)

**Note**

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdices (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_MakeBox2D(ST_Point(0,0), ST_Point(5,5)) ~ ST_Buffer(ST_GeomFromText('POINT(2 2)')
, 1) AS contains;

contains
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,box2df\)](#), [@\(geometry,box2df\)](#), [@\(box2df,geometry\)](#), [@\(box2df,box2df\)](#)

8.10.1.25 ~(box2df,box2df)

`~(box2df,box2df)` — Returns `TRUE` if a 2D float precision bounding box (BOX2DF) contains another 2D float precision bounding box (BOX2DF).

Synopsis

boolean `~(box2df A , box2df B);`

Descripción

The `~` operator returns `TRUE` if the 2D bounding box A contains the 2D bounding box B, using float precision. This means that if A is a (double precision) `box2d`, it will be internally converted to a float precision 2D bounding box (`BOX2DF`)



Note

This operand is intended to be used internally by BRIN indexes, more than by users.

Availability: 2.3.0 support for Block Range INdexes (BRIN) was introduced. Requires PostgreSQL 9.5+.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.

Ejemplos

```
SELECT ST_MakeBox2D(ST_Point(0,0), ST_Point(5,5)) ~ ST_MakeBox2D(ST_Point(2,2), ST_Point(3,3)) AS contains;

contains
-----
t
(1 row)
```

Ver también

[&&\(geometry,box2df\)](#), [&&\(box2df,geometry\)](#), [&&\(box2df,box2df\)](#), [~\(geometry,box2df\)](#), [~\(box2df,geometry\)](#), [@\(geometry,box2df\)](#), [@\(box2df,geometry\)](#), [@\(box2df,box2df\)](#)

8.10.1.26 ~=

`~=` — Returns `TRUE` if A's bounding box is the same as B's.

Synopsis

boolean `~=(geometry A , geometry B);`

Descripción

The `~=` operator returns `TRUE` if the bounding box of geometry/geography A is the same as the bounding box of geometry/geography B.



Note

This operand will make use of any indexes that may be available on the geometries.

Availability: 1.5.0 changed behavior



This function supports Polyhedral surfaces.

**Warning**

This operator has changed behavior in PostGIS 1.5 from testing for actual geometric equality to only checking for bounding box equality. To complicate things it also depends on if you have done a hard or soft upgrade which behavior your database has. To find out which behavior your database has you can run the query below. To check for true equality use [ST_OrderingEquals](#) or [ST_Equals](#).

Ejemplos

```
select 'LINESTRING(0 0, 1 1)::geometry' ~= 'LINESTRING(0 1, 1 0)::geometry' as equality;
equality      |
-----+
t            |
```

Ver también

[ST_Equals](#), [ST_OrderingEquals](#), [=](#)

8.10.2 Operadores**8.10.2.1 <->**

<-> — Returns the 2D distance between A and B.

Synopsis

```
double precision <->( geometry A , geometry B );
double precision <->( geography A , geography B );
```

Descripción

The <-> operator returns the 2D distance between two geometries. Used in the "ORDER BY" clause provides index-assisted nearest-neighbor result sets. For PostgreSQL below 9.5 only gives centroid distance of bounding boxes and for PostgreSQL 9.5+, does true KNN distance search giving true distance between geometries, and distance sphere for geographies.

**Note**

This operand will make use of 2D GiST indexes that may be available on the geometries. It is different from other operators that use spatial indexes in that the spatial index is only used when the operator is in the ORDER BY clause.

**Note**

Index only kicks in if one of the geometries is a constant (not in a subquery/cte). e.g. 'SRID=3005;POINT(1011102 450541)::geometry' instead of a.geom

Refer to [PostGIS workshop: Nearest-Neighbor Searching](#) for a detailed example.

Enhanced: 2.2.0 -- True KNN ("K nearest neighbor") behavior for geometry and geography for PostgreSQL 9.5+. Note for geography KNN is based on sphere rather than spheroid. For PostgreSQL 9.4 and below, geography support is new but only supports centroid box.

Changed: 2.2.0 -- For PostgreSQL 9.5 users, old Hybrid syntax may be slower, so you'll want to get rid of that hack if you are running your code only on PostGIS 2.2+ 9.5+. See examples below.

Availability: 2.0.0 -- Weak KNN provides nearest neighbors based on geometry centroid distances instead of true distances. Exact results for points, inexact for all other types. Available for PostgreSQL 9.1+

Ejemplos

```
SELECT ST_Distance(geom, 'SRID=3005;POINT(1011102 450541)::geometry) as d,edabbr, vaabbr
FROM va2005
ORDER BY d limit 10;
```

d	edabbr	vaabbr
0	ALQ	128
5541.57712511724	ALQ	129A
5579.67450712005	ALQ	001
6083.4207708641	ALQ	131
7691.2205404848	ALQ	003
7900.75451037313	ALQ	122
8694.20710669982	ALQ	129B
9564.24289057111	ALQ	130
12089.665931705	ALQ	127
18472.5531479404	ALQ	002

(10 rows)

Then the KNN raw answer:

```
SELECT st_distance(geom, 'SRID=3005;POINT(1011102 450541)::geometry) as d,edabbr, vaabbr
FROM va2005
ORDER BY geom <-> 'SRID=3005;POINT(1011102 450541)::geometry limit 10;
```

d	edabbr	vaabbr
0	ALQ	128
5541.57712511724	ALQ	129A
5579.67450712005	ALQ	001
6083.4207708641	ALQ	131
7691.2205404848	ALQ	003
7900.75451037313	ALQ	122
8694.20710669982	ALQ	129B
9564.24289057111	ALQ	130
12089.665931705	ALQ	127
18472.5531479404	ALQ	002

(10 rows)

If you run "EXPLAIN ANALYZE" on the two queries you would see a performance improvement for the second.

For users running with PostgreSQL < 9.5, use a hybrid query to find the true nearest neighbors. First a CTE query using the index-assisted KNN, then an exact query to get correct ordering:

```
WITH index_query AS (
  SELECT ST_Distance(geom, 'SRID=3005;POINT(1011102 450541)::geometry) as d,edabbr, vaabbr
  FROM va2005
  ORDER BY geom <-> 'SRID=3005;POINT(1011102 450541)::geometry LIMIT 100)
SELECT *
  FROM index_query
 ORDER BY d limit 10;
```

d	edabbr	vaabbr
0	ALQ	128
5541.57712511724	ALQ	129A
5579.67450712005	ALQ	001
6083.4207708641	ALQ	131
7691.2205404848	ALQ	003
7900.75451037313	ALQ	122
8694.20710669982	ALQ	129B

```
9564.24289057111 | ALQ      | 130
12089.665931705  | ALQ      | 127
18472.5531479404 | ALQ      | 002
(10 rows)
```

Ver también

[ST_DWithin](#), [ST_Distance](#), [<#>](#)

8.10.2.2 `|=`

`|=` — Returns the distance between A and B trajectories at their closest point of approach.

Synopsis

double precision `|=(geometry A , geometry B);`

Descripción

The `|=` operator returns the 3D distance between two trajectories (See [ST_IsValidTrajectory](#)). This is the same as [ST_DistanceCPA](#) but as an operator it can be used for doing nearest neighbor searches using an N-dimensional index (requires PostgreSQL 9.5.0 or higher).



Note

This operand will make use of ND GiST indexes that may be available on the geometries. It is different from other operators that use spatial indexes in that the spatial index is only used when the operator is in the ORDER BY clause.



Note

Index only kicks in if one of the geometries is a constant (not in a subquery/cte). e.g. `'SRID=3005;LINESTRINGM(0 0 0,0 0 1)::geometry` instead of `a.geom`

Availability: 2.2.0. Index-supported only available for PostgreSQL 9.5+

Ejemplos

```
-- Save a literal query trajectory in a psql variable...
\set qt 'ST_AddMeasure(ST_MakeLine(ST_MakePointM(-350,300,0),ST_MakePointM(-410,490,0)) ←
,10,20) '
-- Run the query !
SELECT track_id, dist FROM (
  SELECT track_id, ST_DistanceCPA(tr,:qt) dist
  FROM trajectories
  ORDER BY tr |=| :qt
  LIMIT 5
) foo;
track_id      dist
-----+-----
395 | 0.576496831518066
380 | 5.06797130410151
390 | 7.72262293958322
```

```
385 | 9.8004461358071
405 | 10.9534397988433
(5 rows)
```

Ver también

[ST_DistanceCPA](#), [ST_ClosestPointOfApproach](#), [ST_IsValidTrajectory](#)

8.10.2.3 <#>

<#> — Returns the 2D distance between A and B bounding boxes.

Synopsis

double precision <#>(geometry A , geometry B);

Descripción

The <#> operator returns distance between two floating point bounding boxes, possibly reading them from a spatial index (PostgreSQL 9.1+ required). Useful for doing nearest neighbor **approximate** distance ordering.



Note
This operand will make use of any indexes that may be available on the geometries. It is different from other operators that use spatial indexes in that the spatial index is only used when the operator is in the ORDER BY clause.



Note
Index only kicks in if one of the geometries is a constant e.g. ORDER BY (ST_GeomFromText('POINT(1 2)') <#> geom) instead of g1.geom <#>.

Availability: 2.0.0 -- KNN only available for PostgreSQL 9.1+

Ejemplos

```
SELECT *
FROM (
SELECT b.tlid, b.mtfcc,
       b.geom <#> ST_GeomFromText('LINESTRING(746149 2948672,745954 2948576,
       745787 2948499,745740 2948468,745712 2948438,
       745690 2948384,745677 2948319)',2249) As b_dist,
       ST_Distance(b.geom, ST_GeomFromText('LINESTRING(746149 2948672,745954 2948576,
       745787 2948499,745740 2948468,745712 2948438,
       745690 2948384,745677 2948319)',2249)) As act_dist
FROM bos_roads As b
ORDER BY b_dist, b.tlid
LIMIT 100) As foo
ORDER BY act_dist, tlid LIMIT 10;
```

tlid	mtfcc	b_dist	act_dist
85732027	S1400	0	0

```

85732029 | S1400 |          0 |          0
85732031 | S1400 |          0 |          0
85734335 | S1400 |          0 |          0
85736037 | S1400 |          0 |          0
624683742 | S1400 |          0 | 128.528874268666
85719343 | S1400 | 260.839270432962 | 260.839270432962
85741826 | S1400 | 164.759294123275 | 260.839270432962
85732032 | S1400 |      277.75 | 311.830282365264
85735592 | S1400 |      222.25 | 311.830282365264
(10 rows)

```

Ver también

[ST_DWithin](#), [ST_Distance](#), [<->](#)

8.10.2.4 <<->>

[<<->>](#) — Returns the n-D distance between the centroids of A and B bounding boxes.

Synopsis

double precision [<<->>](#)(geometry A , geometry B);

Descripción

The [<<->>](#) operator returns the n-D (euclidean) distance between the centroids of the bounding boxes of two geometries. Useful for doing nearest neighbor **approximate** distance ordering.



Note

This operand will make use of n-D GiST indexes that may be available on the geometries. It is different from other operators that use spatial indexes in that the spatial index is only used when the operator is in the ORDER BY clause.



Note

Index only kicks in if one of the geometries is a constant (not in a subquery/cte). e.g. 'SRID=3005;POINT(1011102 450541)::geometry' instead of a.geom

Availability: 2.2.0 -- KNN only available for PostgreSQL 9.1+

Ver también

[<<#>>](#), [<->](#)

8.10.2.5 <<#>>

[<<#>>](#) — Returns the n-D distance between A and B bounding boxes.

Synopsis

double precision [<<#>>](#)(geometry A , geometry B);

Descripción

The `<<#>>` operator returns distance between two floating point bounding boxes, possibly reading them from a spatial index (PostgreSQL 9.1+ required). Useful for doing nearest neighbor **approximate** distance ordering.



Note

This operand will make use of any indexes that may be available on the geometries. It is different from other operators that use spatial indexes in that the spatial index is only used when the operator is in the ORDER BY clause.



Note

Index only kicks in if one of the geometries is a constant e.g. ORDER BY (ST_GeomFromText('POINT(1 2)') `<<#>>` geom) instead of g1.geom `<<#>>`.

Availability: 2.2.0 -- KNN only available for PostgreSQL 9.1+

Ver también

`<<->>`, `<#>`

8.11 Spatial Relationships

8.11.1 Topological Relationships

8.11.1.1 ST_3DIntersects

ST_3DIntersects — Tests if two geometries spatially intersect in 3D - only for points, linestrings, polygons, polyhedral surface (area).

Synopsis

boolean **ST_3DIntersects**(geometry geomA , geometry geomB);

Description

Overlaps, Touches, Within all imply spatial intersection. If any of the aforementioned returns true, then the geometries also spatially intersect. Disjoint implies false for spatial intersection.



Note

This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries.

Changed: 3.0.0 SFCGAL backend removed, GEOS backend supports TINs.

Availability: 2.0.0



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1

Geometry Examples

```
SELECT ST_3DIntersects(pt, line), ST_Intersects(pt, line)
FROM (SELECT 'POINT(0 0 2)::geometry As pt, 'LINESTRING (0 0 1, 0 2 3)::geometry As ↵
      line) As foo;
st_3dintersects | st_intersects
-----+-----
f               | t
(1 row)
```

TIN Examples

```
SELECT ST_3DIntersects('TIN(((0 0 0,1 0 0,0 1 0,0 0 0)))::geometry, 'POINT(.1 .1 0):: ↵
      geometry);
st_3dintersects
-----
t
```

See Also

[ST_Intersects](#)

8.11.1.2 ST_Contains

ST_Contains — Tests if no points of B lie in the exterior of A, and A and B have at least one interior point in common.

Synopsis

boolean **ST_Contains**(geometry geomA, geometry geomB);

Description

Returns TRUE if geometry B is completely inside geometry A. A contains B if and only if no points of B lie in the exterior of A, and at least one point of the interior of B lies in the interior of A.

A subtlety of the definition is that a geometry does not contain things in its boundary. Thus polygons and lines do *not* contain lines and points lying in their boundary. For further details see [Subtleties of OGC Covers, Contains, Within](#). (The [ST_Covers](#) predicate provides a more inclusive relationship.) However, a geometry does contain itself. (In contrast, in the [ST_ContainsProperly](#) predicate a geometry does *not* properly contain itself.)

ST_Contains is the inverse of [ST_Within](#). So, `ST_Contains(A,B) = ST_Within(B,A)`.



Note

This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid index use, use the function `_ST_Contains`.

Performed by the GEOS module

Enhanced: 2.3.0 Enhancement to PIP short-circuit extended to support MultiPoints with few points. Prior versions only supported point in polygon.

**Important**

Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`

**Important**

Do not use this function with invalid geometries. You will get unexpected results.

NOTE: this is the "allowable" version that returns a boolean, not an integer.



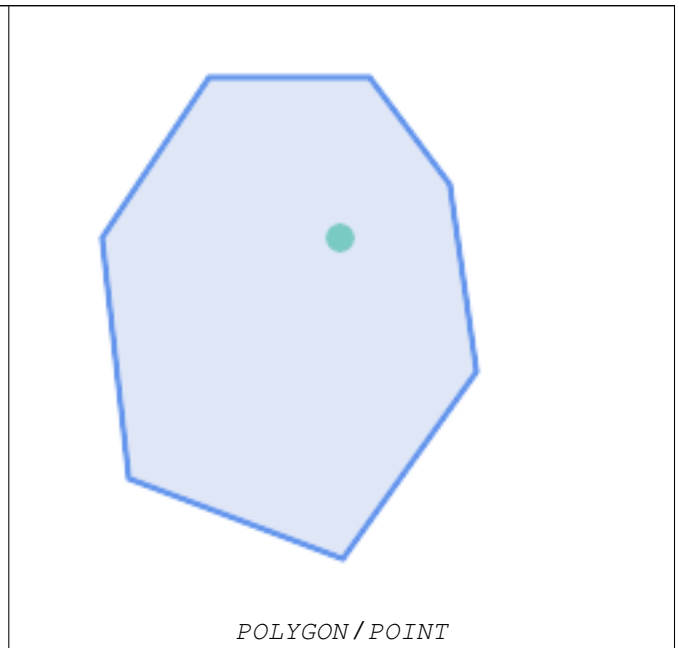
This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 // s2.1.13.3 - same as `within(geometry B, geometry A)`



This method implements the SQL/MM specification. SQL-MM 3: 5.1.31

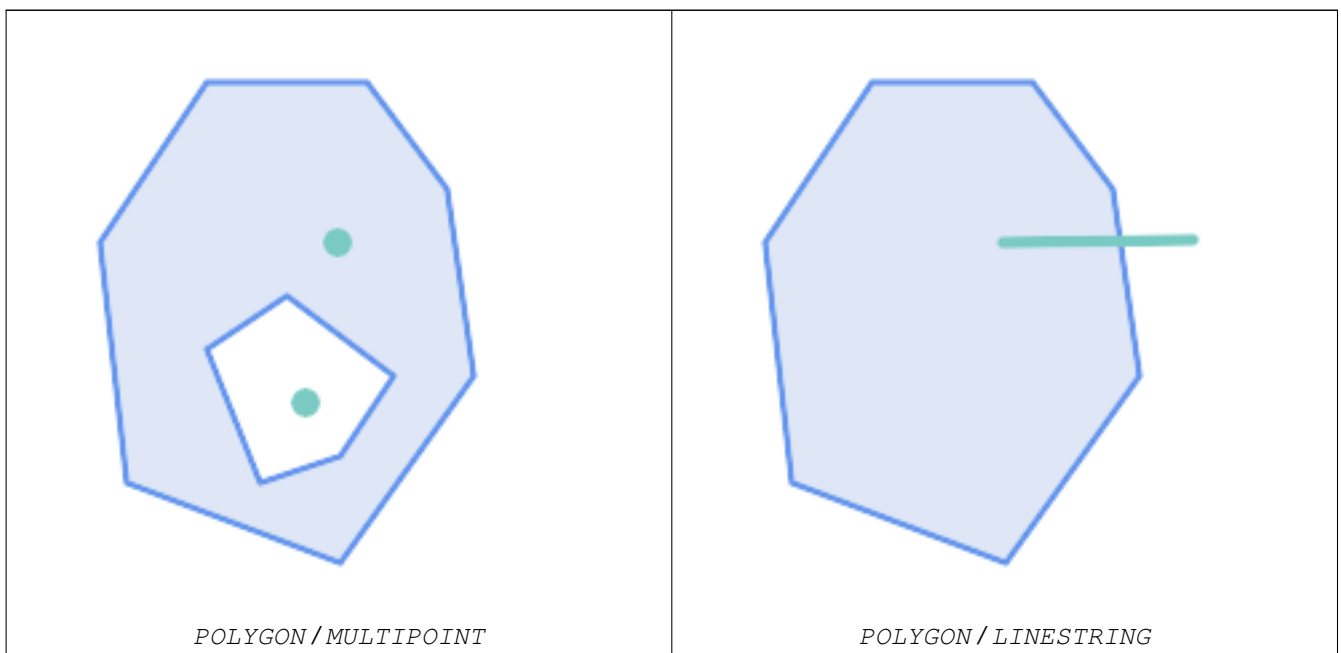
Examples

`ST_Contains` returns TRUE in the following situations:





The `ST_Contains` predicate returns FALSE in the following situations:



```
-- A circle within a circle
SELECT ST_Contains(smallc, bigc) As smallcontainsbig,
       ST_Contains(bigc, smallc) As bigcontainssmall,
       ST_Contains(bigc, ST_Union(smallc, bigc)) as bigcontainsunion,
       ST_Equals(bigc, ST_Union(smallc, bigc)) as bigisunion,
       ST_Covers(bigc, ST_ExteriorRing(bigc)) As bigcoversexterior,
       ST_Contains(bigc, ST_ExteriorRing(bigc)) As bigcontainsexterior
FROM (SELECT ST_Buffer(ST_GeomFromText('POINT(1 2)'), 10) As smallc,
           ST_Buffer(ST_GeomFromText('POINT(1 2)'), 20) As bigc) As foo;

-- Result
smallcontainsbig | bigcontainssmall | bigcontainsunion | bigisunion | bigcoversexterior | bigcontainsexterior | ↵
```

```
f          | t          | t          | t          | t          | f

-- Example demonstrating difference between contains and contains properly
SELECT ST_GeometryType(geomA) As geomtype, ST_Contains(geomA,geomA) AS acontainsa, ↔
       ST_ContainsProperly(geomA, geomA) AS acontainspropa,
       ST_Contains(geomA, ST_Boundary(geomA)) As acontainsba, ST_ContainsProperly(geomA, ↔
       ST_Boundary(geomA)) As acontainspropba
FROM (VALUES ( ST_Buffer(ST_Point(1,1), 5,1) ),
            ( ST_MakeLine(ST_Point(1,1), ST_Point(-1,-1) ) ),
            ( ST_Point(1,1) )
      ) As foo(geomA);

geomtype    | acontainsa | acontainspropa | acontainsba | acontainspropba
-----+-----+-----+-----+-----
ST_Polygon  | t          | f              | f           | f
ST_LineString | t          | f              | f           | f
ST_Point     | t          | t              | f           | f
```

See Also

[ST_Boundary](#), [ST_ContainsProperly](#), [ST_Covers](#), [ST_CoveredBy](#), [ST_Equals](#), [ST_Within](#)

8.11.1.3 ST_ContainsProperly

ST_ContainsProperly — Tests if B intersects the interior of A but not the boundary or exterior.

Synopsis

boolean **ST_ContainsProperly**(geometry geomA, geometry geomB);

Description

Returns true if B intersects the interior of A but not the boundary or exterior.

A does not properly contain itself, but does contain itself.

Every point of the other geometry is a point of this geometry’s interior. The DE-9IM Intersection Matrix for the two geometries matches [T**FF*FF*] used in [ST_Relate](#)

An example use case for this predicate is computing the intersections of a set of geometries with a large polygonal geometry. Since intersection is a fairly slow operation, it can be more efficient to use containsProperly to filter out test geometries which lie wholly inside the area. In these cases the intersection is known a priori to be exactly the original test geometry.



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid index use, use the function `_ST_ContainsProperly`.



Note
The advantage of this predicate over [ST_Contains](#) and [ST_Intersects](#) is that it can be computed more efficiently, with no need to compute topology at individual points.

Performed by the GEOS module.

Availability: 1.4.0



Important

Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION



Important

Do not use this function with invalid geometries. You will get unexpected results.

Examples

```
--a circle within a circle
SELECT ST_ContainsProperly(smallc, bigc) As smallcontainspropbig,
       ST_ContainsProperly(bigc, smallc) As bigcontainspropsmall,
       ST_ContainsProperly(bigc, ST_Union(smallc, bigc)) as bigcontainspropunion,
       ST_Equals(bigc, ST_Union(smallc, bigc)) as bigisunion,
       ST_Covers(bigc, ST_ExteriorRing(bigc)) As bigcoversexterior,
       ST_ContainsProperly(bigc, ST_ExteriorRing(bigc)) As bigcontainsexterior
FROM (SELECT ST_Buffer(ST_GeomFromText('POINT(1 2)'), 10) As smallc,
       ST_Buffer(ST_GeomFromText('POINT(1 2)'), 20) As bigc) As foo;
--Result
smallcontainspropbig | bigcontainspropsmall | bigcontainspropunion | bigisunion | ↔
bigcoversexterior   | bigcontainsexterior
-----+-----+-----+-----+-----
f                    | t                    | f                    | t          | ↔
                    | f                    |                      |            |

--example demonstrating difference between contains and contains properly
SELECT ST_GeometryType(geomA) As geomtype, ST_Contains(geomA, geomA) AS acontainsa, ↔
       ST_ContainsProperly(geomA, geomA) AS acontainspropa,
       ST_Contains(geomA, ST_Boundary(geomA)) As acontainsba, ST_ContainsProperly(geomA, ↔
       ST_Boundary(geomA)) As acontainspropba
FROM (VALUES ( ST_Buffer(ST_Point(1,1), 5,1) ),
            ( ST_MakeLine(ST_Point(1,1), ST_Point(-1,-1) ) ),
            ( ST_Point(1,1) )
      ) As foo(geomA);

geomtype      | acontainsa | acontainspropa | acontainsba | acontainspropba
-----+-----+-----+-----+-----
ST_Polygon    | t          | f              | f           | f
ST_LineString | t          | f              | f           | f
ST_Point      | t          | t              | f           | f
```

See Also

[ST_GeometryType](#), [ST_Boundary](#), [ST_Contains](#), [ST_Covers](#), [ST_CoveredBy](#), [ST_Equals](#), [ST_Relate](#), [ST_Within](#)

8.11.1.4 ST_CoveredBy

ST_CoveredBy — Tests if no point in A is outside B

Synopsis

boolean **ST_CoveredBy**(geometry geomA, geometry geomB);
boolean **ST_CoveredBy**(geography geogA, geography geogB);

Description

Returns `true` if no point in Geometry/Geography A lies outside Geometry/Geography B. Equivalently, tests if every point of geometry A is inside (i.e. intersects the interior or boundary of) geometry B.



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid index use, use the function `_ST_CoveredBy`.



Important
Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`



Important
Do not use this function with invalid geometries. You will get unexpected results.

Performed by the GEOS module

Availability: 1.2.2

NOTE: this is the "allowable" version that returns a boolean, not an integer.

Not an OGC standard, but Oracle has it too.

Examples

```
--a circle coveredby a circle
SELECT ST_CoveredBy(smallc,smallc) As smallinsmall,
       ST_CoveredBy(smallc, bigc) As smallcoveredbybig,
       ST_CoveredBy(ST_ExteriorRing(bigc), bigc) As exteriorcoveredbybig,
       ST_Within(ST_ExteriorRing(bigc),bigc) As exeriorwithinbig
FROM (SELECT ST_Buffer(ST_GeomFromText('POINT(1 2)'), 10) As smallc,
          ST_Buffer(ST_GeomFromText('POINT(1 2)'), 20) As bigc) As foo;
--Result
smallinsmall | smallcoveredbybig | exteriorcoveredbybig | exeriorwithinbig
-----+-----+-----+-----
t            | t                  | t                    | f
(1 row)
```

See Also

[ST_Contains](#), [ST_Covers](#), [ST_ExteriorRing](#), [ST_Within](#)

8.11.1.5 ST_Covers

`ST_Covers` — Tests if no point in B is outside A

Synopsis

boolean **ST_Covers**(geometry geomA, geometry geomB);
boolean **ST_Covers**(geography geogpolyA, geography geogpointB);

Description

Returns `true` if no point in Geometry/Geography B is outside Geometry/Geography A. Equivalently, tests if every point of geometry B is inside (i.e. intersects the interior or boundary of) geometry A.



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid index use, use the function `_ST_Covers`.



Important
Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`



Important
Do not use this function with invalid geometries. You will get unexpected results.

Performed by the GEOS module

Enhanced: 2.4.0 Support for polygon in polygon and line in polygon added for geography type

Enhanced: 2.3.0 Enhancement to PIP short-circuit for geometry extended to support MultiPoints with few points. Prior versions only supported point in polygon.

Availability: 1.5 - support for geography was introduced.

Availability: 1.2.2

NOTE: this is the "allowable" version that returns a boolean, not an integer.

Not an OGC standard, but Oracle has it too.

Examples

Geometry example

```
--a circle covering a circle
SELECT ST_Covers(smallc,smallc) As smallinsmall,
       ST_Covers(smallc, bigc) As smallcoversbig,
       ST_Covers(bigc, ST_ExteriorRing(bigc)) As bigcoversexterior,
       ST_Contains(bigc, ST_ExteriorRing(bigc)) As bigcontainsexterior
FROM (SELECT ST_Buffer(ST_GeomFromText('POINT(1 2)'), 10) As smallc,
       ST_Buffer(ST_GeomFromText('POINT(1 2)'), 20) As bigc) As foo;
--Result
smallinsmall | smallcoversbig | bigcoversexterior | bigcontainsexterior
-----+-----+-----+-----
t            | f              | t                 | f
(1 row)
```


Geography Example

```
-- a point with a 300 meter buffer compared to a point, a point and its 10 meter buffer
SELECT ST_Covers(geog_poly, geog_pt) As poly_covers_pt,
       ST_Covers(ST_Buffer(geog_pt,10), geog_pt) As buff_10m_covers_cent
FROM (SELECT ST_Buffer(ST_GeogFromText('SRID=4326;POINT(-99.327 31.4821)'), 300) As
      geog_poly,
      ST_GeogFromText('SRID=4326;POINT(-99.33 31.483)') As geog_pt ) As foo;

poly_covers_pt | buff_10m_covers_cent
-----+-----
f              | t
```

See Also

[ST_Contains](#), [ST_CoveredBy](#), [ST_Within](#)

8.11.1.6 ST_Crosses

ST_Crosses — Tests if two geometries have some, but not all, interior points in common.

Synopsis

boolean **ST_Crosses**(geometry g1, geometry g2);

Description

Compares two geometry objects and returns `true` if their intersection "spatially cross", that is, the geometries have some, but not all interior points in common. The intersection of the interiors of the geometries must be non-empty and must have dimension less than the maximum dimension of the two input geometries. Additionally, the intersection of the two geometries must not equal either of the source geometries. Otherwise, it returns `false`.

In mathematical terms, this is:

$$a.Crosses(b) \Leftrightarrow (dim(I(a) \cap I(b)) < \max(dim(I(a)), dim(I(b)))) \wedge (a \cap b \neq a) \wedge (a \cap b \neq b)$$

Geometries cross if their DE-9IM Intersection Matrix matches:

- T*T***** for Point/Line, Point/Area, and Line/Area situations
- T*****T** for Line/Point, Area/Point, and Area/Line situations
- 0***** for Line/Line situations

For Point/Point and Area/Area situations this predicate returns `false`.

The OpenGIS Simple Features Specification defines this predicate only for Point/Line, Point/Area, Line/Line, and Line/Area situations. JTS / GEOS extends the definition to apply to Line/Point, Area/Point and Area/Line situations as well. This makes the relation symmetric.



Note

This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries.



Important

Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`



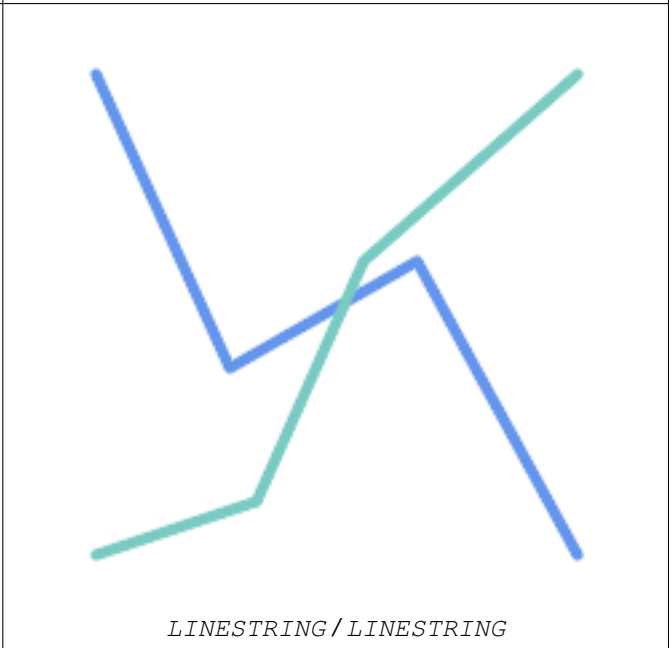
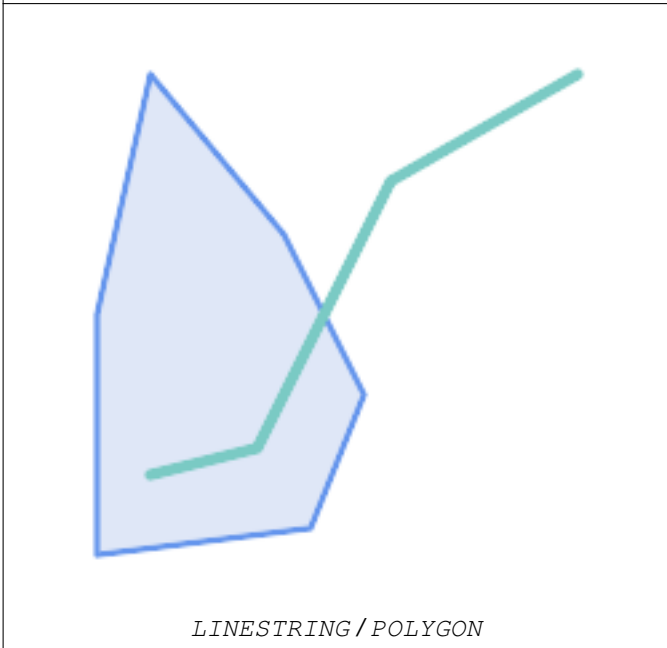
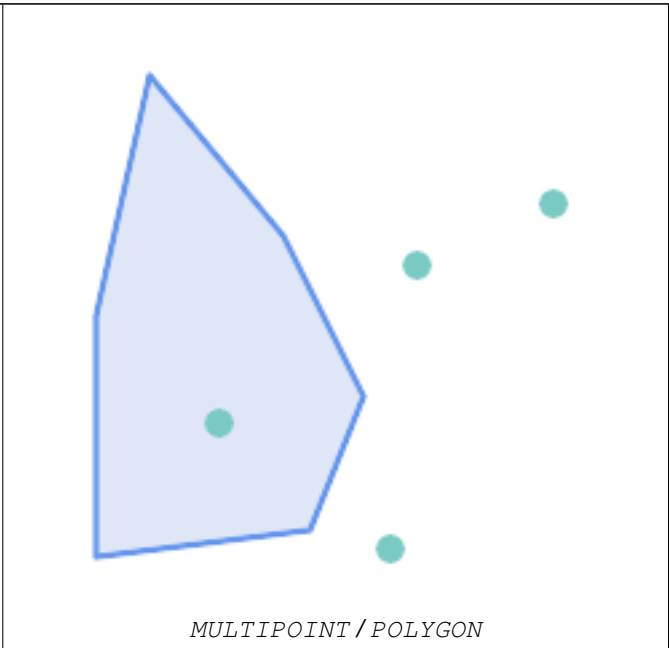
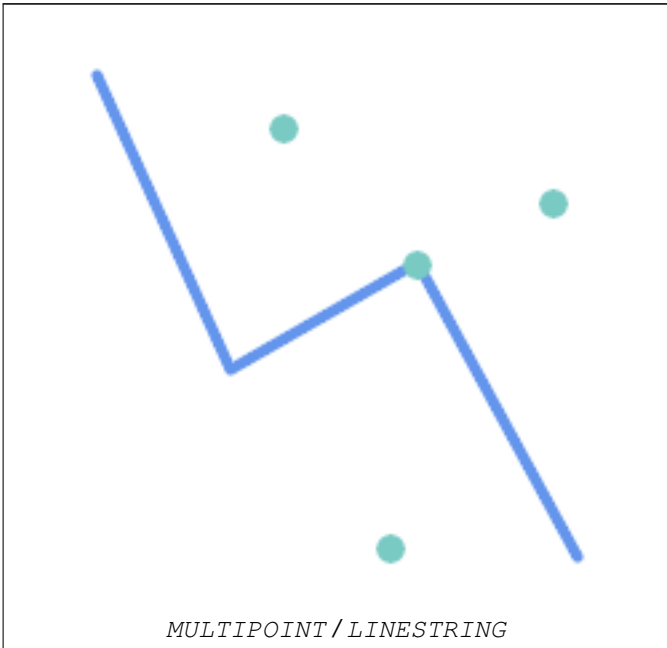
This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.13.3



This method implements the SQL/MM specification. SQL-MM 3: 5.1.29

Examples

The following situations all return `true`.



Consider a situation where a user has two tables: a table of roads and a table of highways.

```
CREATE TABLE roads (
  id serial NOT NULL,
  geom geometry,
  CONSTRAINT roads_pkey PRIMARY KEY ( ↵
    road_id)
);
```

```
CREATE TABLE highways (
  id serial NOT NULL,
  the_geom geometry,
  CONSTRAINT roads_pkey PRIMARY KEY ( ↵
    road_id)
);
```

To determine a list of roads that cross a highway, use a query similar to:

```
SELECT roads.id
FROM roads, highways
WHERE ST_Crosses(roads.geom, highways.geom);
```

See Also

[ST_Contains](#), [ST_Overlaps](#)

8.11.1.7 ST_Disjoint

ST_Disjoint — Tests if two geometries are disjoint (they have no point in common).

Synopsis

boolean **ST_Disjoint**(geometry A , geometry B);

Description

Overlaps, Touches, Within all imply geometries are not spatially disjoint. If any of the aforementioned returns true, then the geometries are not spatially disjoint. Disjoint implies false for spatial intersection.



Important

Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION

Performed by the GEOS module



Note

This function call does not use indexes



Note

NOTE: this is the "allowable" version that returns a boolean, not an integer.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 //s2.1.13.3 - a.Relate(b, 'FF*FF****')



This method implements the SQL/MM specification. SQL-MM 3: 5.1.26

Examples

```
SELECT ST_Disjoint('POINT(0 0)::geometry, 'LINESTRING ( 2 0, 0 2 ) '::geometry);
st_disjoint
-----
t
(1 row)
SELECT ST_Disjoint('POINT(0 0)::geometry, 'LINESTRING ( 0 0, 0 2 ) '::geometry);
st_disjoint
-----
f
(1 row)
```

See Also

[ST_Intersects](#)

8.11.1.8 ST_Equals

ST_Equals — Tests if two geometries include the same set of points.

Synopsis

boolean **ST_Equals**(geometry A, geometry B);

Description

Returns `true` if the given geometries are "spatially equal". Use this for a 'better' answer than `'='`. Note by spatially equal we mean `ST_Within(A,B) = true` and `ST_Within(B,A) = true` and also mean ordering of points can be different but represent the same geometry structure. To verify the order of points is consistent, use `ST_OrderingEquals` (it must be noted `ST_OrderingEquals` is a little more stringent than simply verifying order of points are the same).



Important

Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2



This method implements the SQL/MM specification. SQL-MM 3: 5.1.24

Changed: 2.2.0 Returns true even for invalid geometries if they are binary equal

Examples

```
SELECT ST_Equals(ST_GeomFromText('LINESTRING(0 0, 10 10)'),
  ST_GeomFromText('LINESTRING(0 0, 5 5, 10 10)'));
st_equals
-----
t
(1 row)

SELECT ST_Equals(ST_Reverse(ST_GeomFromText('LINESTRING(0 0, 10 10)')),
  ST_GeomFromText('LINESTRING(0 0, 5 5, 10 10)'));
```

```
st_equals
-----
t
(1 row)
```

See Also

[ST_IsValid](#), [ST_OrderingEquals](#), [ST_Reverse](#), [ST_Within](#)

8.11.1.9 ST_Intersects

ST_Intersects — Tests if two geometries intersect (they have at least one point in common).

Synopsis

```
boolean ST_Intersects( geometry geomA , geometry geomB );
boolean ST_Intersects( geography geogA , geography geogB );
```

Description

Compares two geometries and returns `true` if they intersect. Geometries intersect if they have any point in common.

For geography, a distance tolerance of 0.00001 meters is used (so points that are very close are considered to intersect).

Geometries intersect if their DE-9IM Intersection Matrix matches one of:

- T*****
- *T*****
- ***T*****
- ****T*****

Spatial intersection is implied by all the other spatial relationship tests, except [ST_Disjoint](#), which tests that geometries do NOT intersect.



Note

This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries.

Changed: 3.0.0 SFCGAL version removed and native support for 2D TINS added.

Enhanced: 2.5.0 Supports GEOMETRYCOLLECTION.

Enhanced: 2.3.0 Enhancement to PIP short-circuit extended to support MultiPoints with few points. Prior versions only supported point in polygon.

Performed by the GEOS module (for geometry), geography is native

Availability: 1.5 support for geography was introduced.



Note

For geography, this function has a distance tolerance of about 0.00001 meters and uses the sphere rather than spheroid calculation.

**Note**

NOTE: this is the "allowable" version that returns a boolean, not an integer.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 //s2.1.13.3 - ST_Intersects(g1, g2) --> Not (ST_Disjoint(g1, g2))



This method implements the SQL/MM specification. SQL-MM 3: 5.1.27



This method supports Circular Strings and Curves



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Geometry Examples

```
SELECT ST_Intersects('POINT(0 0)::geometry, 'LINESTRING ( 2 0, 0 2 ) '::geometry);
st_intersects
-----
f
(1 row)
SELECT ST_Intersects('POINT(0 0)::geometry, 'LINESTRING ( 0 0, 0 2 ) '::geometry);
st_intersects
-----
t
(1 row)

-- Look up in table. Make sure table has a GiST index on geometry column for faster lookup.
SELECT id, name FROM cities WHERE ST_Intersects(geom, 'SRID=4326;POLYGON((28 53,27.707 ↵
52.293,27 52,26.293 52.293,26 53,26.293 53.707,27 54,27.707 53.707,28 53)) ');
id | name
----+-----
 2 | Minsk
(1 row)
```

Geography Examples

```
SELECT ST_Intersects(
  'SRID=4326;LINESTRING(-43.23456 72.4567,-43.23456 72.4568) '::geography,
  'SRID=4326;POINT(-43.23456 72.4567772) '::geography
);

st_intersects
-----
t
```

See Also

[&&](#), [ST_3DIntersects](#), [ST_Disjoint](#)

8.11.1.10 ST_LineCrossingDirection

ST_LineCrossingDirection — Returns a number indicating the crossing behavior of two LineStrings.

Synopsis

integer **ST_LineCrossingDirection**(geometry linestringA, geometry linestringB);

Description

Given two linestrings returns an integer between -3 and 3 indicating what kind of crossing behavior exists between them. 0 indicates no crossing. This is only supported for LINESTRINGS.

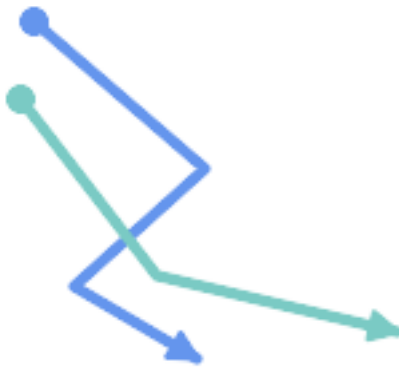
The crossing number has the following meaning:

- 0: LINE NO CROSS
- -1: LINE CROSS LEFT
- 1: LINE CROSS RIGHT
- -2: LINE MULTICROSS END LEFT
- 2: LINE MULTICROSS END RIGHT
- -3: LINE MULTICROSS END SAME FIRST LEFT
- 3: LINE MULTICROSS END SAME FIRST RIGHT

Availability: 1.4

Examples

Example: LINE CROSS LEFT and LINE CROSS RIGHT

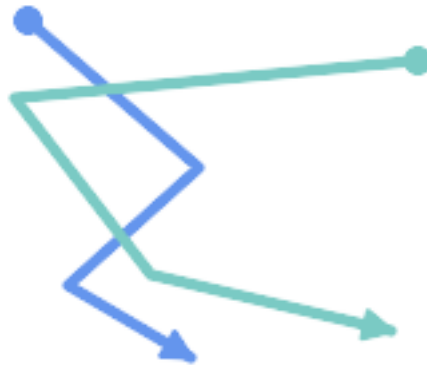


Blue: Line A; Green: Line B

```
SELECT ST_LineCrossingDirection(lineA, lineB) As A_cross_B,  
       ST_LineCrossingDirection(lineB, lineA) As B_cross_A  
FROM (SELECT  
  ST_GeomFromText('LINESTRING(25 169,89 114,40 70,86 43)') As lineA,  
  ST_GeomFromText('LINESTRING (20 140, 71 74, 161 53)') As lineB  
  ) As foo;
```

A_cross_B	B_cross_A
-1	1

Example: LINE MULTICROSS END SAME FIRST LEFT and LINE MULTICROSS END SAME FIRST RIGHT

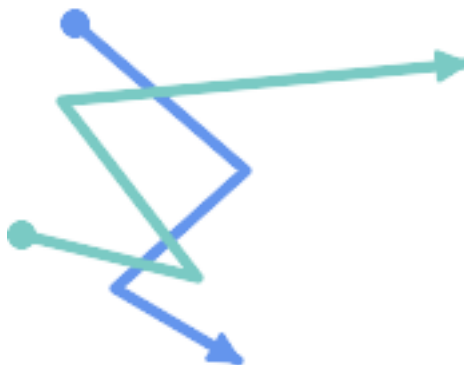


Blue: Line A; Green: Line B

```
SELECT ST_LineCrossingDirection(lineA, lineB) As A_cross_B,
       ST_LineCrossingDirection(lineB, lineA) As B_cross_A
FROM (SELECT
      ST_GeomFromText('LINESTRING(25 169,89 114,40 70,86 43)') As lineA,
      ST_GeomFromText('LINESTRING(171 154,20 140,71 74,161 53)') As lineB
    ) As foo;
```

A_cross_B	B_cross_A
3	-3

Example: LINE MULTICROSS END LEFT and LINE MULTICROSS END RIGHT



Blue: Line A; Green: Line B

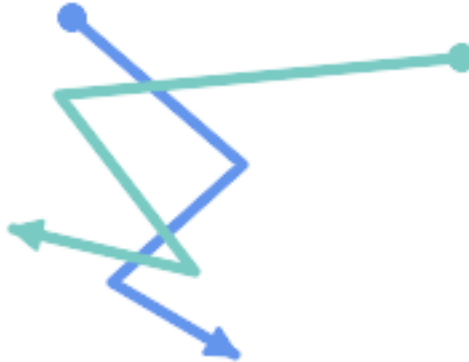
```
SELECT ST_LineCrossingDirection(lineA, lineB) As A_cross_B,
       ST_LineCrossingDirection(lineB, lineA) As B_cross_A
FROM (SELECT
```



```
ST_GeomFromText('LINESTRING(25 169,89 114,40 70,86 43)') As lineA,
ST_GeomFromText('LINESTRING(5 90, 71 74, 20 140, 171 154)') As lineB
) As foo;
```

A_cross_B	B_cross_A
-----+-----	
-2	2

Example: LINE MULTICROSS END LEFT and LINE MULTICROSS END RIGHT



Blue: Line A; Green: Line B

```
SELECT ST_LineCrossingDirection(lineA, lineB) As A_cross_B,
       ST_LineCrossingDirection(lineB, lineA) As B_cross_A
FROM (SELECT
       ST_GeomFromText('LINESTRING(25 169,89 114,40 70,86 43)') As lineA,
       ST_GeomFromText('LINESTRING (171 154, 20 140, 71 74, 2.99 90.16)') As lineB
) As foo;
```

A_cross_B	B_cross_A
-----+-----	
2	-2

```
SELECT s1.gid, s2.gid, ST_LineCrossingDirection(s1.geom, s2.geom)
FROM streets s1 CROSS JOIN streets s2
ON (s1.gid != s2.gid AND s1.geom && s2.geom )
WHERE ST_LineCrossingDirection(s1.geom, s2.geom) > 0;
```

See Also

[ST_Crosses](#)

8.11.1.11 ST_OrderingEquals

ST_OrderingEquals — Tests if two geometries represent the same geometry and have points in the same directional order.

Synopsis

boolean **ST_OrderingEquals**(geometry A, geometry B);

Description

`ST_OrderingEquals` compares two geometries and returns t (TRUE) if the geometries are equal and the coordinates are in the same order; otherwise it returns f (FALSE).



Note

This function is implemented as per the ArcSDE SQL specification rather than SQL-MM. http://edndoc.esri.com/arcsde/9.1/sql_api/sqlapi3.htm#ST_OrderingEquals



This method implements the SQL/MM specification. SQL-MM 3: 5.1.43

Examples

```
SELECT ST_OrderingEquals(ST_GeomFromText('LINESTRING(0 0, 10 10)'),
  ST_GeomFromText('LINESTRING(0 0, 5 5, 10 10)'));
 st_orderingequals
-----
f
(1 row)

SELECT ST_OrderingEquals(ST_GeomFromText('LINESTRING(0 0, 10 10)'),
  ST_GeomFromText('LINESTRING(0 0, 0 0, 10 10)'));
 st_orderingequals
-----
t
(1 row)

SELECT ST_OrderingEquals(ST_Reverse(ST_GeomFromText('LINESTRING(0 0, 10 10)'),
  ST_GeomFromText('LINESTRING(0 0, 0 0, 10 10)'));
 st_orderingequals
-----
f
(1 row)
```

See Also

[&&](#), [ST_Equals](#), [ST_Reverse](#)

8.11.1.12 ST_Overlaps

`ST_Overlaps` — Tests if two geometries intersect and have the same dimension, but are not completely contained by each other.

Synopsis

boolean **ST_Overlaps**(geometry A, geometry B);

Description

Returns TRUE if geometry A and B "spatially overlap". Two geometries overlap if they have the same dimension, each has at least one point not shared by the other (or equivalently neither covers the other), and the intersection of their interiors has the same dimension. The overlaps relationship is symmetrical.



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid index use, use the function `_ST_Overlaps`.

Performed by the GEOS module



Important
Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`

NOTE: this is the "allowable" version that returns a boolean, not an integer.



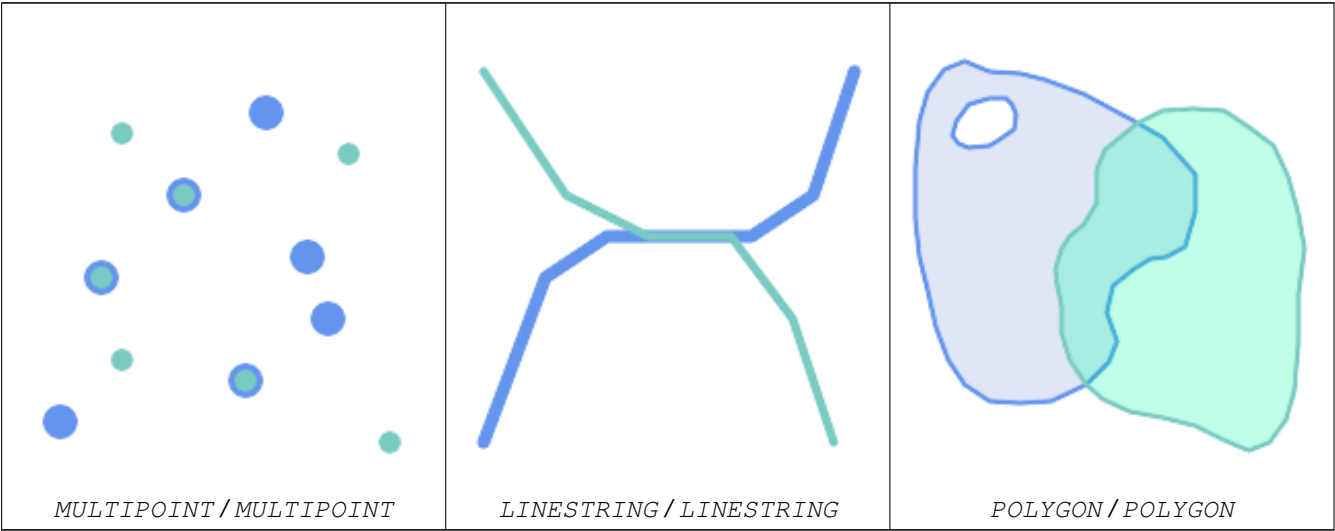
This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 // s2.1.13.3

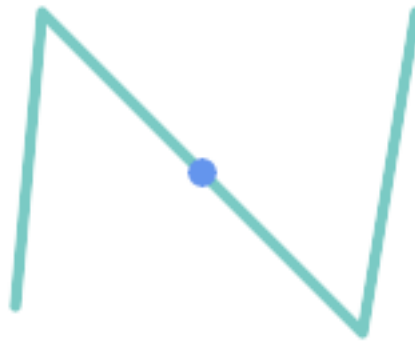


This method implements the SQL/MM specification. SQL-MM 3: 5.1.32

Examples

`ST_Overlaps` returns TRUE in the following situations:





A Point on a LineString is contained, but since it has lower dimension it does not overlap or cross.

```
SELECT ST_Overlaps(a,b) AS overlaps,      ST_Crosses(a,b) AS crosses,
       ST_Intersects(a, b) AS intersects,  ST_Contains(b,a) AS b_contains_a
FROM (SELECT ST_GeomFromText('POINT (100 100)') As a,
       ST_GeomFromText('LINESTRING (30 50, 40 160, 160 40, 180 160)') AS b) AS t
```

overlaps	crosses	intersects	b_contains_a
f	f	t	t



A LineString that partly covers a Polygon intersects and crosses, but does not overlap since it has different dimension.

```
SELECT ST_Overlaps(a,b) AS overlaps,      ST_Crosses(a,b) AS crosses,
       ST_Intersects(a, b) AS intersects,  ST_Contains(a,b) AS contains
FROM (SELECT ST_GeomFromText('POLYGON ((40 170, 90 30, 180 100, 40 170))') AS a,
       ST_GeomFromText('LINESTRING(10 10, 190 190)') AS b) AS t;
```

overlap	crosses	intersects	contains
f	t	t	f



Two Polygons that intersect but with neither contained by the other overlap, but do not cross because their intersection has the same dimension.

```
SELECT ST_Overlaps(a,b) AS overlaps,      ST_Crosses(a,b) AS crosses,
       ST_Intersects(a, b) AS intersects,  ST_Contains(b, a) AS b_contains_a,
       ST_Dimension(a) AS dim_a, ST_Dimension(b) AS dim_b,
       ST_Dimension(ST_Intersection(a,b)) AS dim_int
FROM (SELECT ST_GeomFromText('POLYGON ((40 170, 90 30, 180 100, 40 170))') AS a,
         ST_GeomFromText('POLYGON ((110 180, 20 60, 130 90, 110 180))') AS b) AS t;
```

overlaps	crosses	intersects	b_contains_a	dim_a	dim_b	dim_int
t	f	t	f	2	2	2

See Also

[ST_Contains](#), [ST_Crosses](#), [ST_Dimension](#), [ST_Intersects](#)

8.11.1.13 ST_Relate

ST_Relate — Tests if two geometries have a topological relationship matching an Intersection Matrix pattern, or computes their Intersection Matrix

Synopsis

boolean **ST_Relate**(geometry geomA, geometry geomB, text intersectionMatrixPattern);
text **ST_Relate**(geometry geomA, geometry geomB);
text **ST_Relate**(geometry geomA, geometry geomB, integer boundaryNodeRule);

Description

These functions allow testing and evaluating the spatial (topological) relationship between two geometries, as defined by the [Dimensionally Extended 9-Intersection Model](#) (DE-9IM).

The DE-9IM is specified as a 9-element matrix indicating the dimension of the intersections between the Interior, Boundary and Exterior of two geometries. It is represented by a 9-character text string using the symbols 'F', '0', '1', '2' (e.g. 'FF1FF0102').

A specific kind of spatial relationships is evaluated by comparing the intersection matrix to an *intersection matrix pattern*. A pattern can include the additional symbols 'T' and '*'. Common spatial relationships are provided by the named functions [ST_Contains](#), [ST_ContainsProperly](#), [ST_Covers](#), [ST_CoveredBy](#), [ST_Crosses](#), [ST_Disjoint](#), [ST_Equals](#), [ST_Intersects](#), [ST_Overlaps](#), [ST_Touches](#), and [ST_Within](#). Using an explicit pattern allows testing multiple conditions of intersects, crosses, etc in one step. It also allows testing spatial relationships which do not have a named spatial relationship function. For example, the relationship "Interior-Intersects" has the DE-9IM pattern T*****, which is not evaluated by any named predicate.

For more information refer to [Section 5.1](#).

Variant 1: Tests if two geometries are spatially related according to the given `intersectionMatrixPattern`.



Note

Unlike most of the named spatial relationship predicates, this does NOT automatically include an index call. The reason is that some relationships are true for geometries which do NOT intersect (e.g. Disjoint). If you are using a relationship pattern that requires intersection, then include the && index call.



Note

It is better to use a named relationship function if available, since they automatically use a spatial index where one exists. Also, they may implement performance optimizations which are not available with full relate evaluation.

Variant 2: Returns the DE-9IM matrix string for the spatial relationship between the two input geometries. The matrix string can be tested for matching a DE-9IM pattern using [ST_RelateMatch](#).

Variant 3: Like variant 2, but allows specifying a **Boundary Node Rule**. A boundary node rule allows finer control over whether geometry boundary points are considered to lie in the DE-9IM Interior or Boundary. The `boundaryNodeRule` code is: 1: OGC/MOD2, 2: Endpoint, 3: MultivalentEndpoint, 4: MonovalentEndpoint.

This function is not in the OGC spec, but is implied. see s2.1.13.2



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 // s2.1.13.3



This method implements the SQL/MM specification. SQL-MM 3: 5.1.25

Performed by the GEOS module

Enhanced: 2.0.0 - added support for specifying boundary node rule.



Important

Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION

Examples

Using the boolean-valued function to test spatial relationships.

```
SELECT ST_Relate('POINT(1 2)', ST_Buffer( 'POINT(1 2)', 2), 'OFFFFF212');
st_relate
-----
t

SELECT ST_Relate(POINT(1 2)', ST_Buffer( 'POINT(1 2)', 2), '*FF*FF212');
st_relate
-----
t
```

Testing a custom spatial relationship pattern as a query condition, with && to enable using a spatial index.

```
-- Find compounds that properly intersect (not just touch) a poly (Interior Intersects)

SELECT c.* , p.name As poly_name
  FROM polys AS p
  INNER JOIN compounds As c
        ON c.geom && p.geom
        AND ST_Relate(p.geom, c.geom, 'T*****');
```

Computing the intersection matrix for spatial relationships.

```
SELECT ST_Relate( 'POINT(1 2)',
                  ST_Buffer( 'POINT(1 2)', 2));

st_relate
-----
0FFFFF212

SELECT ST_Relate( 'LINESTRING(1 2, 3 4)',
                  'LINESTRING(5 6, 7 8)' );

st_relate
-----
FF1FF0102
```

See Also

Section 5.1, [ST_RelateMatch](#), [ST_Contains](#), [ST_ContainsProperly](#), [ST_Covers](#), [ST_CoveredBy](#), [ST_Crosses](#), [ST_Disjoint](#), [ST_Equals](#), [ST_Intersects](#), [ST_Overlaps](#), [ST_Touches](#), [ST_Within](#)

8.11.1.14 ST_RelateMatch

ST_RelateMatch — Tests if a DE-9IM Intersection Matrix matches an Intersection Matrix pattern

Synopsis

boolean **ST_RelateMatch**(text intersectionMatrix, text intersectionMatrixPattern);

Description

Tests if a [Dimensionally Extended 9-Intersection Model](#) (DE-9IM) intersectionMatrix value satisfies an intersectionMatrixPattern. Intersection matrix values can be computed by [ST_Relate](#).

For more information refer to Section 5.1.

Performed by the GEOS module

Availability: 2.0.0

Examples

```
SELECT ST_RelateMatch('101202FFF', 'TTTTTTFFF') ;
-- result --
t
```

Patterns for common spatial relationships matched against intersection matrix values, for a line in various positions relative to a polygon

```

SELECT pat.name AS relationship, pat.val AS pattern,
       mat.name AS position, mat.val AS matrix,
       ST_RelateMatch(mat.val, pat.val) AS match
FROM (VALUES ( 'Equality', 'T1FF1FFF1' ),
            ( 'Overlaps', 'T*T***T**' ),
            ( 'Within', 'T*F**F***' ),
            ( 'Disjoint', 'FF*FF****' )) AS pat(name,val)
CROSS JOIN
  (VALUES ('non-intersecting', 'FF1FF0212'),
         ('overlapping', '1010F0212'),
         ('inside', '1FF0FF212')) AS mat(name,val);

```

relationship	pattern	position	matrix	match
Equality	T1FF1FFF1	non-intersecting	FF1FF0212	f
Equality	T1FF1FFF1	overlapping	1010F0212	f
Equality	T1FF1FFF1	inside	1FF0FF212	f
Overlaps	T*T***T**	non-intersecting	FF1FF0212	f
Overlaps	T*T***T**	overlapping	1010F0212	t
Overlaps	T*T***T**	inside	1FF0FF212	f
Within	T*F**F***	non-intersecting	FF1FF0212	f
Within	T*F**F***	overlapping	1010F0212	f
Within	T*F**F***	inside	1FF0FF212	t
Disjoint	FF*FF****	non-intersecting	FF1FF0212	t
Disjoint	FF*FF****	overlapping	1010F0212	f
Disjoint	FF*FF****	inside	1FF0FF212	f

See Also

Section [5.1](#), [ST_Relate](#)

8.11.1.15 ST_Touches

ST_Touches — Tests if two geometries have at least one point in common, but their interiors do not intersect.

Synopsis

boolean **ST_Touches**(geometry A, geometry B);

Description

Returns TRUE if A and B intersect, but their interiors do not intersect. Equivalently, A and B have at least one point in common, and the common points lie in at least one boundary. For Point/Point inputs the relationship is always FALSE, since points do not have a boundary.

In mathematical terms, this relationship is:

$$a.Touches(b) \Leftrightarrow (I(a) \cap I(b) = \emptyset) \wedge (a \cap b) \neq \emptyset$$

This relationship holds if the DE-9IM Intersection Matrix for the two geometries matches one of:

- FT*****
- F**T*****
- F***T****



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid using an index, use `_ST_Touches` instead.



Important
Enhanced: 3.0.0 enabled support for `GEOMETRYCOLLECTION`



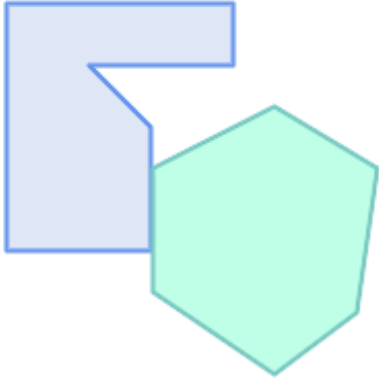
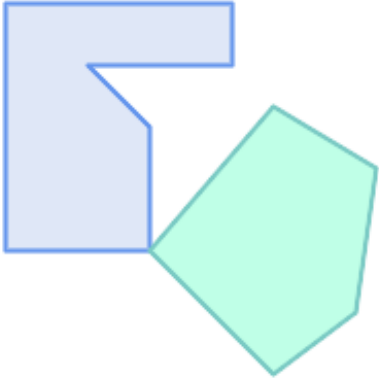
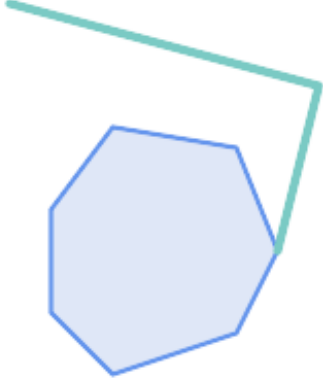
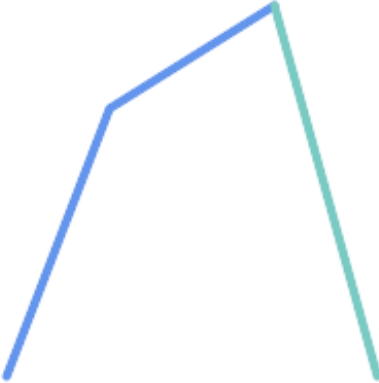

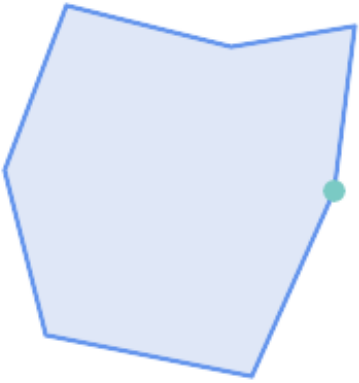
This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 // s2.1.13.3



This method implements the SQL/MM specification. SQL-MM 3: 5.1.28

Examples

The `ST_Touches` predicate returns `TRUE` in the following examples.

 <p><i>POLYGON / POLYGON</i></p>	 <p><i>POLYGON / POLYGON</i></p>	 <p><i>POLYGON / LINESTRING</i></p>
 <p><i>LINESTRING / LINESTRING</i></p>	 <p><i>LINESTRING / LINESTRING</i></p>	 <p><i>POLYGON / POINT</i></p>

```
SELECT ST_Touches('LINESTRING(0 0, 1 1, 0 2)::geometry, 'POINT(1 1)::geometry');
```

```

st_touches
-----
f
(1 row)

SELECT ST_Touches('LINESTRING(0 0, 1 1, 0 2)::geometry, 'POINT(0 2)::geometry');
st_touches
-----
t
(1 row)

```

8.11.1.16 ST_Within

ST_Within — Tests if no points of A lie in the exterior of B, and A and B have at least one interior point in common.

Synopsis

boolean **ST_Within**(geometry A, geometry B);

Description

Returns TRUE if geometry A is completely inside geometry B. For this function to make sense, the source geometries must both be of the same coordinate projection, having the same SRID. It is a given that if **ST_Within**(A,B) is true and **ST_Within**(B,A) is true, then the two geometries are considered spatially equal.

A subtlety of this definition is that the boundary of a geometry is not within the geometry. This means that lines and points lying in the boundary of a polygon or line are *not* within the geometry. For further details see [Subtleties of OGC Covers, Contains, Within](#). (The **ST_CoveredBy** predicate provides a more inclusive relationship).

ST_Within is the inverse of **ST_Contains**. So, **ST_Within**(A,B) = **ST_Contains**(B,A).



Note

This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries. To avoid index use, use the function **_ST_Within**.

Performed by the GEOS module

Enhanced: 2.3.0 Enhancement to PIP short-circuit for geometry extended to support MultiPoints with few points. Prior versions only supported point in polygon.



Important

Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION



Important

Do not use this function with invalid geometries. You will get unexpected results.

NOTE: this is the "allowable" version that returns a boolean, not an integer.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.2 // s2.1.13.3 - a.Relate(b, 'T**F**F***')



This method implements the SQL/MM specification. SQL-MM 3: 5.1.30

Examples

```
--a circle within a circle
SELECT ST_Within(smallc,smallc) As smallinsmall,
       ST_Within(smallc, bigc) As smallinbig,
       ST_Within(bigc,smallc) As biginsmall,
       ST_Within(ST_Union(smallc, bigc), bigc) as unioninbig,
       ST_Within(bigc, ST_Union(smallc, bigc)) as beginunion,
       ST_Equals(bigc, ST_Union(smallc, bigc)) as bigisunion
FROM
(
SELECT ST_Buffer(ST_GeomFromText('POINT(50 50)'), 20) As smallc,
       ST_Buffer(ST_GeomFromText('POINT(50 50)'), 40) As bigc) As foo;
--Result
smallinsmall | smallinbig | biginsmall | unioninbig | beginunion | bigisunion
-----+-----+-----+-----+-----+-----
t            | t          | f          | t          | t          | t
(1 row)
```



See Also

[ST_Contains](#), [ST_CoveredBy](#), [ST_Equals](#), [ST_IsValid](#)

8.11.2 Distance Relationships

8.11.2.1 ST_3DDWithin

ST_3DDWithin — Tests if two 3D geometries are within a given 3D distance

Synopsis

boolean **ST_3DDWithin**(geometry g1, geometry g2, double precision distance_of_srid);

Description

Returns true if the 3D distance between two geometry values is no larger than distance `distance_of_srid`. The distance is specified in units defined by the spatial reference system of the geometries. For this function to make sense the source geometries must be in the same coordinate system (have the same SRID).

**Note**

This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This method implements the SQL/MM specification. SQL-MM ?

Availability: 2.0.0

Examples

```
-- Geometry example - units in meters (SRID: 2163 US National Atlas Equal area) (3D point  ←
and line compared 2D point and line)
-- Note: currently no vertical datum support so Z is not transformed and assumed to be same  ←
units as final.
SELECT ST_3DDWithin(
    ST_Transform(ST_GeomFromEWKT('SRID=4326;POINT(-72.1235 42.3521 4)'),2163),
    ST_Transform(ST_GeomFromEWKT('SRID=4326;LINESTRING(-72.1260 42.45 15, -72.123 42.1546  ←
    20)'),2163),
    126.8
) As within_dist_3d,
ST_DWithin(
    ST_Transform(ST_GeomFromEWKT('SRID=4326;POINT(-72.1235 42.3521 4)'),2163),
    ST_Transform(ST_GeomFromEWKT('SRID=4326;LINESTRING(-72.1260 42.45 15, -72.123 42.1546  ←
    20)'),2163),
    126.8
) As within_dist_2d;

within_dist_3d | within_dist_2d
-----+-----
f              | t
```

See Also

[ST_3DDFullyWithin](#), [ST_DWithin](#), [ST_DFullyWithin](#), [ST_3DDistance](#), [ST_Distance](#), [ST_3DMaxDistance](#), [ST_Transform](#)

8.11.2.2 ST_3DDFullyWithin

ST_3DDFullyWithin — Tests if two 3D geometries are entirely within a given 3D distance

Synopsis

boolean **ST_3DDFullyWithin**(geometry g1, geometry g2, double precision distance);

Description

Returns true if the 3D geometries are fully within the specified distance of one another. The distance is specified in units defined by the spatial reference system of the geometries. For this function to make sense, the source geometries must both be of the same coordinate projection, having the same SRID.



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries.

Availability: 2.0.0

- This function supports 3d and will not drop the z-index.
- This function supports Polyhedral surfaces.

Examples

```
-- This compares the difference between fully within and distance within as well
-- as the distance fully within for the 2D footprint of the line/point vs. the 3d fully
-- within
SELECT ST_3DDFullyWithin(geom_a, geom_b, 10) as D3DFullyWithin10, ST_3DDWithin(geom_a,
geom_b, 10) as D3DWithin10,
ST_DFullyWithin(geom_a, geom_b, 20) as D2DFullyWithin20,
ST_3DDFullyWithin(geom_a, geom_b, 20) as D3DFullyWithin20 from
(select ST_GeomFromEWKT('POINT(1 1 2)') as geom_a,
ST_GeomFromEWKT('LINESTRING(1 5 2, 2 7 20, 1 9 100, 14 12 3)') as geom_b) t1;
d3dfullywithin10 | d3dwithin10 | d2dfullywithin20 | d3dfullywithin20
-----+-----+-----+-----
f                | t           | t               | f
```

See Also

[ST_3DDWithin](#), [ST_DWithin](#), [ST_DFullyWithin](#), [ST_3DMaxDistance](#)

8.11.2.3 ST_DFullyWithin

ST_DFullyWithin — Tests if two geometries are entirely within a given distance

Synopsis

boolean **ST_DFullyWithin**(geometry g1, geometry g2, double precision distance);

Description

Returns true if the geometries are entirely within the specified distance of one another. The distance is specified in units defined by the spatial reference system of the geometries. For this function to make sense, the source geometries must both be of the same coordinate projection, having the same SRID.



Note
This function automatically includes a bounding box comparison that makes use of any spatial indexes that are available on the geometries.

Availability: 1.5.0

Examples

```
postgis=# SELECT ST_DFullyWithin(geom_a, geom_b, 10) as DFullyWithin10, ST_DWithin(geom_a, ←
geom_b, 10) as DWithin10, ST_DFullyWithin(geom_a, geom_b, 20) as DFullyWithin20 from
(select ST_GeomFromText('POINT(1 1)') as geom_a, ST_GeomFromText('LINESTRING(1 5, 2 7, 1 ←
9, 14 12)') as geom_b) t1;

-----
DFullyWithin10 | DWithin10 | DFullyWithin20 |
-----+-----+-----+
f              | t         | t              |
```

See Also

[ST_MaxDistance](#), [ST_DWithin](#), [ST_3DDWithin](#), [ST_3DDFullyWithin](#)

8.11.2.4 ST_DWithin

ST_DWithin — Tests if two geometries are within a given distance

Synopsis

boolean **ST_DWithin**(geometry g1, geometry g2, double precision distance_of_srid);
boolean **ST_DWithin**(geography gg1, geography gg2, double precision distance_meters, boolean use_spheroid = true);


Description

Returns true if the geometries are within a given distance

For geometry: The distance is specified in units defined by the spatial reference system of the geometries. For this function to make sense, the source geometries must be in the same coordinate system (have the same SRID).

For geography: units are in meters and distance measurement defaults to use_spheroid=true. For faster evaluation use use_spheroid=false to measure on the sphere.

**Note**
Use [ST_3DDWithin](#) for 3D geometries.

**Note**
This function call includes a bounding box comparison that makes use of any indexes that are available on the geometries.

 This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).

- Availability: 1.5.0 support for geography was introduced
- Enhanced: 2.1.0 improved speed for geography. See [Making Geography faster](#) for details.
- Enhanced: 2.1.0 support for curved geometries was introduced.

Prior to 1.3, [ST_Expand](#) was commonly used in conjunction with && and ST_Distance to test for distance, and in pre-1.3.4 this function used that logic. From 1.3.4, ST_DWithin uses a faster short-circuit distance function.

Examples

```
-- Find the nearest hospital to each school
-- that is within 3000 units of the school.
-- We do an ST_DWithin search to utilize indexes to limit our search list
-- that the non-indexable ST_Distance needs to process
-- If the units of the spatial reference is meters then units would be meters
SELECT DISTINCT ON (s.gid) s.gid, s.school_name, s.geom, h.hospital_name
  FROM schools s
    LEFT JOIN hospitals h ON ST_DWithin(s.geom, h.geom, 3000)
 ORDER BY s.gid, ST_Distance(s.geom, h.geom);

-- The schools with no close hospitals
-- Find all schools with no hospital within 3000 units
-- away from the school. Units is in units of spatial ref (e.g. meters, feet, degrees)
SELECT s.gid, s.school_name
  FROM schools s
    LEFT JOIN hospitals h ON ST_DWithin(s.geom, h.geom, 3000)
 WHERE h.gid IS NULL;

-- Find broadcasting towers that receiver with limited range can receive.
-- Data is geometry in Spherical Mercator (SRID=3857), ranges are approximate.

-- Create geometry index that will check proximity limit of user to tower
CREATE INDEX ON broadcasting_towers using gist (geom);

-- Create geometry index that will check proximity limit of tower to user
CREATE INDEX ON broadcasting_towers using gist (ST_Expand(geom, sending_range));

-- Query towers that 4-kilometer receiver in Minsk Hackerspace can get
-- Note: two conditions, because shorter LEAST(b.sending_range, 4000) will not use index.
SELECT b.tower_id, b.geom
  FROM broadcasting_towers b
 WHERE ST_DWithin(b.geom, 'SRID=3857;POINT(3072163.4 7159374.1)', 4000)
    AND ST_DWithin(b.geom, 'SRID=3857;POINT(3072163.4 7159374.1)', b.sending_range);
```

See Also

[ST_Distance](#), [ST_3DDWithin](#)

8.11.2.5 ST_PointInsideCircle

ST_PointInsideCircle — Tests if a point geometry is inside a circle defined by a center and radius.

Synopsis

boolean **ST_PointInsideCircle**(geometry a_point, float center_x, float center_y, float radius);

Description

Returns true if the geometry is a point and is inside the circle with center `center_x,center_y` and radius `radius`.



Warning

Does not use spatial indexes. Use [ST_DWithin](#) instead.

Availability: 1.2

Changed: 2.2.0 In prior versions this was called ST_Point_Inside_Circle

Examples

```
SELECT ST_PointInsideCircle(ST_Point(1,2), 0.5, 2, 3);
 st_pointinsidecircle
-----
t
```

See Also

[ST_DWithin](#)

8.12 Measurement Functions

8.12.1 ST_Area

ST_Area — Returns the area of a polygonal geometry.

Synopsis

```
float ST_Area(geometry g1);
float ST_Area(geography geog, boolean use_spheroid=true);
```

Descripción

Returns the area of a polygonal geometry. For geometry types a 2D Cartesian (planar) area is computed, with units specified by the SRID. For geography types by default area is determined on a spheroid with units in square meters. To compute the area using the faster but less accurate spherical model use `ST_Area(geog, false)`.

Enhanced: 2.0.0 - support for 2D polyhedral surfaces was introduced.

Enhanced: 2.2.0 - measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires PROJ >= 4.9.0 to take advantage of the new feature.

Changed: 3.0.0 - does not depend on SFCGAL anymore.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 8.1.2, 9.5.3



This function supports Polyhedral surfaces.



Note

For polyhedral surfaces, only supports 2D polyhedral surfaces (not 2.5D). For 2.5D, may give a non-zero answer, but only for the faces that sit completely in XY plane.

Ver también

[ST_3DArea](#), [ST_Distance](#), [ST_LongestLine](#), [ST_MaxDistance](#)

8.12.2 ST_Azimuth

ST_Azimuth — Returns the north-based azimuth of a line between two points.

Synopsis

float **ST_Azimuth**(geometry origin, geometry target);
float **ST_Azimuth**(geography origin, geography target);

Descripción

Returns the azimuth in radians of the target point from the origin point, or NULL if the two points are coincident. The azimuth angle is a positive clockwise angle referenced from the positive Y axis (geometry) or the North meridian (geography): North = 0; Northeast = $\pi/4$; East = $\pi/2$; Southeast = $3\pi/4$; South = π ; Southwest $5\pi/4$; West = $3\pi/2$; Northwest = $7\pi/4$.

For the geography type, the azimuth solution is known as the [inverse geodesic problem](#).

The azimuth is a mathematical concept defined as the angle between a reference vector and a point, with angular units in radians. The result value in radians can be converted to degrees using the PostgreSQL function `degrees()`.

Azimuth can be used in conjunction with [ST_Translate](#) to shift an object along its perpendicular axis. See the `upgis_lineshift()` function in the [PostGIS wiki](#) for an implementation of this.

Disponibilidad: 1.1.0

Enhanced: 2.0.0 support for geography was introduced.

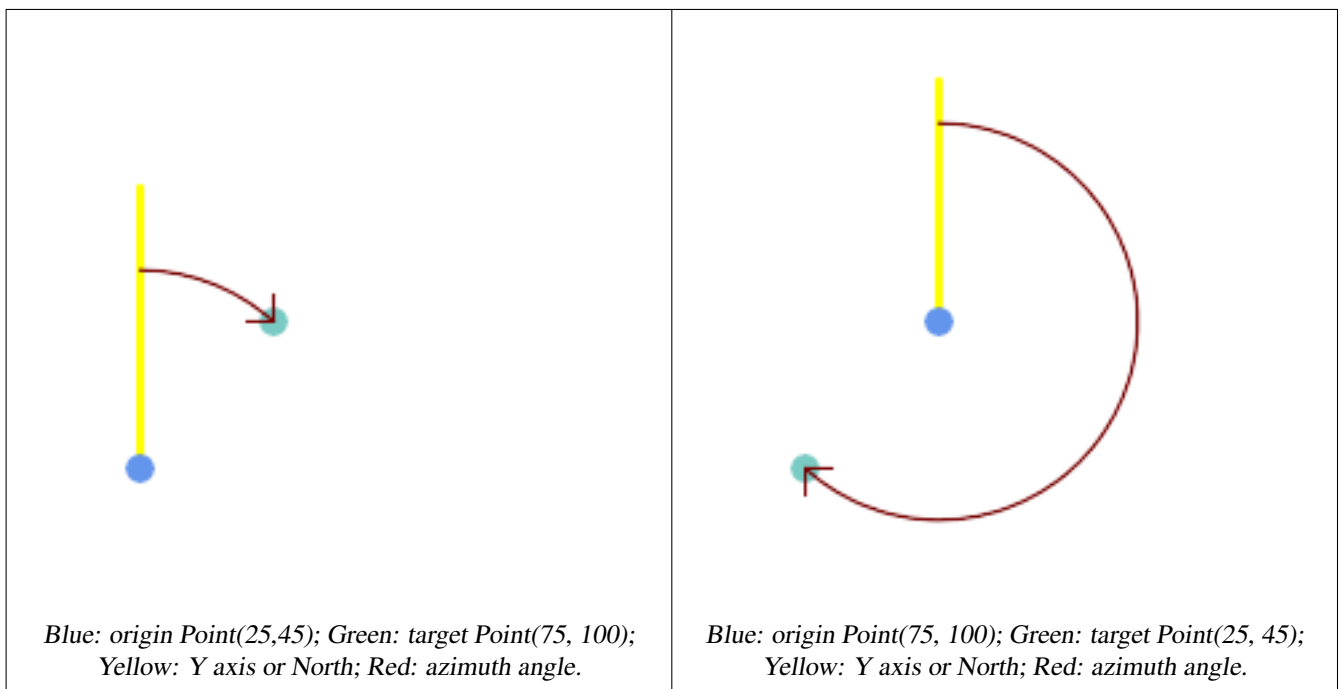
Enhanced: 2.2.0 measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires PROJ >= 4.9.0 to take advantage of the new feature.

Ejemplos

Geometry Azimuth in degrees

```
SELECT degrees(ST_Azimuth( ST_Point(25, 45), ST_Point(75, 100))) AS degA_B,  
       degrees(ST_Azimuth( ST_Point(75, 100), ST_Point(25, 45) )) AS degB_A;
```

dega_b	degb_a
42.2736890060937	222.273689006094



Ver también

[ST_Angle](#), [ST_Point](#), [ST_Translate](#), [ST_Project](#), [PostgreSQL Math Functions](#)

8.12.3 ST_Angle

ST_Angle — Returns the angle between two vectors defined by 3 or 4 points, or 2 lines.

Synopsis

```
float ST_Angle(geometry point1, geometry point2, geometry point3, geometry point4);
float ST_Angle(geometry line1, geometry line2);
```

Descripción

Computes the clockwise angle between two vectors.

Variant 1: computes the angle enclosed by the points P1-P2-P3. If a 4th point provided computes the angle points P1-P2 and P3-P4

Variant 2: computes the angle between two vectors S1-E1 and S2-E2, defined by the start and end points of the input lines

The result is a positive angle between 0 and 2π radians. The radian result can be converted to degrees using the PostgreSQL function `degrees()`.

Note that `ST_Angle(P1,P2,P3) = ST_Angle(P2,P1,P2,P3)`.

Availability: 2.5.0

Ejemplos

Angle between three points

```
SELECT degrees( ST_Angle('POINT(0 0)', 'POINT(10 10)', 'POINT(20 0)') );
```

degrees
270

Angle between vectors defined by four points

```
SELECT degrees( ST_Angle('POINT (10 10)', 'POINT (0 0)', 'POINT(90 90)', 'POINT (100 80)') ←
);
```

degrees
269.99999999999999

Angle between vectors defined by the start and end points of lines

```
SELECT degrees( ST_Angle('LINESTRING(0 0, 0.3 0.7, 1 1)', 'LINESTRING(0 0, 0.2 0.5, 1 0)') ←
);
```

degrees
45

Ver también

[ST_Azimuth](#)

8.12.4 ST_ClosestPoint

ST_ClosestPoint — Returns the 2D point on `g1` that is closest to `g2`. This is the first point of the shortest line from one geometry to the other.

Synopsis

geometry **ST_ClosestPoint**(geometry geom1, geometry geom2);

Descripción

Returns the 2-dimensional point on `geom1` that is closest to `geom2`. This is the first point of the shortest line between the geometries (as computed by [ST_ShortestLine](#)).

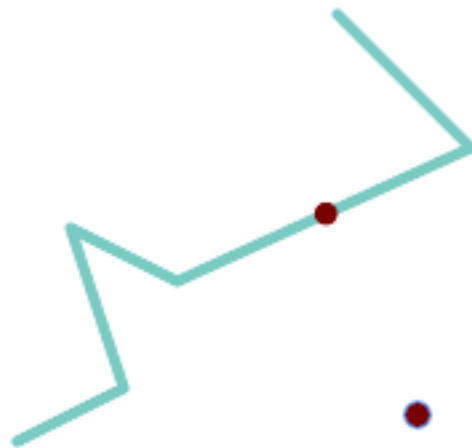


Note

If you have a 3D Geometry, you may prefer to use [ST_3DClosestPoint](#).

Disponibilidad: 1.5.0

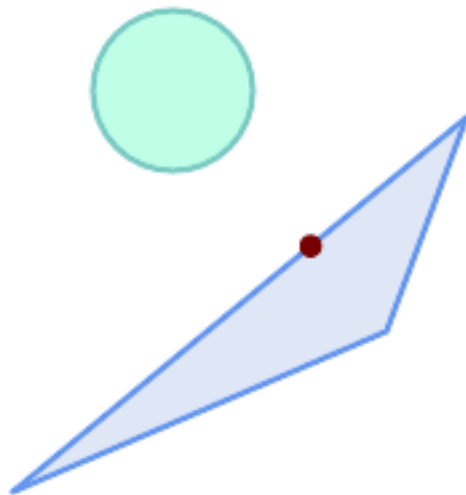
Ejemplos



The closest point for a Point and a LineString is the point itself. The closest point for a LineString and a Point is a point on the line.

```
SELECT ST_AsText( ST_ClosestPoint(pt,line)) AS cp_pt_line,
       ST_AsText( ST_ClosestPoint(line,pt)) AS cp_line_pt
FROM (SELECT 'POINT (160 40)::geometry AS pt,
            'LINESTRING (10 30, 50 50, 30 110, 70 90, 180 140, 130 190)::geometry AS line ) AS t;
```

cp_pt_line	cp_line_pt
POINT(160 40)	POINT(125.75342465753425 115.34246575342466)



The closest point on polygon A to polygon B

```
SELECT ST_AsText( ST_ClosestPoint(
    'POLYGON ((190 150, 20 10, 160 70, 190 150))',
    ST_Buffer('POINT(80 160)', 30) )) As ptwkt;
```

POINT(131.59149149528952 101.89887534906197)
--

Ver también

[ST_3DClosestPoint](#), [ST_Distance](#), [ST_LongestLine](#), [ST_ShortestLine](#), [ST_MaxDistance](#)

8.12.5 ST_3DClosestPoint

ST_3DClosestPoint — Returns the 3D point on g1 that is closest to g2. This is the first point of the 3D shortest line.

Synopsis

geometry **ST_3DClosestPoint**(geometry g1, geometry g2);

Descripción

Returns the 3-dimensional point on g1 that is closest to g2. This is the first point of the 3D shortest line. The 3D length of the 3D shortest line is the 3D distance.

- ✔ This function supports 3d and will not drop the z-index.
- ✔ This function supports Polyhedral surfaces.

Disponibilidad: 2.0.0

Changed: 2.2.0 - if 2 2D geometries are input, a 2D point is returned (instead of old behavior assuming 0 for missing Z). In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.

Ejemplos

```
linestring and point -- both 3d and 2d closest point

SELECT ST_AsEWKT(ST_3DClosestPoint(line,pt)) AS cp3d_line_pt,
       ST_AsEWKT(ST_ClosestPoint(line,pt)) As cp2d_line_pt
FROM (SELECT 'POINT(100 100 30)::geometry As pt,
            'LINESTRING (20 80 20, 98 190 1, 110 180 3, 50 75 1000)':':: ←
      geometry As line
      ) As foo;

cp3d_line_pt | cp2d_line_pt
-----+-----
POINT(54.6993798867619 128.935022917228 11.5475869506606) | POINT(73.0769230769231 115.384615384615)

linestring and multipoint -- both 3d and 2d closest point

SELECT ST_AsEWKT(ST_3DClosestPoint(line,pt)) AS cp3d_line_pt,
       ST_AsEWKT(ST_ClosestPoint(line,pt)) As cp2d_line_pt
FROM (SELECT 'MULTIPOINT(100 100 30, 50 74 1000)':'::geometry As pt,
            'LINESTRING (20 80 20, 98 190 1, 110 180 3, 50 75 900)':':: ←
      geometry As line
      ) As foo;

cp3d_line_pt | cp2d_line_pt
-----+-----
POINT(54.6993798867619 128.935022917228 11.5475869506606) | POINT(50 75)
```

Multilinestring and polygon both 3d and 2d closest point

```

SELECT ST_AsEWKT(ST_3DClosestPoint(poly, mline)) As cp3d,
       ST_AsEWKT(ST_ClosestPoint(poly, mline)) As cp2d
FROM (SELECT ST_GeomFromEWKT('POLYGON((175 150 5, 20 40 5, 35 45 5, 50 60 5,
100 100 5, 175 150 5))') As poly,
      ST_GeomFromEWKT('MULTILINESTRING((175 155 2, 20 40 20, 50 60 -2, 125
100 1, 175 155 1),
      (1 10 2, 5 20 1))') As mline ) As foo;
      cp3d                                |      cp2d
-----+-----
POINT(39.993580415989 54.1889925532825 5) | POINT(20 40)

```

Ver también

[ST_AsEWKT](#), [ST_ClosestPoint](#), [ST_3DDistance](#), [ST_3DShortestLine](#)

8.12.6 ST_Distance

ST_Distance — Returns the distance between two geometry or geography values.

Synopsis

```

float ST_Distance(geometry g1, geometry g2);
float ST_Distance(geography geog1, geography geog2, boolean use_spheroid=true);

```

Descripción

For **geometry** types returns the minimum 2D Cartesian (planar) distance between two geometries, in projected units (spatial ref units).

For **geography** types defaults to return the minimum geodesic distance between two geographies in meters, compute on the spheroid determined by the SRID. If `use_spheroid` is false, a faster spherical calculation is used.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).



This method implements the SQL/MM specification. SQL-MM 3: 5.1.23



This method supports Circular Strings and Curves

Availability: 1.5.0 geography support was introduced in 1.5. Speed improvements for planar to better handle large or many vertex geometries

Enhanced: 2.1.0 improved speed for geography. See [Making Geography faster](#) for details.

Enhanced: 2.1.0 - support for curved geometries was introduced.

Enhanced: 2.2.0 - measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires PROJ >= 4.9.0 to take advantage of the new feature.

Changed: 3.0.0 - does not depend on SFCGAL anymore.

Geometry Examples

Geometry example - units in planar degrees 4326 is WGS 84 long lat, units are degrees.

```
SELECT ST_Distance(
  'SRID=4326;POINT(-72.1235 42.3521)::geometry',
  'SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)::geometry ');
-----
0.00150567726382282
```

Geometry example - units in meters (SRID: 3857, proportional to pixels on popular web maps). Although the value is off, nearby ones can be compared correctly, which makes it a good choice for algorithms like KNN or KMeans.

```
SELECT ST_Distance(
  ST_Transform('SRID=4326;POINT(-72.1235 42.3521)::geometry', 3857),
  ST_Transform('SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)::geometry', 3857) ) ←
  ;
-----
167.441410065196
```

Geometry example - units in meters (SRID: 3857 as above, but corrected by cos(lat) to account for distortion)

```
SELECT ST_Distance(
  ST_Transform('SRID=4326;POINT(-72.1235 42.3521)::geometry', 3857),
  ST_Transform('SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)::geometry', 3857)
    ) * cosd(42.3521);
-----
123.742351254151
```

Geometry example - units in meters (SRID: 26986 Massachusetts state plane meters) (most accurate for Massachusetts)

```
SELECT ST_Distance(
  ST_Transform('SRID=4326;POINT(-72.1235 42.3521)::geometry', 26986),
  ST_Transform('SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)::geometry', 26986) ) ←
  ;
-----
123.797937878454
```

Geometry example - units in meters (SRID: 2163 US National Atlas Equal area) (least accurate)

```
SELECT ST_Distance(
  ST_Transform('SRID=4326;POINT(-72.1235 42.3521)::geometry', 2163),
  ST_Transform('SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)::geometry', 2163) ) ←
  ;
-----
126.664256056812
```

Geography Examples

Same as geometry example but note units in meters - use sphere for slightly faster and less accurate computation.

```
SELECT ST_Distance(gg1, gg2) As spheroid_dist, ST_Distance(gg1, gg2, false) As sphere_dist
FROM (SELECT
  'SRID=4326;POINT(-72.1235 42.3521)::geography as gg1,
  'SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)::geography as gg2
    ) As foo ;

spheroid_dist | sphere_dist
-----+-----
123.802076746848 | 123.475736916397
```


Ver también

[ST_3DDistance](#), [ST_DWithin](#), [ST_DistanceSphere](#), [ST_DistanceSpheroid](#), [ST_MaxDistance](#), [ST_HausdorffDistance](#), [ST_FrechetDistance](#), [ST_Transform](#)

8.12.7 ST_3DDistance




ST_3DDistance — Returns the 3D cartesian minimum distance (based on spatial ref) between two geometries in projected units.

Synopsis

float ST_3DDistance(geometry g1, geometry g2);

Descripción

Returns the 3-dimensional minimum cartesian distance between two geometries in projected units (spatial ref units).

-  This function supports 3d and will not drop the z-index.
-  This function supports Polyhedral surfaces.
-  This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3

Disponibilidad: 2.0.0

Changed: 2.2.0 - In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.

Changed: 3.0.0 - SFCGAL version removed

Ejemplos

```
-- Geometry example - units in meters (SRID: 2163 US National Atlas Equal area) (3D point and line compared 2D point and line)
-- Note: currently no vertical datum support so Z is not transformed and assumed to be same units as final.
SELECT ST_3DDistance(
    ST_Transform('SRID=4326;POINT(-72.1235 42.3521 4) '::geometry,2163),
    ST_Transform('SRID=4326;LINESTRING(-72.1260 42.45 15, -72.123 42.1546 20) '::geometry,2163)
) As dist_3d,
ST_Distance(
    ST_Transform('SRID=4326;POINT(-72.1235 42.3521) '::geometry,2163),
    ST_Transform('SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546) '::geometry,2163)
) As dist_2d;

dist_3d      |      dist_2d
-----+-----
127.295059324629 | 126.66425605671

-- Multilinestring and polygon both 3d and 2d distance
-- Same example as 3D closest point example
SELECT ST_3DDistance(poly, mline) As dist3d,
    ST_Distance(poly, mline) As dist2d
    FROM (SELECT 'POLYGON((175 150 5, 20 40 5, 35 45 5, 50 60 5, 100 100 5, 175 150 5) )'::geometry as poly,
```

```
'MULTILINESTRING((175 155 2, 20 40 20, 50 60 -2, 125 100 1, 175 155 1), (1 10 2, 5 20 1))'::geometry as mline) as foo;
dist3d      | dist2d
-----+-----
0.716635696066337 | 0
```

Ver también

[ST_Distance](#), [ST_3DClosestPoint](#), [ST_3DDWithin](#), [ST_3DMaxDistance](#), [ST_3DShortestLine](#), [ST_Transform](#)

8.12.8 ST_DistanceSphere

ST_DistanceSphere — Returns minimum distance in meters between two lon/lat geometries using a spherical earth model.

Synopsis

float ST_DistanceSphere(geometry geom1lonlatA, geometry geom1lonlatB, float8 radius=6371008);

Descripción

Returns minimum distance in meters between two lon/lat points. Uses a spherical earth and radius derived from the spheroid defined by the SRID. Faster than [ST_DistanceSpheroid](#), but less accurate. PostGIS Versions prior to 1.5 only implemented for points.

Availability: 1.5 - support for other geometry types besides points was introduced. Prior versions only work with points.

Changed: 2.2.0 In prior versions this used to be called ST_Distance_Sphere

Ejemplos

```
SELECT round(CAST(ST_DistanceSphere(ST_Centroid(geom), ST_GeomFromText('POINT(-118 38)', 4326)) As numeric), 2) As dist_meters,
round(CAST(ST_Distance(ST_Transform(ST_Centroid(geom), 32611),
ST_Transform(ST_GeomFromText('POINT(-118 38)', 4326), 32611)) As numeric), 2) As dist_utm11_meters,
round(CAST(ST_Distance(ST_Centroid(geom), ST_GeomFromText('POINT(-118 38)', 4326)) As numeric), 5) As dist_degrees,
round(CAST(ST_Distance(ST_Transform(geom, 32611),
ST_Transform(ST_GeomFromText('POINT(-118 38)', 4326), 32611)) As numeric), 2) As min_dist_line_point_meters
FROM
(SELECT ST_GeomFromText('LINESTRING(-118.584 38.374,-118.583 38.5)', 4326) As geom)
as foo;
dist_meters | dist_utm11_meters | dist_degrees | min_dist_line_point_meters
-----+-----+-----+-----
70424.47 | 70438.00 | 0.72900 | 65871.18
```

Ver también

[ST_Distance](#), [ST_DistanceSpheroid](#)

8.12.9 ST_DistanceSpheroid

ST_DistanceSpheroid — Returns the minimum distance between two lon/lat geometries using a spheroidal earth model.

Synopsis

float **ST_DistanceSpheroid**(geometry geomlonlatA, geometry geomlonlatB, spheroid measurement_spheroid=WGS84);

Descripción

Returns minimum distance in meters between two lon/lat geometries given a particular spheroid. See the explanation of spheroids given for [ST_LengthSpheroid](#).



Note

This function does not look at the SRID of the geometry. It assumes the geometry coordinates are based on the provided spheroid.

Availability: 1.5 - support for other geometry types besides points was introduced. Prior versions only work with points.

Changed: 2.2.0 In prior versions this was called ST_Distance_Spheroid

Ejemplos

```
SELECT round(CAST(
    ST_DistanceSpheroid(ST_Centroid(geom), ST_GeomFromText('POINT(-118 38) ↵
    ',4326), 'SPHEROID["WGS 84",6378137,298.257223563]')
    As numeric),2) As dist_meters_spheroid,
    round(CAST(ST_DistanceSphere(ST_Centroid(geom), ST_GeomFromText('POINT(-118 ↵
    38)',4326)) As numeric),2) As dist_meters_sphere,
round(CAST(ST_Distance(ST_Transform(ST_Centroid(geom),32611),
    ST_Transform(ST_GeomFromText('POINT(-118 38)', 4326),32611)) As numeric),2) ↵
    As dist_utm11_meters
FROM
    (SELECT ST_GeomFromText('LINESTRING(-118.584 38.374,-118.583 38.5)', 4326) As geom) ↵
    as foo;
dist_meters_spheroid | dist_meters_sphere | dist_utm11_meters
-----+-----+-----
70454.92 | 70424.47 | 70438.00
```

Ver también

[ST_Distance](#), [ST_DistanceSphere](#)

8.12.10 ST_FrechetDistance

ST_FrechetDistance — Returns the Fréchet distance between two geometries.

Synopsis

float **ST_FrechetDistance**(geometry g1, geometry g2, float densifyFrac = -1);

Descripción

Implements algorithm for computing the Fréchet distance restricted to discrete points for both geometries, based on [Computing Discrete Fréchet Distance](#). The Fréchet distance is a measure of similarity between curves that takes into account the location and ordering of the points along the curves. Therefore it is often better than the Hausdorff distance.

When the optional densifyFrac is specified, this function performs a segment densification before computing the discrete Fréchet distance. The densifyFrac parameter sets the fraction by which to densify each segment. Each segment will be split into a number of equal-length subsegments, whose fraction of the total length is closest to the given fraction.

Units are in the units of the spatial reference system of the geometries.



Note

The current implementation supports only vertices as the discrete locations. This could be extended to allow an arbitrary density of points to be used.



Note

The smaller densifyFrac we specify, the more accurate Fréchet distance we get. But, the computation time and the memory usage increase with the square of the number of subsegments.

Realizado por el módulo de GEOS

Availability: 2.4.0 - requires GEOS >= 3.7.0

Ejemplos

```
postgres=# SELECT st_frechetdistance('LINESTRING (0 0, 100 0)::geometry, 'LINESTRING (0 0, ↵
50 50, 100 0)::geometry');
st_frechetdistance
-----
70.7106781186548
(1 row)
```

```
SELECT st_frechetdistance('LINESTRING (0 0, 100 0)::geometry, 'LINESTRING (0 0, 50 50, 100 ↵
0)::geometry, 0.5);
st_frechetdistance
-----
50
(1 row)
```

Ver también

[ST_HausdorffDistance](#)

8.12.11 ST_HausdorffDistance

ST_HausdorffDistance — Returns the Hausdorff distance between two geometries.

Synopsis

```
float ST_HausdorffDistance(geometry g1, geometry g2);
float ST_HausdorffDistance(geometry g1, geometry g2, float densifyFrac);
```

Descripción

Returns the **Hausdorff distance** between two geometries. The Hausdorff distance is a measure of how similar or dissimilar 2 geometries are.

The function actually computes the "Discrete Hausdorff Distance". This is the Hausdorff distance computed at discrete points on the geometries. The *densifyFrac* parameter can be specified, to provide a more accurate answer by densifying segments before computing the discrete Hausdorff distance. Each segment is split into a number of equal-length subsegments whose fraction of the segment length is closest to the given fraction.

Units are in the units of the spatial reference system of the geometries.



Note This algorithm is NOT equivalent to the standard Hausdorff distance. However, it computes an approximation that is correct for a large subset of useful cases. One important case is Linestrings that are roughly parallel to each other, and roughly equal in length. This is a useful metric for line matching.

Disponibilidad: 1.5.0

Ejemplos



Hausdorff distance (red) and distance (yellow) between two lines

```
SELECT ST_HausdorffDistance(geomA, geomB),
       ST_Distance(geomA, geomB)
FROM (SELECT 'LINESTRING (20 70, 70 60, 110 70, 170 70)::geometry AS geomA,
            'LINESTRING (20 90, 130 90, 60 100, 190 100)::geometry AS geomB) AS t;
st_hausdorffdistance | st_distance
-----+-----
37.26206567625497 | 20
```

Example: Hausdorff distance with densification.

```
SELECT ST_HausdorffDistance(
    'LINESTRING (130 0, 0 0, 0 150)::geometry',
    'LINESTRING (10 10, 10 150, 130 10)::geometry',
    0.5);
-----
70
```

Example: For each building, find the parcel that best represents it. First we require that the parcel intersect with the building geometry. `DISTINCT ON` guarantees we get each building listed only once. `ORDER BY .. ST_HausdorffDistance` selects the parcel that is most similar to the building.

```
SELECT DISTINCT ON (buildings.gid) buildings.gid, parcels.parcel_id
FROM buildings
  INNER JOIN parcels
    ON ST_Intersects(buildings.geom, parcels.geom)
ORDER BY buildings.gid, ST_HausdorffDistance(buildings.geom, parcels.geom);
```

Ver también

[ST_FrechetDistance](#)

8.12.12 ST_Length

`ST_Length` — Returns the 2D length of a linear geometry.

Synopsis

```
float ST_Length(geometry a_2dlinestring);
float ST_Length(geography geog, boolean use_spheroid=true);
```

Descripción

For geometry types: returns the 2D Cartesian length of the geometry if it is a `LineString`, `MultiLineString`, `ST_Curve`, `ST_MultiCurve`. For areal geometries 0 is returned; use [ST_Perimeter](#) instead. The units of length is determined by the spatial reference system of the geometry.

For geography types: computation is performed using the inverse geodesic calculation. Units of length are in meters. If PostGIS is compiled with PROJ version 4.8.0 or later, the spheroid is specified by the SRID, otherwise it is exclusive to WGS84. If `use_spheroid=false`, then the calculation is based on a sphere instead of a spheroid.

Currently for geometry this is an alias for `ST_Length2D`, but this may change to support higher dimensions.



Warning

Changed: 2.0.0 Breaking change -- in prior versions applying this to a `MULTI/POLYGON` of type geography would give you the perimeter of the `POLYGON/MULTIPOLYGON`. In 2.0.0 this was changed to return 0 to be in line with geometry behavior. Please use `ST_Perimeter` if you want the perimeter of a polygon



Note

For geography the calculation defaults to using a spheroidal model. To use the faster but less accurate spherical calculation use `ST_Length(gg,false)`;



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.5.1



This method implements the SQL/MM specification. SQL-MM 3: 7.1.2, 9.3.4

Availability: 1.5.0 geography support was introduced in 1.5.



This method is also provided by SFCGAL backend.

Geometry Examples

Return length in feet for line string. Note this is in feet because EPSG:2249 is Massachusetts State Plane Feet

```
SELECT ST_Length(ST_GeomFromText('LINESTRING(743238 2967416,743238 2967450,743265 2967450,
743265.625 2967416,743238 2967416)',2249));

st_length
-----
122.630744000095

--Transforming WGS 84 LineString to Massachusetts state plane meters
SELECT ST_Length(
    ST_Transform(
        ST_GeomFromEWKT('SRID=4326;LINESTRING(-72.1260 42.45, -72.1240 42.45666, ↵
        -72.123 42.1546)'),
        26986
    )
);

st_length
-----
34309.4563576191
```

Geography Examples

Return length of WGS 84 geography line

```
-- the default calculation uses a spheroid
SELECT ST_Length(the_geog) As length_spheroid, ST_Length(the_geog,false) As length_sphere
FROM (SELECT ST_GeographyFromText(
'SRID=4326;LINESTRING(-72.1260 42.45, -72.1240 42.45666, -72.123 42.1546)') As the_geog)
As foo;

length_spheroid | length_sphere
-----+-----
34310.5703627288 | 34346.2060960742
```

Ver también

[ST_GeographyFromText](#), [ST_GeomFromEWKT](#), [ST_LengthSpheroid](#), [ST_Perimeter](#), [ST_Transform](#)

8.12.13 ST_Length2D

ST_Length2D — Returns the 2D length of a linear geometry. Alias for `ST_Length`

Synopsis

```
float ST_Length2D(geometry a_2dlinestring);
```

Descripción

Returns the 2D length of the geometry if it is a linestring or multi-linestring. This is an alias for `ST_Length`

Ver también

[ST_Length](#), [ST_3DLength](#)

8.12.14 ST_3DLength

ST_3DLength — Returns the 3D length of a linear geometry.

Synopsis

```
float ST_3DLength(geometry a_3dlinestring);
```

Descripción

Returns the 3-dimensional or 2-dimensional length of the geometry if it is a LineString or MultiLineString. For 2-d lines it will just return the 2-d length (same as ST_Length and ST_Length2D)



This function supports 3d and will not drop the z-index.



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 7.1, 10.3

Changed: 2.0.0 In prior versions this used to be called ST_Length3D

Ejemplos

Return length in feet for a 3D cable. Note this is in feet because EPSG:2249 is Massachusetts State Plane Feet

```
SELECT ST_3DLength(ST_GeomFromText('LINESTRING(743238 2967416 1,743238 2967450 1,743265
2967450 3,
743265.625 2967416 3,743238 2967416 3)',2249));
ST_3DLength
-----
122.704716741457
```

Ver también

[ST_Length](#), [ST_Length2D](#)

8.12.15 ST_LengthSpheroid

ST_LengthSpheroid — Returns the 2D or 3D length/perimeter of a lon/lat geometry on a spheroid.

Synopsis

```
float ST_LengthSpheroid(geometry a_geometry, spheroid a_spheroid);
```


Descripción

Calculates the length or perimeter of a geometry on an ellipsoid. This is useful if the coordinates of the geometry are in longitude/latitude and a length is desired without reprojection. The spheroid is specified by a text value as follows:

SPHEROID [<NAME>, <SEMI-MAJOR AXIS>, <INVERSE FLATTENING>]

Ejemplos

```
SPHEROID ["GRS_1980", 6378137, 298.257222101]
```

Disponibilidad: 1.2.2

Changed: 2.2.0 In prior versions this was called ST_Length_Spheroid and had the alias ST_3DLength_Spheroid



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_LengthSpheroid( geometry_column,
                          'SPHEROID["GRS_1980",6378137,298.257222101]' )
FROM geometry_table;

SELECT ST_LengthSpheroid( geom, sph_m ) As tot_len,
ST_LengthSpheroid(ST_GeometryN(geom,1), sph_m) As len_line1,
ST_LengthSpheroid(ST_GeometryN(geom,2), sph_m) As len_line2
FROM (SELECT ST_GeomFromText('MULTILINESTRING((-118.584 38.374,-118.583 38.5),
(-71.05957 42.3589 , -71.061 43))') As geom,
CAST('SPHEROID["GRS_1980",6378137,298.257222101]' As spheroid) As sph_m) as foo;
-----+-----+-----
tot_len      | len_line1    | len_line2
-----+-----+-----
85204.5207562955 | 13986.8725229309 | 71217.6482333646

--3D
SELECT ST_LengthSpheroid( geom, sph_m ) As tot_len,
ST_LengthSpheroid(ST_GeometryN(geom,1), sph_m) As len_line1,
ST_LengthSpheroid(ST_GeometryN(geom,2), sph_m) As len_line2
FROM (SELECT ST_GeomFromEWKT('MULTILINESTRING((-118.584 38.374 20,-118.583 38.5 30),
(-71.05957 42.3589 75, -71.061 43 90))') As geom,
CAST('SPHEROID["GRS_1980",6378137,298.257222101]' As spheroid) As sph_m) as foo;
-----+-----+-----
tot_len      | len_line1    | len_line2
-----+-----+-----
85204.5259107402 | 13986.876097711 | 71217.6498130292
```

Ver también

[ST_GeometryN](#), [ST_Length](#)

8.12.16 ST_LongestLine

ST_LongestLine — Returns the 2D longest line between two geometries.

Synopsis

geometry **ST_LongestLine**(geometry g1, geometry g2);

Descripción

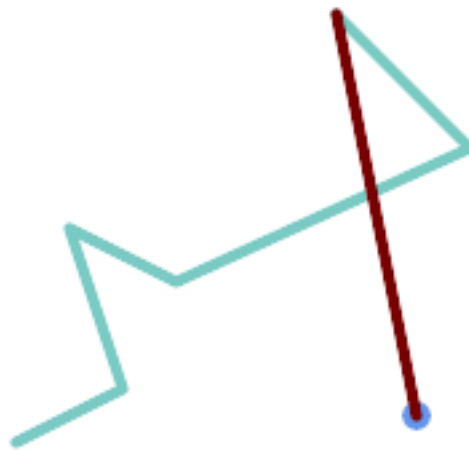
Returns the 2-dimensional longest line between the points of two geometries. The line returned starts on g1 and ends on g2.

The longest line always occurs between two vertices. The function returns the first longest line if more than one is found. The length of the line is equal to the distance returned by **ST_MaxDistance**.

If g1 and g2 are the same geometry, returns the line between the two vertices farthest apart in the geometry. This is a diameter of the circle computed by **ST_MinimumBoundingCircle**

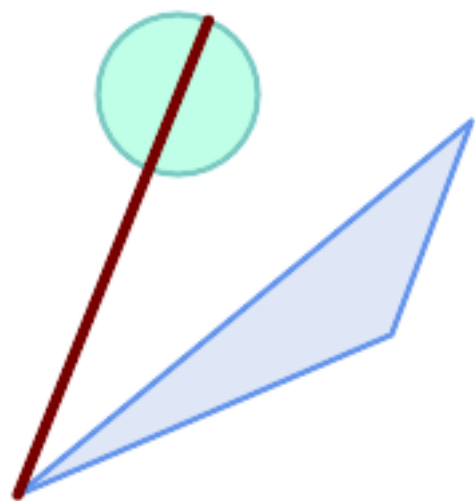
Disponibilidad: 1.5.0

Ejemplos



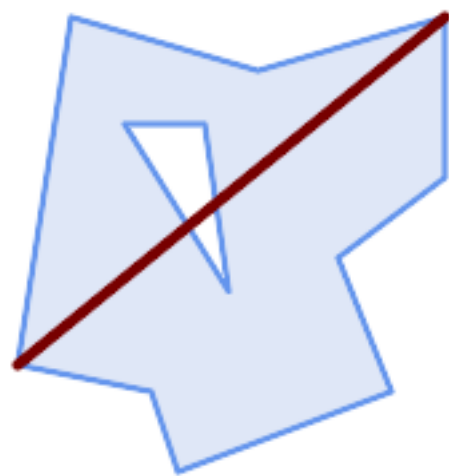
Longest line between a point and a line

```
SELECT ST_AsText( ST_LongestLine(
    'POINT (160 40)',
    'LINESTRING (10 30, 50 50, 30 110, 70 90, 180 140, 130 190)' )
) AS lline;
-----
LINESTRING(160 40,130 190)
```



Longest line between two polygons

```
SELECT ST_AsText( ST_LongestLine(
    'POLYGON ((190 150, 20 10, 160 70, 190 150))',
    ST_Buffer('POINT(80 160)', 30)
    ) ) AS llinewkt;
-----
LINESTRING(20 10,105.3073372946034 186.95518130045156)
```



Longest line across a single geometry. The length of the line is equal to the Maximum Distance. The line is a diameter of the Minimum Bounding Circle.

```
SELECT ST_AsText( ST_LongestLine( geom, geom)) AS llinewkt,
       ST_MaxDistance( geom, geom) AS max_dist,
       ST_Length( ST_LongestLine(geom, geom)) AS lenll
FROM (SELECT 'POLYGON ((40 180, 110 160, 180 180, 180 120, 140 90, 160 40, 80 10, 70 40, 20 50, 40 180),
       (60 140, 99 77.5, 90 140, 60 140))'::geometry AS geom) AS t;

-----
llinewkt | max_dist | lenll
-----+-----+-----
LINESTRING(20 50,180 180) | 206.15528128088303 | 206.15528128088303
```

Ver también

[ST_MaxDistance](#), [ST_ShortestLine](#), [ST_3DLongestLine](#), [ST_MinimumBoundingCircle](#)

8.12.17 ST_3DLongestLine

ST_3DLongestLine — Returns the 3D longest line between two geometries

Synopsis

geometry **ST_3DLongestLine**(geometry g1, geometry g2);

Descripción

Returns the 3-dimensional longest line between two geometries. The function returns the first longest line if more than one. The line returned starts in g1 and ends in g2. The 3D length of the line is equal to the distance returned by [ST_3DMaxDistance](#).

Disponibilidad: 2.0.0

Changed: 2.2.0 - if 2 2D geometries are input, a 2D point is returned (instead of old behavior assuming 0 for missing Z). In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Ejemplos

linestring and point -- both 3d and 2d longest line

```
SELECT ST_AsEWKT(ST_3DLongestLine(line,pt)) AS lol3d_line_pt,
       ST_AsEWKT(ST_LongestLine(line,pt)) As lol2d_line_pt
FROM (SELECT 'POINT(100 100 30)'::geometry As pt,
            'LINESTRING (20 80 20, 98 190 1, 110 180 3, 50 75 1000)'::
            geometry As line
      ) As foo;
```

lol3d_line_pt		lol2d_line_pt
-----+-----		
LINESTRING(50 75 1000,100 100 30)		LINESTRING(98 190,100 100)

linestring and multipoint -- both 3d and 2d longest line

```
SELECT ST_AsEWKT(ST_3DLongestLine(line,pt)) AS lol3d_line_pt,
       ST_AsEWKT(ST_LongestLine(line,pt)) As lol2d_line_pt
FROM (SELECT 'MULTIPOINT(100 100 30, 50 74 1000)'::geometry As pt,
            'LINESTRING (20 80 20, 98 190 1, 110 180 3, 50 75 900)'::
            geometry As line
      ) As foo;
```

lol3d_line_pt		lol2d_line_pt
-----+-----		
LINESTRING(98 190 1,50 74 1000)		LINESTRING(98 190,50 74)

MultiLineString and Polygon both 3d and 2d longest line

```

SELECT ST_AsEWKT(ST_3DLongestLine(poly, mline)) As lol3d,
       ST_AsEWKT(ST_LongestLine(poly, mline)) As lol2d
  FROM (SELECT ST_GeomFromEWKT('POLYGON((175 150 5, 20 40 5, 35 45 5, 50 60 5, ↵
        100 100 5, 175 150 5))') As poly,
        ST_GeomFromEWKT('MULTILINESTRING((175 155 2, 20 40 20, 50 60 -2, 125 ↵
        100 1, 175 155 1),
        (1 10 2, 5 20 1))') As mline ) As foo;
       lol3d          |          lol2d
-----+-----
LINESTRING(175 150 5,1 10 2) | LINESTRING(175 150,1 10)

```

Ver también

[ST_3DClosestPoint](#), [ST_3DDistance](#), [ST_LongestLine](#), [ST_3DShortestLine](#), [ST_3DMaxDistance](#)

8.12.18 ST_MaxDistance

ST_MaxDistance — Returns the 2D largest distance between two geometries in projected units.

Synopsis

float **ST_MaxDistance**(geometry g1, geometry g2);

Descripción

Returns the 2-dimensional maximum distance between two geometries, in projected units. The maximum distance always occurs between two vertices. This is the length of the line returned by [ST_LongestLine](#).

If g1 and g2 are the same geometry, returns the distance between the two vertices farthest apart in that geometry.

Disponibilidad: 1.5.0

Ejemplos

Maximum distance between a point and lines.

```

SELECT ST_MaxDistance('POINT(0 0)::geometry, 'LINESTRING ( 2 0, 0 2 ) '::geometry);
-----
2

SELECT ST_MaxDistance('POINT(0 0)::geometry, 'LINESTRING ( 2 2, 2 2 ) '::geometry);
-----
2.82842712474619

```

Maximum distance between vertices of a single geometry.

```

SELECT ST_MaxDistance('POLYGON ((10 10, 10 0, 0 0, 10 10)) '::geometry,
        'POLYGON ((10 10, 10 0, 0 0, 10 10)) '::geometry);
-----
14.142135623730951

```

Ver también

[ST_Distance](#), [ST_LongestLine](#), [ST_DFullyWithin](#)

8.12.19 ST_3DMaxDistance

ST_3DMaxDistance — Returns the 3D cartesian maximum distance (based on spatial ref) between two geometries in projected units.

Synopsis

```
float ST_3DMaxDistance(geometry g1, geometry g2);
```

Descripción

Returns the 3-dimensional maximum cartesian distance between two geometries in projected units (spatial ref units).



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Disponibilidad: 2.0.0

Changed: 2.2.0 - In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.

Ejemplos

```
-- Geometry example - units in meters (SRID: 2163 US National Atlas Equal area) (3D point ↔
  and line compared 2D point and line)
-- Note: currently no vertical datum support so Z is not transformed and assumed to be same ↔
  units as final.
SELECT ST_3DMaxDistance(
    ST_Transform(ST_GeomFromEWKT('SRID=4326;POINT(-72.1235 42.3521 10000)'),2163),
    ST_Transform(ST_GeomFromEWKT('SRID=4326;LINESTRING(-72.1260 42.45 15, -72.123 42.1546 20)'),2163)
) As dist_3d,
ST_MaxDistance(
    ST_Transform(ST_GeomFromEWKT('SRID=4326;POINT(-72.1235 42.3521 10000)'),2163),
    ST_Transform(ST_GeomFromEWKT('SRID=4326;LINESTRING(-72.1260 42.45 15, -72.123 42.1546 20)'),2163)
) As dist_2d;

dist_3d      |      dist_2d
-----+-----
24383.7467488441 | 22247.8472107251
```

Ver también

[ST_Distance](#), [ST_3DDWithin](#), [ST_3DMaxDistance](#), [ST_Transform](#)

8.12.20 ST_MinimumClearance

ST_MinimumClearance — Returns the minimum clearance of a geometry, a measure of a geometry's robustness.

Synopsis

```
float ST_MinimumClearance(geometry g);
```

Descripción

It is possible for a geometry to meet the criteria for validity according to **ST_IsValid** (polygons) or **ST_IsSimple** (lines), but to become invalid if one of its vertices is moved by a small distance. This can happen due to loss of precision during conversion to text formats (such as WKT, KML, GML, GeoJSON), or binary formats that do not use double-precision floating point coordinates (e.g. MapInfo TAB).

The minimum clearance is a quantitative measure of a geometry's robustness to change in coordinate precision. It is the largest distance by which vertices of the geometry can be moved without creating an invalid geometry. Larger values of minimum clearance indicate greater robustness.

If a geometry has a minimum clearance of ϵ , then:

- No two distinct vertices in the geometry are closer than the distance ϵ .
- No vertex is closer than ϵ to a line segment of which it is not an endpoint.

If no minimum clearance exists for a geometry (e.g. a single point, or a MultiPoint whose points are identical), the return value is *Infinity*.

To avoid validity issues caused by precision loss, **ST_ReducePrecision** can reduce coordinate precision while ensuring that polygonal geometry remains valid.

Disponibilidad: 2.3.0

Ejemplos

```
SELECT ST_MinimumClearance('POLYGON ((0 0, 1 0, 1 1, 0.5 3.2e-4, 0 0))');
st_minimumclearance
-----
0.00032
```

Ver también

ST_MinimumClearanceLine, **ST_Distance**, **ST_LongestLine**, **ST_MaxDistance**

8.12.21 ST_MinimumClearanceLine

ST_MinimumClearanceLine — Returns the two-point LineString spanning a geometry's minimum clearance.

Synopsis

Geometry **ST_MinimumClearanceLine**(geometry g);

Descripción

Returns the two-point LineString spanning a geometry's minimum clearance. If the geometry does not have a minimum clearance, **LINestring EMPTY** is returned.

Realizado por el módulo de GEOS

Availability: 2.3.0 - requires GEOS >= 3.6.0

Ejemplos

```
SELECT ST_AsText(ST_MinimumClearanceLine('POLYGON ((0 0, 1 0, 1 1, 0.5 3.2e-4, 0 0))'));
-----
LINESTRING(0.5 0.00032,0.5 0)
```

Ver también

[ST_MinimumClearance](#)

8.12.22 ST_Perimeter

ST_Perimeter — Returns the length of the boundary of a polygonal geometry or geography.

Synopsis

```
float ST_Perimeter(geometry g1);
float ST_Perimeter(geography geog, boolean use_spheroid=true);
```

Descripción

Returns the 2D perimeter of the geometry/geography if it is a **ST_Surface**, **ST_MultiSurface** (**Polygon**, **MultiPolygon**). 0 is returned for non-areal geometries. For linear geometries use [ST_Length](#). For geometry types, units for perimeter measures are specified by the spatial reference system of the geometry.

For geography types, the calculations are performed using the inverse geodesic problem, where perimeter units are in meters. If PostGIS is compiled with PROJ version 4.8.0 or later, the spheroid is specified by the SRID, otherwise it is exclusive to WGS84. If `use_spheroid=false`, then calculations will approximate a sphere instead of a spheroid.

Currently this is an alias for **ST_Perimeter2D**, but this may change to support higher dimensions.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.5.1



This method implements the SQL/MM specification. SQL-MM 3: 8.1.3, 9.5.4

Availability 2.0.0: Support for geography was introduced

Ejemplos: Geometry

Return perimeter in feet for **Polygon** and **MultiPolygon**. Note this is in feet because EPSG:2249 is Massachusetts State Plane Feet

```
SELECT ST_Perimeter(ST_GeomFromText('POLYGON((743238 2967416,743238 2967450,743265 2967450,
743265.625 2967416,743238 2967416))', 2249));
st_perimeter
-----
122.630744000095
(1 row)

SELECT ST_Perimeter(ST_GeomFromText('MULTIPOLYGON(((763104.471273676 2949418.44119003,
763104.477769673 2949418.42538203,
763104.189609677 2949418.22343004,763104.471273676 2949418.44119003)),
((763104.471273676 2949418.44119003,763095.804579742 2949436.33850239,
763086.132105649 2949451.46730207,763078.452329651 2949462.11549407,
763075.354136904 2949466.17407812,763064.362142565 2949477.64291974,
763059.953961626 2949481.28983009,762994.637609571 2949532.04103014,
```



```
762990.568508415 2949535.06640477,762986.710889563 2949539.61421415,
763117.237897679 2949709.50493431,763235.236617789 2949617.95619822,
763287.718121842 2949562.20592617,763111.553321674 2949423.91664605,
763104.471273676 2949418.44119003)))', 2249));
st_perimeter
-----
      845.227713366825
(1 row)
```

Ejemplos: Geography

Return perimeter in meters and feet for Polygon and MultiPolygon. Note this is geography (WGS 84 long lat)

```
SELECT ST_Perimeter(geog) As per_meters, ST_Perimeter(geog)/0.3048 As per_ft
FROM ST_GeogFromText('POLYGON((-71.1776848522251 42.3902896512902,-71.1776843766326 ↩
      42.3903829478009,
-71.1775844305465 42.3903826677917,-71.1775825927231 42.3902893647987,-71.1776848522251 ↩
      42.3902896512902)))') As geog;

per_meters | per_ft
-----+-----
37.3790462565251 | 122.634666195949

-- MultiPolygon example --
SELECT ST_Perimeter(geog) As per_meters, ST_Perimeter(geog,false) As per_sphere_meters, ↩
      ST_Perimeter(geog)/0.3048 As per_ft
FROM ST_GeogFromText('MULTIPOLYGON((( -71.1044543107478 42.340674480411,-71.1044542869917 ↩
      42.3406744369506,
-71.1044553562977 42.340673886454,-71.1044543107478 42.340674480411))),
((-71.1044543107478 42.340674480411,-71.1044860600303 42.3407237015564,-71.1045215770124 ↩
      42.3407653385914,
-71.1045498002983 42.3407946553165,-71.1045611902745 42.3408058316308,-71.1046016507427 ↩
      42.340837442371,
-71.104617893173 42.3408475056957,-71.1048586153981 42.3409875993595,-71.1048736143677 ↩
      42.3409959528211,
-71.1048878050242 42.3410084812078,-71.1044020965803 42.3414730072048,
-71.1039672113619 42.3412202916693,-71.1037740497748 42.3410666421308,
-71.1044280218456 42.3406894151355,-71.1044543107478 42.340674480411)))') As geog;

per_meters | per_sphere_meters | per_ft
-----+-----+-----
257.634283683311 | 257.412311446337 | 845.256836231335
```

Ver también

[ST_GeogFromText](#), [ST_GeomFromText](#), [ST_Length](#)

8.12.23 ST_Perimeter2D

ST_Perimeter2D — Returns the 2D perimeter of a polygonal geometry. Alias for ST_Perimeter.

Synopsis

float ST_Perimeter2D(geometry geomA);

Descripción

Returns the 2-dimensional perimeter of a polygonal geometry.



Note
This is currently an alias for ST_Perimeter. In future versions ST_Perimeter may return the highest dimension perimeter for a geometry. This is still under consideration

Ver también

[ST_Perimeter](#)

8.12.24 ST_3DPerimeter

ST_3DPerimeter — Returns the 3D perimeter of a polygonal geometry.

Synopsis

float **ST_3DPerimeter**(geometry geomA);

Descripción

Returns the 3-dimensional perimeter of the geometry, if it is a polygon or multi-polygon. If the geometry is 2-dimensional, then the 2-dimensional perimeter is returned.



This function supports 3d and will not drop the z-index.



This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3: 8.1, 10.5

Changed: 2.0.0 In prior versions this used to be called ST_Perimeter3D

Ejemplos

Perimeter of a slightly elevated polygon in the air in Massachusetts state plane feet

```
SELECT ST_3DPerimeter(geom), ST_Perimeter2d(geom), ST_Perimeter(geom) FROM
      (SELECT ST_GeomFromEWKT('SRID=2249;POLYGON((743238 2967416 2,743238 2967450 1,
743265.625 2967416 1,743238 2967416 2))') As geom) As foo;
```

ST_3DPerimeter	st_perimeter2d	st_perimeter
105.465793597674	105.432997272188	105.432997272188

Ver también

[ST_GeomFromEWKT](#), [ST_Perimeter](#), [ST_Perimeter2D](#)

8.12.25 ST_Project

ST_Project — Returns a point projected from a start point by a distance and bearing (azimuth).

Synopsis

geography **ST_Project**(geography g1, float distance, float azimuth);

Descripción

Returns a point projected from a start point along a geodesic using a given distance and azimuth (bearing). This is known as the direct geodesic problem.

The distance is given in meters. Negative values are supported.

The azimuth (also known as heading or bearing) is given in radians. It is measured clockwise from true north (azimuth zero). East is azimuth $\pi/2$ (90 degrees); south is azimuth π (180 degrees); west is azimuth $3\pi/2$ (270 degrees). Negative azimuth values and values greater than 2π (360 degrees) are supported.

Disponibilidad: 2.0.0

Enhanced: 2.4.0 Allow negative distance and non-normalized azimuth.

Example: Projected point at 100,000 meters and bearing 45 degrees

```
SELECT ST_AsText(ST_Project('POINT(0 0)::geography', 100000, radians(45.0)));
-----
POINT(0.635231029125537 0.639472334729198)
```

Ver también

[ST_Azimuth](#), [ST_Distance](#), [PostgreSQL function radians\(\)](#)

8.12.26 ST_ShortestLine

ST_ShortestLine — Returns the 2D shortest line between two geometries

Synopsis

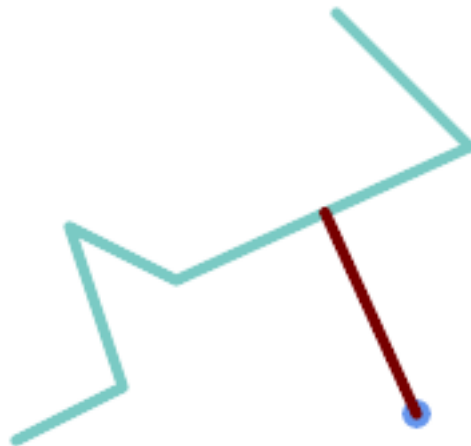
geometry **ST_ShortestLine**(geometry geom1, geometry geom2);

Descripción

Returns the 2-dimensional shortest line between two geometries. The line returned starts in `geom1` and ends in `geom2`. If `geom1` and `geom2` intersect the result is a line with start and end at an intersection point. The length of the line is the same as [ST_Distance](#) returns for `g1` and `g2`.

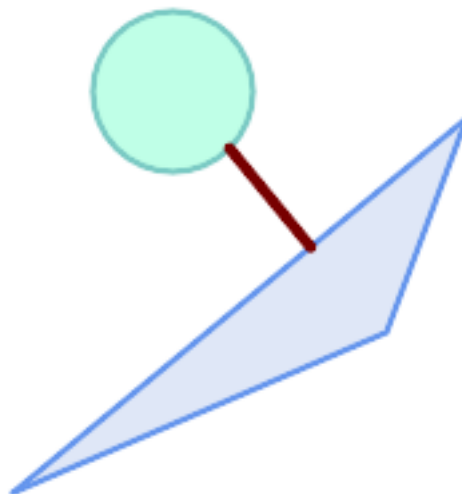
Disponibilidad: 1.5.0

Ejemplos



Shortest line between Point and LineString

```
SELECT ST_AsText( ST_ShortestLine(
    'POINT (160 40)',
    'LINESTRING (10 30, 50 50, 30 110, 70 90, 180 140, 130 190)')
) As sline;
-----
LINESTRING(160 40,125.75342465753425 115.34246575342466)
```



Shortest line between Polygons

```
SELECT ST_AsText( ST_ShortestLine(
    'POLYGON ((190 150, 20 10, 160 70, 190 150))',
    ST_Buffer('POINT(80 160)', 30)
) ) AS llinevkt;
-----
LINESTRING(131.59149149528952 101.89887534906197,101.21320343559644 138.78679656440357)
```

Ver también

[ST_ClosestPoint](#), [ST_Distance](#), [ST_LongestLine](#), [ST_MaxDistance](#)

8.12.27 ST_3DShortestLine

ST_3DShortestLine — Returns the 3D shortest line between two geometries

Synopsis

geometry **ST_3DShortestLine**(geometry g1, geometry g2);

Descripción

Returns the 3-dimensional shortest line between two geometries. The function will only return the first shortest line if more than one, that the function finds. If g1 and g2 intersects in just one point the function will return a line with both start and end in that intersection-point. If g1 and g2 are intersecting with more than one point the function will return a line with start and end in the same point but it can be any of the intersecting points. The line returned will always start in g1 and end in g2. The 3D length of the line this function returns will always be the same as [ST_3DDistance](#) returns for g1 and g2.

Disponibilidad: 2.0.0

Changed: 2.2.0 - if 2 2D geometries are input, a 2D point is returned (instead of old behavior assuming 0 for missing Z). In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

Ejemplos

linestring and point -- both 3d and 2d shortest line

```
SELECT ST_AseWKT(ST_3DShortestLine(line,pt)) AS shl3d_line_pt,
       ST_AseWKT(ST_ShortestLine(line,pt)) As shl2d_line_pt
FROM (SELECT 'POINT(100 100 30)::geometry As pt,
            'LINESTRING (20 80 20, 98 190 1, 110 180 3, 50 75 1000)::':: ↵
       geometry As line
       ) As foo;
```

shl3d_line_pt	shl2d_line_pt
LINESTRING(54.6993798867619 128.935022917228 11.5475869506606,100 100 30)	LINESTRING(73.0769230769231 115.384615384615,100 100)

linestring and multipoint -- both 3d and 2d shortest line

```
SELECT ST_AsEWKT(ST_3DShortestLine(line,pt)) AS shl3d_line_pt,
       ST_AsEWKT(ST_ShortestLine(line,pt)) As shl2d_line_pt
FROM (SELECT 'MULTIPOINT(100 100 30, 50 74 1000) '::geometry As pt,
            'LINESTRING (20 80 20, 98 190 1, 110 180 3, 50 75 900) '::
geometry As line
      ) As foo;

           shl3d_line_pt           |
shl2d_line_pt
-----+-----
LINESTRING(54.6993798867619 128.935022917228 11.5475869506606,100 100 30) | LINESTRING (50 75,50 74)
```

MultiLineString and polygon both 3d and 2d shortest line

```
SELECT ST_AsEWKT(ST_3DShortestLine(poly, mline)) As shl3d,
       ST_AsEWKT(ST_ShortestLine(poly, mline)) As shl2d
FROM (SELECT ST_GeomFromEWKT('POLYGON((175 150 5, 20 40 5, 35 45 5, 50 60 5,
100 100 5, 175 150 5))') As poly,
       ST_GeomFromEWKT('MULTILINESTRING((175 155 2, 20 40 20, 50 60 -2, 125
100 1, 175 155 1),
       (1 10 2, 5 20 1))') As mline ) As foo;
           shl3d           |
                           | shl2d
-----+-----
LINESTRING(39.993580415989 54.1889925532825 5,40.4078575708294 53.6052383805529
5.03423778139177) | LINESTRING(20 40,20 40)
```

Ver también

[ST_3DClosestPoint](#), [ST_3DDistance](#), [ST_LongestLine](#), [ST_ShortestLine](#), [ST_3DMaxDistance](#)

8.13 Overlay Functions

8.13.1 ST_ClipByBox2D

ST_ClipByBox2D — Computes the portion of a geometry falling within a rectangle.

Synopsis

geometry **ST_ClipByBox2D**(geometry geom, box2d box);

Description

Clips a geometry by a 2D box in a fast and tolerant but possibly invalid way. Topologically invalid input geometries do not result in exceptions being thrown. The output geometry is not guaranteed to be valid (in particular, self-intersections for a polygon may be introduced).

Performed by the GEOS module.

Availability: 2.2.0

Examples

```
-- Rely on implicit cast from geometry to box2d for the second parameter
SELECT ST_ClipByBox2D(geom, ST_MakeEnvelope(0,0,10,10)) FROM mytab;
```

See Also

[ST_Intersection](#), [ST_MakeBox2D](#), [ST_MakeEnvelope](#)

8.13.2 ST_Difference

ST_Difference — Computes a geometry representing the part of geometry A that does not intersect geometry B.

Synopsis

geometry **ST_Difference**(geometry geomA, geometry geomB, float8 gridSize = -1);

Description

Returns a geometry representing the part of geometry A that does not intersect geometry B. This is equivalent to $A - \text{ST_Intersection}(A, B)$. If A is completely contained in B then an empty atomic geometry of appropriate type is returned.



Note

This is the only overlay function where input order matters. **ST_Difference**(A, B) always returns a portion of A.

If the optional `gridSize` argument is provided, the inputs are snapped to a grid of the given size, and the result vertices are computed on that same grid. (Requires GEOS-3.9.0 or higher)

Performed by the GEOS module

Enhanced: 3.1.0 accept a `gridSize` parameter - requires GEOS \geq 3.9.0



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.3

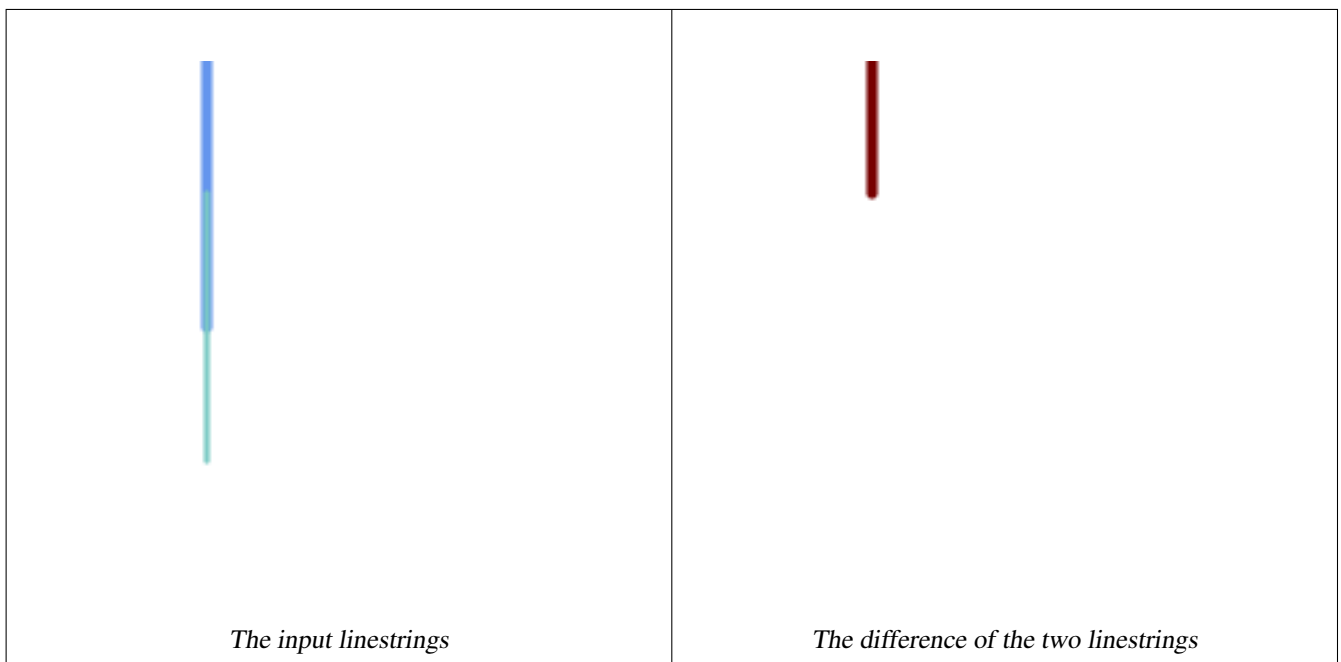


This method implements the SQL/MM specification. SQL-MM 3: 5.1.20



This function supports 3d and will not drop the z-index. However, the result is computed using XY only. The result Z values are copied, averaged or interpolated.

Examples



The difference of 2D linestrings.

```
SELECT ST_AsText (
    ST_Difference (
        'LINESTRING(50 100, 50 200)::geometry',
        'LINESTRING(50 50, 50 150)::geometry'
    )
);

st_astext
-----
LINESTRING(50 150,50 200)
```

The difference of 3D points.

```
SELECT ST_AsEWKT( ST_Difference(
    'MULTIPOINT(-118.58 38.38 5,-118.60 38.329 6,-118.614 38.281 7)' :: geometry,
    'POINT(-118.614 38.281 5)' :: geometry
) );

st_asewkt
-----
MULTIPOINT(-118.6 38.329 6,-118.58 38.38 5)
```

See Also

[ST_SymDifference](#), [ST_Intersection](#), [ST_Union](#)

8.13.3 ST_Intersection

ST_Intersection — Computes a geometry representing the shared portion of geometries A and B.

Synopsis

```
geometry ST_Intersection( geometry geomA , geometry geomB , float8 gridSize = -1 );
geography ST_Intersection( geography geogA , geography geogB );
```

Description

Returns a geometry representing the point-set intersection of two geometries. In other words, that portion of geometry A and geometry B that is shared between the two geometries.

If the geometries have no points in common (i.e. are disjoint) then an empty atomic geometry of appropriate type is returned.

If the optional `gridSize` argument is provided, the inputs are snapped to a grid of the given size, and the result vertices are computed on that same grid. (Requires GEOS-3.9.0 or higher)

`ST_Intersection` in conjunction with `ST_Intersects` is useful for clipping geometries such as in bounding box, buffer, or region queries where you only require the portion of a geometry that is inside a country or region of interest.

Note



Geography: For geography this is really a thin wrapper around the geometry implementation. It first determines the best SRID that fits the bounding box of the 2 geography objects (if geography objects are within one half zone UTM but not same UTM will pick one of those) (favoring UTM or Lambert Azimuthal Equal Area (LAEA) north/south pole, and falling back on mercator in worst case scenario) and then intersection in that best fit planar spatial ref and retransforms back to WGS84 geography.



Warning

This function will drop the M coordinate values if present.



Warning

If working with 3D geometries, you may want to use SFGCAL based `ST_3DIntersection` which does a proper 3D intersection for 3D geometries. Although this function works with Z-coordinate, it does an averaging of Z-Coordinate.

Performed by the GEOS module

Enhanced: 3.1.0 accept a `gridSize` parameter - requires GEOS \geq 3.9.0

Changed: 3.0.0 does not depend on SFCGAL.

Availability: 1.5 support for geography data type was introduced.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.3



This method implements the SQL/MM specification. SQL-MM 3: 5.1.18



This function supports 3d and will not drop the z-index. However, the result is computed using XY only. The result Z values are copied, averaged or interpolated.

Examples

```

SELECT ST_AsText(ST_Intersection('POINT(0 0)::geometry, 'LINESTRING ( 2 0, 0 2 )':: ↵
    geometry));
    st_astext
-----
GEOMETRYCOLLECTION EMPTY

SELECT ST_AsText(ST_Intersection('POINT(0 0)::geometry, 'LINESTRING ( 0 0, 0 2 )':: ↵
    geometry));
    st_astext
-----
POINT(0 0)

```

Clip all lines (trails) by country. Here we assume country geom are POLYGON or MULTIPOLYGONS. NOTE: we are only keeping intersections that result in a LINESTRING or MULTILINESTRING because we don't care about trails that just share a point. The dump is needed to expand a geometry collection into individual single MULT* parts. The below is fairly generic and will work for polys, etc. by just changing the where clause.

```

select clipped.gid, clipped.f_name, clipped_geom
from (
    select trails.gid, trails.f_name,
           (ST_Dump(ST_Intersection(country.geom, trails.geom))).geom clipped_geom
    from country
         inner join trails on ST_Intersects(country.geom, trails.geom)
    ) as clipped
where ST_Dimension(clipped.clipped_geom) = 1;

```

For polys e.g. polygon landmarks, you can also use the sometimes faster hack that buffering anything by 0.0 except a polygon results in an empty geometry collection. (So a geometry collection containing polys, lines and points buffered by 0.0 would only leave the polygons and dissolve the collection shell.)

```

select poly.gid,
       ST_Multi(
           ST_Buffer(
               ST_Intersection(country.geom, poly.geom),
               0.0
           )
       ) clipped_geom
from country
     inner join poly on ST_Intersects(country.geom, poly.geom)
where not ST_IsEmpty(ST_Buffer(ST_Intersection(country.geom, poly.geom), 0.0));

```

Examples: 2.5Dish

Note this is not a true intersection, compare to the same example using [ST_3DIntersection](#).

```

select ST_AsText(ST_Intersection(linestring, polygon)) As wkt
from   ST_GeomFromText('LINESTRING Z (2 2 6,1.5 1.5 7,1 1 8,0.5 0.5 8,0 0 10)') AS ↵
       linestring
CROSS JOIN ST_GeomFromText('POLYGON((0 0 8, 0 1 8, 1 1 8, 1 0 8, 0 0 8))') AS polygon;

           st_astext
-----
LINESTRING Z (1 1 8,0.5 0.5 8,0 0 10)

```

See Also

[ST_3DIntersection](#), [ST_Difference](#), [ST_Union](#), [ST_Dimension](#), [ST_Dump](#), [ST_Force2D](#), [ST_SymDifference](#), [ST_Intersects](#), [ST_Multi](#)

8.13.4 ST_MemUnion

ST_MemUnion — Aggregate function which unions geometries in a memory-efficient but slower way

Synopsis

geometry **ST_MemUnion**(geometry set geomfield);

Description

An aggregate function that unions the input geometries, merging them to produce a result geometry with no overlaps. The output may be a single geometry, a MultiGeometry, or a Geometry Collection.



Note

Produces the same result as **ST_Union**, but uses less memory and more processor time. This aggregate function works by unioning the geometries incrementally, as opposed to the ST_Union aggregate which first accumulates an array and then unions the contents using a fast algorithm.



This function supports 3d and will not drop the z-index. However, the result is computed using XY only. The result Z values are copied, averaged or interpolated.

Examples

```
SELECT id,
       ST_MemUnion(geom) as singlegeom
FROM sometable f
GROUP BY id;
```

See Also

ST_Union

8.13.5 ST_Node

ST_Node — Nodes a collection of lines.

Synopsis

geometry **ST_Node**(geometry geom);

Description

Returns a (Multi)LineString representing the fully noded version of a collection of linestrings. The noding preserves all of the input nodes, and introduces the least possible number of new nodes. The resulting linework is dissolved (duplicate lines are removed).

This is a good way to create fully-noded linework suitable for use as input to **ST_Polygonize**.



This function supports 3d and will not drop the z-index.

Performed by the GEOS module.

Availability: 2.0.0

Changed: 2.4.0 this function uses GEOSNode internally instead of GEOSUnaryUnion. This may cause the resulting linestrings to have a different order and direction compared to PostGIS < 2.4.

Examples

Noding a 3D LineString which self-intersects

```
SELECT ST_AsText (
    ST_Node('LINESTRINGZ(0 0 0, 10 10 10, 0 10 5, 10 0 3)::geometry')
) As output;
output
-----
MULTILINESTRING Z ((0 0 0,5 5 4.5),(5 5 4.5,10 10 10,0 10 5,5 5 4.5),(5 5 4.5,10 0 3))
```

Noding two LineStrings which share common linework. Note that the result linework is dissolved.

```
SELECT ST_AsText (
    ST_Node('MULTILINESTRING ((2 5, 2 1, 7 1), (6 1, 4 1, 2 3, 2 5))::geometry')
) As output;
output
-----
MULTILINESTRING((2 5,2 3),(2 3,2 1,4 1),(4 1,2 3),(4 1,6 1),(6 1,7 1))
```

See Also

[ST_UnaryUnion](#)

8.13.6 ST_Split

ST_Split — Returns a collection of geometries created by splitting a geometry by another geometry.

Synopsis

geometry **ST_Split**(geometry input, geometry blade);

Description

The function supports splitting a LineString by a (Multi)Point, (Multi)LineString or (Multi)Polygon boundary, or a (Multi)Polygon by a LineString. When a (Multi)Polygon is used as the blade, its linear components (the boundary) are used for splitting the input. The result geometry is always a collection.

This function is in a sense the opposite of [ST_Union](#). Applying ST_Union to the returned collection should theoretically yield the original geometry (although due to numerical rounding this may not be exactly the case).



Note

If the the input and blade do not intersect due to numerical precision issues, the input may not be split as expected. To avoid this situation it may be necessary to snap the input to the blade first, using [ST_Snap](#) with a small tolerance.

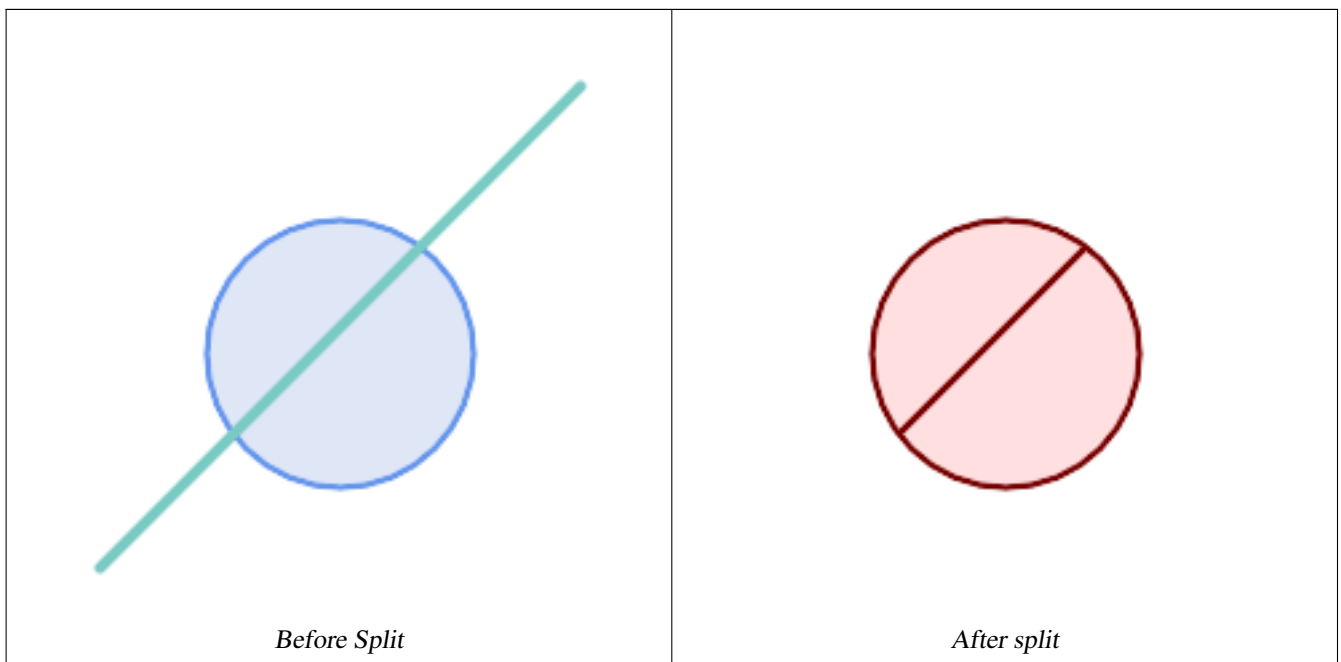
Availability: 2.0.0 requires GEOS

Enhanced: 2.2.0 support for splitting a line by a multiline, a multipoint or (multi)polygon boundary was introduced.

Enhanced: 2.5.0 support for splitting a polygon by a multiline was introduced.

Examples

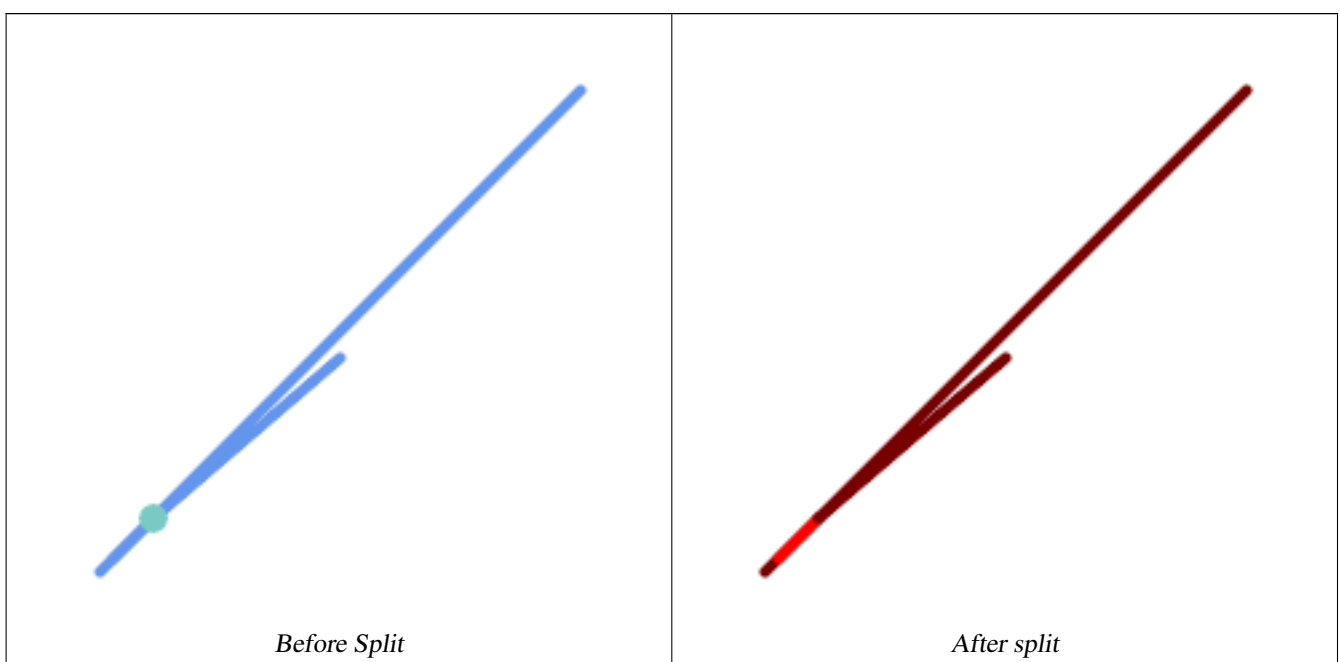
Polygon split by a Line



```
SELECT ST_AsText( ST_Split(
    ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50), -- circle
    ST_MakeLine(ST_Point(10, 10),ST_Point(190, 190)) -- line
));

-- result --
GEOMETRYCOLLECTION(
  POLYGON((150 90,149.039264020162 80.2454838991936,146.193976625564 70.8658283817455,...),
  POLYGON(...))
)
```

MultiLineString split by a Point, where the point lies exactly on both LineStrings.



```
SELECT ST_AsText(ST_Split(
  'MULTILINESTRING((10 10, 190 191), (15 15, 30 30, 100 90))',
  ST_Point(30,30))) As split;

split
-----
GEOMETRYCOLLECTION(
  LINESTRING(10 10,30 30),
  LINESTRING(30 30,190 190),
  LINESTRING(15 15,30 30),
  LINESTRING(30 30,100 90)
)
```

LineString split by a Point, where the point does not lie exactly on the line. Shows using **ST_Snap** to snap the line to the point to allow it to be split.

```
WITH data AS (SELECT
  'LINESTRING(0 0, 100 100) '::geometry AS line,
  'POINT(51 50) ':: geometry AS point
)
SELECT ST_AsText( ST_Split(line, point)) AS no_split,
       ST_AsText( ST_Split( ST_Snap(line, point, 1), point)) AS split
FROM data;
```

no_split		split
<hr/>		
GEOMETRYCOLLECTION(LINESTRING(0 0,100 100)) GEOMETRYCOLLECTION(LINESTRING(0 0,51 50), ↵ LINESTRING(51 50,100 100))		

See Also

ST_Snap, **ST_Union**

8.13.7 ST_Subdivide

ST_Subdivide — Computes a rectilinear subdivision of a geometry.

Synopsis

setof geometry **ST_Subdivide**(geometry geom, integer max_vertices=256, float8 gridSize = -1);

Description

Returns a set of geometries that are the result of dividing geom into parts using rectilinear lines, with each part containing no more than max_vertices.

max_vertices must be 5 or more, as 5 points are needed to represent a closed box. gridSize can be specified to have clipping work in fixed-precision space (requires GEOS-3.9.0+).

Point-in-polygon and other spatial operations are normally faster for indexed subdivided datasets. Since the bounding boxes for the parts usually cover a smaller area than the original geometry bbox, index queries produce fewer "hit" cases. The "hit" cases are faster because the spatial operations executed by the index recheck process fewer points.

**Note**

This is a **set-returning function** (SRF) that return a set of rows containing single geometry values. It can be used in a SELECT list or a FROM clause to produce a result set with one record for each result geometry.

Performed by the GEOS module.

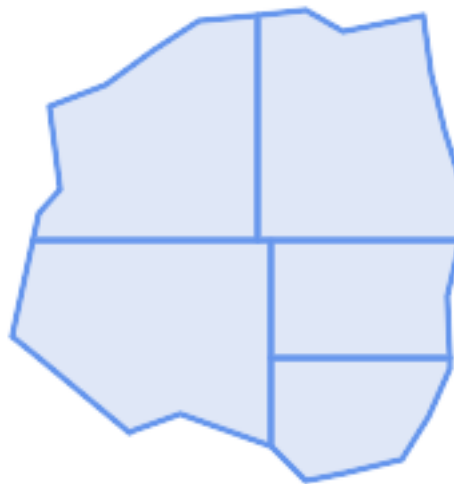
Availability: 2.2.0

Enhanced: 2.5.0 reuses existing points on polygon split, vertex count is lowered from 8 to 5.

Enhanced: 3.1.0 accept a gridSize parameter, requires GEOS >= 3.9.0 to use this new feature.

Examples

Example: Subdivide a polygon into parts with no more than 10 vertices, and assign each part a unique id.

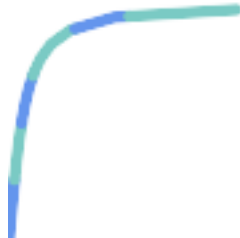


Subdivided to maximum 10 vertices

```
SELECT row_number() OVER() As rn, ST_AsText(geom) As wkt
FROM (SELECT ST_SubDivide(
    'POLYGON((132 10,119 23,85 35,68 29,66 28,49 42,32 56,22 64,32 110,40 119,36 150,
    57 158,75 171,92 182,114 184,132 186,146 178,176 184,179 162,184 141,190 122,
    190 100,185 79,186 56,186 52,178 34,168 18,147 13,132 10))'::geometry,10)) AS f(
    geom);
```

rn	wkt
1	POLYGON((119 23,85 35,68 29,66 28,32 56,22 64,29.8260869565217 100,119 100,119 23))
2	POLYGON((132 10,119 23,119 56,186 56,186 52,178 34,168 18,147 13,132 10))
3	POLYGON((119 56,119 100,190 100,185 79,186 56,119 56))
4	POLYGON((29.8260869565217 100,32 110,40 119,36 150,57 158,75 171,92 182,114 184,114 100,29.8260869565217 100))
5	POLYGON((114 184,132 186,146 178,176 184,179 162,184 141,190 122,190 100,114 100,114 184))

Example: Densify a long geography line using ST_Segmentize(geography, distance), and use ST_Subdivide to split the resulting line into sublines of 8 vertices.



The densified and split lines.

```
SELECT ST_AsText( ST_Subdivide(
    ST_Segmentize('LINESTRING(0 0, 85 85)::geography',
        1200000)::geometry, 8));
```

```
LINESTRING(0 0,0.487578359029357 5.57659056746196,0.984542144675897 ↵
    11.1527721155093,1.50101059639722 16.7281035483571,1.94532113630331 21.25)
LINESTRING(1.94532113630331 21.25,2.04869538062779 22.3020741387339,2.64204641967673 ↵
    27.8740533545155,3.29994062412787 33.443216802941,4.04836719489742 ↵
    39.0084282520239,4.59890468420694 42.5)
LINESTRING(4.59890468420694 42.5,4.92498503922732 44.5680389206321,5.98737409390639 ↵
    50.1195229244701,7.3290919767674 55.6587646879025,8.79638749938413 60.1969505994924)
LINESTRING(8.79638749938413 60.1969505994924,9.11375579533779 ↵
    61.1785363177625,11.6558166691368 66.6648504160202,15.642041247655 ↵
    72.0867690601745,22.8716627200212 77.3609628116894,24.6991785131552 77.8939011989848)
LINESTRING(24.6991785131552 77.8939011989848,39.4046096622744 ↵
    82.1822848017636,44.7994523421035 82.5156766227011)
LINESTRING(44.7994523421035 82.5156766227011,85 85)
```

Example: Subdivide the complex geometries of a table in-place. The original geometry records are deleted from the source table, and new records for each subdivided result geometry are inserted.

```
WITH complex_areas_to_subdivide AS (
    DELETE from polygons_table
    WHERE ST_NPoints(geom) > 255
    RETURNING id, column1, column2, column3, geom
)
INSERT INTO polygons_table (fid, column1, column2, column3, geom)
SELECT fid, column1, column2, column3,
    ST_Subdivide(geom, 255) as geom
FROM complex_areas_to_subdivide;
```

Example: Create a new table containing subdivided geometries, retaining the key of the original geometry so that the new table can be joined to the source table. Since `ST_Subdivide` is a set-returning (table) function that returns a set of single-value rows, this syntax automatically produces a table with one row for each result part.

```
CREATE TABLE subdivided_geoms AS
SELECT pkey, ST_Subdivide(geom) AS geom
FROM original_geoms;
```


See Also

[ST_ClipByBox2D](#), [ST_Segmentize](#), [ST_Split](#), [ST_NPoints](#)

8.13.8 ST_SymDifference

ST_SymDifference — Computes a geometry representing the portions of geometries A and B that do not intersect.

Synopsis

```
geometry ST_SymDifference(geometry geomA, geometry geomB, float8 gridSize = -1);
```

Description

Returns a geometry representing the portions of geometries A and B that do not intersect. This is equivalent to $ST_Union(A, B) - ST_Intersection(A, B)$. It is called a symmetric difference because $ST_SymDifference(A, B) = ST_SymDifference(B, A)$.

If the optional `gridSize` argument is provided, the inputs are snapped to a grid of the given size, and the result vertices are computed on that same grid. (Requires GEOS-3.9.0 or higher)

Performed by the GEOS module

Enhanced: 3.1.0 accept a `gridSize` parameter - requires GEOS \geq 3.9.0



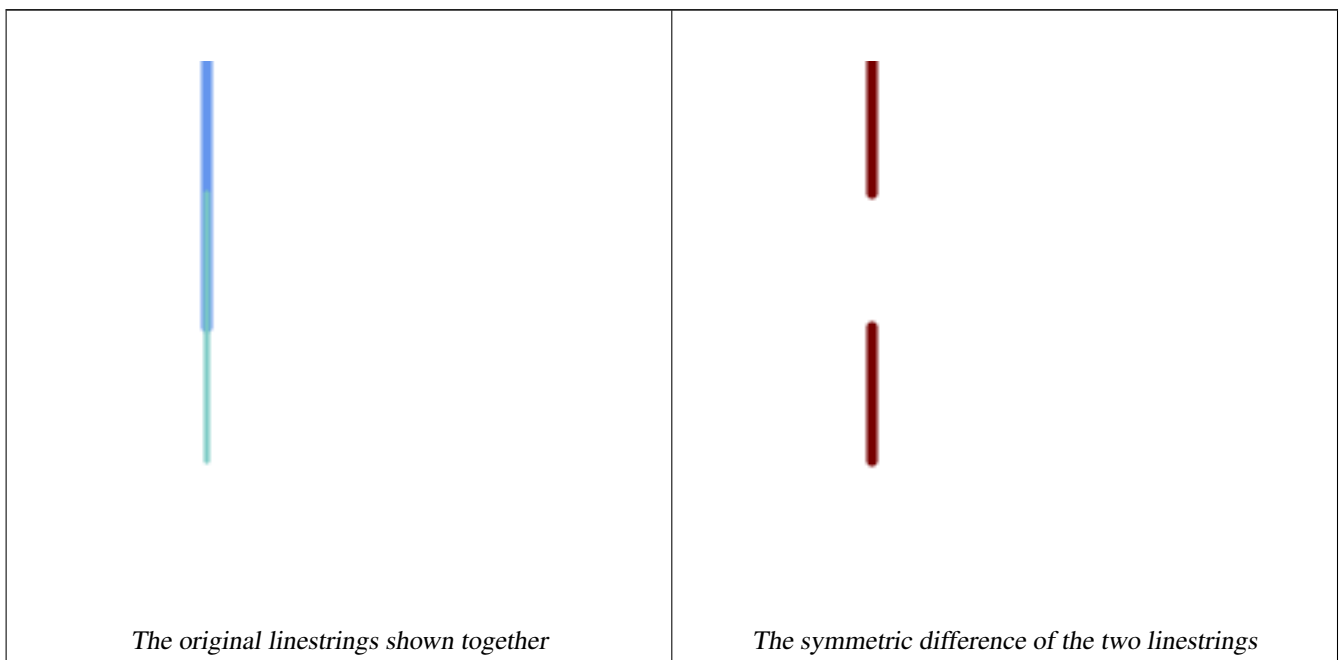
This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.3



This method implements the SQL/MM specification. SQL-MM 3: 5.1.21



This function supports 3d and will not drop the z-index. However, the result is computed using XY only. The result Z values are copied, averaged or interpolated.

Examples

```
--Safe for 2d - symmetric difference of 2 linestrings
SELECT ST_AsText(
  ST_SymDifference(
    ST_GeomFromText('LINESTRING(50 100, 50 200)'),
    ST_GeomFromText('LINESTRING(50 50, 50 150)')
  )
);

st_astext
-----
MULTILINESTRING((50 150,50 200),(50 50,50 100))
```

```
--When used in 3d doesn't quite do the right thing
SELECT ST_AsEWKT(ST_SymDifference(ST_GeomFromEWKT('LINESTRING(1 2 1, 1 4 2)'),
  ST_GeomFromEWKT('LINESTRING(1 1 3, 1 3 4)')));

st_astext
-----
MULTILINESTRING((1 3 2.75,1 4 2),(1 1 3,1 2 2.25))
```

See Also

[ST_Difference](#), [ST_Intersection](#), [ST_Union](#)

8.13.9 ST_UnaryUnion

ST_UnaryUnion — Computes the union of the components of a single geometry.

Synopsis

geometry **ST_UnaryUnion**(geometry geom, float8 gridSize = -1);

Description

A single-input variant of [ST_Union](#). The input may be a single geometry, a MultiGeometry, or a GeometryCollection. The union is applied to the individual elements of the input.

This function can be used to fix MultiPolygons which are invalid due to overlapping components. However, the input components must each be valid. An invalid input component such as a bow-tie polygon may cause an error. For this reason it may be better to use [ST_MakeValid](#).

Another use of this function is to node and dissolve a collection of linestrings which cross or overlap to make them [simple](#). (To add nodes but not dissolve duplicate linework use [ST_Node](#).)

It is possible to combine **ST_UnaryUnion** with [ST_GeomCollFromText](#) to fine-tune how many geometries are be unioned at once. This allows trading off between memory usage and compute time, striking a balance between **ST_Union** and [ST_MemUnion](#).

If the optional `gridSize` argument is provided, the inputs are snapped to a grid of the given size, and the result vertices are computed on that same grid. (Requires GEOS-3.9.0 or higher)



This function supports 3d and will not drop the z-index. However, the result is computed using XY only. The result Z values are copied, averaged or interpolated.

Enhanced: 3.1.0 accept a `gridSize` parameter - requires GEOS >= 3.9.0

Availability: 2.0.0

See Also

[ST_Union](#), [ST_MemUnion](#), [ST_MakeValid](#), [ST_GeomCollFromText](#), [ST_Node](#)

8.13.10 ST_Union

ST_Union — Computes a geometry representing the point-set union of the input geometries.

Synopsis

```
geometry ST_Union(geometry g1, geometry g2);
geometry ST_Union(geometry g1, geometry g2, float8 gridSize);
geometry ST_Union(geometry[] g1_array);
geometry ST_Union(geometry set g1field);
geometry ST_Union(geometry set g1field, float8 gridSize);
```

Description

Unions the input geometries, merging geometry to produce a result geometry with no overlaps. The output may be an atomic geometry, a MultiGeometry, or a Geometry Collection. Comes in several variants:

Two-input variant: returns a geometry that is the union of two input geometries. If either input is NULL, then NULL is returned.

Array variant: returns a geometry that is the union of an array of geometries.

Aggregate variant: returns a geometry that is the union of a rowset of geometries. The `ST_Union()` function is an "aggregate" function in the terminology of PostgreSQL. That means that it operates on rows of data, in the same way the `SUM()` and `AVG()` functions do and like most aggregates, it also ignores NULL geometries.

See [ST_UnaryUnion](#) for a non-aggregate, single-input variant.

The `ST_Union` array and set variants use the fast Cascaded Union algorithm described in <http://blog.cleverelephant.ca/2009/01/must-faster-unions-in-postgis-14.html>

A `gridSize` can be specified to work in fixed-precision space. The inputs are snapped to a grid of the given size, and the result vertices are computed on that same grid. (Requires GEOS-3.9.0 or higher)

**Note**

[ST_GeomCollFromText](#) may sometimes be used in place of `ST_Union`, if the result is not required to be non-overlapping. `ST_Collect` is usually faster than `ST_Union` because it performs no processing on the collected geometries.

Performed by the GEOS module.

`ST_Union` creates `MultiLineString` and does not sew `LineStrings` into a single `LineString`. Use [ST_LineMerge](#) to sew `LineStrings`.

NOTE: this function was formerly called `GeomUnion()`, which was renamed from "Union" because UNION is an SQL reserved word.

Enhanced: 3.1.0 accept a `gridSize` parameter - requires GEOS >= 3.9.0

Changed: 3.0.0 does not depend on SFCGAL.

Availability: 1.4.0 - `ST_Union` was enhanced. `ST_Union(geometry array)` was introduced and also faster aggregate collection in PostgreSQL.



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.3

**Note**

Aggregate version is not explicitly defined in OGC SPEC.



This method implements the SQL/MM specification. SQL-MM 3: 5.1.19 the z-index (elevation) when polygons are involved.



This function supports 3d and will not drop the z-index. However, the result is computed using XY only. The result Z values are copied, averaged or interpolated.

Examples**Aggregate example**

```
SELECT id,
       ST_Union(geom) as singlegeom
FROM sometable f
GROUP BY id;
```

Non-Aggregate example

```
select ST_AsText(ST_Union('POINT(1 2)' :: geometry, 'POINT(-2 3)' :: geometry))

st_astext
-----
MULTIPOINT(-2 3,1 2)

select ST_AsText(ST_Union('POINT(1 2)' :: geometry, 'POINT(1 2)' :: geometry))

st_astext
-----
POINT(1 2)
```

3D example - sort of supports 3D (and with mixed dimensions!)

```
select ST_AsEWKT(ST_Union(geom))
from (
    select 'POLYGON((-7 4.2,-7.1 4.2,-7.1 4.3, -7 4.2))'::geometry geom
    union all
    select 'POINT(5 5 5)'::geometry geom
    union all
    select 'POINT(-2 3 1)'::geometry geom
    union all
    select 'LINESTRING(5 5 5, 10 10 10)'::geometry geom
) as foo;

st_asewkt
-----
GEOMETRYCOLLECTION(POINT(-2 3 1),LINESTRING(5 5 5,10 10 10),POLYGON((-7 4.2 5,-7.1 4.2 5,-7.1 4.3 5,-7 4.2 5)));
```

3d example not mixing dimensions

```
select ST_AsEWKT(ST_Union(geom))
from (
    select 'POLYGON((-7 4.2 2,-7.1 4.2 3,-7.1 4.3 2, -7 4.2 2))'::geometry geom
    union all
    select 'POINT(5 5 5)'::geometry geom
```

```

        union all
        select 'POINT(-2 3 1)::geometry geom
        union all
        select 'LINESTRING(5 5 5, 10 10 10)::geometry geom
    ) as foo;

st_asewkt
-----
GEOMETRYCOLLECTION(POINT(-2 3 1),LINESTRING(5 5 5,10 10 10),POLYGON((-7 4.2 2,-7.1 4.2 2,
3,-7.1 4.3 2,-7 4.2 2)))

--Examples using new Array construct
SELECT ST_Union(ARRAY(SELECT geom FROM sometable));

SELECT ST_AsText(ST_Union(ARRAY[ST_GeomFromText('LINESTRING(1 2, 3 4)'),
ST_GeomFromText('LINESTRING(3 4, 4 5)')])) As wktunion;

--wktunion---
MULTILINESTRING((3 4,4 5),(1 2,3 4))

```

See Also

[ST_GeomCollFromText](#), [ST_UnaryUnion](#), [ST_MemUnion](#), [ST_Intersection](#), [ST_Difference](#), [ST_SymDifference](#)

8.14 Procesamiento de geometría

8.14.1 ST_Buffer

ST_Buffer — Computes a geometry covering all points within a given distance from a geometry.

Synopsis

```

geometry ST_Buffer(geometry g1, float radius_of_buffer, text buffer_style_parameters = '');
geometry ST_Buffer(geometry g1, float radius_of_buffer, integer num_seg_quarter_circle);
geography ST_Buffer(geography g1, float radius_of_buffer, text buffer_style_parameters);
geography ST_Buffer(geography g1, float radius_of_buffer, integer num_seg_quarter_circle);

```

Descripción

Computes a POLYGON or MULTIPOLYGON that represents all points whose distance from a geometry/geography is less than or equal to a given distance. A negative distance shrinks the geometry rather than expanding it. A negative distance may shrink a polygon completely, in which case POLYGON EMPTY is returned. For points and lines negative distances always return empty results.

For geometry, the distance is specified in the units of the Spatial Reference System of the geometry. For geography, the distance is specified in meters.

The optional third parameter controls the buffer accuracy and style. The accuracy of circular arcs in the buffer is specified as the number of line segments used to approximate a quarter circle (default is 8). The buffer style can be specified by providing a list of blank-separated key=value pairs as follows:

- 'quad_segs=#' : number of line segments used to approximate a quarter circle (default is 8).
- 'endcap=round|flat|square' : endcap style (defaults to "round"). 'butt' is accepted as a synonym for 'flat'.

- 'join=round|mitre|bevel' : join style (defaults to "round"). 'miter' is accepted as a synonym for 'mitre'.
- 'mitre_limit=#.#' : mitre ratio limit (only affects mitered join style). 'miter_limit' is accepted as a synonym for 'mitre_limit'.
- 'side=both|left|right' : 'left' or 'right' performs a single-sided buffer on the geometry, with the buffered side relative to the direction of the line. This is only applicable to LINESTRING geometry and does not affect POINT or POLYGON geometries. By default end caps are square.

**Note**

For geography, this is a wrapper around the geometry implementation. It determines a planar spatial reference system that best fits the bounding box of the geography object (trying UTM, Lambert Azimuthal Equal Area (LAEA) North/South pole, and finally Mercator). The buffer is computed in the planar space, and then transformed back to WGS84. This may not produce the desired behavior if the input object is much larger than a UTM zone or crosses the dateline

**Note**

Buffer output is always a valid polygonal geometry. Buffer can handle invalid inputs, so buffering by distance 0 is sometimes used as a way of repairing invalid polygons. [ST_MakeValid](#) can also be used for this purpose.

**Note**

Buffering is sometimes used to perform a within-distance search. For this use case it is more efficient to use [ST_DWithin](#).

**Note**

This function ignores the Z dimension. It always gives a 2D result even when used on a 3D geometry.

Enhanced: 2.5.0 - ST_Buffer geometry support was enhanced to allow for side buffering specification `side=both|left|right`.

Availability: 1.5 - ST_Buffer was enhanced to support different endcaps and join types. These are useful for example to convert road linestrings into polygon roads with flat or square edges instead of rounded edges. Thin wrapper for geography was added.

Realizado por el módulo GEOS.

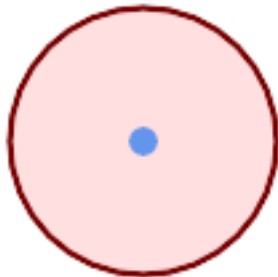


This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.3



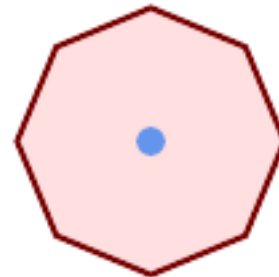
This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.30

Ejemplos



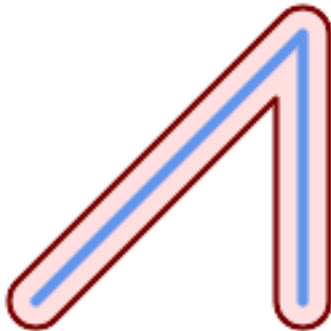
quad_segs=8 (por defecto)

```
SELECT ST_Buffer(  
  ST_GeomFromText('POINT(100 90)'),  
  50, 'quad_segs=8');
```



quad_segs=2 (lame)

```
SELECT ST_Buffer(  
  ST_GeomFromText('POINT(100 90)'),  
  50, 'quad_segs=2');
```



endcap=round join=round (default)

```
SELECT ST_Buffer(  
  ST_GeomFromText(  
    'LINESTRING(50 50,150 150,150 50)'  
  ), 10, 'endcap=round join=round');
```



endcap=square

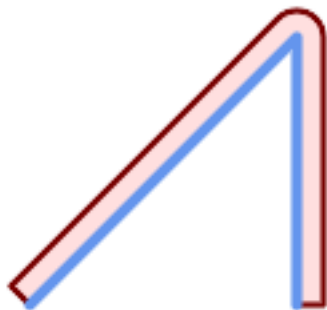
```
SELECT ST_Buffer(  
  ST_GeomFromText(  
    'LINESTRING(50 50,150 150,150 50)'  
  ), 10, 'endcap=square join=round');
```

*join=bevel*

```
SELECT ST_Buffer(
  ST_GeomFromText(
    'LINESTRING(50 50,150 150,150 50)'
  ), 10, 'join=bevel');
```

*join=mitre mitre_limit=5.0 (default mitre limit)*

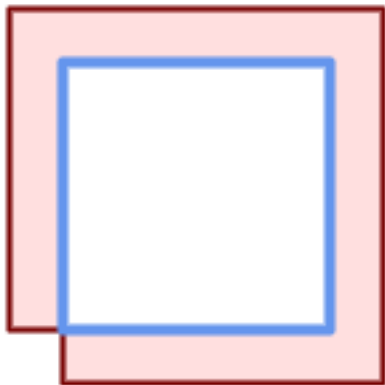
```
SELECT ST_Buffer(
  ST_GeomFromText(
    'LINESTRING(50 50,150 150,150 50)'
  ), 10, 'join=mitre mitre_limit=5.0');
```

*side=left*

```
SELECT ST_Buffer(
  ST_GeomFromText(
    'LINESTRING(50 50,150 150,150 50)'
  ), 10, 'side=left');
```

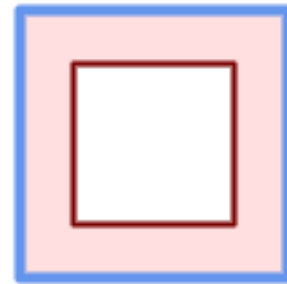
*side=right*

```
SELECT ST_Buffer(
  ST_GeomFromText(
    'LINESTRING(50 50,150 150,150 50)'
  ), 10, 'side=right');
```

right-hand-winding, polygon boundary side=left

```
SELECT ST_Buffer(
ST_ForceRHR(
ST_Boundary(
  ST_GeomFromText(
'POLYGON ((50 50, 50 150, 150 150, 150 50, 50 50))'),
), 20, 'side=left');
```



right-hand-winding, polygon boundary side=right

```
SELECT ST_Buffer(
ST_ForceRHR(
ST_Boundary(
  ST_GeomFromText(
'POLYGON ((50 50, 50 150, 150 150, 150 50, 50 50))'),
), 20, 'side=right');
```

```
--A buffered point approximates a circle
-- A buffered point forcing approximation of (see diagram)
-- 2 points per quarter circle is poly with 8 sides (see diagram)
SELECT ST_NPoints(ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50)) As promisingcircle_pcount,
ST_NPoints(ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50, 2)) As lamecircle_pcount;
```

```
promisingcircle_pcount | lamecircle_pcount
-----+-----
33 | 9
```

```
--A lighter but lamer circle
-- only 2 points per quarter circle is an octagon
--Below is a 100 meter octagon
-- Note coordinates are in NAD 83 long lat which we transform
to Mass state plane meter and then buffer to get measurements in meters;
SELECT ST_AsText(ST_Buffer(
ST_Transform(
ST_SetSRID(ST_Point(-71.063526, 42.35785), 4269), 26986)
, 100, 2)) As octagon;
-----
POLYGON((236057.59057465 900908.759918696,236028.301252769 900838.049240578,235
957.59057465 900808.759918696,235886.879896532 900838.049240578,235857.59057465
900908.759918696,235886.879896532 900979.470596815,235957.59057465 901008.759918
696,236028.301252769 900979.470596815,236057.59057465 900908.759918696))
```

Ver también

[ST_GeomCollFromText](#), [ST_DWithin](#), [ST_SetSRID](#), [ST_Transform](#), [ST_Union](#), [ST_MakeValid](#)

8.14.2 ST_BuildArea

ST_BuildArea — Creates a polygonal geometry formed by the linework of a geometry.

Synopsis

geometry **ST_BuildArea**(geometry geom);

Descripción

Creates an areal geometry formed by the constituent linework of the input geometry. The input can be LINESTRINGS, MULTILINESTRINGS, POLYGONS, MULTIPOLYGONS, and GeometryCollections. The result is a Polygon or MultiPolygon, depending on input. If the input linework does not form polygons, NULL is returned.

This function assumes all inner geometries represent holes



Note

Input linework must be correctly noded for this function to work properly

Disponibilidad: 1.1.0

Ejemplos



These will create a donut

```
--using polygons
SELECT ST_BuildArea(ST_Collect(smallc,bigc))
FROM (SELECT
  ST_Buffer(
    ST_GeomFromText('POINT(100 90)'), 25) As smallc,
    ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50) As bigc) As foo;

--using linestrings
SELECT ST_BuildArea(ST_Collect(smallc,bigc))
FROM (SELECT
  ST_ExteriorRing(ST_Buffer(
    ST_GeomFromText('POINT(100 90)'), 25)) As smallc,
    ST_ExteriorRing(ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50)) As bigc) As foo;
```

Ver también

[ST_Node](#), [ST_MakePolygon](#), [ST_MakeValid](#), [ST_BdPolyFromText](#), [ST_BdMPolyFromText](#) (wrappers to this function with standard OGC interface)

8.14.3 ST_Centroid

ST_Centroid — Returns the geometric center of a geometry.

Synopsis

```
geometry ST_Centroid(geometry g1);
geography ST_Centroid(geography g1, boolean use_spheroid=true);
```

Descripción

Computes a point which is the geometric center of mass of a geometry. For [MULTI]POINTS, the centroid is the arithmetic mean of the input coordinates. For [MULTI]LINESTRINGS, the centroid is computed using the weighted length of each line segment. For [MULTI]POLYGONS, the centroid is computed in terms of area. If an empty geometry is supplied, an empty

GEOMETRYCOLLECTION is returned. If NULL is supplied, NULL is returned. If CIRCULARSTRING or COMPOUNDCURVE are supplied, they are converted to linestring with CurveToLine first, then same than for LINESTRING

For mixed-dimension input, the result is equal to the centroid of the component Geometries of highest dimension (since the lower-dimension geometries contribute zero "weight" to the centroid).

Note that for polygonal geometries the centroid does not necessarily lie in the interior of the polygon. For example, see the diagram below of the centroid of a C-shaped polygon. To construct a point guaranteed to lie in the interior of a polygon use [ST_PointOnSurface](#).

New in 2.3.0 : supports CIRCULARSTRING and COMPOUNDCURVE (using CurveToLine)

Availability: 2.4.0 support for geography was introduced.



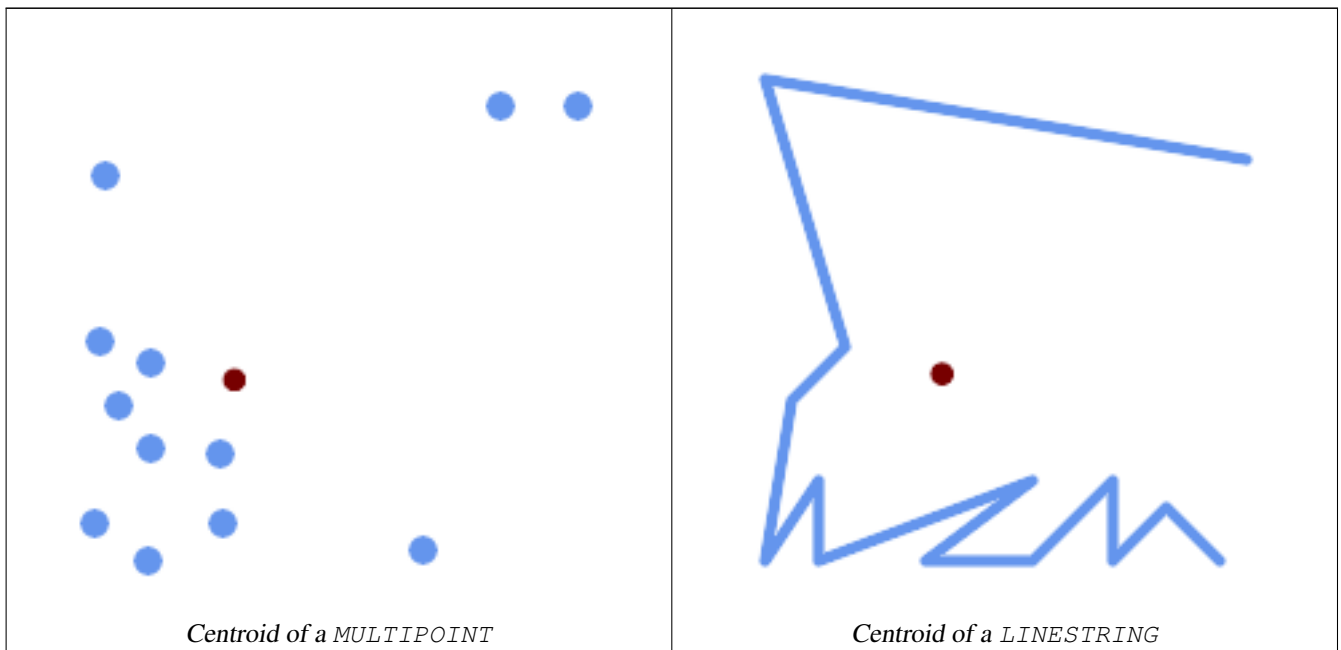
This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#).

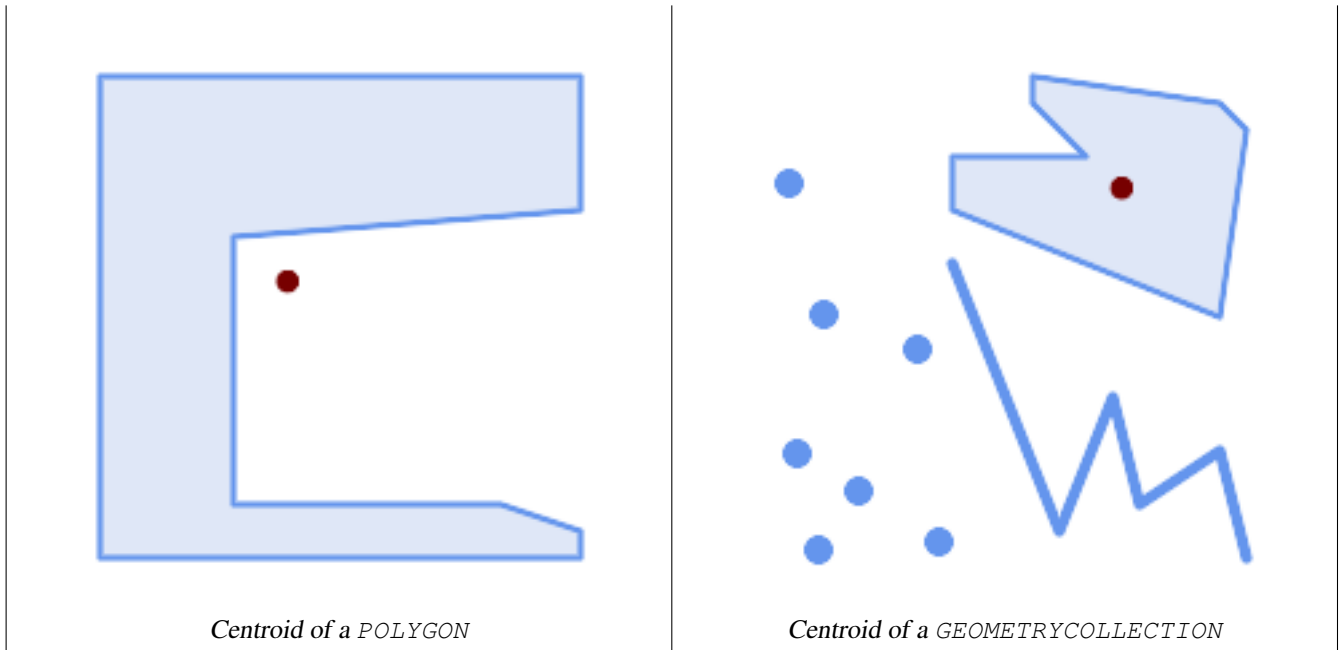


This method implements the SQL/MM specification. SQL-MM 3: 8.1.4, 9.5.5

Ejemplos

In the following illustrations the red dot is the centroid of the source geometry.





```
SELECT ST_AsText(ST_Centroid('MULTIPOINT ( -1 0, -1 2, -1 3, -1 4, -1 7, 0 1, 0 3, 1 1, 2 0, 6 0, 7 8, 9 8, 10 6 )'));
```

st_astext
POINT(2.30769230769231 3.30769230769231)

```
(1 row)
```

```
SELECT ST_AsText(ST_centroid(g))
FROM   ST_GeomFromText('CIRCULARSTRING(0 2, -1 1,0 0, 0.5 0, 1 0, 2 1, 1 2, 0.5 2, 0 2)') AS g ;
```

POINT(0.5 1)

```
SELECT ST_AsText(ST_centroid(g))
FROM   ST_GeomFromText('COMPOUNDCURVE(CIRCULARSTRING(0 2, -1 1,0 0),(0 0, 0.5 0, 1 0), CIRCULARSTRING( 1 0, 2 1, 1 2),(1 2, 0.5 2, 0 2))' ) AS g;
```

POINT(0.5 1)

Ver también

[ST_PointOnSurface](#), [ST_GeometricMedian](#)

8.14.4 ST_ChaikinSmoothing

ST_ChaikinSmoothing — Returns a smoothed version of a geometry, using the Chaikin algorithm

Synopsis

geometry **ST_ChaikinSmoothing**(geometry geom, integer nIterations = 1, boolean preserveEndpoints = false);

The `param_pctconvex` controls the concaveness of the computed hull. A value of 1 produces the convex hull. A value of 0 produces a hull of maximum concaveness (but still a single polygon). Values between 1 and 0 produce hulls of increasing concaveness. Choosing a suitable value depends on the nature of the input data, but often values between 0.3 and 0.1 produce reasonable results.

Technically, the `param_pctconvex` determines a length as a fraction of the difference between the longest and shortest edges in the Delaunay Triangulation of the input points. Edges longer than this length are "eroded" from the triangulation. The triangles remaining form the concave hull.

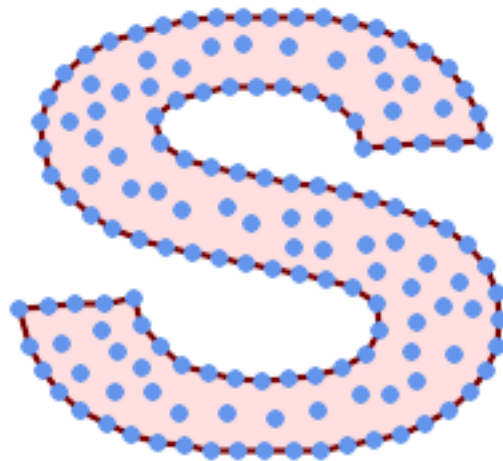
For point and linear inputs, the hull will enclose all the points of the inputs. For polygonal inputs, the hull will enclose all the points of the input *and also* all the areas covered by the input. If you want a point-wise hull of a polygonal input, convert it to points first, using [ST_Points](#).

This is not an aggregate function. To compute the concave hull of a set of geometries use [ST_GeomCollFromText](#) (e.g. `ST_ConcaveHull(ST_Collect(geom), 0.80)`).

Disponibilidad: 2.0.0

Enhanced: 3.3.0, GEOS native implementation enabled for GEOS 3.11+

Ejemplos



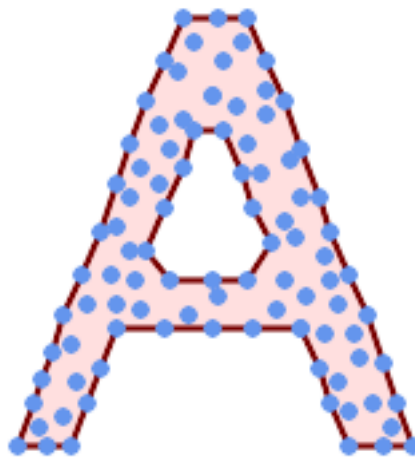
Concave Hull of a MultiPoint

```
SELECT ST_AsText( ST_ConcaveHull(
    'MULTIPOINT ((10 72), (53 76), (56 66), (63 58), (71 51), (81 48), (91 46), (101 45), (111 46), (121 47), (131 50), (140 55), (145 64), (144 74), (135 80), (125 83), (115 85), (105 87), (95 89), (85 91), (75 93), (65 95), (55 98), (45 102), (37 107), (29 114), (22 122), (19 132), (18 142), (21 151), (27 160), (35 167), (44 172), (54 175), (64 178), (74 180), (84 181), (94 181), (104 181), (114 181), (124 181), (134 179), (144 177), (153 173), (162 168), (171 162), (177 154), (182 145), (184 135), (139 132), (136 142), (128 149), (119 153), (109 155), (99 155), (89 155), (79 153), (69 150), (61 144), (63 134), (72 128), (82 125), (92 123), (102 121), (112 119), (122 118), (132 116), (142 113), (151 110), (161 106), (170 102), (178 96), (185 88), (189 78), (190 68), (189 58), (185 49), (179 41), (171 34), (162 29), (153 25), (143 23), (133 21), (123 19), (113 19), (102 19), (92 19), (82 19), (72 21), (62 22), (52 25), (43 29), (33 34), (25 41), (19 49), (14 58), (21 73), (31 74), (42 74), (173 134), (161 134), (150 133), (97 104), (52 117), (157 156), (94 171), (112 106), (169 73), (58 165), (149 40), (70 33), (147 157), (48 153), (140 96), (47 129), (173 55), (144 86), (159 67), (150 146), (38 136), (111 170), (124 94), (26 59), (60 41), (71 162), (41 64), (88 110), (122 34), (151 97), (157 56), (39 146), (88 33), (159 45), (47 56), (138 40), (129 165), (33 48), (106 31), (169 147), (37 122), (71 109), (163 89),
```

```

        (37 156), (82 170), (180 72), (29 142), (46 41), (59 155), (124 106), (157 80), ←
        (175 82), (56 50), (62 116), (113 95), (144 167))',
        0.1 ) );
---st_astext--
POLYGON ((18 142, 21 151, 27 160, 35 167, 44 172, 54 175, 64 178, 74 180, 84 181, 94 181, ←
104 181, 114 181, 124 181, 134 179, 144 177, 153 173, 162 168, 171 162, 177 154, 182 ←
145, 184 135, 173 134, 161 134, 150 133, 139 132, 136 142, 128 149, 119 153, 109 155, 99 ←
155, 89 155, 79 153, 69 150, 61 144, 63 134, 72 128, 82 125, 92 123, 102 121, 112 119, ←
122 118, 132 116, 142 113, 151 110, 161 106, 170 102, 178 96, 185 88, 189 78, 190 68, ←
189 58, 185 49, 179 41, 171 34, 162 29, 153 25, 143 23, 133 21, 123 19, 113 19, 102 19, ←
92 19, 82 19, 72 21, 62 22, 52 25, 43 29, 33 34, 25 41, 19 49, 14 58, 10 72, 21 73, 31 ←
74, 42 74, 53 76, 56 66, 63 58, 71 51, 81 48, 91 46, 101 45, 111 46, 121 47, 131 50, 140 ←
55, 145 64, 144 74, 135 80, 125 83, 115 85, 105 87, 95 89, 85 91, 75 93, 65 95, 55 98, ←
45 102, 37 107, 29 114, 22 122, 19 132, 18 142))

```



Concave Hull of a MultiPoint, allowing holes

```

SELECT ST_AsText( ST_ConcaveHull(
    'MULTIPOINT ((132 64), (114 64), (99 64), (81 64), (63 64), (57 49), (52 36), (46 ←
    20), (37 20), (26 20), (32 36), (39 55), (43 69), (50 84), (57 100), (63 118), ←
    (68 133), (74 149), (81 164), (88 180), (101 180), (112 180), (119 164), (126 ←
    149), (132 131), (139 113), (143 100), (150 84), (157 69), (163 51), (168 36), ←
    (174 20), (163 20), (150 20), (143 36), (139 49), (132 64), (99 151), (92 138), ←
    (88 124), (81 109), (74 93), (70 82), (83 82), (99 82), (112 82), (126 82), (121 ←
    96), (114 109), (110 122), (103 138), (99 151), (34 27), (43 31), (48 44), (46 ←
    58), (52 73), (63 73), (61 84), (72 71), (90 69), (101 76), (123 71), (141 62), ←
    (166 27), (150 33), (159 36), (146 44), (154 53), (152 62), (146 73), (134 76), ←
    (143 82), (141 91), (130 98), (126 104), (132 113), (128 127), (117 122), (112 ←
    133), (119 144), (108 147), (119 153), (110 171), (103 164), (92 171), (86 160), ←
    (88 142), (79 140), (72 124), (83 131), (79 118), (68 113), (63 102), (68 93), ←
    (35 45))',
    0.15, true ) );
---st_astext--
POLYGON ((43 69, 50 84, 57 100, 63 118, 68 133, 74 149, 81 164, 88 180, 101 180, 112 180, ←
119 164, 126 149, 132 131, 139 113, 143 100, 150 84, 157 69, 163 51, 168 36, 174 20, 163 ←
20, 150 20, 143 36, 139 49, 132 64, 114 64, 99 64, 81 64, 63 64, 57 49, 52 36, 46 20, ←
37 20, 26 20, 32 36, 35 45, 39 55, 43 69), (88 124, 81 109, 74 93, 83 82, 99 82, 112 82, ←
121 96, 114 109, 110 122, 103 138, 92 138, 88 124))

```

Using with `ST_Collect` to compute the concave hull of a geometry set.


```
-- Compute estimate of infected area based on point observations
SELECT disease_type,
       ST_ConcaveHull( ST_Collect(obs_pnt), 0.3 ) AS geom
FROM disease_obs
GROUP BY disease_type;
```

Ver también

[ST_ConvexHull](#), [ST_GeomCollFromText](#), [ST_AlphaShape](#), [ST_OptimalAlphaShape](#)

8.14.6 ST_ConvexHull

ST_ConvexHull — Computes the convex hull of a geometry.

Synopsis

geometry **ST_ConvexHull**(geometry geomA);

Descripción

Computes the convex hull of a geometry. The convex hull is the smallest convex geometry that encloses all geometries in the input.

One can think of the convex hull as the geometry obtained by wrapping an rubber band around a set of geometries. This is different from a **concave hull** which is analogous to "shrink-wrapping" the geometries. A convex hull is often used to determine an affected area based on a set of point observations.

In the general case the convex hull is a Polygon. The convex hull of two or more collinear points is a two-point LineString. The convex hull of one or more identical points is a Point.

This is not an aggregate function. To compute the convex hull of a set of geometries, use **ST_GeomCollFromText** to aggregate them into a geometry collection (e.g. `ST_ConvexHull(ST_Collect(geom))`).

Realizado por el módulo de GEOS



This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s2.1.1.3

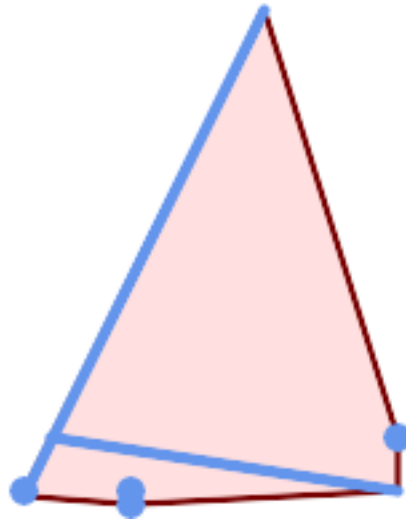


This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.16



This function supports 3d and will not drop the z-index.

Ejemplos



Convex Hull of a MultiLinestring and a MultiPoint

```
SELECT ST_AsText(ST_ConvexHull(
  ST_Collect(
    ST_GeomFromText('MULTILINESTRING((100 190,10 8),(150 10, 20 30))'),
    ST_GeomFromText('MULTIPOINT(50 5, 150 30, 50 10, 10 10)')
  ) );
---st_astext---
POLYGON((50 5,10 8,10 10,100 190,150 30,150 10,50 5))
```

Using with `ST_Collect` to compute the convex hulls of geometry sets.

```
--Get estimate of infected area based on point observations
SELECT d.disease_type,
  ST_ConvexHull(ST_Collect(d.geom)) As geom
FROM disease_obs As d
GROUP BY d.disease_type;
```

Ver también

[ST_GeomCollFromText](#), [ST_ConcaveHull](#), [ST_MinimumBoundingCircle](#)

8.14.7 ST_DelaunayTriangles

`ST_DelaunayTriangles` — Returns the Delaunay triangulation of the vertices of a geometry.

Synopsis

geometry **ST_DelaunayTriangles**(geometry g1, float tolerance, int4 flags);

Descripción

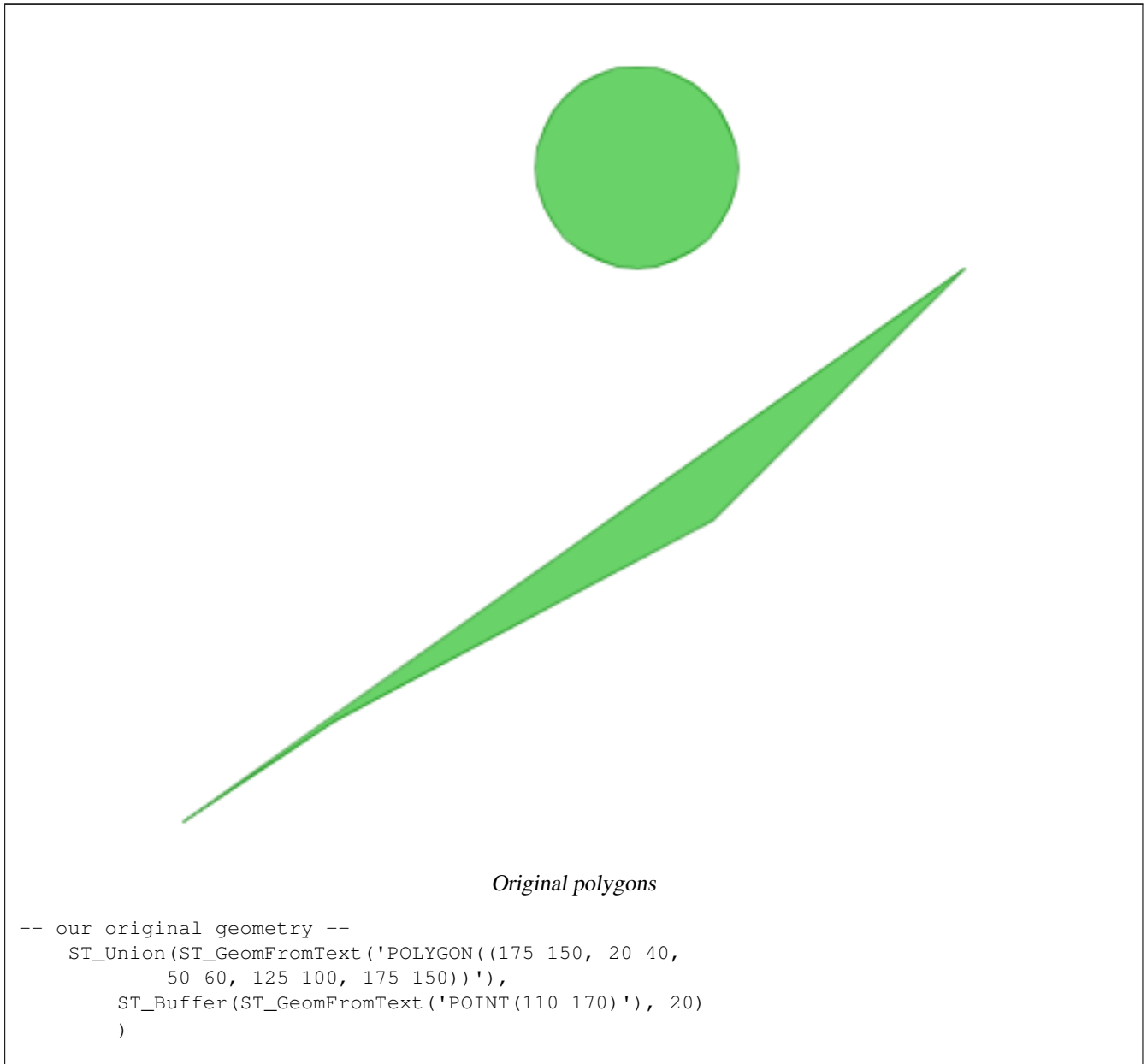
Return the **Delaunay triangulation** of the vertices of the input geometry. Output is a **COLLECTION** of polygons (for flags=0) or a **MULTILINESTRING** (for flags=1) or **TIN** (for flags=2). The tolerance, if any, is used to snap input vertices together.

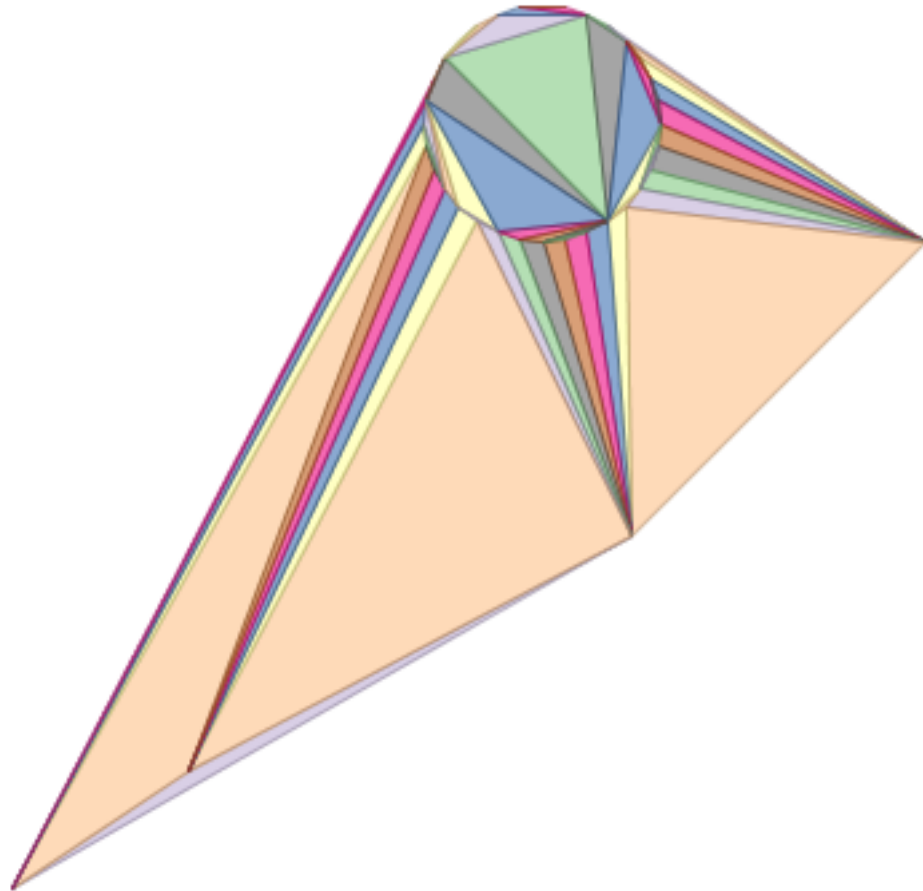
Realizado por el módulo GEOS.

Disponibilidad: 2.1.0

- ✓ This function supports 3d and will not drop the z-index.
- ✓ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

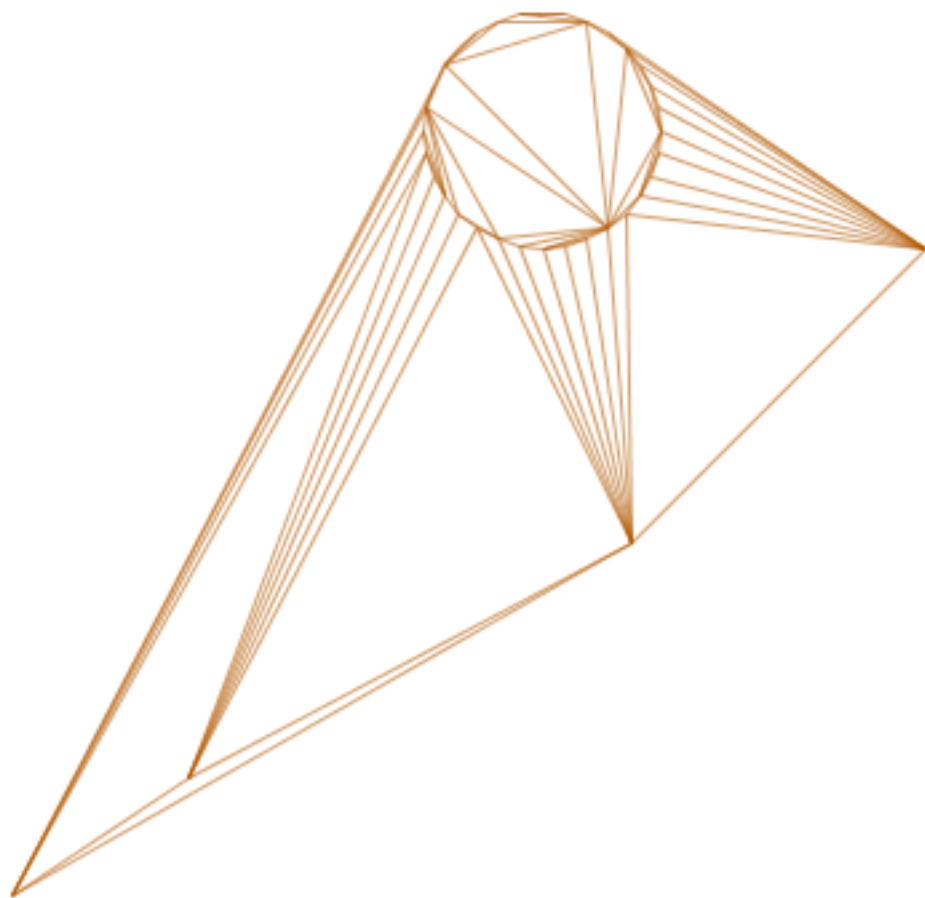
Ejemplos 2D





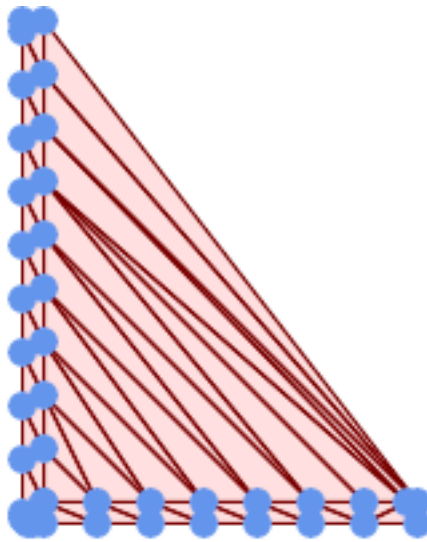
ST_DelaunayTriangles of 2 polygons: delaunay triangle polygons each triangle themed in different color

```
-- geometries overlaid multilinestring triangles
SELECT
  ST_DelaunayTriangles(
    ST_Union(ST_GeomFromText('POLYGON((175 150, 20 40,
      50 60, 125 100, 175 150))'),
    ST_Buffer(ST_GeomFromText('POINT(110 170)'), 20)
  )
  As dtriag;
```



-- delaunay triangles as multilinestring

```
SELECT
  ST_DelaunayTriangles(
    ST_Union(ST_GeomFromText('POLYGON((175 150, 20 40,
      50 60, 125 100, 175 150))'),
    ST_Buffer(ST_GeomFromText('POINT(110 170)'), 20)
  ),0.001,1)
As  dtriag;
```



-- delaunay triangles of 45 points as 55 triangle polygons

```
-- this produces a table of 42 points that form an L shape
SELECT (ST_DumpPoints(ST_GeomFromText(
'MULTIPOINT(14 14,34 14,54 14,74 14,94 14,114 14,134 14,
150 14,154 14,154 6,134 6,114 6,94 6,74 6,54 6,34 6,
14 6,10 6,8 6,7 7,6 8,6 10,6 30,6 50,6 70,6 90,6 110,6 130,
6 150,6 170,6 190,6 194,14 194,14 174,14 154,14 134,14 114,
14 94,14 74,14 54,14 34,14 14)'))).geom
    INTO TABLE l_shape;
-- output as individual polygon triangles
SELECT ST_AsText((ST_Dump(geom)).geom) As wkt
FROM ( SELECT ST_DelaunayTriangles(ST_Collect(geom)) As geom
FROM l_shape) As foo;

---wkt ---
POLYGON((6 194,6 190,14 194,6 194))
POLYGON((14 194,6 190,14 174,14 194))
POLYGON((14 194,14 174,154 14,14 194))
POLYGON((154 14,14 174,14 154,154 14))
POLYGON((154 14,14 154,150 14,154 14))
POLYGON((154 14,150 14,154 6,154 14))
:
:
```

Example 1

```
-- 3D multipoint --
SELECT ST_AsText(ST_DelaunayTriangles(ST_GeomFromText(
'MULTIPOINT Z(14 14 10,
150 14 100,34 6 25, 20 10 150)')))) As wkt;

-----wkt-----
GEOMETRYCOLLECTION Z (POLYGON Z ((14 14 10,20 10 150,34 6 25,14 14 10))
,POLYGON Z ((14 14 10,34 6 25,150 14 100,14 14 10)))
```

8.14.8 ST_FilterByM

ST_FilterByM — Removes vertices based on their M value

Synopsis

geometry **ST_FilterByM**(geometry geom, double precision min, double precision max = null, boolean returnM = false);

Descripción

Filters out vertex points based on their M-value. Returns a geometry with only vertex points that have a M-value larger or equal to the min value and smaller or equal to the max value. If max-value argument is left out only min value is considered. If fourth argument is left out the m-value will not be in the resulting geometry. If resulting geometry have too few vertex points left for its geometry type an empty geometry will be returned. In a geometry collection geometries without enough points will just be left out silently.

This function is mainly intended to be used in conjunction with ST_SetEffectiveArea. ST_EffectiveArea sets the effective area of a vertex in its m-value. With ST_FilterByM it then is possible to get a simplified version of the geometry without any calculations, just by filtering



Note

There is a difference in what ST_SimplifyVW returns when not enough points meet the criteria compared to ST_FilterByM. ST_SimplifyVW returns the geometry with enough points while ST_FilterByM returns an empty geometry



Note

Note that the returned geometry might be invalid



Note

This function returns all dimensions, including the Z and M values

Availability: 2.5.0

Ejemplos

A linestring is filtered

```
SELECT ST_AsText(ST_FilterByM(geom,30)) simplified
FROM (SELECT ST_SetEffectiveArea('LINESTRING(5 2, 3 8, 6 20, 7 25, 10 10)::geometry' geom ↵
) As foo;
-result
      simplified
-----
LINESTRING(5 2,7 25,10 10)
```

Ver también

[ST_SetEffectiveArea](#), [ST_SimplifyVW](#)

8.14.9 ST_GeneratePoints

ST_GeneratePoints — Generates random points contained in a Polygon or MultiPolygon.

Synopsis

```
geometry ST_GeneratePoints( g geometry , npoints integer );
geometry ST_GeneratePoints( geometry g , integer npoints , integer seed );
```

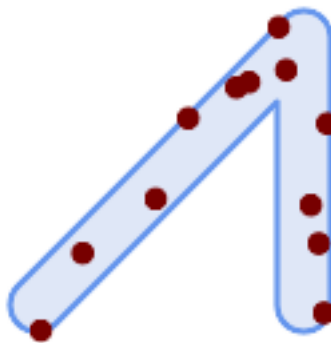
Descripción

ST_GeneratePoints generates a given number of pseudo-random points which lie within the input area. The optional `seed` is used to regenerate a deterministic sequence of points, and must be greater than zero.

Disponibilidad: 2.3.0

Enhanced: 3.0.0, added seed parameter

Ejemplos



Generated 12 Points overlaid on top of original polygon using a random seed value 1996

```
SELECT ST_GeneratePoints(geom, 12, 1996)
FROM (
  SELECT ST_Buffer(
    ST_GeomFromText(
      'LINESTRING(50 50,150 150,150 50)'),
    10, 'endcap=round join=round') AS geom
  ) AS s;
```

8.14.10 ST_GeometricMedian

ST_GeometricMedian — Returns the geometric median of a MultiPoint.

Synopsis

```
geometry ST_GeometricMedian ( geometry geom, float8 tolerance = NULL, int max_iter = 10000, boolean fail_if_not_converged = false);
```


Descripción

Computes the approximate geometric median of a MultiPoint geometry using the Weiszfeld algorithm. The geometric median is the point minimizing the sum of distances to the input points. It provides a centrality measure that is less sensitive to outlier points than the centroid (center of mass).

The algorithm iterates until the distance change between successive iterations is less than the supplied `tolerance` parameter. If this condition has not been met after `max_iterations` iterations, the function produces an error and exits, unless `fail_if_not_converged` is set to `false` (the default).

If a `tolerance` argument is not provided, the tolerance value is calculated based on the extent of the input geometry.

If present, the input point M values are interpreted as their relative weights.

Disponibilidad: 2.3.0

Enhanced: 2.5.0 Added support for M as weight of points.

- ✔ This function supports 3d and will not drop the z-index.
- ✔ This function supports M coordinates.

Ejemplos



Comparison of the geometric median (red) and centroid (turquoise) of a MultiPoint.

```
WITH test AS (  
SELECT 'MULTIPOINT((10 10), (10 40), (40 10), (190 190))'::geometry geom  
SELECT  
  ST_AsText(ST_Centroid(geom)) centroid,  
  ST_AsText(ST_GeometricMedian(geom)) median  
FROM test;  
  
  centroid      |      median  
-----+-----  
POINT(62.5 62.5) | POINT(25.01778421249728 25.01778421249728)  
(1 row)
```

Ver también

[ST_Centroid](#)

8.14.11 ST_LineMerge

ST_LineMerge — Return the lines formed by sewing together a MultiLineString.

Synopsis

```
geometry ST_LineMerge(geometry amultilinestring);  
geometry ST_LineMerge(geometry amultilinestring, boolean directed);
```

Descripción

Returns a LineString or MultiLineString formed by joining together the line elements of a MultiLineString. Lines are joined at their endpoints at 2-way intersections. Lines are not joined across intersections of 3-way or greater degree.

If **directed** is TRUE, then ST_LineMerge will not change point order within LineStrings, so lines with opposite directions will not be merged



Note

Only use with MultiLineString/LineStrings. Other geometry types return an empty GeometryCollection

Realizado por el módulo GEOS.

Enhanced: 3.3.0 accept a directed parameter - requires GEOS >= 3.11.0

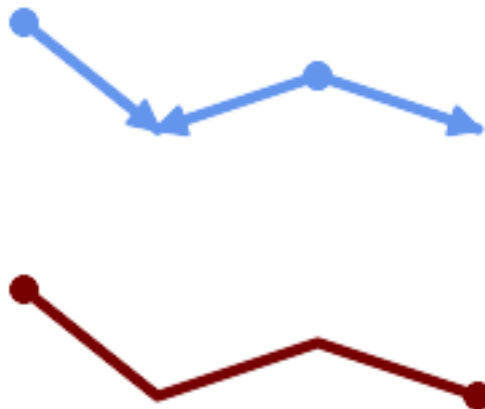
Disponibilidad: 1.1.0



Warning

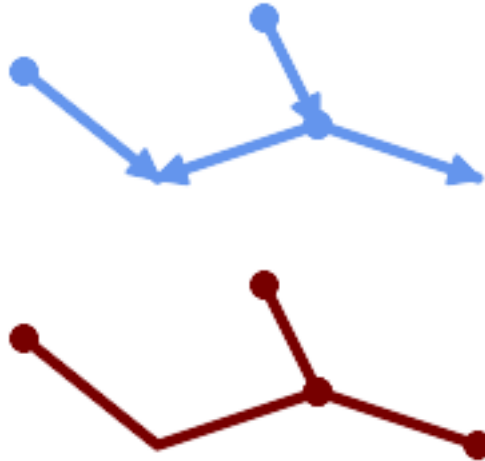
This function strips the M dimension.

Ejemplos



Merging lines with different orientation.

```
SELECT ST_AsText(ST_LineMerge(
'MULTILINESTRING((10 160, 60 120), (120 140, 60 120), (120 140, 180 120))'
));
-----
LINESTRING(10 160,60 120,120 140,180 120)
```

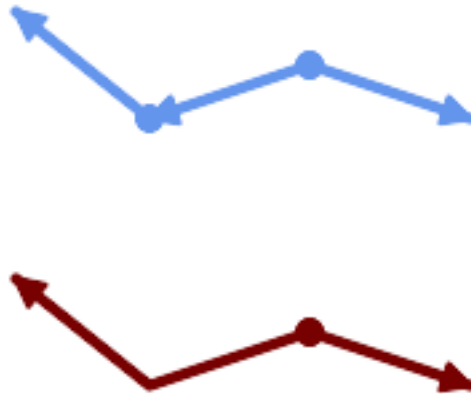


Lines are not merged across intersections with degree > 2.

```
SELECT ST_AsText(ST_LineMerge(
'MULTILINESTRING((10 160, 60 120), (120 140, 60 120), (120 140, 180 120), (100 180, 120 140))'
));
-----
MULTILINESTRING((10 160,60 120,120 140),(100 180,120 140),(120 140,180 120))
```

If merging is not possible due to non-touching lines, the original MultiLineString is returned.

```
SELECT ST_AsText(ST_LineMerge(
'MULTILINESTRING((-29 -27,-30 -29.7,-36 -31,-45 -33), (-45.2 -33.2,-46 -32))'
));
-----
MULTILINESTRING((-45.2 -33.2,-46 -32), (-29 -27,-30 -29.7,-36 -31,-45 -33))
```



Lines with opposite directions are not merged if directed = TRUE.

```
SELECT ST_AsText(ST_LineMerge(
'MULTILINESTRING((60 30, 10 70), (120 50, 60 30), (120 50, 180 30))',
TRUE));
```

```
MULTILINESTRING((120 50,60 30,10 70),(120 50,180 30))
```

Example showing Z-dimension handling.

```
SELECT ST_AsText(ST_LineMerge(
'MULTILINESTRING((-29 -27 11,-30 -29.7 10,-36 -31 5,-45 -33 6), (-29 -27 12,-30 -29.7 5), (-45 -33 1,-46 -32 11))'
));
```

```
LINESTRING Z (-30 -29.7 5,-29 -27 11,-30 -29.7 10,-36 -31 5,-45 -33 1,-46 -32 11)
```

Ver también

[ST_Segmentize](#), [ST_LineSubstring](#)

8.14.12 ST_MaximumInscribedCircle

ST_MaximumInscribedCircle — Computes the largest circle contained within a geometry.

Synopsis

(geometry, geometry, double precision) **ST_MaximumInscribedCircle**(geometry geom);

Descripción

Finds the largest circle that is contained within a (multi)polygon, or which does not overlap any lines and points. Returns a record with fields:

- `center` - center point of the circle

- nearest - a point on the geometry nearest to the center
- radius - radius of the circle

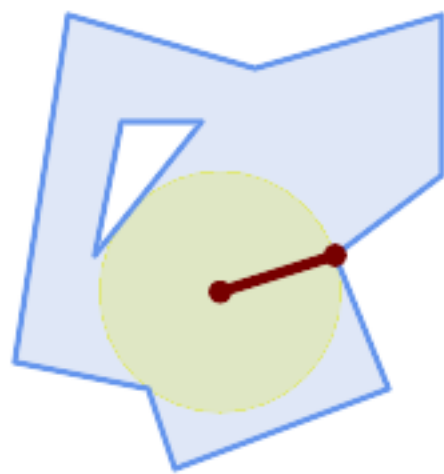
For polygonal inputs, the circle is inscribed within the boundary rings, using the internal rings as boundaries. For linear and point inputs, the circle is inscribed within the convex hull of the input, using the input lines and points as further boundaries.

Availability: 3.1.0 - requires GEOS >= 3.9.0.

Ver también

[ST_MinimumBoundingCircle](#)

Ejemplos

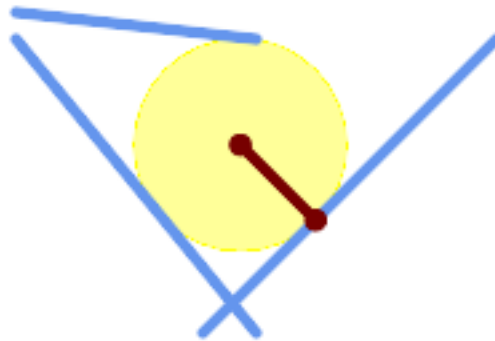


Maximum inscribed circle of a polygon. Center, nearest point, and radius are returned.

```
SELECT radius, ST_AsText(center) AS center, ST_AsText(nearest) AS nearest
FROM ST_MaximumInscribedCircle(
  'POLYGON ((40 180, 110 160, 180 180, 180 120, 140 90, 160 40, 80 10, 70 40, 20 50, 40 180),
    (60 140, 50 90, 90 140, 60 140))');

```

radius	center	nearest
45.165845650018	POINT(96.953125 76.328125)	POINT(140 90)



Maximum inscribed circle of a multi-linestring. Center, nearest point, and radius are returned.

Ver también

[ST_MinimumBoundingRadius](#)

8.14.13 ST_MinimumBoundingCircle

`ST_MinimumBoundingCircle` — Returns the smallest circle polygon that contains a geometry.

Synopsis

geometry **ST_MinimumBoundingCircle**(geometry geomA, integer num_segs_per_qt_circ=48);

Descripción

Returns the smallest circle polygon that contains a geometry.



Note

The bounding circle is approximated by a polygon with a default of 48 segments per quarter circle. Because the polygon is an approximation of the minimum bounding circle, some points in the input geometry may not be contained within the polygon. The approximation can be improved by increasing the number of segments. For applications where an approximation is not suitable [ST_MinimumBoundingRadius](#) may be used.

This function is not an aggregate. It can be used with [ST_GeomCollFromText](#) to get the minimum bounding circle of a set of geometries.

The ratio of the area of a polygon divided by the area of its Minimum Bounding Circle is referred to as the *Reock compactness score*.

Realizado por el módulo GEOS.

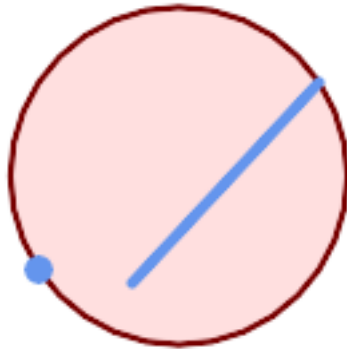
Disponibilidad: 1.4.0

Ver también

[ST_GeomCollFromText](#), [ST_MinimumBoundingRadius](#)

Ejemplos

```
SELECT d.disease_type,
       ST_MinimumBoundingCircle(ST_Collect(d.geom)) As geom
FROM disease_obs As d
GROUP BY d.disease_type;
```



Minimum bounding circle of a point and linestring. Using 8 segs to approximate a quarter circle

```
SELECT ST_AsText(ST_MinimumBoundingCircle(
    ST_Collect(
        ST_GeomFromText('LINESTRING(55 75,125 150)'),
        ST_Point(20, 80)), 8
    )) As wktmbc;

wktmbc
-----
POLYGON((135.59714732062 115,134.384753327498 102.690357210921,130.79416296937 ↵
    90.8537670908995,124.963360620072 79.9451031602111,117.116420743937 ↵
    70.3835792560632,107.554896839789 62.5366393799277,96.6462329091006 ↵
    56.70583703063,84.8096427890789 53.115246672502,72.5000000000001 ↵
    51.9028526793802,60.1903572109213 53.1152466725019,48.3537670908996 ↵
    56.7058370306299,37.4451031602112 62.5366393799276,27.8835792560632 ↵
    70.383579256063,20.0366393799278 79.9451031602109,14.20583703063 ↵
    90.8537670908993,10.615246672502 102.690357210921,9.40285267938019 115,10.6152466725019 ↵
    127.309642789079,14.2058370306299 139.1462329091,20.0366393799275 ↵
    150.054896839789,27.883579256063 159.616420743937,
    37.4451031602108 167.463360620072,48.3537670908992 173.29416296937,60.190357210921 ↵
    176.884753327498,
    72.4999999999998 178.09714732062,84.8096427890786 176.884753327498,96.6462329091003 ↵
    173.29416296937,107.554896839789 167.463360620072,
    117.116420743937 159.616420743937,124.963360620072 150.054896839789,130.79416296937 ↵
    139.146232909101,134.384753327498 127.309642789079,135.59714732062 115))
```

Ver también

[ST_GeomCollFromText](#), [ST_MinimumBoundingRadius](#)

8.14.14 ST_MinimumBoundingRadius

ST_MinimumBoundingRadius — Returns the center point and radius of the smallest circle that contains a geometry.

Synopsis

(geometry, double precision) **ST_MinimumBoundingRadius**(geometry geom);

Descripción

Computes the center point and radius of the smallest circle that contains a geometry. Returns a record with fields:

- `center` - center point of the circle
- `radius` - radius of the circle

Use in conjunction with **ST_GeomCollFromText** to get the minimum bounding circle of a set of geometries.

Disponibilidad: 2.3.0

Ver también

ST_GeomCollFromText, **ST_MinimumBoundingCircle**

Ejemplos

```
SELECT ST_AsText(center), radius FROM ST_MinimumBoundingRadius('POLYGON((26426 65078,26531 65242,26075 65136,26096 65427,26426 65078))');

```

st_astext	radius
POINT(26284.8418027133 65267.1145090825)	247.436045591407

8.14.15 ST_OrientedEnvelope

ST_OrientedEnvelope — Returns a minimum-area rectangle containing a geometry.

Synopsis

geometry **ST_OrientedEnvelope**(geometry geom);

Descripción

Returns the minimum-area rotated rectangle enclosing a geometry. Note that more than one such rectangle may exist. May return a Point or LineString in the case of degenerate inputs.

Availability: 2.5.0

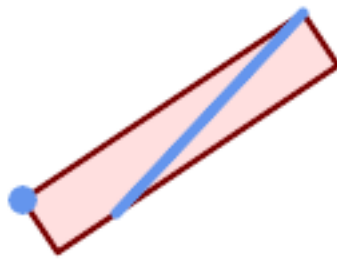
Ver también

ST_Envelope **ST_MinimumBoundingCircle**

Ejemplos

```
SELECT ST_AsText(ST_OrientedEnvelope('MULTIPOINT ((0 0), (-1 -1), (3 2))'));
```

```
st_astext
-----
POLYGON((3 2,2.88 2.16,-1.12 -0.84,-1 -1,3 2))
```



Oriented envelope of a point and linestring.

```
SELECT ST_AsText(ST_OrientedEnvelope(
  ST_Collect(
    ST_GeomFromText('LINESTRING(55 75,125 150)'),
    ST_Point(20, 80)
  )) As wktenv;
wktenv
-----
POLYGON((19.9999999999997 79.9999999999999,33.0769230769229 ↵
  60.3846153846152,138.076923076924 130.384615384616,125.000000000001 ↵
  150.000000000001,19.9999999999997 79.9999999999999))
```

8.14.16 ST_OffsetCurve

ST_OffsetCurve — Returns an offset line at a given distance and side from an input line.

Synopsis

geometry **ST_OffsetCurve**(geometry line, float signed_distance, text style_parameters=’');

Descripción

Return an offset line at a given distance and side from an input line. All points of the returned geometries are not further than the given distance from the input geometry. Useful for computing parallel lines about a center line.

For positive distance the offset is on the left side of the input line and retains the same direction. For a negative distance it is on the right side and in the opposite direction.

Units of distance are measured in units of the spatial reference system.

Note that output may be a MULTILINESTRING or EMPTY for some jigsaw-shaped input geometries.

The optional third parameter allows specifying a list of blank-separated key=value pairs to tweak operations as follows:

- 'quad_segs=#' : number of segments used to approximate a quarter circle (defaults to 8).
- 'join=round|mitre|bevel' : join style (defaults to "round"). 'miter' is also accepted as a synonym for 'mitre'.
- 'mitre_limit=#.#' : mitre ratio limit (only affects mitred join style). 'miter_limit' is also accepted as a synonym for 'mitre_limit'.

Realizado por el módulo GEOS.

Disponibilidad: 2.0

Enhanced: 2.5 - added support for GEOMETRYCOLLECTION and MULTILINESTRING

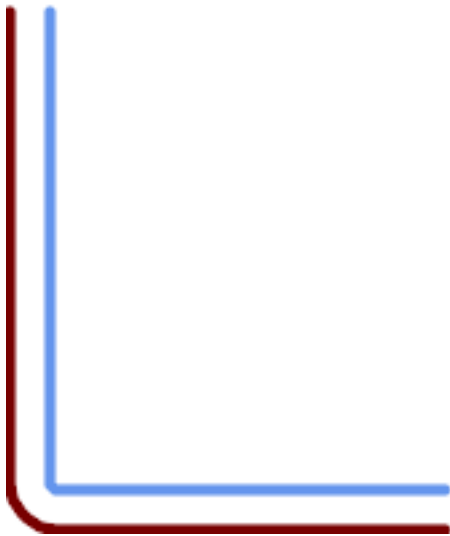
**Note**

This function ignores the Z dimension. It always gives a 2D result even when used on a 3D geometry.

Ejemplos

Compute an open buffer around roads

```
SELECT ST_Union(
  ST_OffsetCurve(f.geom, f.width/2, 'quad_segs=4 join=round'),
  ST_OffsetCurve(f.geom, -f.width/2, 'quad_segs=4 join=round')
) as track
FROM someroadstable;
```



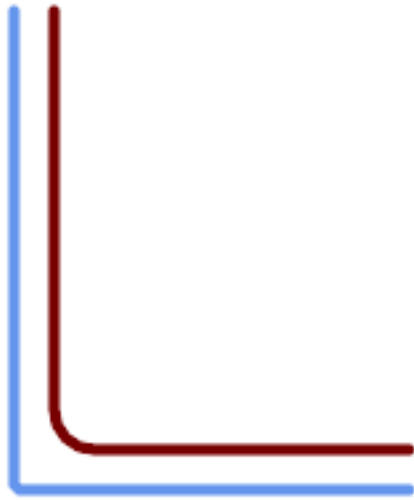
15, 'quad_segs=4 join=round' original line and its offset 15 units.

```
SELECT ST_AsText(ST_OffsetCurve(↵
    ST_GeomFromText(
'LINESTRING(164 16,144 16,124 16,104 ↵
    16,84 16,64 16,
    44 16,24 16,20 16,18 16,17 17,
    16 18,16 20,16 40,16 60,16 80,16 100,
    16 120,16 140,16 160,16 180,16 195)') ↵
    ,
    15, 'quad_segs=4 join=round'));
--output --
LINESTRING(164 1,18 1,12.2597485145237 ↵
    2.1418070123307,
    7.39339828220179 5.39339828220179,
    5.39339828220179 7.39339828220179,
    2.14180701233067 12.2597485145237,1 ↵
    18,1 195)
```



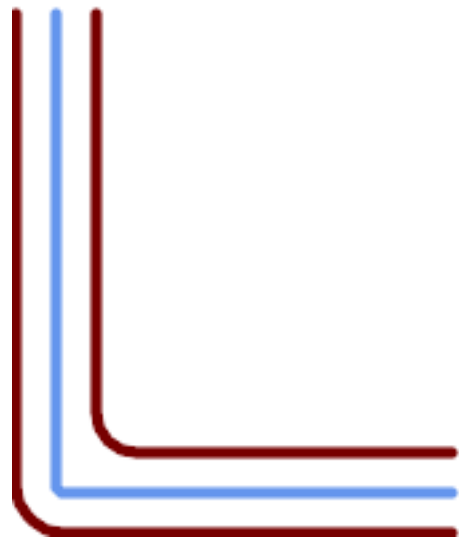
-15, 'quad_segs=4 join=round' original line and its offset -15 units

```
SELECT ST_AsText(ST_OffsetCurve(geom,
    -15, 'quad_segs=4 join=round')) As ↵
    notsocurvy
FROM ST_GeomFromText(
'LINESTRING(164 16,144 16,124 16,104 ↵
    16,84 16,64 16,
    44 16,24 16,20 16,18 16,17 17,
    16 18,16 20,16 40,16 60,16 80,16 100,
    16 120,16 140,16 160,16 180,16 195)') ↵
    As geom;
-- notsocurvy --
LINESTRING(31 195,31 31,164 31)
```





double-offset to get more curvy, note the first reverses direction, so $-30 + 15 = -15$

```
SELECT ST_AsText(ST_OffsetCurve(↵
    ST_OffsetCurve(geom,↵
        -30, 'quad_segs=4 join=round'), -15, ↵
        'quad_segs=4 join=round')) As morecurvy
FROM ST_GeomFromText(
'LINESTRING(164 16,144 16,124 16,104 ↵
    16,84 16,64 16,↵
    44 16,24 16,20 16,18 16,17 17,↵
    16 18,16 20,16 40,16 60,16 80,16 100,↵
    16 120,16 140,16 160,16 180,16 195)') ↵
    As geom;
-- morecurvy --
LINESTRING(164 31,46 31,40.2597485145236 ↵
    32.1418070123307,↵
    35.3933982822018 35.3933982822018,↵
    32.1418070123307 40.2597485145237,31 ↵
    46,31 195)
```



double-offset to get more curvy,combined with regular offset 15 to get parallel lines. Overlaid with original.

```
SELECT ST_AsText(ST_Collect(
    ST_OffsetCurve(geom, 15, 'quad_segs=4 ↵
        join=round'),
    ST_OffsetCurve(ST_OffsetCurve(geom,
        -30, 'quad_segs=4 join=round'), -15, ↵
        'quad_segs=4 join=round')
    )
) As parallel_curves
FROM ST_GeomFromText(
'LINESTRING(164 16,144 16,124 16,104 ↵
    16,84 16,64 16,↵
    44 16,24 16,20 16,18 16,17 17,↵
    16 18,16 20,16 40,16 60,16 80,16 100,↵
    16 120,16 140,16 160,16 180,16 195)') ↵
    As geom;
-- parallel curves --
MULTILINESTRING((164 1,18 ↵
    1,12.2597485145237 2.1418070123307,↵
    7.39339828220179 ↵
    5.39339828220179,5.39339828220179 7.39339828220179,↵
    2.14180701233067 12.2597485145237,1 18,1 ↵
    195),
(164 31,46 31,40.2597485145236 ↵
    32.1418070123307,35.3933982822018 35.3933982822018,↵
    32.1418070123307 40.2597485145237,31 ↵
    46,31 195))
```

 <p><i>15, 'quad_segs=4 join=bevel' shown with original line</i></p> <pre>SELECT ST_AsText(ST_OffsetCurve(↵ ST_GeomFromText(↵ 'LINESTRING(164 16,144 16,124 16,104 ↵ 16,84 16,64 16,↵ 44 16,24 16,20 16,18 16,17 17,↵ 16 18,16 20,16 40,16 60,16 80,16 100,↵ 16 120,16 140,16 160,16 180,16 195)')↵ ,↵ 15, 'quad_segs=4 join=bevel'));↵ -- output --↵ LINESTRING(164 1,18 1,7.39339828220179 ↵ 5.39339828220179,↵ 5.39339828220179 7.39339828220179,1 ↵ 18,1 195)</pre>	 <p><i>15,-15 collected, join=mitre mitre_limit=2.1</i></p> <pre>SELECT ST_AsText(ST_Collect(↵ ST_OffsetCurve(geom, 15, 'quad_segs=4 ↵ join=mitre mitre_limit=2.2'),↵ ST_OffsetCurve(geom, -15, 'quad_segs ↵ =4 join=mitre mitre_limit=2.2')↵))↵ FROM ST_GeomFromText(↵ 'LINESTRING(164 16,144 16,124 16,104 ↵ 16,84 16,64 16,↵ 44 16,24 16,20 16,18 16,17 17,↵ 16 18,16 20,16 40,16 60,16 80,16 100,↵ 16 120,16 140,16 160,16 180,16 195)')↵ As geom;↵ -- output --↵ MULTILINESTRING((164 1,11.7867965644036 ↵ 1,1 11.7867965644036,1 195),↵ (31 195,31 31,164 31))</pre>
--	--

Ver también

[ST_Buffer](#)

8.14.17 ST_PointOnSurface

ST_PointOnSurface — Computes a point guaranteed to lie in a polygon, or on a geometry.

Synopsis

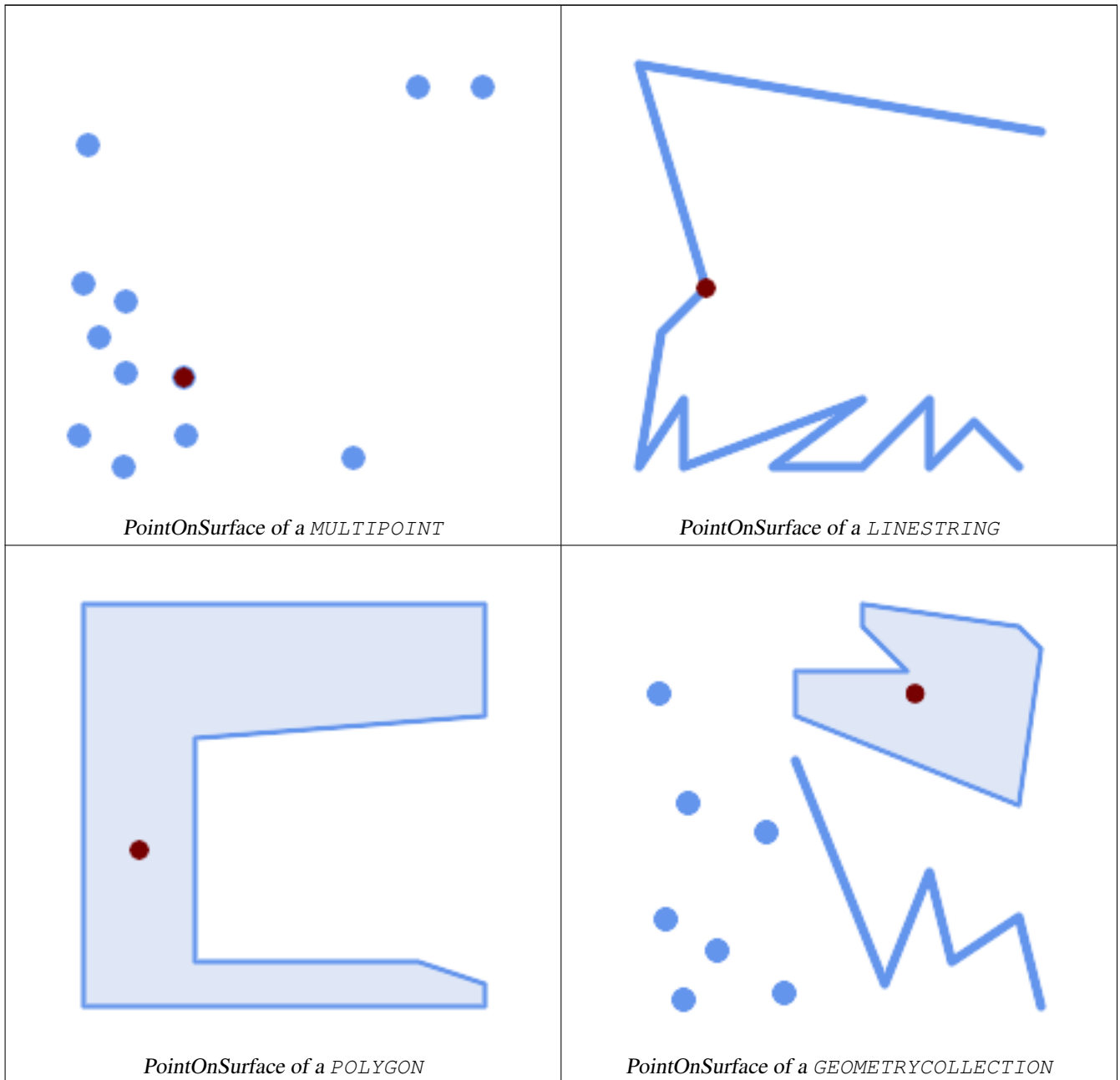
geometry **ST_PointOnSurface**(geometry g1);

Descripción

Returns a POINT which is guaranteed to lie in the interior of a surface (POLYGON, MULTIPOLYGON, and CURVED POLYGON). In PostGIS this function also works on line and point geometries.

- ✓ This method implements the [OGC Simple Features Implementation Specification for SQL 1.1](#). s3.2.14.2 // s3.2.18.2
- ✓ This method implements the SQL/MM specification. SQL-MM 3: 8.1.5, 9.5.6. The specifications define ST_PointOnSurface for surface geometries only. PostGIS extends the function to support all common geometry types. Other databases (Oracle, DB2, ArcSDE) seem to support this function only for surfaces. SQL Server 2008 supports all common geometry types.
- ✓ This function supports 3d and will not drop the z-index.

Ejemplos



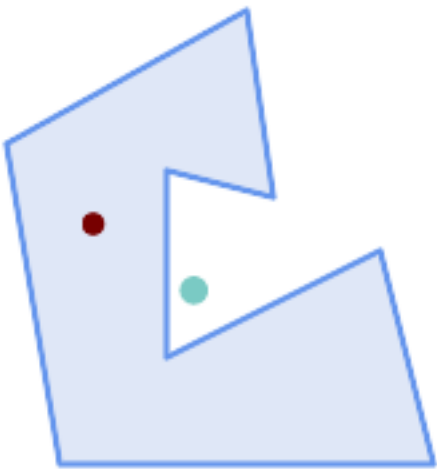
```
SELECT ST_AsText(ST_PointOnSurface('POINT(0 5)::geometry'));
-----
POINT(0 5)
```

```
SELECT ST_AsText(ST_PointOnSurface('LINESTRING(0 5, 0 10)::geometry));
-----
POINT(0 5)

SELECT ST_AsText(ST_PointOnSurface('POLYGON((0 0, 0 5, 5 5, 5 0, 0 0))::geometry));
-----
POINT(2.5 2.5)

SELECT ST_AsEWKT(ST_PointOnSurface(ST_GeomFromEWKT('LINESTRING(0 5 1, 0 0 1, 0 10 2)')));
-----
POINT(0 0 1)
```

Example: The result of ST_PointOnSurface is guaranteed to lie within polygons, whereas the point computed by **ST_Centroid** may be outside.



Red: point on surface; Green: centroid

```
SELECT ST_AsText(ST_PointOnSurface(geom)) AS pt_on_surf,
       ST_AsText(ST_Centroid(geom)) AS centroid
FROM (SELECT 'POLYGON ((130 120, 120 190, 30 140, 50 20, 190 20,
                        170 100, 90 60, 90 130, 130 120))'::geometry AS geom) AS t;

pt_on_surf | centroid
-----+-----
POINT(62.5 110) | POINT(100.18264840182648 85.11415525114155)
```

Ver también

ST_Centroid, **ST_MaximumInscribedCircle**

8.14.18 ST_Polygonize

ST_Polygonize — Computes a collection of polygons formed from the linework of a set of geometries.

Synopsis

```
geometry ST_Polygonize(geometry set geomfield);
geometry ST_Polygonize(geometry[] geom_array);
```

Descripción

Creates a GeometryCollection containing the polygons formed by the constituent linework of a set of geometries. Input linework must be correctly noded for this function to work properly.



Note

To ensure input is fully noded use [ST_Node](#) on the input geometry before polygonizing.



Note

GeometryCollections are often difficult to deal with with third party tools. Use [ST_Dump](#) to convert the polygonize result into separate polygons.

Realizado por el módulo GEOS.

Disponibilidad: 1.0.0RC1

Examples: Polygonizing single linestrings

```
SELECT ST_AsEWKT(ST_Polygonize(geom_4269)) As geomtextrep
FROM (SELECT geom_4269 FROM ma.suffolk_edges ORDER BY tlid LIMIT 45) As foo;
```

geomtextrep

```
SRID=4269;GEOMETRYCOLLECTION(POLYGON((-71.040878 42.285678,-71.040943 42.2856,-71.04096 42.285752,-71.040878 42.285678)),
POLYGON((-71.17166 42.353675,-71.172026 42.354044,-71.17239 42.354358,-71.171794 42.354971,-71.170511 42.354855,
-71.17112 42.354238,-71.17166 42.353675)))
(1 row)
```

--Use ST_Dump to dump out the polygonize geoms into individual polygons

```
SELECT ST_AsEWKT((ST_Dump(foofoo.polycoll)).geom) As geomtextrep
FROM (SELECT ST_Polygonize(geom_4269) As polycoll
      FROM (SELECT geom_4269 FROM ma.suffolk_edges
            ORDER BY tlid LIMIT 45) As foo) As foofoo;
```

geomtextrep

```
SRID=4269;POLYGON((-71.040878 42.285678,-71.040943 42.2856,-71.04096 42.285752,-71.040878 42.285678))
SRID=4269;POLYGON((-71.17166 42.353675,-71.172026 42.354044,-71.17239 42.354358,-71.171794 42.354971,-71.170511 42.354855,-71.17112 42.354238,-71.17166 42.353675))
(2 rows)
```

Ver también

[ST_Node](#), [ST_Dump](#)

8.14.19 ST_ReducePrecision

ST_ReducePrecision — Returns a valid geometry with points rounded to a grid tolerance.

Synopsis

geometry **ST_ReducePrecision**(geometry g, float8 gridsz);

Descripción

Returns a valid geometry with all points rounded to the provided grid tolerance, and features below the tolerance removed.

Unlike **ST_SnapToGrid** the returned geometry will be valid, with no ring self-intersections or collapsed components.

Precision reduction can be used to:

- match coordinate precision to the data accuracy
- reduce the number of coordinates needed to represent a geometry
- ensure valid geometry output to formats which use lower precision (e.g. text formats such as WKT, GeoJSON or KML when the number of output decimal places is limited).
- export valid geometry to systems which use lower or limited precision (e.g. SDE, Oracle tolerance value)

Availability: 3.1.0 - requires GEOS >= 3.9.0.

Ejemplos

```
SELECT ST_AsText(ST_ReducePrecision('POINT(1.412 19.323)', 0.1));
      st_astext
-----
POINT(1.4 19.3)

SELECT ST_AsText(ST_ReducePrecision('POINT(1.412 19.323)', 1.0));
      st_astext
-----
POINT(1 19)

SELECT ST_AsText(ST_ReducePrecision('POINT(1.412 19.323)', 10));
      st_astext
-----
POINT(0 20)
```

Precision reduction can reduce number of vertices

```
SELECT ST_AsText(ST_ReducePrecision('LINESTRING (10 10, 19.6 30.1, 20 30, 20.3 30, 40 40)', 1));
      st_astext
-----
LINESTRING (10 10, 20 30, 40 40)
```

Precision reduction splits polygons if needed to ensure validity

```
SELECT ST_AsText(ST_ReducePrecision('POLYGON ((10 10, 60 60.1, 70 30, 40 40, 50 10, 10 10))', 10));
      st_astext
-----
MULTIPOLYGON (((60 60, 70 30, 40 40, 60 60)), ((40 40, 50 10, 10 10, 40 40)))
```

Ver también

ST_SnapToGrid, **ST_Simplify**, **ST_SimplifyVW**

8.14.20 ST_SharedPaths

ST_SharedPaths — Returns a collection containing paths shared by the two input linestrings/multilinestrings.

Synopsis

geometry **ST_SharedPaths**(geometry lineal1, geometry lineal2);

Descripción

Returns a collection containing paths shared by the two input geometries. Those going in the same direction are in the first element of the collection, those going in the opposite direction are in the second element. The paths themselves are given in the direction of the first geometry.

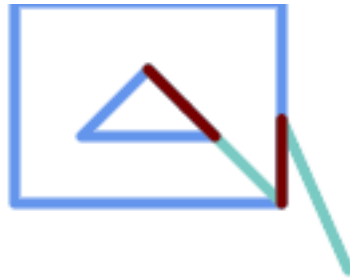
Realizado por el módulo GEOS.

Disponibilidad: 2.0.0

Examples: Finding shared paths



A multilinestring and a linestring



The shared path of multilinestring and linestring overlaid with original geometries.

```
SELECT ST_AsText(
  ST_SharedPaths(
    ST_GeomFromText('MULTILINESTRING((26 125,26 200,126 200,126 125,26 125),
      (51 150,101 150,76 175,51 150))'),
    ST_GeomFromText('LINESTRING(151 100,126 156.25,126 125,90 161, 76 175)')
  )
) As wkt
```

wkt

```
-----
GEOMETRYCOLLECTION(MULTILINESTRING((126 156.25,126 125),
  (101 150,90 161)), (90 161,76 175)),MULTILINESTRING EMPTY)
```

-- same example but linestring orientation flipped

```
SELECT ST_AsText(
  ST_SharedPaths(
    ST_GeomFromText('LINESTRING(76 175,90 161,126 125,126 156.25,151 100)'),
    ST_GeomFromText('MULTILINESTRING((26 125,26 200,126 200,126 125,26 125),
      (51 150,101 150,76 175,51 150))')
  )
) As wkt
```

wkt

```
-----
GEOMETRYCOLLECTION(MULTILINESTRING EMPTY,
  MULTILINESTRING((76 175,90 161), (90 161,101 150), (126 125,126 156.25)))
```

Ver también

[ST_Dump](#), [ST_GeometryN](#), [ST_NumGeometries](#)

8.14.21 ST_Simplify

ST_Simplify — Returns a simplified version of a geometry, using the Douglas-Peucker algorithm.

Synopsis

geometry **ST_SimplifyPreserveTopology**(geometry geomA, float tolerance);

Descripción

Returns a "simplified" version of the given geometry using the Douglas-Peucker algorithm. Will avoid creating derived geometries (polygons in particular) that are invalid. Will actually do something only with (multi)lines and (multi)polygons but you can safely call it with any kind of geometry. Since simplification occurs on a object-by-object basis you can also feed a GeometryCollection to this function.

Realizado por el módulo GEOS.

Disponibilidad: 1.3.3

Ejemplos

Same example as Simplify, but we see Preserve Topology prevents oversimplification. The circle can at most become a square.

```
SELECT ST_Npoints(geom) As np_before, ST_NPoints(ST_SimplifyPreserveTopology(geom,0.1)) As ↵
      np01_notbadcircle, ST_NPoints(ST_SimplifyPreserveTopology(geom,0.5)) As ↵
      np05_notquitecircle,
ST_NPoints(ST_SimplifyPreserveTopology(geom,1)) As np1_octagon, ST_NPoints( ↵
      ST_SimplifyPreserveTopology(geom,10)) As np10_square,
ST_NPoints(ST_SimplifyPreserveTopology(geom,100)) As np100_stillsquare
FROM (SELECT ST_Buffer('POINT(1 3)', 10,12) As geom) As foo;

--result--
np_before | np01_notbadcircle | np05_notquitecircle | np1_octagon | np10_square | ↵
np100_stillsquare
-----+-----+-----+-----+-----+-----
          49 |          33 |          17 |          9 |          5 | ↵
              5
```

Ver también

[ST_Simplify](#)

8.14.23 ST_SimplifyPolygonHull

ST_SimplifyPolygonHull — Computes a simplified topology-preserving outer or inner hull of a polygonal geometry.

Synopsis

geometry **ST_SimplifyPolygonHull**(geometry param_geom, float vertex_fraction, boolean is_outer = true);

Descripción

Computes a simplified topology-preserving outer or inner hull of a polygonal geometry. An outer hull completely covers the input geometry. An inner hull is completely covered by the input geometry. The result is a polygonal geometry formed by a subset of the input vertices. MultiPolygons and holes are handled and produce a result with the same structure as the input.

The reduction in vertex count is controlled by the `vertex_fraction` parameter, which is a number in the range 0 to 1. Lower values produce simpler results, with smaller vertex count and less concaveness. For both outer and inner hulls a vertex fraction

of 1.0 produces the original geometry. For outer hulls a value of 0.0 produces the convex hull (for a single polygon); for inner hulls it produces a triangle.

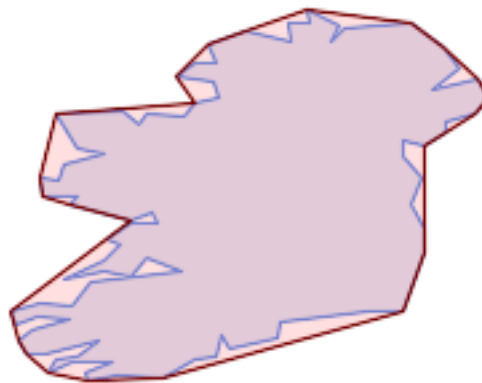
The simplification process operates by progressively removing concave corners that contain the least amount of area, until the vertex count target is reached. It prevents edges from crossing, so the result is always a valid polygonal geometry.

To get better results with geometries that contain relatively long line segments, it might be necessary to "segmentize" the input, as shown below.

Realizado por el módulo GEOS.

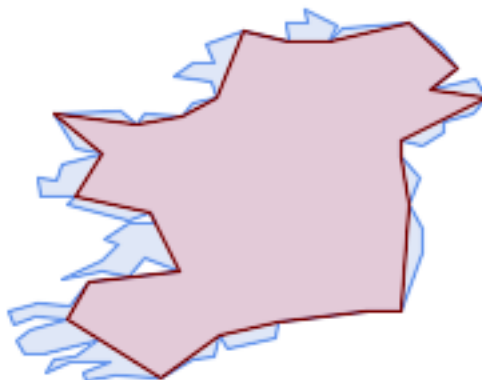
Availability: 3.3.0 - requires GEOS >= 3.11.0

Ejemplos



Outer hull of a Polygon

```
SELECT ST_SimplifyPolygonHull(
  'POLYGON ((131 158, 136 163, 161 165, 173 156, 179 148, 169 140, 186 144, 190 137, 185 ↵
    131, 174 128, 174 124, 166 119, 158 121, 158 115, 165 107, 161 97, 166 88, 166 79, 158 ↵
    57, 145 57, 112 53, 111 47, 93 43, 90 48, 88 40, 80 39, 68 32, 51 33, 40 31, 39 34, ↵
    49 38, 34 38, 25 34, 28 39, 36 40, 44 46, 24 41, 17 41, 14 46, 19 50, 33 54, 21 55, 13 ↵
    52, 11 57, 22 60, 34 59, 41 68, 75 72, 62 77, 56 70, 46 72, 31 69, 46 76, 52 82, 47 ↵
    84, 56 90, 66 90, 64 94, 56 91, 33 97, 36 100, 23 100, 22 107, 29 106, 31 112, 46 116, ↵
    36 118, 28 131, 53 132, 59 127, 62 131, 76 130, 80 135, 89 137, 87 143, 73 145, 80 ↵
    150, 88 150, 85 157, 99 162, 116 158, 115 165, 123 165, 122 170, 134 164, 131 158))',
  0.3);
```



Inner hull of a Polygon

```
SELECT ST_SimplifyPolygonHull(
  'POLYGON ((131 158, 136 163, 161 165, 173 156, 179 148, 169 140, 186 144, 190 137, 185 ↵
    131, 174 128, 174 124, 166 119, 158 121, 158 115, 165 107, 161 97, 166 88, 166 79, 158 ↵
    57, 145 57, 112 53, 111 47, 93 43, 90 48, 88 40, 80 39, 68 32, 51 33, 40 31, 39 34, ↵
    49 38, 34 38, 25 34, 28 39, 36 40, 44 46, 24 41, 17 41, 14 46, 19 50, 33 54, 21 55, 13 ↵
    52, 11 57, 22 60, 34 59, 41 68, 75 72, 62 77, 56 70, 46 72, 31 69, 46 76, 52 82, 47 ↵
    84, 56 90, 66 90, 64 94, 56 91, 33 97, 36 100, 23 100, 22 107, 29 106, 31 112, 46 116, ↵
    36 118, 28 131, 53 132, 59 127, 62 131, 76 130, 80 135, 89 137, 87 143, 73 145, 80 ↵
    150, 88 150, 85 157, 99 162, 116 158, 115 165, 123 165, 122 170, 134 164, 131 158))',
  0.3, false);
```



Outer hull simplification of a MultiPolygon, with segmentization

```
SELECT ST_SimplifyPolygonHull(
  ST_Segmentize(ST_Letters('xt'), 2.0),
  0.1);
```

Ver también

[ST_ConvexHull](#), [ST_SimplifyVW](#), [ST_ConcaveHull](#), [ST_Segmentize](#)

8.14.24 ST_SimplifyVW

ST_SimplifyVW — Returns a simplified version of a geometry, using the Visvalingam-Whyatt algorithm

Synopsis

geometry **ST_SimplifyVW**(geometry geomA, float tolerance);

Descripción

Returns a "simplified" version of the given geometry using the Visvalingam-Whyatt algorithm. Will actually do something only with (multi)lines and (multi)polygons but you can safely call it with any kind of geometry. Since simplification occurs on a object-by-object basis you can also feed a GeometryCollection to this function.



Note

Note that returned geometry might lose its simplicity (see [ST_IsSimple](#))



Note

Note topology may not be preserved and may result in invalid geometries. Use (see [ST_SimplifyPreserveTopology](#)) to preserve topology.



Note

This function handles 3D and the third dimension will affect the result.

Disponibilidad: 2.2.0

Ejemplos

A LineString is simplified with a minimum area threshold of 30.

```
select ST_AsText(ST_SimplifyVW(geom,30)) simplified
FROM (SELECT 'LINESTRING(5 2, 3 8, 6 20, 7 25, 10 10)::geometry geom) As foo;
-result
simplified
-----
LINESTRING(5 2,7 25,10 10)
```

Ver también

[ST_SetEffectiveArea](#), [ST_Simplify](#), [ST_SimplifyPreserveTopology](#), [Topology ST_Simplify](#)

8.14.25 ST_SetEffectiveArea

ST_SetEffectiveArea — Sets the effective area for each vertex, using the Visvalingam-Whyatt algorithm.

Synopsis

geometry **ST_SetEffectiveArea**(geometry geomA, float threshold = 0, integer set_area = 1);

Descripción

Sets the effective area for each vertex, using the Visvalingam-Whyatt algorithm. The effective area is stored as the M-value of the vertex. If the optional "theshold" parameter is used, a simplified geometry will be returned, containing only vertices with an effective area greater than or equal to the threshold value.

This function can be used for server-side simplification when a threshold is specified. Another option is to use a threshold value of zero. In this case, the full geometry will be returned with effective areas as M-values, which can be used by the client to simplify very quickly.

Will actually do something only with (multi)lines and (multi)polygons but you can safely call it with any kind of geometry. Since simplification occurs on a object-by-object basis you can also feed a GeometryCollection to this function.



Note

Note that returned geometry might lose its simplicity (see [ST_IsSimple](#))



Note

Note topology may not be preserved and may result in invalid geometries. Use (see [ST_SimplifyPreserveTopology](#)) to preserve topology.



Note

The output geometry will lose all previous information in the M-values



Note

This function handles 3D and the third dimension will affect the effective area

Disponibilidad: 2.2.0

Ejemplos

Calculating the effective area of a LineString. Because we use a threshold value of zero, all vertices in the input geometry are returned.

```
select ST_AsText(ST_SetEffectiveArea(geom)) all_pts, ST_AsText(ST_SetEffectiveArea(geom,30) ←
) thrshld_30
FROM (SELECT 'LINESTRING(5 2, 3 8, 6 20, 7 25, 10 10)'::geometry geom) As foo;
--result
all_pts | thrshld_30
-----+-----+
LINESTRING M (5 2 3.40282346638529e+38,3 8 29,6 20 1.5,7 25 49.5,10 10 3.40282346638529e ←
+38) | LINESTRING M (5 2 3.40282346638529e+38,7 25 49.5,10 10 3.40282346638529e+38)
```

Ver también

[ST_SimplifyVW](#)

8.14.26 ST_TriangulatePolygon

ST_TriangulatePolygon — Computes the constrained Delaunay triangulation of polygons

Synopsis

geometry **ST_TriangulatePolygon**(geometry geom);

Descripción

Computes the constrained Delaunay triangulation of polygons. Holes and Multipolygons are supported.

The "constrained Delaunay triangulation" of a polygon is a set of triangles formed from the vertices of the polygon, and covering it exactly, with the maximum total interior angle over all possible triangulations. It provides the "best quality" triangulation of the polygon.

Availability: 3.3.0 - requires GEOS >= 3.11.0

Example

Triangulation of a square.

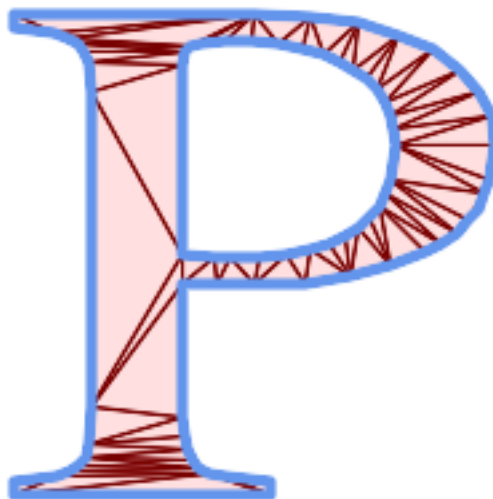
```
SELECT ST_AsText (
    ST_TriangulatePolygon('POLYGON((0 0, 0 1, 1 1, 1 0, 0 0))'));

          st_astext
-----
GEOMETRYCOLLECTION(POLYGON((0 0,0 1,1 1,0 0)),POLYGON((1 1,1 0,0 0,1 1)))
```

Example

Triangulation of the letter P.

```
SELECT ST_AsText(ST_TriangulatePolygon(
    'POLYGON ((26 17, 31 19, 34 21, 37 24, 38 29, 39 43, 39 161, 38 172, 36 176, 34 179, 30 ↵
        181, 25 183, 10 185, 10 190, 100 190, 121 189, 139 187, 154 182, 167 177, 177 169, ↵
        184 161, 189 152, 190 141, 188 128, 186 123, 184 117, 180 113, 176 108, 170 104, 164 ↵
        101, 151 96, 136 92, 119 89, 100 89, 86 89, 73 89, 73 39, 74 32, 75 27, 77 23, 79 ↵
        20, 83 18, 89 17, 106 15, 106 10, 10 10, 10 15, 26 17), (152 147, 151 152, 149 157, ↵
        146 162, 142 166, 137 169, 132 172, 126 175, 118 177, 109 179, 99 180, 89 180, 80 ↵
        179, 76 178, 74 176, 73 171, 73 100, 85 99, 91 99, 102 99, 112 100, 121 102, 128 ↵
        104, 134 107, 139 110, 143 114, 147 118, 149 123, 151 128, 153 141, 152 147)))'
));
```



Polygon Triangulation

Ver también

[ST_DelaunayTriangles](#), [ST_ConstrainedDelaunayTriangles](#), [ST_Tessellate](#)

8.14.27 ST_VoronoiLines

`ST_VoronoiLines` — Returns the boundaries of the Voronoi diagram of the vertices of a geometry.

Synopsis

geometry **ST_VoronoiLines**(g1 geometry , tolerance float8 , extend_to geometry);

Descripción

`ST_VoronoiLines` computes a two-dimensional **Voronoi diagram** from the vertices of the supplied geometry and returns the boundaries between cells in that diagram as a `MultiLineString`. Returns null if input geometry is null. Returns an empty geometry collection if the input geometry contains only one vertex. Returns an empty geometry collection if the `extend_to` envelope has zero area.

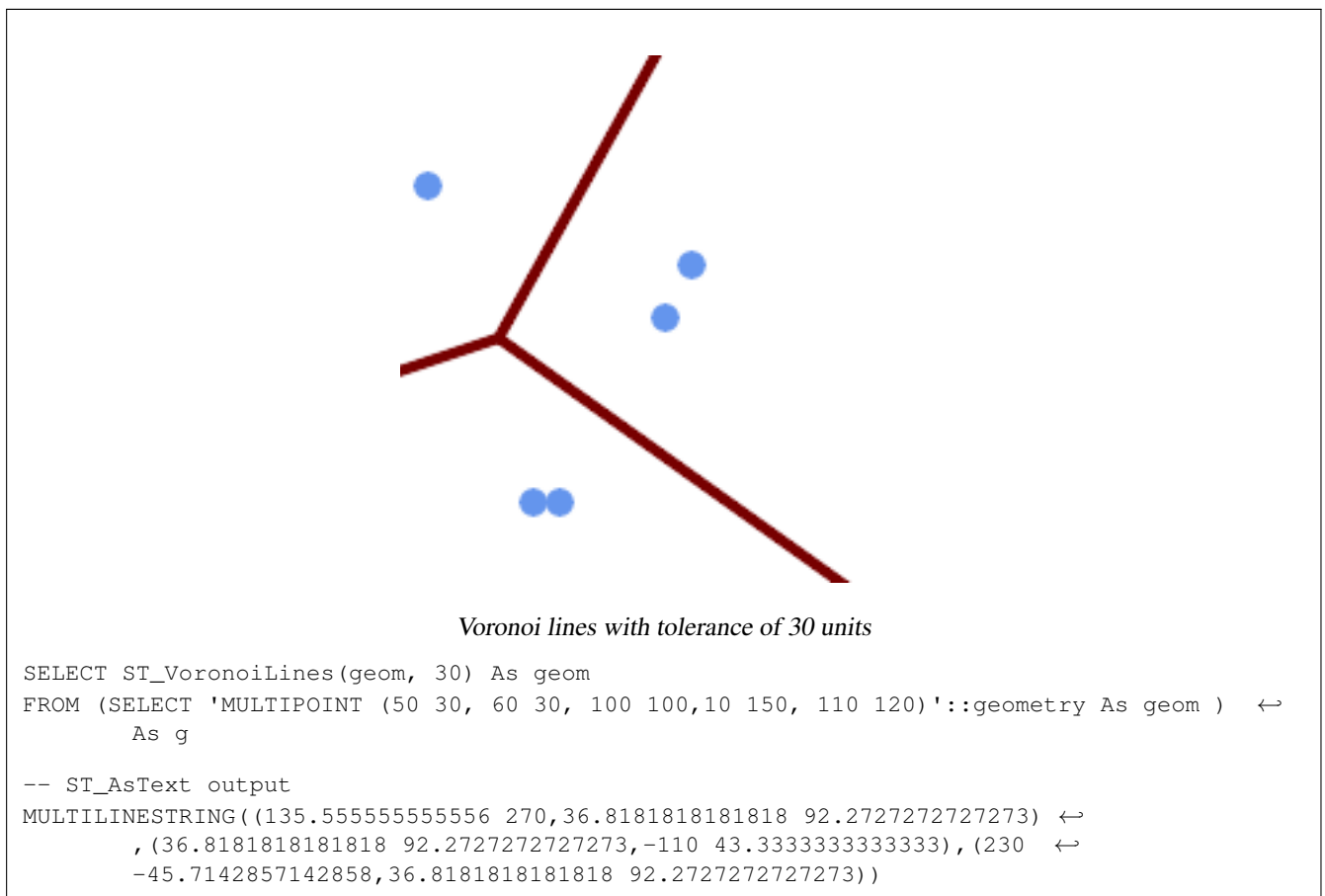
Optional parameters:

- 'tolerance' : The distance within which vertices will be considered equivalent. Robustness of the algorithm can be improved by supplying a nonzero tolerance distance. (default = 0.0)
- 'extend_to' : If a geometry is supplied as the "extend_to" parameter, the diagram will be extended to cover the envelope of the "extend_to" geometry, unless that envelope is smaller than the default envelope (default = NULL, default envelope is boundingbox of input geometry extended by about 50% in each direction).

Realizado por el módulo GEOS.

Disponibilidad: 2.3.0

Ejemplos



Ver también

[ST_DelaunayTriangles](#), [ST_VoronoiPolygons](#), [ST_GeomCollFromText](#)

8.14.28 ST_VoronoiPolygons

ST_VoronoiPolygons — Returns the cells of the Voronoi diagram of the vertices of a geometry.

Synopsis

```
geometry ST_VoronoiPolygons( g1 geometry , tolerance float8 , extend_to geometry );
```

Descripción

ST_VoronoiPolygons computes a two-dimensional **Voronoi diagram** from the vertices of the supplied geometry. The result is a GeometryCollection of Polygons that covers an envelope larger than the extent of the input vertices. Returns null if input geometry is null. Returns an empty geometry collection if the input geometry contains only one vertex. Returns an empty geometry collection if the extend_to envelope has zero area.

Optional parameters:

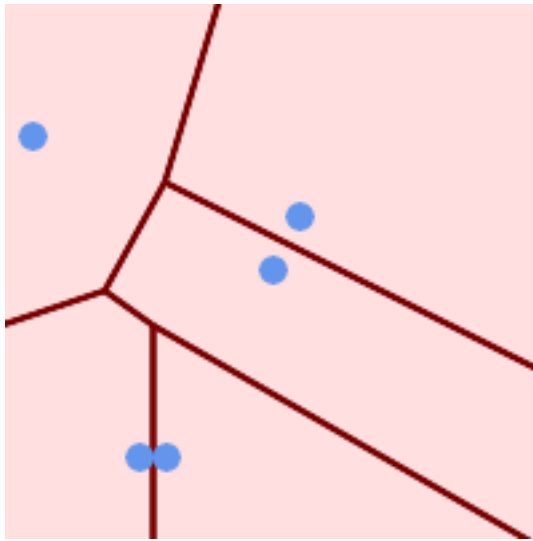
- 'tolerance' : The distance within which vertices will be considered equivalent. Robustness of the algorithm can be improved by supplying a nonzero tolerance distance. (default = 0.0)

- 'extend_to' : If a geometry is supplied as the "extend_to" parameter, the diagram will be extended to cover the envelope of the "extend_to" geometry, unless that envelope is smaller than the default envelope (default = NULL, default envelope is boundingbox of input geometry extended by about 50% in each direction).

Realizado por el módulo GEOS.

Disponibilidad: 2.3.0

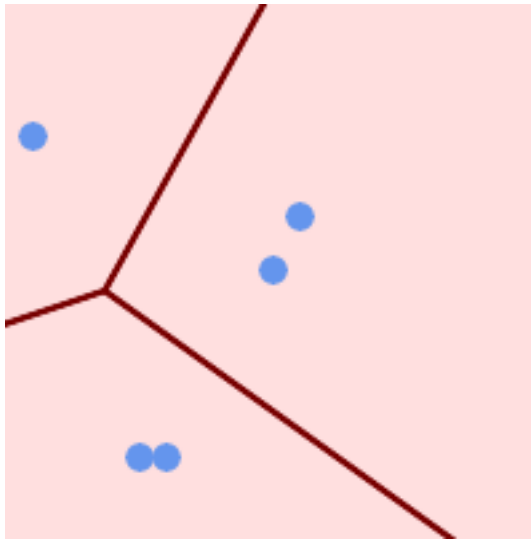
Ejemplos



Points overlaid on top of Voronoi diagram

```
SELECT
    ST_VoronoiPolygons(geom) As geom
FROM (SELECT 'MULTIPOINT (50 30, 60 30, 100 100,10 150, 110 120) '::geometry As geom ) ↵
    As g;

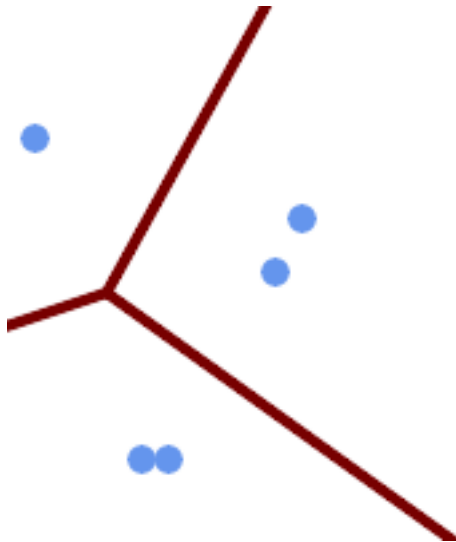
-- ST_AsText output
GEOMETRYCOLLECTION(POLYGON((-110 43.3333333333333,-110 270,100.5 270,59.3478260869565 ↵
    132.826086956522,36.8181818181818 92.2727272727273,-110 43.3333333333333)),
POLYGON((55 -90,-110 -90,-110 43.3333333333333,36.8181818181818 92.2727272727273,55 ↵
    79.2857142857143,55 -90)),
POLYGON((230 47.5,230 -20.7142857142857,55 79.2857142857143,36.8181818181818 ↵
    92.2727272727273,59.3478260869565 132.826086956522,230 47.5)),POLYGON((230 ↵
    -20.7142857142857,230 -90,55 -90,55 79.2857142857143,230 -20.7142857142857)),
POLYGON((100.5 270,230 270,230 47.5,59.3478260869565 132.826086956522,100.5 270)))
```



Voronoi with tolerance of 30 units

```
SELECT ST_VoronoiPolygons(geom, 30) As geom
FROM (SELECT 'MULTIPOINT (50 30, 60 30, 100 100,10 150,110 120) '::geometry As geom ) ↵
      As g;

-- ST_AsText output
GEOMETRYCOLLECTION(POLYGON((-110 43.3333333333333,-110 270,100.5 270,59.3478260869565 ↵
      132.826086956522,36.8181818181818 92.2727272727273,-110 43.3333333333333)), ↵
POLYGON((230 47.5,230 -45.7142857142858,36.8181818181818 ↵
      92.2727272727273,59.3478260869565 132.826086956522,230 47.5)),POLYGON((230 ↵
      -45.7142857142858,230 -90,-110 -90,-110 43.3333333333333,36.8181818181818 ↵
      92.2727272727273,230 -45.7142857142858)),
POLYGON((100.5 270,230 270,230 47.5,59.3478260869565 132.826086956522,100.5 270)))
```



Voronoi with tolerance of 30 units as MultiLineString

```
SELECT ST_VoronoiLines(geom, 30) As geom
FROM (SELECT 'MULTIPOINT (50 30, 60 30, 100 100, 10 150, 110 120)'::geometry As geom ) ↔
      As g

-- ST_AsText output
MULTILINESTRING((135.555555555556 270, 36.8181818181818 92.2727272727273) ↔
                , (36.8181818181818 92.2727272727273, -110 43.3333333333333), (230 ↔
                -45.7142857142858, 36.8181818181818 92.2727272727273))
```

Ver también

[ST_DelaunayTriangles](#), [ST_VoronoiLines](#), [ST_GeomCollFromText](#)

8.15 Affine Transformations

8.15.1 ST_Affine

ST_Affine — Apply a 3D affine transformation to a geometry.

Synopsis

geometry **ST_Affine**(geometry geomA, float a, float b, float c, float d, float e, float f, float g, float h, float i, float xoff, float yoff, float zoff);
 geometry **ST_Affine**(geometry geomA, float a, float b, float d, float e, float xoff, float yoff);

Description

Applies a 3D affine transformation to the geometry to do things like translate, rotate, scale in one step.

Version 1: The call

```
ST_Affine(geom, a, b, c, d, e, f, g, h, i, xoff, yoff, zoff)
```

represents the transformation matrix

```

/ a  b  c  xoff \
| d  e  f  yoff |
| g  h  i  zoff |
\ 0  0  0    1 /

```

and the vertices are transformed as follows:

```

x' = a*x + b*y + c*z + xoff
y' = d*x + e*y + f*z + yoff
z' = g*x + h*y + i*z + zoff

```

All of the translate / scale functions below are expressed via such an affine transformation.

Version 2: Applies a 2d affine transformation to the geometry. The call

```
ST_Affine(geom, a, b, d, e, xoff, yoff)
```

represents the transformation matrix

```

/ a  b  0  xoff \      / a  b  xoff \
| d  e  0  yoff |  rsp. | d  e  yoff |
| 0  0  1    0 |      \ 0  0    1  /
\ 0  0  0    1 /

```

and the vertices are transformed as follows:

```

x' = a*x + b*y + xoff
y' = d*x + e*y + yoff
z' = z

```

This method is a subcase of the 3D method above.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Availability: 1.1.2. Name changed from Affine to ST_Affine in 1.2.2



Note

Prior to 1.3.4, this function crashes if used with geometries that contain CURVES. This is fixed in 1.3.4+



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```

--Rotate a 3d line 180 degrees about the z axis. Note this is long-hand for doing ↔
ST_Rotate();
SELECT ST_AseWKT(ST_Affine(geom, cos(pi()), -sin(pi()), 0, sin(pi()), cos(pi()), 0, 0, ↔
0, 1, 0, 0, 0)) As using_affine,
ST_AseWKT(ST_Rotate(geom, pi())) As using_rotate
FROM (SELECT ST_GeomFromEWKT('LINESTRING(1 2 3, 1 4 3)') As geom) As foo;
using_affine | using_rotate

```



```

-----+-----
LINESTRING(-1 -2 3,-1 -4 3) | LINESTRING(-1 -2 3,-1 -4 3)
(1 row)

--Rotate a 3d line 180 degrees in both the x and z axis
SELECT ST_AsEWKT(ST_Affine(geom, cos(pi()), -sin(pi()), 0, sin(pi()), cos(pi()), -sin(pi()) ←
    , 0, sin(pi()), cos(pi()), 0, 0, 0))
    FROM (SELECT ST_GeomFromEWKT('LINESTRING(1 2 3, 1 4 3)') As geom) As foo;
    st_asewkt
-----
LINESTRING(-1 -2 -3,-1 -4 -3)
(1 row)

```

See Also

[ST_Rotate](#), [ST_Scale](#), [ST_Translate](#), [ST_TransScale](#)

8.15.2 ST_Rotate

ST_Rotate — Rotates a geometry about an origin point.

Synopsis

```

geometry ST_Rotate(geometry geomA, float rotRadians);
geometry ST_Rotate(geometry geomA, float rotRadians, float x0, float y0);
geometry ST_Rotate(geometry geomA, float rotRadians, geometry pointOrigin);

```

Description

Rotates geometry `rotRadians` counter-clockwise about the origin point. The rotation origin can be specified either as a `POINT` geometry, or as `x` and `y` coordinates. If the origin is not specified, the geometry is rotated about `POINT(0 0)`.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Enhanced: 2.0.0 additional parameters for specifying the origin of rotation were added.

Availability: 1.1.2. Name changed from `Rotate` to `ST_Rotate` in 1.2.2



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples

```

--Rotate 180 degrees
SELECT ST_AsEWKT(ST_Rotate('LINESTRING (50 160, 50 50, 100 50)', pi()));
    st_asewkt
-----
LINESTRING(-50 -160,-50 -50,-100 -50)
(1 row)

```

```
--Rotate 30 degrees counter-clockwise at x=50, y=160
SELECT ST_AsEWKT(ST_Rotate('LINESTRING (50 160, 50 50, 100 50)', pi()/6, 50, 160));
           st_asewkt
-----
LINESTRING(50 160,105 64.7372055837117,148.301270189222 89.7372055837117)
(1 row)

--Rotate 60 degrees clockwise from centroid
SELECT ST_AsEWKT(ST_Rotate(geom, -pi()/3, ST_Centroid(geom)))
FROM (SELECT 'LINESTRING (50 160, 50 50, 100 50)::geometry AS geom) AS foo;
           st_asewkt
-----
LINESTRING(116.4225 130.6721,21.1597 75.6721,46.1597 32.3708)
(1 row)
```

See Also

[ST_Affine](#), [ST_RotateX](#), [ST_RotateY](#), [ST_RotateZ](#)

8.15.3 ST_RotateX

ST_RotateX — Rotates a geometry about the X axis.

Synopsis

geometry **ST_RotateX**(geometry geomA, float rotRadians);

Description

Rotates a geometry geomA - rotRadians about the X axis.



Note

ST_RotateX(geomA, rotRadians) is short-hand for ST_Affine(geomA, 1, 0, 0, 0, cos(rotRadians), -sin(rotRadians), 0, sin(rotRadians), cos(rotRadians), 0, 0).

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Availability: 1.1.2. Name changed from RotateX to ST_RotateX in 1.2.2



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples

```
--Rotate a line 90 degrees along x-axis
SELECT ST_AsEWKT(ST_RotateX(ST_GeomFromEWKT('LINESTRING(1 2 3, 1 1 1)'), pi()/2));
           st_asewkt
-----
LINESTRING(1 -3 2,1 -1 1)
```

See Also

[ST_Affine](#), [ST_RotateY](#), [ST_RotateZ](#)

8.15.4 ST_RotateY

ST_RotateY — Rotates a geometry about the Y axis.

Synopsis

geometry **ST_RotateY**(geometry geomA, float rotRadians);

Description

Rotates a geometry geomA - rotRadians about the y axis.

**Note**

ST_RotateY(geomA, rotRadians) is short-hand for ST_Affine(geomA, cos(rotRadians), 0, sin(rotRadians), 0, 1, 0, -sin(rotRadians), 0, cos(rotRadians), 0, 0, 0).

Availability: 1.1.2. Name changed from RotateY to ST_RotateY in 1.2.2

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples

```
--Rotate a line 90 degrees along y-axis
SELECT ST_AsEWKT(ST_RotateY(ST_GeomFromEWKT('LINESTRING(1 2 3, 1 1 1)'), pi()/2));
           st_asewkt
-----
LINESTRING(3 2 -1,1 1 -1)
```

See Also

[ST_Affine](#), [ST_RotateX](#), [ST_RotateZ](#)

8.15.5 ST_RotateZ

ST_RotateZ — Rotates a geometry about the Z axis.

Synopsis

geometry **ST_RotateZ**(geometry geomA, float rotRadians);

Description

Rotates a geometry geomA - rotRadians about the Z axis.



Note

This is a synonym for ST_Rotate



Note

ST_RotateZ(geomA, rotRadians) is short-hand for SELECT ST_Affine(geomA, cos(rotRadians), -sin(rotRadians), 0, sin(rotRadians), cos(rotRadians), 0, 0, 0, 1, 0, 0, 0).

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Availability: 1.1.2. Name changed from RotateZ to ST_RotateZ in 1.2.2



Note

Prior to 1.3.4, this function crashes if used with geometries that contain CURVES. This is fixed in 1.3.4+



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples

```
--Rotate a line 90 degrees along z-axis
SELECT ST_AsEWKT(ST_RotateZ(ST_GeomFromEWKT('LINESTRING(1 2 3, 1 1 1)'), pi()/2));
           st_asewkt
-----
LINESTRING(-2 1 3,-1 1 1)

--Rotate a curved circle around z-axis
SELECT ST_AsEWKT(ST_RotateZ(geom, pi()/2))
FROM (SELECT ST_LineToCurve(ST_Buffer(ST_GeomFromText('POINT(234 567)'), 3)) As geom) As
      foo;

-----

CURVEPOLYGON(CIRCULARSTRING(-567 237,-564.87867965644 236.12132034356,-564
234,-569.12132034356 231.87867965644,-567 237))
```

See Also

[ST_Affine](#), [ST_RotateX](#), [ST_RotateY](#)

8.15.6 ST_Scale

ST_Scale — Scales a geometry by given factors.

Synopsis

```
geometry ST_Scale(geometry geomA, float XFactor, float YFactor, float ZFactor);  
geometry ST_Scale(geometry geomA, float XFactor, float YFactor);  
geometry ST_Scale(geometry geom, geometry factor);  
geometry ST_Scale(geometry geom, geometry factor, geometry origin);
```

Description

Scales the geometry to a new size by multiplying the ordinates with the corresponding factor parameters.

The version taking a geometry as the `factor` parameter allows passing a 2d, 3dm, 3dz or 4d point to set scaling factor for all supported dimensions. Missing dimensions in the `factor` point are equivalent to no scaling the corresponding dimension.

The three-geometry variant allows a "false origin" for the scaling to be passed in. This allows "scaling in place", for example using the centroid of the geometry as the false origin. Without a false origin, scaling takes place relative to the actual origin, so all coordinates are just multiplied by the scale factor.

**Note**

Prior to 1.3.4, this function crashes if used with geometries that contain CURVES. This is fixed in 1.3.4+

Availability: 1.1.0.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Enhanced: 2.2.0 support for scaling all dimension (`factor` parameter) was introduced.

Enhanced: 2.5.0 support for scaling relative to a local origin (`origin` parameter) was introduced.



This function supports Polyhedral surfaces.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports M coordinates.

Examples

```

--Version 1: scale X, Y, Z
SELECT ST_AsEWKT(ST_Scale(ST_GeomFromEWKT('LINESTRING(1 2 3, 1 1 1)'), 0.5, 0.75, 0.8));
          st_asewkt
-----
LINESTRING(0.5 1.5 2.4,0.5 0.75 0.8)

--Version 2: Scale X Y
SELECT ST_AsEWKT(ST_Scale(ST_GeomFromEWKT('LINESTRING(1 2 3, 1 1 1)'), 0.5, 0.75));
          st_asewkt
-----
LINESTRING(0.5 1.5 3,0.5 0.75 1)

--Version 3: Scale X Y Z M
SELECT ST_AsEWKT(ST_Scale(ST_GeomFromEWKT('LINESTRING(1 2 3 4, 1 1 1 1)'),
  ST_MakePoint(0.5, 0.75, 2, -1)));
          st_asewkt
-----
LINESTRING(0.5 1.5 6 -4,0.5 0.75 2 -1)

--Version 4: Scale X Y using false origin
SELECT ST_AsText(ST_Scale('LINESTRING(1 1, 2 2)', 'POINT(2 2)', 'POINT(1 1)::geometry'));
          st_astext
-----
LINESTRING(1 1,3 3)

```

See Also

[ST_Affine](#), [ST_TransScale](#)

8.15.7 ST_Translate

ST_Translate — Translates a geometry by given offsets.

Synopsis

```

geometry ST_Translate(geometry g1, float deltax, float deltax);
geometry ST_Translate(geometry g1, float deltax, float deltax, float deltaz);

```

Description

Returns a new geometry whose coordinates are translated delta x,delta y,delta z units. Units are based on the units defined in spatial reference (SRID) for this geometry.



Note

Prior to 1.3.4, this function crashes if used with geometries that contain CURVES. This is fixed in 1.3.4+

Availability: 1.2.2



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

Move a point 1 degree longitude

```
SELECT ST_AsText(ST_Translate(ST_GeomFromText('POINT(-71.01 42.37)',4326),1,0)) As ↵
      wgs_transgeomtxt;

      wgs_transgeomtxt
      -----
POINT(-70.01 42.37)
```

Move a linestring 1 degree longitude and 1/2 degree latitude

```
SELECT ST_AsText(ST_Translate(ST_GeomFromText('LINESTRING(-71.01 42.37,-71.11 42.38)',4326) ↵
      ,1,0.5)) As wgs_transgeomtxt;
      wgs_transgeomtxt
      -----
LINESTRING(-70.01 42.87,-70.11 42.88)
```

Move a 3d point

```
SELECT ST_AsEWKT(ST_Translate(CAST('POINT(0 0 0)' As geometry), 5, 12,3));
      st_asewkt
      -----
POINT(5 12 3)
```

Move a curve and a point

```
SELECT ST_AsText(ST_Translate(ST_Collect('CURVEPOLYGON(CIRCULARSTRING(4 3,3.12 0.878,1 ↵
      0,-1.121 5.1213,6 7, 8 9,4 3))','POINT(1 3)'),1,2));

-----

GEOMETRYCOLLECTION(CURVEPOLYGON(CIRCULARSTRING(5 5,4.12 2.878,2 2,-0.121 7.1213,7 9,9 11,5 ↵
      5)),POINT(2 5))
```

See Also

[ST_Affine](#), [ST_AsText](#), [ST_GeomFromText](#)

8.15.8 ST_TransScale

ST_TransScale — Translates and scales a geometry by given offsets and factors.

Synopsis

geometry **ST_TransScale**(geometry geomA, float deltaX, float deltaY, float XFactor, float YFactor);

Description

Translates the geometry using the deltaX and deltaY args, then scales it using the XFactor, YFactor args, working in 2D only.



Note

ST_TransScale(geomA, deltaX, deltaY, XFactor, YFactor) is short-hand for **ST_Affine**(geomA, XFactor, 0, 0, 0, YFactor, 0, 0, 0, 1, deltaX*XFactor, deltaY*YFactor, 0).

**Note**

Prior to 1.3.4, this function crashes if used with geometries that contain CURVES. This is fixed in 1.3.4+

Availability: 1.1.0.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_AsEWKT(ST_TransScale(ST_GeomFromEWKT('LINESTRING(1 2 3, 1 1 1)'), 0.5, 1, 1, 2));
           st_asewkt
-----
LINESTRING(1.5 6 3,1.5 4 1)

--Buffer a point to get an approximation of a circle, convert to curve and then translate ↩
  1,2 and scale it 3,4
SELECT ST_AsText(ST_Transscale(ST_LineToCurve(ST_Buffer('POINT(234 567)', 3)),1,2,3,4));

-----

CURVEPOLYGON(CIRCULARSTRING(714 2276,711.363961030679 2267.51471862576,705 ↩
  2264,698.636038969321 2284.48528137424,714 2276))
```

See Also

[ST_Affine](#), [ST_Translate](#)

8.16 Clustering Functions

8.16.1 ST_ClusterDBSCAN

ST_ClusterDBSCAN — Window function that returns a cluster id for each input geometry using the DBSCAN algorithm.

Synopsis

integer **ST_ClusterDBSCAN**(geometry winset geom, float8 eps, integer minpoints);

Description

Returns cluster number for each input geometry, based on a 2D implementation of the [Density-based spatial clustering of applications with noise \(DBSCAN\)](#) algorithm. Unlike [ST_ClusterKMeans](#), it does not require the number of clusters to be specified, but instead uses the desired [distance](#) (eps) and density (minpoints) parameters to construct each cluster.

An input geometry will be added to a cluster if it is either:

- A "core" geometry, that is within `eps distance` of at least `minpoints` input geometries (including itself) or
- A "border" geometry, that is within `eps distance` of a core geometry.

Note that border geometries may be within `eps` distance of core geometries in more than one cluster; in this case, either assignment would be correct, and the border geometry will be arbitrarily assigned to one of the available clusters. In these cases, it is possible for a correct cluster to be generated with fewer than `minpoints` geometries. When assignment of a border geometry is ambiguous, repeated calls to `ST_ClusterDBSCAN` will produce identical results if an `ORDER BY` clause is included in the window definition, but cluster assignments may differ from other implementations of the same algorithm.

**Note**

Input geometries that do not meet the criteria to join any other cluster will be assigned a cluster number of `NULL`.

Availability: 2.3.0

Examples

Assigning a cluster number to each polygon within 50 meters of each other. Require at least 2 polygons per cluster

																																																																																																																																																																													
<p><i>within 50 meters at least 2 per cluster. singletons have NULL for cid</i></p> <pre>SELECT name, ST_ClusterDBSCAN(geom, eps ↵ := 50, minpoints := 2) over () AS cid FROM boston_polys WHERE name > '' AND building > '' AND ST_DWithin(geom, ST_Transform(ST_GeomFromText('POINT ↵ (-71.04054 42.35141)', 4326), 26986), 500);</pre>	<table><tr><th>bucket</th><th>name</th><th></th><th>↵</th></tr><tr><td colspan="4">-----+-----</td></tr><tr><td></td><td>Manulife Tower</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>Park Lane Seaport I</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>Park Lane Seaport II</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>Renaissance Boston Waterfront Hotel</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>Seaport Boston Hotel</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>Seaport Hotel & World Trade Center</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>Waterside Place</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>World Trade Center East</td><td> </td><td>↵</td></tr><tr><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td>100 Northern Avenue</td><td> </td><td>↵</td></tr><tr><td>1</td><td></td><td></td><td></td></tr><tr><td></td><td>100 Pier 4</td><td> </td><td>↵</td></tr><tr><td>1</td><td></td><td></td><td></td></tr><tr><td></td><td>The Institute of Contemporary Art</td><td> </td><td>↵</td></tr><tr><td>1</td><td></td><td></td><td></td></tr><tr><td></td><td>101 Seaport</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>District Hall</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>One Marina Park Drive</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>Twenty Two Liberty</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>Vertex</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>Vertex</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>Watermark Seaport</td><td> </td><td>↵</td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td></td><td>Blue Hills Bank Pavilion</td><td> </td><td>↵</td></tr><tr><td>NULL</td><td></td><td></td><td></td></tr><tr><td></td><td>World Trade Center West</td><td> </td><td>↵</td></tr><tr><td>NULL</td><td></td><td></td><td></td></tr><tr><td>(20 rows)</td><td></td><td></td><td></td></tr></table>	bucket	name		↵	-----+-----					Manulife Tower		↵	0					Park Lane Seaport I		↵	0					Park Lane Seaport II		↵	0					Renaissance Boston Waterfront Hotel		↵	0					Seaport Boston Hotel		↵	0					Seaport Hotel & World Trade Center		↵	0					Waterside Place		↵	0					World Trade Center East		↵	0					100 Northern Avenue		↵	1					100 Pier 4		↵	1					The Institute of Contemporary Art		↵	1					101 Seaport		↵	2					District Hall		↵	2					One Marina Park Drive		↵	2					Twenty Two Liberty		↵	2					Vertex		↵	2					Vertex		↵	2					Watermark Seaport		↵	2					Blue Hills Bank Pavilion		↵	NULL					World Trade Center West		↵	NULL				(20 rows)			
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Combining parcels with the same cluster number into a single geometry. This uses named argument calling

```
SELECT cid, ST_Collect(geom) AS cluster_geom, array_agg(parcel_id) AS ids_in_cluster FROM (
  SELECT parcel_id, ST_ClusterDBSCAN(geom, eps := 0.5, minpoints := 5) over () AS cid, ↵
    geom
  FROM parcels) sq
GROUP BY cid;
```

See Also

[ST_DWithin](#), [ST_ClusterKMeans](#), [ST_ClusterIntersecting](#), [ST_ClusterWithin](#)

8.16.2 ST_ClusterIntersecting

ST_ClusterIntersecting — Aggregate function that clusters the input geometries into connected sets.

Synopsis

```
geometry[] ST_ClusterIntersecting(geometry set g);
```

Description

ST_ClusterIntersecting is an aggregate function that returns an array of GeometryCollections, where each GeometryCollection represents an interconnected set of geometries.

Availability: 2.2.0

Examples

```
WITH testdata AS
  (SELECT unnest(ARRAY['LINESTRING (0 0, 1 1)::geometry',
                       'LINESTRING (5 5, 4 4)::geometry',
                       'LINESTRING (6 6, 7 7)::geometry',
                       'LINESTRING (0 0, -1 -1)::geometry',
                       'POLYGON ((0 0, 4 0, 4 4, 0 4, 0 0))::geometry']) AS geom)

SELECT ST_AsText(unnest(ST_ClusterIntersecting(geom))) FROM testdata;

--result

st_astext
-----
GEOMETRYCOLLECTION(LINESTRING(0 0,1 1),LINESTRING(5 5,4 4),LINESTRING(0 0,-1 -1),POLYGON((0 0,4 0,4 4,0 4,0 0)))
GEOMETRYCOLLECTION(LINESTRING(6 6,7 7))
```

See Also

[ST_ClusterDBSCAN](#), [ST_ClusterKMeans](#), [ST_ClusterWithin](#)

8.16.3 ST_ClusterKMeans

ST_ClusterKMeans — Window function that returns a cluster id for each input geometry using the K-means algorithm.

Synopsis

```
integer ST_ClusterKMeans(geometry winset geom, integer number_of_clusters, float max_radius);
```

Description

Returns **K-means** cluster number for each input geometry. The distance used for clustering is the distance between the centroids for 2D geometries, and distance between bounding box centers for 3D geometries. For POINT inputs, M coordinate will be treated as weight of input and has to be larger than 0.

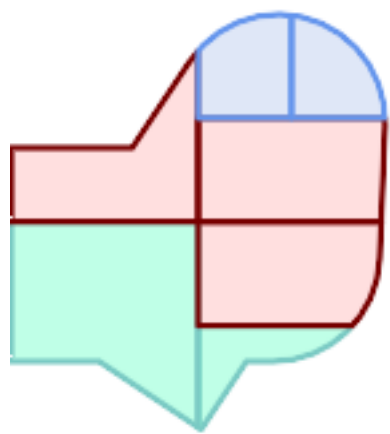
`max_radius`, if set, will cause **ST_ClusterKMeans** to generate more clusters than `k` ensuring that no cluster in output has radius larger than `max_radius`. This is useful in reachability analysis.

Enhanced: 3.2.0 Support for max_radius
Enhanced: 3.1.0 Support for 3D geometries and weights
Availability: 2.3.0

Examples

Generate dummy set of parcels for examples:

```
CREATE TABLE parcels AS
SELECT lpad((row_number() over())::text,3,'0') As parcel_id, geom,
('{residential, commercial}'::text[])[1 + mod(row_number()OVER(),2)] As type
FROM
  ST_Subdivide(ST_Buffer('SRID=3857;LINESTRING(40 100, 98 100, 100 150, 60 90)'::geometry ←
    40, 'endcap=square'),12) As geom;
```



Parcels color-coded by cluster number (cid)

```
SELECT ST_ClusterKMeans(geom, 3) OVER() AS cid, parcel_id, geom
FROM parcels;
```

cid	parcel_id	geom
0	001	0103000000...
0	002	0103000000...
1	003	0103000000...
0	004	0103000000...
1	005	0103000000...
2	006	0103000000...
2	007	0103000000...

Partitioning parcel clusters by type:

```
SELECT ST_ClusterKMeans(geom, 3) over (PARTITION BY type) AS cid, parcel_id, type
FROM parcels;
```

cid	parcel_id	type
1	005	commercial
1	003	commercial
2	007	commercial
0	001	commercial
1	004	residential
0	002	residential
2	006	residential

Example: Clustering a preaggregated planetary-scale data population dataset using 3D clustering and weighting. Identify at least 20 regions based on **Kontur Population Data** that do not span more than 3000 km from their center:

```
create table kontur_population_3000km_clusters as
select
  geom,
  ST_ClusterKMeans(
    ST_Force4D(
      ST_Transform(ST_Force3D(geom), 4978), -- cluster in 3D XYZ CRS
      mvalue := population -- set clustering to be weighed by population
    ),
    20, -- aim to generate at least 20 clusters
    max_radius := 3000000 -- but generate more to make each under 3000 km radius
  ) over () as cid
from
  kontur_population;
```



World population clustered to above specs produces 46 clusters. Clusters are centered at well-populated regions (New York, Moscow). Greenland is one cluster. There are island clusters that span across the antimeridian. Cluster edges follow Earth's curvature.

See Also

[ST_ClusterDBSCAN](#), [ST_ClusterIntersecting](#), [ST_ClusterWithin](#), [ST_Subdivide](#), [ST_Force3D](#), [ST_Force4D](#),

8.16.4 ST_ClusterWithin

ST_ClusterWithin — Aggregate function that clusters the input geometries by separation distance.

Synopsis

```
geometry[] ST_ClusterWithin(geometry set g, float8 distance);
```

Description

`ST_ClusterWithin` is an aggregate function that returns an array of `GeometryCollections`, where each `GeometryCollection` represents a set of geometries separated by no more than the specified distance. (Distances are Cartesian distances in the units of the SRID.)

Availability: 2.2.0

Examples

```
WITH testdata AS
  (SELECT unnest(ARRAY['LINESTRING (0 0, 1 1)::geometry',
                       'LINESTRING (5 5, 4 4)::geometry',
                       'LINESTRING (6 6, 7 7)::geometry',
                       'LINESTRING (0 0, -1 -1)::geometry',
                       'POLYGON ((0 0, 4 0, 4 4, 0 4, 0 0))::geometry']) AS geom)

SELECT ST_AsText(unnest(ST_ClusterWithin(geom, 1.4))) FROM testdata;

--result

st_astext
-----
GEOMETRYCOLLECTION(LINESTRING(0 0,1 1),LINESTRING(5 5,4 4),LINESTRING(0 0,-1 -1),POLYGON((0 0,4 0,4 4,0 4,0 0)))
GEOMETRYCOLLECTION(LINESTRING(6 6,7 7))
```

See Also

[ST_ClusterDBSCAN](#), [ST_ClusterKMeans](#), [ST_ClusterIntersecting](#)

8.17 Bounding Box Functions

8.17.1 Box2D

`Box2D` — Returns a `BOX2D` representing the 2D extent of a geometry.

Synopsis

`box2d` **Box2D**(geometry geom);

Description

Returns a **box2d** representing the 2D extent of the geometry.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples

```
SELECT Box2D(ST_GeomFromText('LINESTRING(1 2, 3 4, 5 6)'));
```

```
box2d
```

```
-----
```

```
BOX(1 2,5 6)
```

```
SELECT Box2D(ST_GeomFromText('CIRCULARSTRING(220268 150415,220227 150505,220227 150406)'));
```

```
box2d
```

```
-----
```

```
BOX(220186.984375 150406,220288.25 150506.140625)
```

See Also

[Box3D](#), [ST_GeomFromText](#)

8.17.2 Box3D

Box3D — Returns a BOX3D representing the 3D extent of a geometry.

Synopsis

```
box3d Box3D(geometry geom);
```

Description

Returns a **box3d** representing the 3D extent of the geometry.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.



This method supports Circular Strings and Curves



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).



This function supports 3d and will not drop the z-index.

Examples

```
SELECT Box3D(ST_GeomFromEWKT('LINESTRING(1 2 3, 3 4 5, 5 6 5)'));
```

```
Box3d
```

```
-----
```

```
BOX3D(1 2 3,5 6 5)
```

```
SELECT Box3D(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 1,220227 150406 1)'));
```

```
Box3d
```

```
-----
```

```
BOX3D(220227 150406 1,220268 150415 1)
```

See Also[Box2D](#), [ST_GeomFromEWKT](#)**8.17.3 ST_EstimatedExtent**

ST_EstimatedExtent — Returns the estimated extent of a spatial table.

Synopsis

```
box2d ST_EstimatedExtent(text schema_name, text table_name, text geocolumn_name, boolean parent_only);
box2d ST_EstimatedExtent(text schema_name, text table_name, text geocolumn_name);
box2d ST_EstimatedExtent(text table_name, text geocolumn_name);
```

Description

Returns the estimated extent of a spatial table as a [box2d](#). The current schema is used if not specified. The estimated extent is taken from the geometry column's statistics. This is usually much faster than computing the exact extent of the table using [ST_Extent](#) or [ST_3DExtent](#).

The default behavior is to also use statistics collected from child tables (tables with INHERITS) if available. If `parent_only` is set to TRUE, only statistics for the given table are used and child tables are ignored.

For PostgreSQL >= 8.0.0 statistics are gathered by VACUUM ANALYZE and the result extent will be about 95% of the actual one. For PostgreSQL < 8.0.0 statistics are gathered by running `update_geometry_stats()` and the result extent is exact.

**Note**

In the absence of statistics (empty table or no ANALYZE called) this function returns NULL. Prior to version 1.5.4 an exception was thrown instead.

Availability: 1.0.0

Changed: 2.1.0. Up to 2.0.x this was called `ST_Estimated_Extent`.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_EstimatedExtent('ny', 'edges', 'geom');
--result--
BOX(-8877653 4912316,-8010225.5 5589284)

SELECT ST_EstimatedExtent('feature_poly', 'geom');
--result--
BOX(-124.659652709961 24.6830825805664,-67.7798080444336 49.0012092590332)
```

See Also[ST_Extent](#), [ST_3DExtent](#)**8.17.4 ST_Expand**

ST_Expand — Returns a bounding box expanded from another bounding box or a geometry.

Synopsis

```
geometry ST_Expand(geometry geom, float units_to_expand);
geometry ST_Expand(geometry geom, float dx, float dy, float dz=0, float dm=0);
box2d ST_Expand(box2d box, float units_to_expand);
box2d ST_Expand(box2d box, float dx, float dy);
box3d ST_Expand(box3d box, float units_to_expand);
box3d ST_Expand(box3d box, float dx, float dy, float dz=0);
```

Description

Returns a bounding box expanded from the bounding box of the input, either by specifying a single distance with which the box should be expanded on both axes, or by specifying an expansion distance for each axis. Uses double-precision. Can be used for distance queries, or to add a bounding box filter to a query to take advantage of a spatial index.

In addition to the version of `ST_Expand` accepting and returning a geometry, variants are provided that accept and return **box2d** and **box3d** data types.

Distances are in the units of the spatial reference system of the input.

`ST_Expand` is similar to **ST_Buffer**, except while buffering expands a geometry in all directions, `ST_Expand` expands the bounding box along each axis.



Note

Pre version 1.3, `ST_Expand` was used in conjunction with **ST_Distance** to do indexable distance queries. For example, `geom && ST_Expand('POINT(10 20)', 10) AND ST_Distance(geom, 'POINT(10 20)') < 10`. This has been replaced by the simpler and more efficient **ST_DWithin** function.

Availability: 1.5.0 behavior changed to output double precision instead of float4 coordinates.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Enhanced: 2.3.0 support was added to expand a box by different amounts in different dimensions.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples



Note

Examples below use US National Atlas Equal Area (SRID=2163) which is a meter projection

```
--10 meter expanded box around bbox of a linestring
SELECT CAST(ST_Expand(ST_GeomFromText('LINESTRING(2312980 110676,2312923 110701,2312892 110714)', 2163),10) As box2d);
                                st_expand
-----
BOX(2312882 110666,2312990 110724)

--10 meter expanded 3D box of a 3D box
SELECT ST_Expand(CAST('BOX3D(778783 2951741 1,794875 2970042.61545891 10)' As box3d),10)
                                st_expand
-----
```

```

BOX3D(778773 2951731 -9,794885 2970052.61545891 20)

--10 meter geometry astext rep of a expand box around a point geometry
SELECT ST_AsEWKT(ST_Expand(ST_GeomFromEWKT('SRID=2163;POINT(2312980 110676)'),10));
-- st_asewkt
-----
SRID=2163;POLYGON((2312970 110666,2312970 110686,2312990 110686,2312990 110666,2312970 110666))

```

See Also

[ST_Buffer](#), [ST_DWithin](#), [ST_SRID](#)

8.17.5 ST_Extent

ST_Extent — Aggregate function that returns the bounding box of geometries.

Synopsis

box2d **ST_Extent**(geometry set geomfield);

Description

An aggregate function that returns a **box2d** bounding box that bounds a set of geometries.

The bounding box coordinates are in the spatial reference system of the input geometries.

ST_Extent is similar in concept to Oracle Spatial/Locator's **SDO_AGGR_MBR**.



Note

ST_Extent returns boxes with only X and Y ordinates even with 3D geometries. To return XYZ ordinates use **ST_3DExtent**.



Note

The returned **box3d** value does not include a SRID. Use **ST_SetSRID** to convert it into a geometry with SRID meta-data. The SRID is the same as the input geometries.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples



Note
Examples below use Massachusetts State Plane ft (SRID=2249)

```
SELECT ST_Extent(geom) as bextent FROM sometable;
                                st_bextent
-----
BOX(739651.875 2908247.25,794875.8125 2970042.75)

--Return extent of each category of geometries
SELECT ST_Extent(geom) as bextent
FROM sometable
GROUP BY category ORDER BY category;
```

bextent	name
BOX(778783.5625 2951741.25,794875.8125 2970042.75)	A
BOX(751315.8125 2919164.75,765202.6875 2935417.25)	B
BOX(739651.875 2917394.75,756688.375 2935866)	C

```
--Force back into a geometry
-- and render the extended text representation of that geometry
SELECT ST_SetSRID(ST_Extent(geom),2249) as bextent FROM sometable;
```

bextent
SRID=2249;POLYGON((739651.875 2908247.25,739651.875 2970042.75,794875.8125 2970042.75,794875.8125 2908247.25,739651.875 2908247.25))

See Also

[ST_EstimatedExtent](#), [ST_3DExtent](#), [ST_SetSRID](#)

8.17.6 ST_3DExtent

ST_3DExtent — Aggregate function that returns the 3D bounding box of geometries.

Synopsis

box3d **ST_3DExtent**(geometry set geomfield);

Description

An aggregate function that returns a **box3d** (includes Z ordinate) bounding box that bounds a set of geometries. The bounding box coordinates are in the spatial reference system of the input geometries.



Note
The returned **box3d** value does not include a SRID. Use [ST_SetSRID](#) to convert it into a geometry with SRID meta-data. The SRID is the same as the input geometries.

Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.

Changed: 2.0.0 In prior versions this used to be called ST_Extent3D

- ✔ This function supports 3d and will not drop the z-index.
- ✔ This method supports Circular Strings and Curves
- ✔ This function supports Polyhedral surfaces.
- ✔ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Examples

```
SELECT ST_3DExtent(foo.geom) As b3extent
FROM (SELECT ST_MakePoint(x,y,z) As geom
      FROM generate_series(1,3) As x
           CROSS JOIN generate_series(1,2) As y
           CROSS JOIN generate_series(0,2) As Z) As foo;

-----
b3extent
-----
BOX3D(1 1 0,3 2 2)

--Get the extent of various elevated circular strings
SELECT ST_3DExtent(foo.geom) As b3extent
FROM (SELECT ST_Translate(ST_Force_3DZ(ST_LineToCurve(ST_Buffer(ST_Point(x,y),1))),0,0,z)  ←
      As geom
      FROM generate_series(1,3) As x
           CROSS JOIN generate_series(1,2) As y
           CROSS JOIN generate_series(0,2) As Z) As foo;

-----
b3extent
-----
BOX3D(1 0 0,4 2 2)
```

See Also

[ST_Extent](#), [ST_Force3DZ](#), [ST_SetSRID](#)

8.17.7 ST_MakeBox2D

ST_MakeBox2D — Creates a BOX2D defined by two 2D point geometries.

Synopsis

box2d **ST_MakeBox2D**(geometry pointLowLeft, geometry pointUpRight);

Description

Creates a **box2d** defined by two Point geometries. This is useful for doing range queries.

Examples

```
--Return all features that fall reside or partly reside in a US national atlas coordinate ↵
    bounding box
--It is assumed here that the geometries are stored with SRID = 2163 (US National atlas ↵
    equal area)
SELECT feature_id, feature_name, geom
FROM features
WHERE geom && ST_SetSRID(ST_MakeBox2D(ST_Point(-989502.1875, 528439.5625),
    ST_Point(-987121.375 ,529933.1875)),2163)
```

See Also

[ST_Point](#), [ST_SetSRID](#), [ST_SRID](#)

8.17.8 ST_3DMakeBox

ST_3DMakeBox — Creates a BOX3D defined by two 3D point geometries.

Synopsis

box3d **ST_3DMakeBox**(geometry point3DLowLeftBottom, geometry point3DUpRightTop);

Description

Creates a **box3d** defined by two 3D Point geometries.



This function supports 3D and will not drop the z-index.

Changed: 2.0.0 In prior versions this used to be called ST_MakeBox3D

Examples

```
SELECT ST_3DMakeBox(ST_MakePoint(-989502.1875, 528439.5625, 10),
    ST_MakePoint(-987121.375 ,529933.1875, 10)) As abb3d

--bb3d--
-----
BOX3D(-989502.1875 528439.5625 10,-987121.375 529933.1875 10)
```

See Also

[ST_MakePoint](#), [ST_SetSRID](#), [ST_SRID](#)

8.17.9 ST_XMax

ST_XMax — Returns the X maxima of a 2D or 3D bounding box or a geometry.

Synopsis

float **ST_XMax**(box3d aGeomorBox2DorBox3D);

Description

Returns the X maxima of a 2D or 3D bounding box or a geometry.



Note

Although this function is only defined for box3d, it also works for box2d and geometry values due to automatic casting. However, it will not accept a geometry or box2d text representation, since those do not auto-cast.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_XMax('BOX3D(1 2 3, 4 5 6)');
st_xmax
-----
4

SELECT ST_XMax(ST_GeomFromText('LINESTRING(1 3 4, 5 6 7)'));
st_xmax
-----
5

SELECT ST_XMax(CAST('BOX(-3 2, 3 4)' As box2d));
st_xmax
-----
3
--Observe THIS DOES NOT WORK because it will try to auto-cast the string representation to
a BOX3D
SELECT ST_XMax('LINESTRING(1 3, 5 6)');

--ERROR: BOX3D parser - doesn't start with BOX3D(

SELECT ST_XMax(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227
150406 3)'));
st_xmax
-----
220288.248780547
```

See Also

[ST_XMin](#), [ST_YMax](#), [ST_YMin](#), [ST_ZMax](#), [ST_ZMin](#)

8.17.10 ST_XMin

ST_XMin — Returns the X minima of a 2D or 3D bounding box or a geometry.

Synopsis

```
float ST_XMin(box3d aGeomorBox2DorBox3D);
```

Description

Returns the X minima of a 2D or 3D bounding box or a geometry.



Note

Although this function is only defined for box3d, it also works for box2d and geometry values due to automatic casting. However it will not accept a geometry or box2d text representation, since those do not auto-cast.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_XMin('BOX3D(1 2 3, 4 5 6)');
st_xmin
-----
1

SELECT ST_XMin(ST_GeomFromText('LINESTRING(1 3 4, 5 6 7)'));
st_xmin
-----
1

SELECT ST_XMin(CAST('BOX(-3 2, 3 4)' As box2d));
st_xmin
-----
-3
--Observe THIS DOES NOT WORK because it will try to auto-cast the string representation to
a BOX3D
SELECT ST_XMin('LINESTRING(1 3, 5 6)');

--ERROR: BOX3D parser - doesn't start with BOX3D(

SELECT ST_XMin(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227
150406 3)'));
st_xmin
-----
220186.995121892
```

See Also

[ST_XMax](#), [ST_YMax](#), [ST_YMin](#), [ST_ZMax](#), [ST_ZMin](#)

8.17.11 ST_YMax

ST_YMax — Returns the Y maxima of a 2D or 3D bounding box or a geometry.

Synopsis

```
float ST_YMax(box3d aGeomorBox2DorBox3D);
```

Description

Returns the Y maxima of a 2D or 3D bounding box or a geometry.



Note

Although this function is only defined for box3d, it also works for box2d and geometry values due to automatic casting. However it will not accept a geometry or box2d text representation, since those do not auto-cast.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_YMax('BOX3D(1 2 3, 4 5 6)');
st_ymax
-----
5

SELECT ST_YMax(ST_GeomFromText('LINESTRING(1 3 4, 5 6 7)'));
st_ymax
-----
6

SELECT ST_YMax(CAST('BOX(-3 2, 3 4)' As box2d));
st_ymax
-----
4
--Observe THIS DOES NOT WORK because it will try to auto-cast the string representation to
a BOX3D
SELECT ST_YMax('LINESTRING(1 3, 5 6)');

--ERROR: BOX3D parser - doesn't start with BOX3D(

SELECT ST_YMax(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227
150406 3)'));
st_ymax
-----
150506.126829327
```

See Also

[ST_XMin](#), [ST_XMax](#), [ST_YMin](#), [ST_ZMax](#), [ST_ZMin](#)

8.17.12 ST_YMin

ST_YMin — Returns the Y minima of a 2D or 3D bounding box or a geometry.

Synopsis

```
float ST_YMin(box3d aGeomorBox2DorBox3D);
```


Description

Returns the Y minima of a 2D or 3D bounding box or a geometry.



Note

Although this function is only defined for box3d, it also works for box2d and geometry values due to automatic casting. However it will not accept a geometry or box2d text representation, since those do not auto-cast.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_YMin('BOX3D(1 2 3, 4 5 6)');
st_ymin
-----
2

SELECT ST_YMin(ST_GeomFromText('LINESTRING(1 3 4, 5 6 7)'));
st_ymin
-----
3

SELECT ST_YMin(CAST('BOX(-3 2, 3 4)' As box2d));
st_ymin
-----
2
--Observe THIS DOES NOT WORK because it will try to auto-cast the string representation to
a BOX3D
SELECT ST_YMin('LINESTRING(1 3, 5 6)');

--ERROR: BOX3D parser - doesn't start with BOX3D(

SELECT ST_YMin(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227
150406 3)'));
st_ymin
-----
150406
```

See Also

[ST_GeomFromEWKT](#), [ST_XMin](#), [ST_XMax](#), [ST_YMax](#), [ST_ZMax](#), [ST_ZMin](#)

8.17.13 ST_ZMax

ST_ZMax — Returns the Z maxima of a 2D or 3D bounding box or a geometry.

Synopsis

```
float ST_ZMax(box3d aGeomorBox2DorBox3D);
```

Description

Returns the Z maxima of a 2D or 3D bounding box or a geometry.



Note

Although this function is only defined for box3d, it also works for box2d and geometry values due to automatic casting. However it will not accept a geometry or box2d text representation, since those do not auto-cast.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_ZMax('BOX3D(1 2 3, 4 5 6)');
st_zmax
-----
6

SELECT ST_ZMax(ST_GeomFromEWKT('LINESTRING(1 3 4, 5 6 7)'));
st_zmax
-----
7

SELECT ST_ZMax('BOX3D(-3 2 1, 3 4 1)');
st_zmax
-----
1
--Observe THIS DOES NOT WORK because it will try to auto-cast the string representation to
a BOX3D
SELECT ST_ZMax('LINESTRING(1 3 4, 5 6 7)');

--ERROR: BOX3D parser - doesn't start with BOX3D(

SELECT ST_ZMax(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227
150406 3)'));
st_zmax
-----
3
```

See Also

[ST_GeomFromEWKT](#), [ST_XMin](#), [ST_XMax](#), [ST_YMax](#), [ST_YMin](#), [ST_ZMax](#)

8.17.14 ST_ZMin

ST_ZMin — Returns the Z minima of a 2D or 3D bounding box or a geometry.

Synopsis

```
float ST_ZMin(box3d aGeomorBox2DorBox3D);
```

Description

Returns the Z minima of a 2D or 3D bounding box or a geometry.

**Note**

Although this function is only defined for box3d, it also works for box2d and geometry values due to automatic casting. However it will not accept a geometry or box2d text representation, since those do not auto-cast.



This function supports 3d and will not drop the z-index.



This method supports Circular Strings and Curves

Examples

```
SELECT ST_ZMin('BOX3D(1 2 3, 4 5 6)');
st_zmin
-----
3

SELECT ST_ZMin(ST_GeomFromEWKT('LINESTRING(1 3 4, 5 6 7)'));
st_zmin
-----
4

SELECT ST_ZMin('BOX3D(-3 2 1, 3 4 1)');
st_zmin
-----
1
--Observe THIS DOES NOT WORK because it will try to auto-cast the string representation to
a BOX3D
SELECT ST_ZMin('LINESTRING(1 3 4, 5 6 7)');

--ERROR: BOX3D parser - doesn't start with BOX3D(

SELECT ST_ZMin(ST_GeomFromEWKT('CIRCULARSTRING(220268 150415 1,220227 150505 2,220227
150406 3)'));
st_zmin
-----
1
```

See Also

[ST_GeomFromEWKT](#), [ST_GeomFromText](#), [ST_XMin](#), [ST_XMax](#), [ST_YMax](#), [ST_YMin](#), [ST_ZMax](#)

8.18 Referencia Lineal

8.18.1 ST_LineInterpolatePoint

ST_LineInterpolatePoint — Returns a point interpolated along a line at a fractional location.

Synopsis

geometry **ST_LineInterpolatePoint**(geometry a_linestring, float8 a_fraction);

Descripción

Devuelve un punto interpolado a lo largo de una línea. El primer argumento debe ser un LINESTRING. El segundo argumento es un float8 entre 0 y 1 que representa la fracción de la longitud total de la cadena de línea del punto que se quiere localizar.

Ver [ST_LineLocatePoint](#) para calcular la ubicación de la línea más cercana a un punto.



Note

This function computes points in 2D and then interpolates values for Z and M, while [ST_LineInterpolatePoint](#) computes points in 3D and only interpolates the M value.



Note

Desde la versión 1.1.1 esta función también interpola los valores M y Z (cuando están presentes), mientras que las versiones anteriores las establecen en 0.0.

Disponibilidad: 0.8.2, Z y M soportados añadidos en 1.1.1

Cambiado: 2.1.0. Hasta 2.0. x esto se llamaba ST_Line_Interpolate_Point.



This function supports 3d and will not drop the z-index.

Ejemplos



Una cadena de línea con el punto interpolado en la posición del 20% (0,20)

```
-- The point 20% along a line

SELECT ST_AsEWKT( ST_LineInterpolatePoint(
    'LINESTRING(25 50, 100 125, 150 190)',
    0.2 ));

-----
POINT(51.5974135047432 76.5974135047432)
```

The mid-point of a 3D line:

```
SELECT ST_AsEWKT( ST_LineInterpolatePoint('
    LINESTRING(1 2 3, 4 5 6, 6 7 8)',
    0.5 ));
-----
POINT(3.5 4.5 5.5)
```

The closest point on a line to a point:

```
SELECT ST_AsText( ST_LineInterpolatePoint( line.geom,
    ST_LineLocatePoint( line.geom, 'POINT(4 3)'))
FROM (SELECT ST_GeomFromText('LINESTRING(1 2, 4 5, 6 7)') As geom) AS line;
-----
POINT(3 4)
```

Ver también

[ST_LineInterpolatePoints](#), [ST_LineInterpolatePoint](#), [ST_LineMerge](#)

8.18.2 ST_LineInterpolatePoint

ST_LineInterpolatePoint — Returns a point interpolated along a 3D line at a fractional location.

Synopsis

geometry **ST_LineInterpolatePoint**(geometry a_linestring, float8 a_fraction);

Descripción

Devuelve un punto interpolado a lo largo de una línea. El primer argumento debe ser un LINESTRING. El segundo argumento es un float8 entre 0 y 1 que representa la fracción de la longitud total de la cadena de línea del punto tiene que ser localizado.



Note

ST_LineInterpolatePoint computes points in 2D and then interpolates the values for Z and M, while this function computes points in 3D and only interpolates the M value.

Disponibilidad: 2.0.0



This function supports 3d and will not drop the z-index.

Ejemplos

Return point 20% along 3D line

```
--Punto de retorno 20% a lo largo de línea 2D
SELECT ST_AsEWKT(ST_LineInterpolatePoint(the_line, 0.20))
    FROM (SELECT ST_GeomFromEWKT('LINESTRING(25 50, 100 125, 150 190)') as the_line) As ←
    foo;
    st_asewkt
-----
POINT(51.5974135047432 76.5974135047432)
```

Ver también

[ST_LineInterpolatePoint](#), [ST_LineInterpolatePoint](#), [ST_LineMerge](#)

8.18.3 ST_LineInterpolatePoints

ST_LineInterpolatePoints — Returns points interpolated along a line at a fractional interval.

Synopsis

geometry **ST_LineInterpolatePoints**(geometry a_linestring, float8 a_fraction, boolean repeat);

Descripción

Returns one or more points interpolated along a line at a fractional interval. The first argument must be a **LINESTRING**. The second argument is a float8 between 0 and 1 representing the spacing between the points as a fraction of line length. If the third argument is false, at most one point will be constructed (which is equivalent to [ST_LineInterpolatePoint](#).)

If the result has zero or one points, it is returned as a **POINT**. If it has two or more points, it is returned as a **MULTIPOINT**.

Availability: 2.5.0

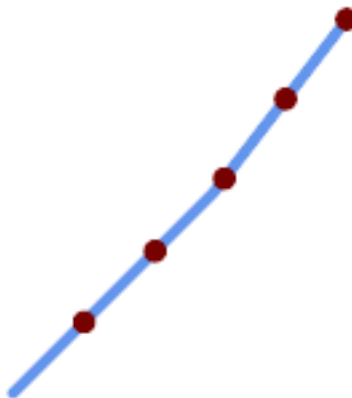


This function supports 3d and will not drop the z-index.



This function supports M coordinates.

Ejemplos



A LineString with points interpolated every 20%

```
--Return points each 20% along a 2D line
SELECT ST_AsText(ST_LineInterpolatePoints('LINESTRING(25 50, 100 125, 150 190)', 0.20))
-----
MULTIPOINT((51.5974135047432 76.5974135047432), (78.1948270094864 103.194827009486) ↔
, (104.132163186446 130.37181214238), (127.066081593223 160.18590607119), (150 190))
```

Ver también

[ST_LineInterpolatePoint](#), [ST_LineLocatePoint](#)

8.18.4 ST_LineLocatePoint

ST_LineLocatePoint — Returns the fractional location of the closest point on a line to a point.

Synopsis

```
float8 ST_LineLocatePoint(geometry a_linestring, geometry a_point);
```

Descripción

Devuelve un float entre 0 y 1 que representa la ubicación del punto más cercano en la cadena de línea al punto dado, como una fracción de la longitud total de la [2d line](#).

Puede utilizar la ubicación devuelta para extraer un punto ([ST_LineInterpolatePoint](#)) o una subcadena ([ST_LineSubstring](#)).

Esto es útil para aproximar números de direcciones

Disponibilidad: 1.1.0

Modificado: 2.1.0. Hasta 2.0.x esto se llamaba ST_Line_Locate_Point.

Ejemplos

```
--Aproximación de encontrar el número de calle de un punto a lo largo de la calle
--Tenga en cuenta que toda la cuestión es sólo para generar datos ficticios que se ve
--como los centroides de las casas y la calle
--Utilizamos ST_DWithin para excluir
--casas demasiado lejos de la calle para ser considerados en la calle
SELECT ST_AsText(house_loc) As as_text_house_loc,
       startstreet_num +
       CAST( (endstreet_num - startstreet_num)
            * ST_LineLocatePoint(street_line, house_loc) As integer) As street_num
FROM
  (SELECT ST_GeomFromText('LINESTRING(1 2, 3 4)') As street_line,
        ST_MakePoint(x*1.01,y*1.03) As house_loc, 10 As startstreet_num,
        20 As endstreet_num
  FROM generate_series(1,3) x CROSS JOIN generate_series(2,4) As y)
As foo
WHERE ST_DWithin(street_line, house_loc, 0.2);

 as_text_house_loc | street_num
-----+-----
POINT(1.01 2.06) |          10
POINT(2.02 3.09) |          15
POINT(3.03 4.12) |          20

--encontrar el punto más cercano en una línea a un punto u otra geometría
SELECT ST_AsText(ST_LineInterpolatePoint(foo.the_line, ST_LineLocatePoint(foo.the_line,
  ST_GeomFromText('POINT(4 3)'))))
FROM (SELECT ST_GeomFromText('LINESTRING(1 2, 4 5, 6 7)') As the_line) As foo;
 st_astext
-----
POINT(3 4)
```

Ver también

[ST_DWithin](#), [ST_Length2D](#), [ST_LineInterpolatePoint](#), [ST_LineSubstring](#)

8.18.5 ST_LineSubstring

`ST_LineSubstring` — Returns the part of a line between two fractional locations.

Synopsis

geometry **ST_LineSubstring**(geometry a_linestring, float8 startfraction, float8 endfraction);

Descripción

Computes the line which is the section of the input line starting and ending at the given fractional locations. The first argument must be a LINESTRING. The second and third arguments are values in the range [0, 1] representing the start and end locations as fractions of line length. The Z and M values are interpolated for added endpoints if present.

Si 'Start' y 'End' tienen el mismo valor, esto equivale a [ST_LineInterpolatePoint](#).

**Note**

This only works with LINESTRINGs. To use on contiguous MULTILINESTRINGs first join them with [ST_LineMerge](#).

**Note**

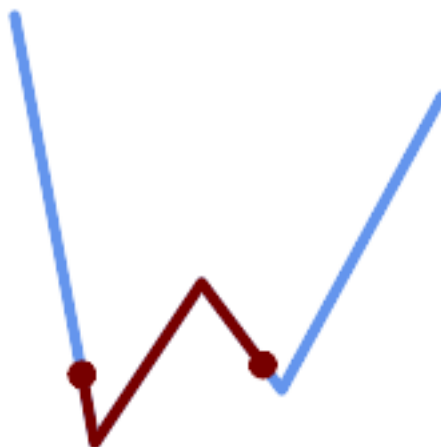
Desde la versión 1.1.1 esta función también interpola los valores M y Z (cuando están presentes), mientras que las versiones anteriores las establecen en valores no especificados.

Disponibilidad: 1.1.0, Soporte de Z y M, añadido en 1.1.1

Modificado: 2.1.0. Hasta 2.0.x esto se llamaba `ST_Line_Substring`.



This function supports 3d and will not drop the z-index.

Ejemplos

Una cadena de línea vista con 1/3 de rango medio superpuestos (0,333, 0,666)


```
SELECT ST_AsText(ST_LineSubstring( 'LINESTRING (20 180, 50 20, 90 80, 120 40, 180 150)', ↵
    0.333, 0.666));
----- ↵
LINESTRING (45.17311810399485 45.74337011202746, 50 20, 90 80, 112.97593050157862 ↵
    49.36542599789519)
```

If start and end locations are the same, the result is a POINT.

```
SELECT ST_AsText(ST_LineSubstring( 'LINESTRING(25 50, 100 125, 150 190)', 0.333, 0.333));
-----
POINT(69.2846934853974 94.2846934853974)
```

A query to cut a LineString into sections of length 100 or shorter. It uses generate_series() with a CROSS JOIN LATERAL to produce the equivalent of a FOR loop.

```
WITH data(id, geom) AS (VALUES
    ( 'A', 'LINESTRING( 0 0, 200 0) '::geometry ),
    ( 'B', 'LINESTRING( 0 100, 350 100) '::geometry ),
    ( 'C', 'LINESTRING( 0 200, 50 200) '::geometry )
)
SELECT id, i,
       ST_AsText( ST_LineSubstring( geom, startfrac, LEAST( endfrac, 1 )) ) AS geom
FROM (
    SELECT id, geom, ST_Length(geom) len, 100 sublen FROM data
  ) AS d
CROSS JOIN LATERAL (
    SELECT i, (sublen * i) / len AS startfrac,
           (sublen * (i+1)) / len AS endfrac
    FROM generate_series(0, floor( len / sublen )::integer ) AS t(i)
    -- skip last i if line length is exact multiple of sublen
    WHERE (sublen * i) / len <> 1.0
  ) AS d2;

id | i | geom
---+---+-----
A  | 0 | LINESTRING(0 0,100 0)
A  | 1 | LINESTRING(100 0,200 0)
B  | 0 | LINESTRING(0 100,100 100)
B  | 1 | LINESTRING(100 100,200 100)
B  | 2 | LINESTRING(200 100,300 100)
B  | 3 | LINESTRING(300 100,350 100)
C  | 0 | LINESTRING(0 200,50 200)
```

Ver también

[ST_Length](#), [ST_LineInterpolatePoint](#), [ST_LineMerge](#)

8.18.6 ST_LocateAlong

ST_LocateAlong — Returns the point(s) on a geometry that match a measure value.

Synopsis

geometry **ST_LocateAlong**(geometry ageom_with_measure, float8 a_measure, float8 offset);

Descripción

Returns the location(s) along a measured geometry that have the given measure values. The result is a Point or MultiPoint. Polygonal inputs are not supported.

If `offset` is provided, the result is offset to the left or right of the input line by the specified distance. A positive offset will be to the left, and a negative one to the right.



Note

Use this function only for linear geometries with an M component

The semantic is specified by the *ISO/IEC 13249-3 SQL/MM Spatial* standard.

Disponibilidad: 1.1.0 por antiguo nombre `ST_LocateAlong_Measure`.

Modificado: 2.0.0 en versiones anteriores éste solía llamarse `ST_LocateAlong_Measure`. El nombre anterior ha quedado obsoleto y se eliminará en el futuro, pero aún está disponible.



This function supports M coordinates.



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.13

Ejemplos

```
SELECT ST_AsText(
  ST_LocateAlong(
    'MULTILINESTRINGM((1 2 3, 3 4 2, 9 4 3),(1 2 3, 5 4 5))'::geometry,
    3 ));

-----
MULTIPOINT M ((1 2 3),(9 4 3),(1 2 3))
```

Ver también

[ST_LocateBetween](#), [ST_LocateBetweenElevations](#), [ST_InterpolatePoint](#)

8.18.7 ST_LocateBetween

`ST_LocateBetween` — Returns the portions of a geometry that match a measure range.

Synopsis

geometry **ST_LocateBetween**(geometry geomA, float8 measure_start, float8 measure_end, float8 offset);

Descripción

Devuelve un valor de la colección Geometry derivado con elementos que coinciden con la medida especificada. No se admiten elementos poligonales.

Si se proporciona un desplazamiento, el resultado se desplazará a la izquierda o a la derecha de la línea de entrada por el número de unidades especificado. Un desplazamiento positivo será a la izquierda, y uno negativo a la derecha.

Clipping a non-convex POLYGON may produce invalid geometry.

The semantic is specified by the *ISO/IEC 13249-3 SQL/MM Spatial* standard.

Disponibilidad: 1.1.0 por nombre antiguo `ST_Locate_Between_Measures`.

Modificado: 2.0.0 en versiones anteriores éste solía llamarse `ST_Locate_Along_Measure`. El nombre anterior ha quedado obsoleto y se eliminará en el futuro, pero aún está disponible.

Enhanced: 3.0.0 - added support for POLYGON, TIN, TRIANGLE.



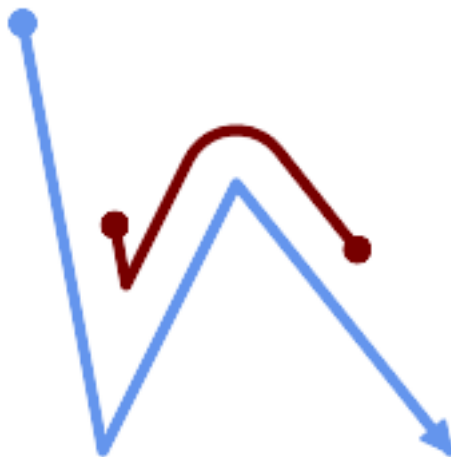
This function supports M coordinates.



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1

Ejemplos

```
SELECT ST_AsText (
  ST_LocateBetween(
    'MULTILINESTRING M ((1 2 3, 3 4 2, 9 4 3),(1 2 3, 5 4 5))':: geometry,
    1.5, 3 ));
-----
GEOMETRYCOLLECTION M (LINESTRING M (1 2 3,3 4 2,9 4 3),POINT M (1 2 3))
```



A LineString with the section between measures 2 and 8, offset to the left

```
SELECT ST_AsText( ST_LocateBetween(
  ST_AddMeasure('LINESTRING (20 180, 50 20, 100 120, 180 20)', 0, 10),
  2, 8,
  20
));
-----
MULTILINESTRING((54.49835019899045 104.53426957938231,58.70056060327303 ↵
  82.12248075654186,69.16695286779743 103.05526528559065,82.11145618000168 ↵
  128.94427190999915,84.24893681714357 132.32493442618113,87.01636951231555 ↵
  135.21267035596549,90.30307285299679 137.49198684843182,93.97759758337769 ↵
  139.07172433557758,97.89298381958797 139.8887023914453,101.89263860095893 ↵
  139.9102465862721,105.81659870902816 139.13549527600819,109.50792827749828 ↵
  137.5954340631298,112.81899532549731 135.351656550512,115.6173761888606 ↵
  132.49390095108848,145.31017306064817 95.37790486135405))
```

Ver también

[ST_LocateAlong](#), [ST_LocateAlong](#), [ST_LocateBetween](#)

8.18.8 ST_LocateBetweenElevations

ST_LocateBetweenElevations — Returns the portions of a geometry that lie in an elevation (Z) range.

Synopsis

geometry **ST_LocateBetweenElevations**(geometry geom_mline, float8 elevation_start, float8 elevation_end);

Descripción

Returns a geometry (collection) with the portions of a geometry that lie in an elevation (Z) range.

Clipping a non-convex POLYGON may produce invalid geometry.

Disponibilidad: 1.4.0

Enhanced: 3.0.0 - added support for POLYGON, TIN, TRIANGLE.



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsText (
  ST_LocateBetweenElevations(
    'LINESTRING(1 2 3, 4 5 6)::geometry,
    2, 4 ));

          st_astext
-----
MULTILINESTRING Z ((1 2 3,2 3 4))

SELECT ST_AsText (
  ST_LocateBetweenElevations(
    'LINESTRING(1 2 6, 4 5 -1, 7 8 9)',
    6, 9)) As ewelev;

          ewelev
-----
GEOMETRYCOLLECTION Z (POINT Z (1 2 6),LINESTRING Z (6.1 7.1 6,7 8 9))
```

Ver también

[ST_Dump](#), [ST_LocateAlong](#), [ST_LocateBetween](#)

8.18.9 ST_InterpolatePoint

ST_InterpolatePoint — Devuelve el valor de la dimensión medida de una geometría en el punto cerrado al punto proporcionado.

Synopsis

float8 **ST_InterpolatePoint**(geometry linear_geom_with_measure, geometry point);

Descripción

Returns an interpolated measure value of a linear measured geometry at the location closest to the given point.



Note

Use this function only for linear geometries with an M component

Disponibilidad: 2.0.0



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_InterpolatePoint('LINESTRING M (0 0 0, 10 0 20)', 'POINT(5 5)');
-----
10
```

Ver también

[ST_AddMeasure](#), [ST_LocateAlong](#), [ST_LocateBetween](#)

8.18.10 ST_AddMeasure

ST_AddMeasure — Interpolates measures along a linear geometry.

Synopsis

geometry **ST_AddMeasure**(geometry geom_mline, float8 measure_start, float8 measure_end);

Descripción

Devuelve una geometría derivada con elementos de medida interpolados linealmente entre los puntos inicial y final. Si la geometría no tiene una dimensión de medida, se añadirá una. Si la geometría tiene una dimensión de medida, se sobrescribe con nuevos valores. Sólo se admiten LINESTRINGS y MULTILINESTRINGS.

Disponibilidad: 1.5.0



This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsText(ST_AddMeasure(
ST_GeomFromEWKT('LINESTRING(1 0, 2 0, 4 0)'),1,4)) As ewelev;
-----
LINESTRINGM(1 0 1,2 0 2,4 0 4)

SELECT ST_AsText(ST_AddMeasure(
ST_GeomFromEWKT('LINESTRING(1 0 4, 2 0 4, 4 0 4)'),10,40)) As ewelev;
-----
LINESTRINGM(1 0 10,2 0 20,4 0 40)
```

```

-----
LINESTRING(1 0 4 10,2 0 4 20,4 0 4 40)

SELECT ST_AsText(ST_AddMeasure(
ST_GeomFromEWKT('LINESTRINGM(1 0 4, 2 0 4, 4 0 4)'),10,40)) As ewelev;
           ewelev
-----
LINESTRINGM(1 0 10,2 0 20,4 0 40)

SELECT ST_AsText(ST_AddMeasure(
ST_GeomFromEWKT('MULTILINESTRINGM((1 0 4, 2 0 4, 4 0 4),(1 0 4, 2 0 4, 4 0 4)'),10,70)) As ←
           ewelev;
                                     ewelev
-----
MULTILINESTRINGM((1 0 10,2 0 20,4 0 40),(1 0 40,2 0 50,4 0 70))

```

8.19 Trajectory Functions

8.19.1 ST_IsValidTrajectory

ST_IsValidTrajectory — Tests if the geometry is a valid trajectory.

Synopsis

boolean **ST_IsValidTrajectory**(geometry line);

Description

Tests if a geometry encodes a valid trajectory. A valid trajectory is represented as a **LINESTRING** with measures (M values). The measure values must increase from each vertex to the next.

Valid trajectories are expected as input to spatio-temporal functions like [ST_ClosestPointOfApproach](#)

Availability: 2.2.0



This function supports 3d and will not drop the z-index.

Examples

```

-- A valid trajectory
SELECT ST_IsValidTrajectory(ST_MakeLine(
  ST_MakePointM(0,0,1),
  ST_MakePointM(0,1,2))
);
t

-- An invalid trajectory
SELECT ST_IsValidTrajectory(ST_MakeLine(ST_MakePointM(0,0,1), ST_MakePointM(0,1,0)));
NOTICE:  Measure of vertex 1 (0) not bigger than measure of vertex 0 (1)
st_isvalidtrajectory
-----
f

```

See Also

[ST_ClosestPointOfApproach](#)

8.19.2 ST_ClosestPointOfApproach

ST_ClosestPointOfApproach — Returns a measure at the closest point of approach of two trajectories.

Synopsis

float8 ST_ClosestPointOfApproach(geometry track1, geometry track2);

Description

Returns the smallest measure at which points interpolated along the given trajectories are at the smallest distance.

Inputs must be valid trajectories as checked by [ST_IsValidTrajectory](#). Null is returned if the trajectories do not overlap in their M ranges.

See [ST_LocateAlong](#) for getting the actual points at the given measure.

Availability: 2.2.0



This function supports 3d and will not drop the z-index.

Examples

```
-- Return the time in which two objects moving between 10:00 and 11:00
-- are closest to each other and their distance at that point
WITH inp AS ( SELECT
  ST_AddMeasure('LINESTRING Z (0 0 0, 10 0 5) '::geometry,
    extract(epoch from '2015-05-26 10:00'::timestampz),
    extract(epoch from '2015-05-26 11:00'::timestampz)
  ) a,
  ST_AddMeasure('LINESTRING Z (0 2 10, 12 1 2) '::geometry,
    extract(epoch from '2015-05-26 10:00'::timestampz),
    extract(epoch from '2015-05-26 11:00'::timestampz)
  ) b
), cpa AS (
  SELECT ST_ClosestPointOfApproach(a,b) m FROM inp
), points AS (
  SELECT ST_Force3DZ(ST_GeometryN(ST_LocateAlong(a,m),1)) pa,
    ST_Force3DZ(ST_GeometryN(ST_LocateAlong(b,m),1)) pb
  FROM inp, cpa
)
SELECT to_timestamp(m) t,
  ST_Distance(pa,pb) distance
FROM points, cpa;
```

t	distance
2015-05-26 10:45:31.034483+02	1.96036833151395

See Also

[ST_IsValidTrajectory](#), [ST_DistanceCPA](#), [ST_LocateAlong](#), [ST_AddMeasure](#)

8.19.3 ST_DistanceCPA

ST_DistanceCPA — Returns the distance between the closest point of approach of two trajectories.

Synopsis

```
float8 ST_DistanceCPA(geometry track1, geometry track2);
```

Description

Returns the minimum distance two moving objects have ever been each other.

Inputs must be valid trajectories as checked by [ST_IsValidTrajectory](#). Null is returned if the trajectories do not overlap in their M ranges.

Availability: 2.2.0



This function supports 3d and will not drop the z-index.

Examples

```
-- Return the minimum distance of two objects moving between 10:00 and 11:00
WITH inp AS ( SELECT
  ST_AddMeasure('LINESTRING Z (0 0 0, 10 0 5) '::geometry,
    extract(epoch from '2015-05-26 10:00'::timestampz),
    extract(epoch from '2015-05-26 11:00'::timestampz)
  ) a,
  ST_AddMeasure('LINESTRING Z (0 2 10, 12 1 2) '::geometry,
    extract(epoch from '2015-05-26 10:00'::timestampz),
    extract(epoch from '2015-05-26 11:00'::timestampz)
  ) b
)
SELECT ST_DistanceCPA(a,b) distance FROM inp;

      distance
-----
1.96036833151395
```

See Also

[ST_IsValidTrajectory](#), [ST_ClosestPointOfApproach](#), [ST_AddMeasure](#), [ST_Distance](#)

8.19.4 ST_CPAWithin

ST_CPAWithin — Tests if the closest point of approach of two trajectories is within the specified distance.

Synopsis

```
boolean ST_CPAWithin(geometry track1, geometry track2, float8 dist);
```


Description

Tests whether two moving objects have ever been closer than the specified distance.

Inputs must be valid trajectories as checked by [ST_IsValidTrajectory](#). False is returned if the trajectories do not overlap in their M ranges.

Availability: 2.2.0



This function supports 3d and will not drop the z-index.

Examples

```
WITH inp AS ( SELECT
  ST_AddMeasure('LINESTRING Z (0 0 0, 10 0 5)::geometry',
    extract(epoch from '2015-05-26 10:00'::timestampz),
    extract(epoch from '2015-05-26 11:00'::timestampz)
  ) a,
  ST_AddMeasure('LINESTRING Z (0 2 10, 12 1 2)::geometry',
    extract(epoch from '2015-05-26 10:00'::timestampz),
    extract(epoch from '2015-05-26 11:00'::timestampz)
  ) b
)
SELECT ST_CPAWithin(a,b,2), ST_DistanceCPA(a,b) distance FROM inp;
```

st_cpawithin	distance
t	1.96521473776207

See Also

[ST_IsValidTrajectory](#), [ST_ClosestPointOfApproach](#), [ST_DistanceCPA](#), [ST_Distance](#)

8.20 SFCGAL Functions

8.20.1 postgis_sfcgal_version

postgis_sfcgal_version — Returns the version of SFCGAL in use

Synopsis

```
text postgis_sfcgal_version(void);
```

Descripción

Returns the version of SFCGAL in use

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ver también

[postgis_sfcgal_full_version](#)

8.20.2 postgis_sfcgal_full_version

`postgis_sfcgal_full_version` — Returns the full version of SFCGAL in use including CGAL and Boost versions

Synopsis

text `postgis_sfcgal_full_version`(void);

Descripción

Returns the full version of SFCGAL in use including CGAL and Boost versions

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ver también

[postgis_sfcgal_version](#)

8.20.3 ST_3DArea

`ST_3DArea` — Computes area of 3D surface geometries. Will return 0 for solids.

Synopsis

float `ST_3DArea`(geometry geom1);

Descripción

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 8.1, 10.5



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

Note: By default a PolyhedralSurface built from WKT is a surface geometry, not solid. It therefore has surface area. Once converted to a solid, no area.

```
SELECT ST_3DArea(geom) As cube_surface_area,
       ST_3DArea(ST_MakeSolid(geom)) As solid_surface_area
FROM (SELECT 'POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
  ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)),
  ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
  ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
  ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)),
  ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )'::geometry) As f(geom);
```

cube_surface_area	solid_surface_area
6	0

Ver también

[ST_Area](#), [ST_MakeSolid](#), [ST_IsSolid](#), [ST_Area](#)

8.20.4 ST_3DConvexHull

ST_3DConvexHull — Computes the 3D convex hull of a geometry.

Synopsis

geometry **ST_3DConvexHull**(geometry geom1);

Descripción

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



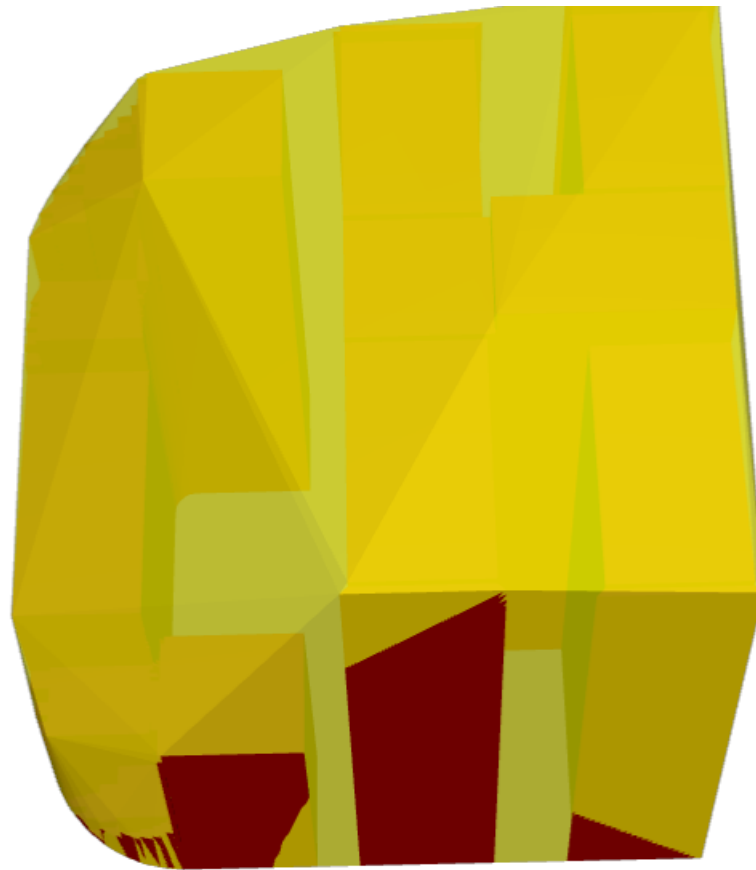
This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_AsText(ST_3DConvexHull('LINESTRING Z(0 0 5, 1 5 3, 5 7 6, 9 5 3, 5 7 5, 6 3 5) '←
'::geometry));
```

```
POLYHEDRALSURFACE Z (((1 5 3,9 5 3,0 0 5,1 5 3)),((1 5 3,0 0 5,5 7 6,1 5 3)),((5 7 6,5 7 ←
5,1 5 3,5 7 6)),((0 0 5,6 3 5,5 7 6,0 0 5)),((6 3 5,9 5 3,5 7 6,6 3 5)),((0 0 5,9 5 3,6 ←
3 5,0 0 5)),((9 5 3,5 7 5,5 7 6,9 5 3)),((1 5 3,5 7 5,9 5 3,1 5 3)))
```

```
WITH f AS (SELECT i, ST_Extrude(geom, 0,0, i ) AS geom
FROM ST_Subdivide(ST_Letters('CH'),5) WITH ORDINALITY AS sd(geom,i)
)
SELECT ST_3DConvexHull(ST_Collect(f.geom) )
FROM f;
```



Original geometry overlaid with 3D convex hull

Ver también

[ST_Letters](#), [ST_AsX3D](#)

8.20.5 ST_3DIntersection

ST_3DIntersection — Perform 3D intersection

Synopsis

geometry **ST_3DIntersection**(geometry geom1, geometry geom2);

Descripción

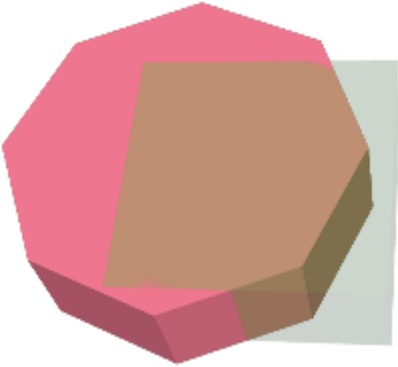
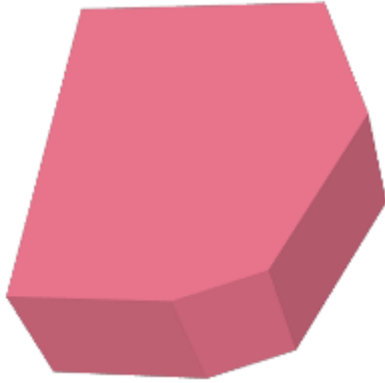
Return a geometry that is the shared portion between geom1 and geom2.

Disponibilidad: 2.1.0

- ✓ This method needs SFCGAL backend.
- ✓ This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
- ✓ This function supports 3d and will not drop the z-index.
- ✓ This function supports Polyhedral surfaces.
- ✓ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

3D images were generated using PostGIS [ST_AsX3D](#) and rendering in HTML using [X3Dom HTML Javascript rendering library](#).

<pre>SELECT ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(100 90)'), 50, 'quad_segs=2'),0,0,30) AS geom1, ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(80 80)'), 50, 'quad_segs=1'),0,0,30) AS geom2;</pre>  <p><i>Original 3D geometries overlaid. geom2 is shown semi-transparent</i></p>	<pre>SELECT ST_3DIntersection(geom1,geom2) FROM (SELECT ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(100 90)'), 50, 'quad_segs=2'),0,0,30) AS geom1, ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(80 80)'), 50, 'quad_segs=1'),0,0,30) AS geom2) As ↵ t;</pre>  <p><i>Intersection of geom1 and geom2</i></p>
--	---

3D linestrings and polygons

```
SELECT ST_AsText(ST_3DIntersection(linestring, polygon)) As wkt
FROM ST_GeomFromText('LINESTRING Z (2 2 6,1.5 1.5 7,1 1 8,0.5 0.5 8,0 0 10)') AS ↵
    linestring
CROSS JOIN ST_GeomFromText('POLYGON((0 0 8, 0 1 8, 1 1 8, 1 0 8, 0 0 8))') AS polygon;
```

wkt

```
LINESTRING Z (1 1 8,0.5 0.5 8)
```

Cube (closed Polyhedral Surface) and Polygon Z

```
SELECT ST_AsText(ST_3DIntersection(
    ST_GeomFromText('POLYHEDRALSURFACE Z( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)) ↵
    ',
    ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
```

```
((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )'),
'POLYGON Z ((0 0 0, 0 0 0.5, 0 0.5 0.5, 0 0.5 0, 0 0 0))'::geometry))
```

```
TIN Z (((0 0 0,0 0 0.5,0 0.5 0.5,0 0 0)),((0 0.5 0,0 0 0,0 0.5 0.5,0 0.5 0)))
```

Intersection of 2 solids that result in volumetric intersection is also a solid (ST_Dimension returns 3)

```
SELECT ST_AsText(ST_3DIntersection( ST_Extrude(ST_Buffer('POINT(10 20)'::geometry,10,1) ↔
,0,0,30),
ST_Extrude(ST_Buffer('POINT(10 20)'::geometry,10,1),2,0,10) ));
```

```
POLYHEDRALSURFACE Z (((13.3333333333333 13.3333333333333 10,20 20 0,20 20 ↔
10,13.3333333333333 13.3333333333333 10)),
((20 20 10,16.6666666666667 23.3333333333333 10,13.3333333333333 13.3333333333333 ↔
10,20 20 10)),
((20 20 0,16.6666666666667 23.3333333333333 10,20 20 10,20 20 0)),
((13.3333333333333 13.3333333333333 10,10 10 0,20 20 0,13.3333333333333 ↔
13.3333333333333 10)),
((16.6666666666667 23.3333333333333 10,12 28 10,13.3333333333333 13.3333333333333 ↔
10,16.6666666666667 23.3333333333333 10)),
((20 20 0,9.99999999999995 30 0,16.6666666666667 23.3333333333333 10,20 20 0)),
((10 10 0,9.99999999999995 30 0,20 20 0,10 10 0)),((13.3333333333333 ↔
13.3333333333333 10,12 12 10,10 10 0,13.3333333333333 13.3333333333333 10)),
((12 28 10,12 12 10,13.3333333333333 13.3333333333333 10,12 28 10)),
((16.6666666666667 23.3333333333333 10,9.99999999999995 30 0,12 28 ↔
10,16.6666666666667 23.3333333333333 10)),
((10 10 0,0 20 0,9.99999999999995 30 0,10 10 0)),
((12 12 10,11 11 10,10 10 0,12 12 10)),((12 28 10,11 11 10,12 12 10,12 28 10)),
((9.99999999999995 30 0,11 29 10,12 28 10,9.99999999999995 30 0)),((0 20 0,2 20 ↔
10,9.99999999999995 30 0,0 20 0)),
((10 10 0,2 20 10,0 20 0,10 10 0)),((11 11 10,2 20 10,10 10 0,11 11 10)),((12 28 ↔
10,11 29 10,11 11 10,12 28 10)),
((9.99999999999995 30 0,2 20 10,11 29 10,9.99999999999995 30 0)),((11 11 10,11 29 ↔
10,2 20 10,11 11 10)))
```

8.20.6 ST_3DDifference

ST_3DDifference — Perform 3D difference

Synopsis

geometry **ST_3DDifference**(geometry geom1, geometry geom2);

Descripción

Returns that part of geom1 that is not part of geom2.

Disponibilidad: 2.2.0



This method needs SFCGAL backend.



This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1



This function supports 3d and will not drop the z-index.



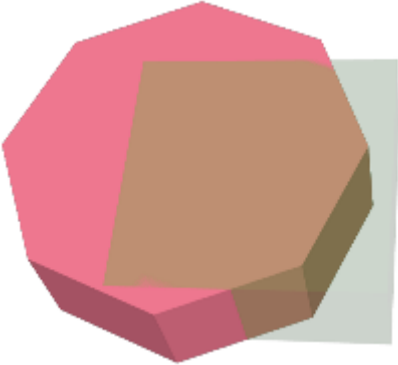
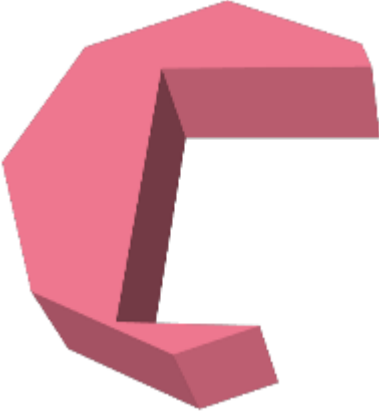
This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

3D images were generated using PostGIS **ST_AsX3D** and rendering in HTML using **X3Dom HTML Javascript rendering library**.

<pre>SELECT ST_Extrude(ST_Buffer(← ST_GeomFromText('POINT(100 90)'), 50, 'quad_segs=2'),0,0,30) AS geom1, ST_Extrude(ST_Buffer(← ST_GeomFromText('POINT(80 80)'), 50, 'quad_segs=1'),0,0,30) AS geom2;</pre>  <p><i>Original 3D geometries overlaid. geom2 is the part that will be removed.</i></p>	<pre>SELECT ST_3DDifference(geom1,geom2) FROM (SELECT ST_Extrude(ST_Buffer(← ST_GeomFromText('POINT(100 90)'), 50, 'quad_segs=2'),0,0,30) AS geom1, ST_Extrude(ST_Buffer(← ST_GeomFromText('POINT(80 80)'), 50, 'quad_segs=1'),0,0,30) AS geom2) As ← t;</pre>  <p><i>What's left after removing geom2</i></p>
--	---

Ver también

ST_Extrude, **ST_AsX3D**, **ST_3DIntersection** **ST_3DUnion**

8.20.7 ST_3DUnion

ST_3DUnion — Perform 3D union.

Synopsis

geometry **ST_3DUnion**(geometry geom1, geometry geom2);
geometry **ST_3DUnion**(geometry set g1field);

Descripción

Disponibilidad: 2.2.0

Availability: 3.3.0 aggregate variant was added

- ✔ This method needs SFCGAL backend.
- ✔ This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
- ✔ This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.

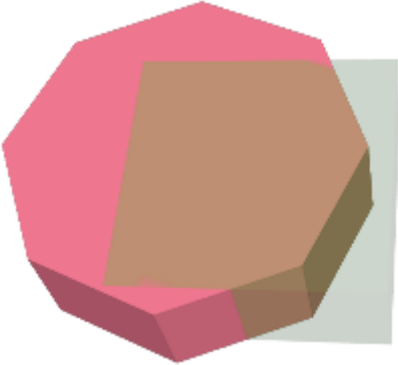
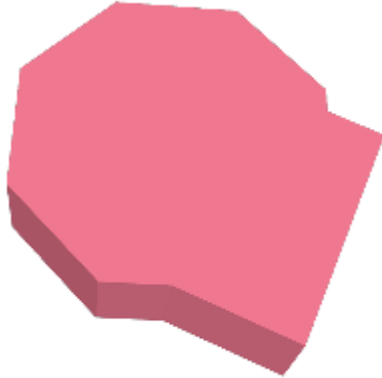


This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Aggregate variant: returns a geometry that is the 3D union of a rowset of geometries. The `ST_3DUnion()` function is an "aggregate" function in the terminology of PostgreSQL. That means that it operates on rows of data, in the same way the `SUM()` and `AVG()` functions do and like most aggregates, it also ignores NULL geometries.

Ejemplos

3D images were generated using PostGIS [ST_AsX3D](#) and rendering in HTML using [X3Dom HTML Javascript rendering library](#).

<pre>SELECT ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(100 90)'), 50, 'quad_segs=2'),0,0,30) AS geom1, ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(80 80)'), 50, 'quad_segs=1'),0,0,30) AS geom2;</pre>  <p><i>Original 3D geometries overlaid. geom2 is the one with transparency.</i></p>	<pre>SELECT ST_3DUnion(geom1,geom2) FROM (SELECT ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(100 90)'), 50, 'quad_segs=2'),0,0,30) AS geom1, ST_Extrude(ST_Buffer(↵ ST_GeomFromText('POINT(80 80)'), 50, 'quad_segs=1'),0,0,30) AS geom2) As ↵ t;</pre>  <p><i>Union of geom1 and geom2</i></p>
--	--

Ver también

[ST_Extrude](#), [ST_AsX3D](#), [ST_3DIntersection](#) [ST_3DDifference](#)

8.20.8 ST_AlphaShape

`ST_AlphaShape` — Computes a possible concave geometry using the CGAL Alpha Shapes algorithm.

Synopsis

geometry **ST_AlphaShape**(geometry geom, float alpha, boolean allow_holes = false);

Descripción

Assume we are given a set *S* of points in 2D [...] and we would like to have something like "the shape formed by these points". This is quite a vague notion and there are probably many possible interpretations, the α -shape being one of them. Alpha shapes

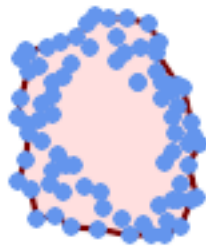
can be used for shape reconstruction from a dense unorganized set of data points. Indeed, an α -shape is demarcated by a frontier, which is a linear approximation of the original shape [1]. [1] F. Bernardini and C. Bajaj. Sampling and reconstructing manifolds using alpha-shapes. Technical Report CSD-TR-97-013, Dept. Comput. Sci., Purdue Univ., West Lafayette, IN, 1997. Source: [CGAL ALpha Shapes](#) This function compute the concave hull of a set of geometry, but using CGAL and a different algorithm than ST_ConcaveHull performed by the GEOS module. See : [Concave Hulls in JTS](#)

Availability: 3.3.0 - requires SFCGAL >= 1.4.1.



This method needs SFCGAL backend.

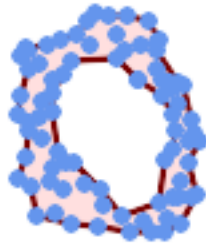
Ejemplos



Concave Hull of a MultiPoint (same example As ST_OptimalAlphaShape)

```
SELECT ST_AsText(ST_AlphaShape('MULTIPOINT((63 84),(76 88),(68 73),(53 18),(91 50),(81 70),
(88 29),(24 82),(32 51),(37 23),(27 54),(84 19),(75 87),(44 42),(77 67),(90 ←
30),(36 61),(32 65),
(81 47),(88 58),(68 73),(49 95),(81 60),(87 50),
(78 16),(79 21),(30 22),(78 43),(26 85),(48 34),(35 35),(36 40),(31 79),(83 ←
29),(27 84),(52 98),(72 95),(85 71),
(75 84),(75 77),(81 29),(77 73),(41 42),(83 72),(23 36),(89 53),(27 57),(57 ←
97),(27 77),(39 88),(60 81),
(80 72),(54 32),(55 26),(62 22),(70 20),(76 27),(84 35),(87 42),(82 54),(83 ←
64),(69 86),(60 90),(50 86),(43 80),(36 73),
(36 68),(40 75),(24 67),(23 60),(26 44),(28 33),(40 32),(43 19),(65 16),(73 ←
16),(38 46),(31 59),(34 86),(45 90),(64 97))'::geometry,80.2));
```

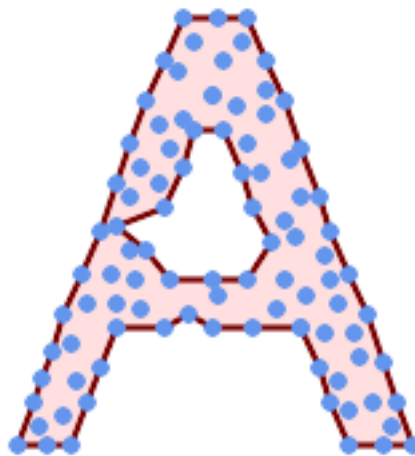
```
POLYGON((89 53,91 50,87 42,90 30,88 29,84 19,78 16,73 16,65 16,53 18,43 19,37 23,30 22,28 ←
33,23 36,26 44,27 54,23 60,24 67,
27 77,24 82,26 85,34 86,39 88,45 90,49 95,52 98,57 97,64 97,72 95,76 88,75 84,83 ←
72,85 71,88 58,89 53))
```



Concave Hull of a MultiPoint, allowing holes (same example as ST_OptimalAlphaShape)

```
SELECT ST_AsText(ST_AlphaShape('MULTIPOINT((63 84),(76 88),(68 73),(53 18),(91 50),(81 70) ↵
, (88 29),(24 82),(32 51),(37 23),(27 54),(84 19),(75 87),(44 42),(77 67),(90 30),(36 61) ↵
, (32 65),(81 47),(88 58),(68 73),(49 95),(81 60),(87 50),
    (78 16),(79 21),(30 22),(78 43),(26 85),(48 34),(35 35),(36 40),(31 79),(83 ↵
    29),(27 84),(52 98),(72 95),(85 71),
    (75 84),(75 77),(81 29),(77 73),(41 42),(83 72),(23 36),(89 53),(27 57),(57 ↵
    97),(27 77),(39 88),(60 81),
    (80 72),(54 32),(55 26),(62 22),(70 20),(76 27),(84 35),(87 42),(82 54),(83 ↵
    64),(69 86),(60 90),(50 86),(43 80),(36 73),
    (36 68),(40 75),(24 67),(23 60),(26 44),(28 33),(40 32),(43 19),(65 16),(73 ↵
    16),(38 46),(31 59),(34 86),(45 90),(64 97))'::geometry, 100.1,true))

POLYGON((89 53,91 50,87 42,90 30,88 29,84 19,78 16,73 16,65 16,53 18,43 19,37 23,30 22,28 ↵
33,23 36,26 44,27 54,23 60,24 67,27 77,24 82,26 85,34 86,39 88,45 90,49 95,52 98,57 ↵
97,64 97,72 95,76 88,75 84,83 72,85 71,88 58,89 53),
    (36 61,36 68,40 75,43 80,50 86,60 81,68 73,77 67,81 60,82 54,81 47,78 43,76 ↵
    27,62 22,54 32,48 34,44 42,38 46,36 61))
```



Concave Hull of a MultiPoint, allowing holes (same example as ST_ConcaveHull)

```

SELECT ST_AlphaShape(
    'MULTIPOINT ((132 64), (114 64), (99 64), (81 64), (63 64), (57 49), (52 36), (46 20), (37 20), (26 20), (32 36), (39 55), (43 69), (50 84), (57 100), (63 118), (68 133), (74 149), (81 164), (88 180), (101 180), (112 180), (119 164), (126 149), (132 131), (139 113), (143 100), (150 84), (157 69), (163 51), (168 36), (174 20), (163 20), (150 20), (143 36), (139 49), (132 64), (99 151), (92 138), (88 124), (81 109), (74 93), (70 82), (83 82), (99 82), (112 82), (126 82), (121 96), (114 109), (110 122), (103 138), (99 151), (34 27), (43 31), (48 44), (46 58), (52 73), (63 73), (61 84), (72 71), (90 69), (101 76), (123 71), (141 62), (166 27), (150 33), (159 36), (146 44), (154 53), (152 62), (146 73), (134 76), (143 82), (141 91), (130 98), (126 104), (132 113), (128 127), (117 122), (112 133), (119 144), (108 147), (119 153), (110 171), (103 164), (92 171), (86 160), (88 142), (79 140), (72 124), (83 131), (79 118), (68 113), (63 102), (68 93), (35 45))'::geometry,102.2, true);

POLYGON((134 80,136 75,130 63,135 45,132 44,126 28,117 24,110 24,98 24,80 27,82 39,72 51,60 48,56 34,52 52,42 50,
34 54,39 66,40 81,34 90,36 100,40 116,36 123,39 128,51 129,58 132,68 135,74 142,78 147,86 146,96 146,
108 142,114 132,112 126,112 116,116 110,120 108,125 108,128 106,125 96,132 87,134 80))

```

Ver también

[ST_ConcaveHull](#), [ST_OptimalAlphaShape](#)

8.20.9 ST_ApproximateMedialAxis

ST_ApproximateMedialAxis — Compute the approximate medial axis of an areal geometry.

Synopsis

geometry **ST_ApproximateMedialAxis**(geometry geom);

Descripción

Return an approximate medial axis for the areal input based on its straight skeleton. Uses an SFCGAL specific API when built against a capable version (1.2.0+). Otherwise the function is just a wrapper around `ST_StraightSkeleton` (slower case).

Disponibilidad: 2.2.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



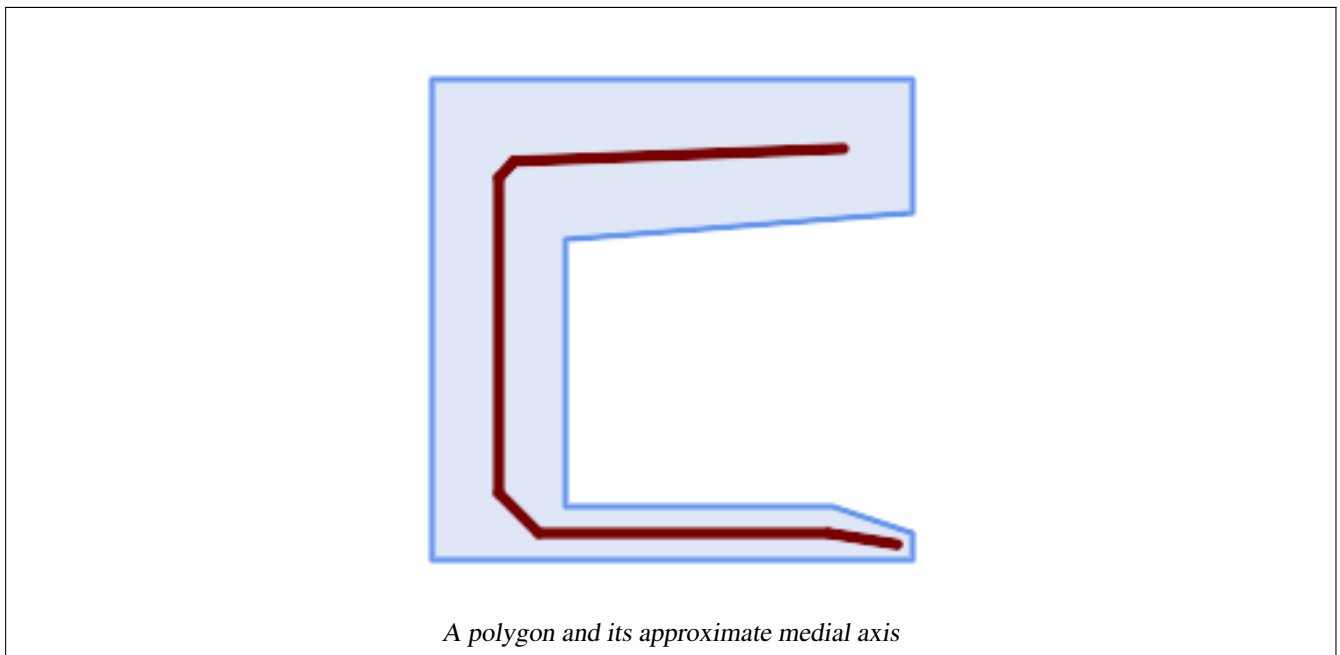
This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```

SELECT ST_ApproximateMedialAxis(ST_GeomFromText('POLYGON (( 190 190, 10 190, 10 10, 190 10, 190 20, 160 30, 60 30, 60 130, 190 140, 190 190 ))'));

```



Ver también

[ST_StraightSkeleton](#)

8.20.10 ST_ConstrainedDelaunayTriangles

ST_ConstrainedDelaunayTriangles — Return a constrained Delaunay triangulation around the given input geometry.

Synopsis

```
geometry ST_ConstrainedDelaunayTriangles(geometry g1);
```

Descripción

Return a **Constrained Delaunay triangulation** around the vertices of the input geometry. Output is a TIN.



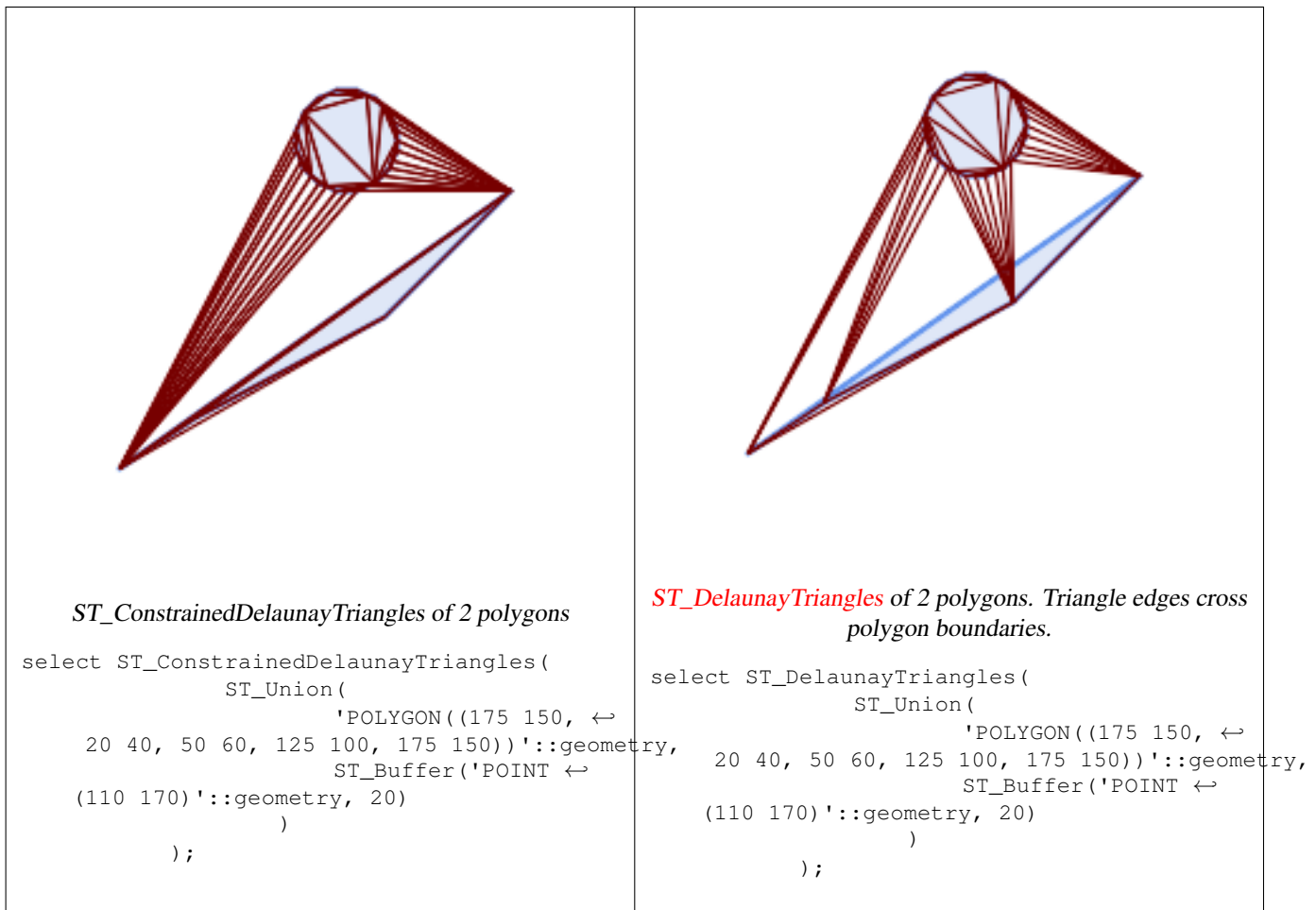
This method needs SFCGAL backend.

Disponibilidad: 2.1.0



This function supports 3d and will not drop the z-index.

Ejemplos

**Ver también**

[ST_DelaunayTriangles](#), [ST_Tessellate](#), [ST_ConcaveHull](#), [ST_Dump](#)

8.20.11 ST_Extrude

ST_Extrude — Extrude a surface to a related volume

Synopsis

geometry **ST_Extrude**(geometry geom, float x, float y, float z);

Descripción

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.






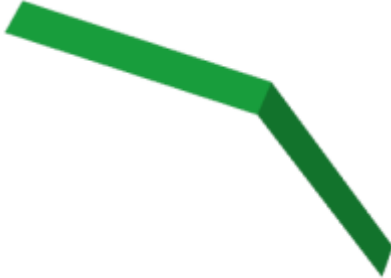
This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

3D images were generated using PostGIS **ST_AsX3D** and rendering in HTML using **X3Dom HTML Javascript rendering library**.

<pre>SELECT ST_Buffer(ST_GeomFromText('POINT ↵ (100 90)'), 50, 'quad_segs=2'),0,0,30);</pre>  <p><i>Original octagon formed from buffering point</i></p>	<pre>ST_Extrude(ST_Buffer(ST_GeomFromText(' ↵ POINT(100 90)'), 50, 'quad_segs=2'),0,0,30);</pre>  <p><i>Hexagon extruded 30 units along Z produces a PolyhedralSurfaceZ</i></p>
<pre>SELECT ST_GeomFromText('LINESTRING(50 50, ↵ 100 90, 95 150)')</pre>  <p><i>Original linestring</i></p>	<pre>SELECT ST_Extrude(ST_GeomFromText('LINESTRING(50 50, 100 ↵ 90, 95 150)'),0,0,10));</pre>  <p><i>LineString Extruded along Z produces a PolyhedralSurfaceZ</i></p>

Ver también

ST_AsX3D

8.20.12 ST_ForceLHR

ST_ForceLHR — Force LHR orientation

Synopsis

geometry **ST_ForceLHR**(geometry geom);

Descripción

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

8.20.13 ST_IsPlanar

ST_IsPlanar — Check if a surface is or not planar

Synopsis

boolean **ST_IsPlanar**(geometry geom);

Descripción

Availability: 2.2.0: This was documented in 2.1.0 but got accidentally left out in 2.1 release.



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

8.20.14 ST_IsSolid

ST_IsSolid — Test if the geometry is a solid. No validity check is performed.

Synopsis

boolean **ST_IsSolid**(geometry geom1);

Descripción

Disponibilidad: 2.2.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

8.20.15 ST_MakeSolid

ST_MakeSolid — Cast the geometry into a solid. No check is performed. To obtain a valid solid, the input geometry must be a closed Polyhedral Surface or a closed TIN.

Synopsis

geometry **ST_MakeSolid**(geometry geom1);

Descripción

Disponibilidad: 2.2.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

8.20.16 ST_MinkowskiSum

ST_MinkowskiSum — Performs Minkowski sum

Synopsis

geometry **ST_MinkowskiSum**(geometry geom1, geometry geom2);

Descripción

This function performs a 2D minkowski sum of a point, line or polygon with a polygon.

A minkowski sum of two geometries A and B is the set of all points that are the sum of any point in A and B. Minkowski sums are often used in motion planning and computer-aided design. More details on [Wikipedia Minkowski addition](#).

The first parameter can be any 2D geometry (point, linestring, polygon). If a 3D geometry is passed, it will be converted to 2D by forcing Z to 0, leading to possible cases of invalidity. The second parameter must be a 2D polygon.

Implementation utilizes [CGAL 2D Minkowskisum](#).

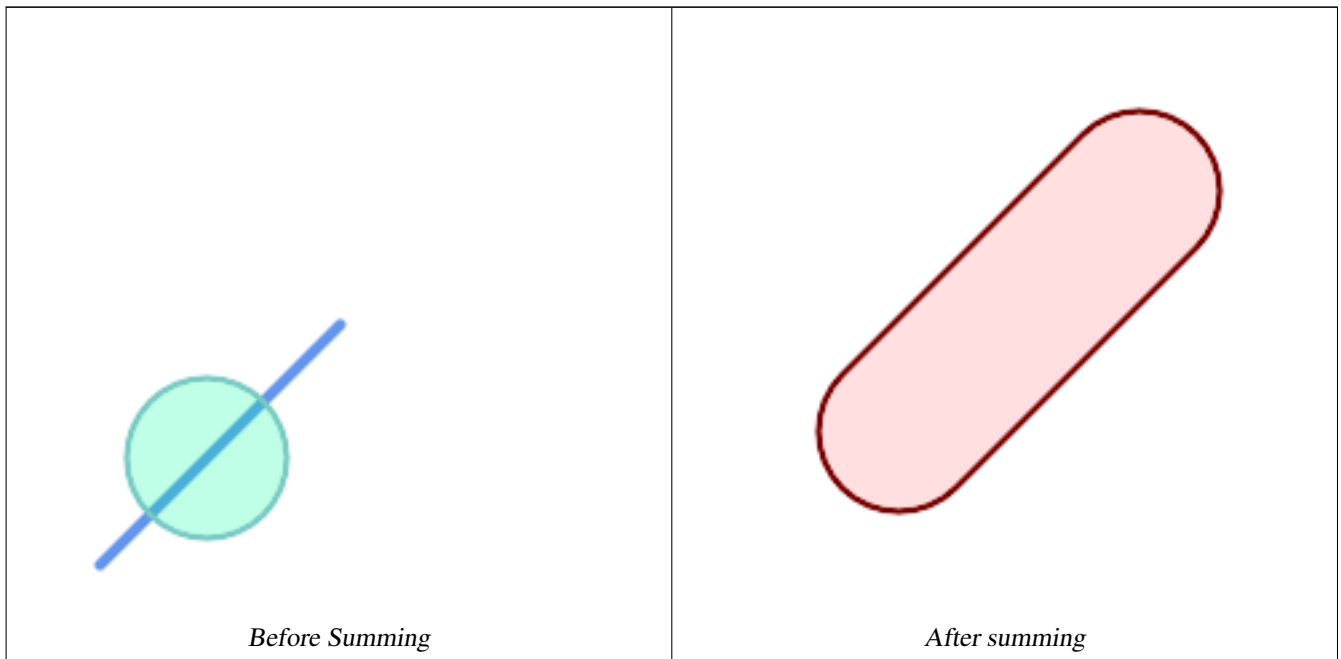
Disponibilidad: 2.1.0



This method needs SFCGAL backend.

Ejemplos

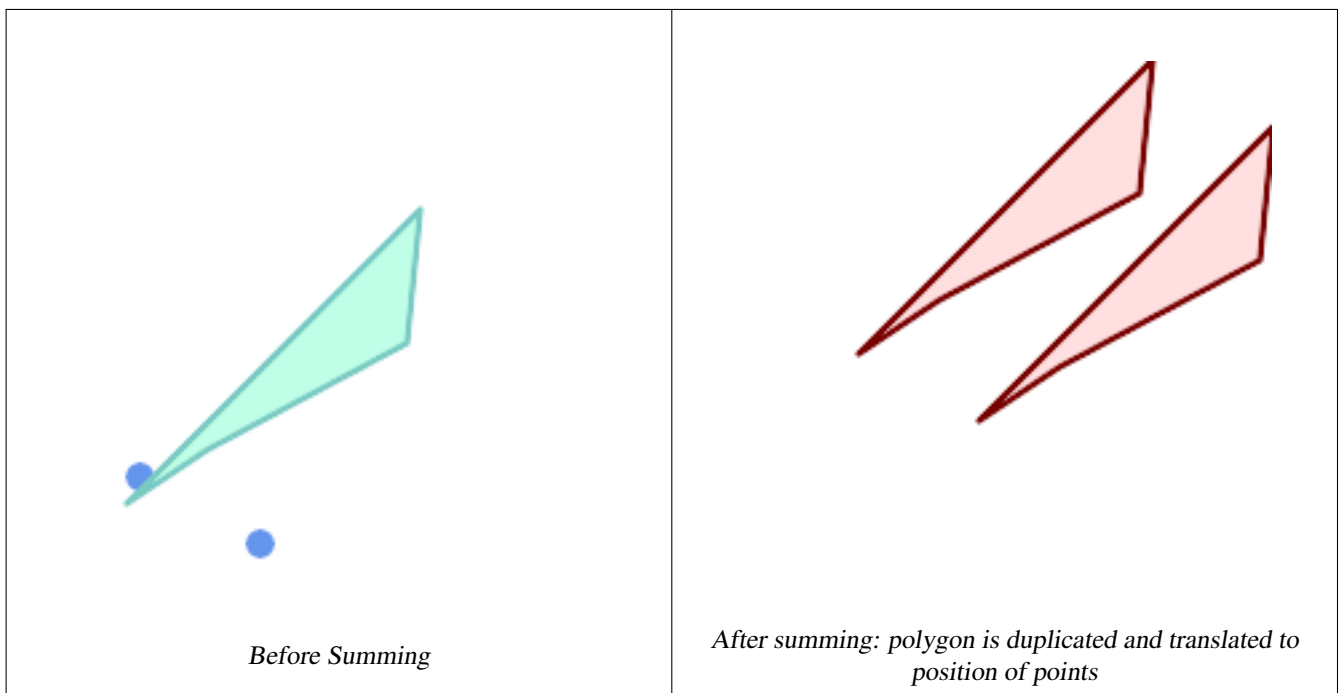
Minkowski Sum of Linestring and circle polygon where Linestring cuts thru the circle



```
SELECT ST_MinkowskiSum(line, circle))
FROM (SELECT
  ST_MakeLine(ST_Point(10, 10),ST_Point(100, 100)) As line,
  ST_Buffer(ST_GeomFromText('POINT(50 50)'), 30) As circle) As foo;

-- wkt --
MULTIPOLYGON(((30 59.9999999999999,30.5764415879031 54.1472903395161,32.2836140246614 ↵
  48.5194970290472,35.0559116309237 43.3328930094119,38.7867965644036 ↵
  38.7867965644035,43.332893009412 35.0559116309236,48.5194970290474 ↵
  32.2836140246614,54.1472903395162 30.5764415879031,60.0000000000001 30,65.8527096604839 ↵
  30.5764415879031,71.4805029709527 32.2836140246614,76.6671069905881 ↵
  35.0559116309237,81.2132034355964 38.7867965644036,171.213203435596 ↵
  128.786796564404,174.944088369076 133.332893009412,177.716385975339 ↵
  138.519497029047,179.423558412097 144.147290339516,180 150,179.423558412097 ↵
  155.852709660484,177.716385975339 161.480502970953,174.944088369076 ↵
  166.667106990588,171.213203435596 171.213203435596,166.667106990588 174.944088369076,
  161.480502970953 177.716385975339,155.852709660484 179.423558412097,150 ↵
  180,144.147290339516 179.423558412097,138.519497029047 177.716385975339,133.332893009412 ↵
  174.944088369076,128.786796564403 171.213203435596,38.7867965644035 ↵
  81.2132034355963,35.0559116309236 76.667106990588,32.2836140246614 ↵
  71.4805029709526,30.5764415879031 65.8527096604838,30 59.9999999999999)))
```

Minkowski Sum of a polygon and multipoint



```
SELECT ST_MinkowskiSum(mp, poly)
FROM (SELECT 'MULTIPOINT(25 50,70 25)::geometry As mp,
      'POLYGON((130 150, 20 40, 50 60, 125 100, 130 150))::geometry As poly
      ) As foo

-- wkt --
MULTIPOLYGON(
  ((70 115,100 135,175 175,225 225,70 115)),
  ((120 65,150 85,225 125,275 175,120 65))
)
```

8.20.17 ST_OptimalAlphaShape

ST_OptimalAlphaShape — Computes a possible concave geometry using the CGAL Alpha Shapes algorithm after have computed the "optimal" alpha value.

Synopsis

```
geometry ST_OptimalAlphaShape(geometry param_geom, boolean allow_holes = false, integer nb_components);
```

Descripción

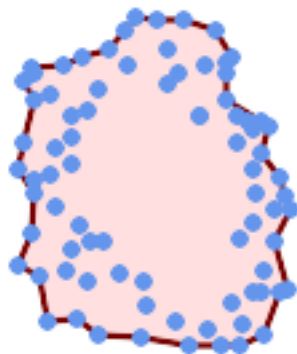
Computes the "optimal" alpha-shapes of the set of geometry. CGAL can automatically find the optimal value of alpha. This version uses it to find an "optimal" alpha-shape. The result is a single polygon. It will not contain holes unless the optional `param_allow_holes` argument is specified as true. The result will be generated such that the number of solid component of the alpha shape is equal to or smaller than `param_nb_components`.

Availability: 3.3.0 - requires SFCGAL >= 1.4.1.



This method needs SFCGAL backend.

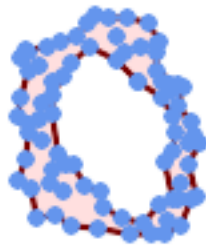
Ejemplos



Concave Hull of a MultiPoint (same example as ST_AlphaShape)

```
SELECT ST_AsText(ST_OptimalAlphaShape('MULTIPOINT((63 84),(76 88),(68 73),(53 18),(91 50) ←
, (81 70),
(88 29),(24 82),(32 51),(37 23),(27 54),(84 19),(75 87),(44 42),(77 67),(90 ←
30),(36 61),(32 65),
(81 47),(88 58),(68 73),(49 95),(81 60),(87 50),
(78 16),(79 21),(30 22),(78 43),(26 85),(48 34),(35 35),(36 40),(31 79),(83 ←
29),(27 84),(52 98),(72 95),(85 71),
(75 84),(75 77),(81 29),(77 73),(41 42),(83 72),(23 36),(89 53),(27 57),(57 ←
97),(27 77),(39 88),(60 81),
(80 72),(54 32),(55 26),(62 22),(70 20),(76 27),(84 35),(87 42),(82 54),(83 ←
64),(69 86),(60 90),(50 86),(43 80),(36 73),
(36 68),(40 75),(24 67),(23 60),(26 44),(28 33),(40 32),(43 19),(65 16),(73 ←
16),(38 46),(31 59),(34 86),(45 90),(64 97))'::geometry));

POLYGON((89 53,91 50,87 42,90 30,88 29,84 19,78 16,73 16,65 16,53 18,43 19,37 23,30 22,28 ←
33,23 36,
26 44,27 54,23 60,24 67,27 77,24 82,26 85,34 86,39 88,45 90,49 95,52 98,57 ←
97,64 97,72 95,76 88,75 84,75 77,83 72,85 71,83 64,88 58,89 53))
```



Concave Hull of a MultiPoint, allowing holes (same example as ST_AlphaShape)

```
SELECT ST_AsText(ST_OptimalAlphaShape('MULTIPOINT((63 84),(76 88),(68 73),(53 18),(91 50) ←
, (81 70),(88 29),(24 82),(32 51),(37 23),(27 54),(84 19),(75 87),(44 42),(77 67),(90 30) ←
, (36 61),(32 65),(81 47),(88 58),(68 73),(49 95),(81 60),(87 50),
(78 16),(79 21),(30 22),(78 43),(26 85),(48 34),(35 35),(36 40),(31 79),(83 ←
29),(27 84),(52 98),(72 95),(85 71),
(75 84),(75 77),(81 29),(77 73),(41 42),(83 72),(23 36),(89 53),(27 57),(57 ←
97),(27 77),(39 88),(60 81),
(80 72),(54 32),(55 26),(62 22),(70 20),(76 27),(84 35),(87 42),(82 54),(83 ←
64),(69 86),(60 90),(50 86),(43 80),(36 73),
(36 68),(40 75),(24 67),(23 60),(26 44),(28 33),(40 32),(43 19),(65 16),(73 ←
16),(38 46),(31 59),(34 86),(45 90),(64 97))'::geometry, allow_holes => ←
true));
```

```
POLYGON((89 53,91 50,87 42,90 30,88 29,84 19,78 16,73 16,65 16,53 18,43 19,37 23,30 22,28 ←
33,23 36,26 44,27 54,23 60,24 67,27 77,24 82,26 85,34 86,39 88,45 90,49 95,52 98,57 ←
97,64 97,72 95,76 88,75 84,75 77,83 72,85 71,83 64,88 58,89 53),(36 61,36 68,40 75,43 ←
80,50 86,60 81,68 73,77 67,81 60,82 54,81 47,78 43,81 29,76 27,70 20,62 22,55 26,54 ←
32,48 34,44 42,38 46,36 61))
```

Ver también

[ST_ConcaveHull](#), [ST_AlphaShape](#)

8.20.18 ST_Orientation

ST_Orientation — Determine surface orientation

Synopsis

integer **ST_Orientation**(geometry geom);

Descripción

The function only applies to polygons. It returns -1 if the polygon is counterclockwise oriented and 1 if the polygon is clockwise oriented.

Disponibilidad: 2.1.0

- ✔ This method needs SFCGAL backend.
- ✔ This function supports 3d and will not drop the z-index.

8.20.19 ST_StraightSkeleton

ST_StraightSkeleton — Compute a straight skeleton from a geometry

Synopsis

geometry **ST_StraightSkeleton**(geometry geom);

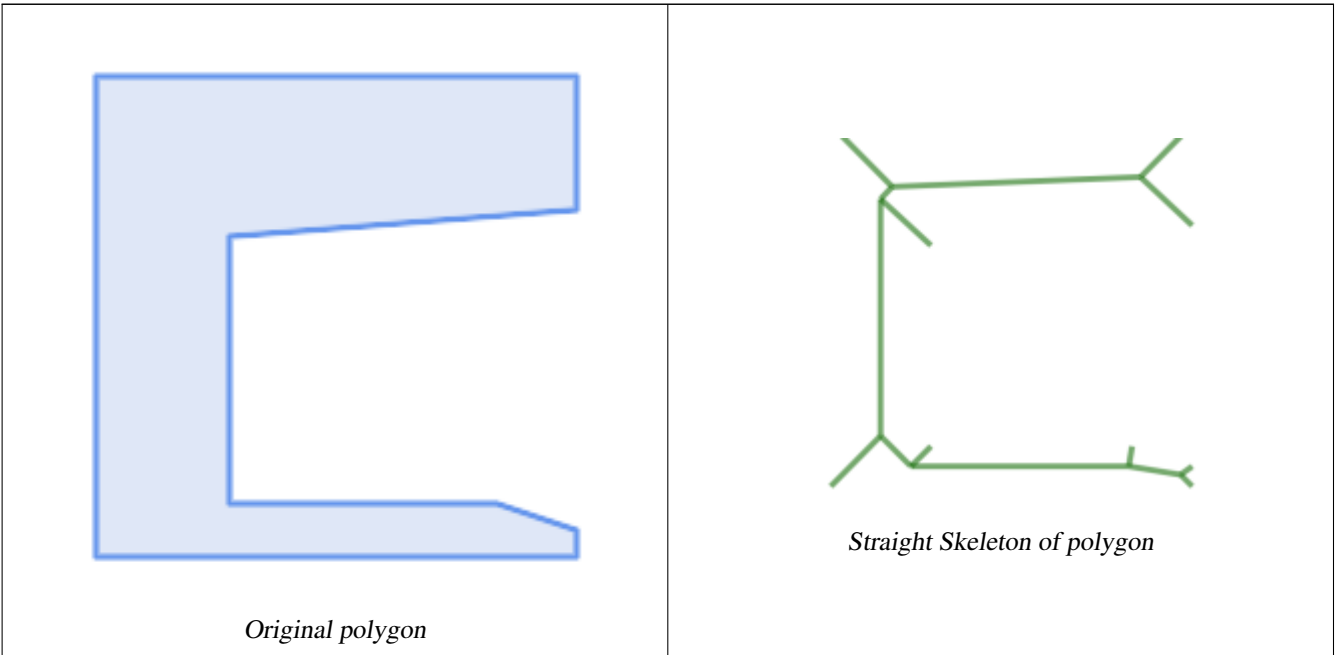
Descripción

Disponibilidad: 2.1.0

- ✔ This method needs SFCGAL backend.
- ✔ This function supports 3d and will not drop the z-index.
- ✔ This function supports Polyhedral surfaces.
- ✔ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_StraightSkeleton(ST_GeomFromText('POLYGON (( 190 190, 10 190, 10 10, 190 10, 190 ←  
20, 160 30, 60 30, 60 130, 190 140, 190 190 ))'));
```



8.20.20 ST_Tessellate

ST_Tessellate — Perform surface Tessellation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS

Synopsis

geometry **ST_Tessellate**(geometry geom);

Descripción

Takes as input a surface such a MULTI(POLYGON) or POLYHEDRALSURFACE and returns a TIN representation via the process of tessellation using triangles.

Disponibilidad: 2.1.0



This method needs SFCGAL backend.



This function supports 3d and will not drop the z-index.



This function supports Polyhedral surfaces.



This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
SELECT ST_GeomFromText('POLYHEDRALSURFACE ↵
  Z( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)), ↵
    ((0 0 0, 0 1 0, 1 1 0, 1 ↵
0 0, 0 0 0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 ↵
    ((1 1 0, 1 1 1, 1 0 1, 1 ↵
0 0, 1 1 0)), ↵
    ((0 1 0, 0 1 1, 1 1 1, 1 ↵
1 0, 0 1 0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))) )')

```



Original Cube

```
SELECT ST_Tessellate(ST_GeomFromText(' ↵
  POLYHEDRALSURFACE Z( ((0 0 0, 0 0 1, 0 1 1, 0 1 ↵
    ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 ↵
0)), ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)), ↵
    ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 ↵
0)), ↵
    ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 ↵
0)), ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1))) )')

```

ST_AsText output:


```
SELECT ST_AsText(ST_Tessellate(ST_GeomFromText(' ↵
  POLYHEDRALSURFACE Z( ((0 0 0, 0 0 1, 0 1 1, 0 0 0)), ((0 1 ↵
0, 0 0 0, 0 1 1, 0 1 0)), ↵
    ((0 0 0, 0 1 0, 1 1 0, 0 0 0)), ↵
    ((1 0 0, 0 0 0, 1 1 0, 1 0 0)), ((0 0 ↵
0, 1 0 1, 0 0 1)), ↵
    ((0 0 1, 0 0 0, 1 0 0, 0 0 1)), ↵
    ((1 1 0, 1 1 1, 1 0 1, 1 1 0)), ((1 0 ↵
0, 1 1 0, 1 0 1, 1 0 0)), ↵
    ((0 1 0, 0 1 1, 1 1 1, 0 1 0)), ((1 1 ↵
0, 0 1 0, 1 1 1, 1 1 0)), ↵
    ((0 1 1, 1 0 1, 1 1 1, 0 1 1)), ((0 1 ↵
1, 0 0 1, 1 0 1, 0 1 1))) )')

```



Tessellated Cube with triangles colored

```
SELECT 'POLYGON (( 10 190, 10 70, 80 70, ↵
      80 130, 50 160, 120 160, 120 190, 10 190 ))';
```

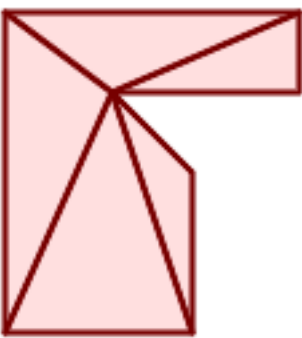


Original polygon

```
SELECT
    ST_Tessellate('POLYGON (( 10 190, ↵
      10 70, 80 70, 80 130, 50 160, 120 160, 120 190, 10 190 ))');
```

ST_AsText output

```
TIN(((80 130,50 160,80 70,80 130)),((50 ↵
      160,10 190,10 70,50 160)),
      ((80 70,50 160,10 70,80 70)) ↵
      ,((120 160,120 190,50 160,120 160)),
      ((120 190,10 190,50 160,120 190)))
```



Tessellated Polygon

Ver también

[ST_ConstrainedDelaunayTriangles](#), [ST_DelaunayTriangles](#)

8.20.21 ST_Volume

ST_Volume — Computes the volume of a 3D solid. If applied to surface (even closed) geometries will return 0.

Synopsis

```
float ST_Volume(geometry geom1);
```

Descripción

Disponibilidad: 2.2.0

- ✔ This method needs SFCGAL backend.
- ✔ This function supports 3d and will not drop the z-index.
- ✔ This function supports Polyhedral surfaces.

- ✔ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).
- ✔ This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 9.1 (same as ST_3DVolume)

Ejemplo

When closed surfaces are created with WKT, they are treated as areal rather than solid. To make them solid, you need to use **ST_MakeSolid**. Areal geometries have no volume. Here is an example to demonstrate.

```
SELECT ST_Volume(geom) As cube_surface_vol,
       ST_Volume(ST_MakeSolid(geom)) As solid_surface_vol
FROM (SELECT 'POLYHEDRALSURFACE( ((0 0 0, 0 0 1, 0 1 1, 0 1 0, 0 0 0)),
  ((0 0 0, 0 1 0, 1 1 0, 1 0 0, 0 0 0)),
  ((0 0 0, 1 0 0, 1 0 1, 0 0 1, 0 0 0)),
  ((1 1 0, 1 1 1, 1 0 1, 1 0 0, 1 1 0)),
  ((0 1 0, 0 1 1, 1 1 1, 1 1 0, 0 1 0)),
  ((0 0 1, 1 0 1, 1 1 1, 0 1 1, 0 0 1)) )'::geometry) As f(geom);

cube_surface_vol | solid_surface_vol
-----+-----
0 | 1
```

Ver también

[ST_3DArea](#), [ST_MakeSolid](#), [ST_IsSolid](#)

8.21 Soporte para transacciones grandes



Note
Los usuarios deben usar **el nivel de transacción en serie** sino se rompería el mecanismo de bloqueo.

8.21.1 AddAuth

AddAuth — Agrega un testigo de autorización para usarlo en la transacción actual.

Synopsis

boolean **AddAuth**(text auth_token);

Descripción

Agrega un testigo de autorización para usarlo en la transacción actual.
Adds the current transaction identifier and authorization token to a temporary table called temp_lock_have_table.
Disponibilidad: 1.1.3

Ejemplos

```
SELECT LockRow('towns', '353', 'priscilla');
      BEGIN TRANSACTION;
      SELECT AddAuth('joey');
      UPDATE towns SET the_geom = ST_Translate(the_geom,2,2) WHERE gid = 353;
      COMMIT;

---Error---
ERROR:  UPDATE where "gid" = '353' requiere la autorización 'priscilla'
```

Ver también

[LockRow](#)

8.21.2 CheckAuth

CheckAuth — Crea un disparador sobre una tabla para prevenir/permitir actualizaciones y borrados de filas basados en el testigo de autorización.

Synopsis

```
integer CheckAuth(text a_schema_name, text a_table_name, text a_key_column_name);
integer CheckAuth(text a_table_name, text a_key_column_name);
```

Descripción

Crea un disparador sobre una tabla para prevenir/permitir actualizaciones y borrado de filas basado en el testigo de autorizaciones. Identifica filas usando la columna <rowid_col> .

Si no se le pasa un nombre de esquema, a_schema_name, busca la tabla en el esquema actual.



Note

Si ya existe un disparador de autorización sobre esta tabla la función da error.
Si no está habilitado el soporte de transacciones, la función lanza una excepción.

Disponibilidad: 1.1.3

Ejemplos

```
SELECT CheckAuth('public', 'towns', 'gid');
      result
      -----
         0
```

Ver también

[EnableLongTransactions](#)

8.21.3 DisableLongTransactions

DisableLongTransactions — DisableLongTransactions

Synopsis

text **DisableLongTransactions**();

Descripción

Deshabilita el soporte de transacciones grandes. Esta función elimina las tablas de metadatos para soporte de transacciones grandes, y borra todos los disparadores vinculados a las tablas de comprobación de bloqueos.

Elimina la meta tabla llamada `authorization_table` y una vista llamada `authorized_tables` y todos los disparadores llamados `checkauthtrigger`

Disponibilidad: 1.1.3

Ejemplos

```
SELECT DisableLongTransactions();
--result--
Soporte de transacciones grandes deshabilitado
```

Ver también

[EnableLongTransactions](#)

8.21.4 EnableLongTransactions

EnableLongTransactions — EnableLongTransactions

Synopsis

text **EnableLongTransactions**();

Descripción

Habilita el soporte de transacciones grandes. Esta función crea las tablas de metadatos requeridas, necesita ser llamada una vez antes de usar las otras funciones en esta sección. Llamarla más de una vez no produce problemas.

Crea una meta tabla llamada `authorization_table` y una vista llamada `authorized_tables`

Disponibilidad: 1.1.3

Ejemplos

```
SELECT EnableLongTransactions();
--result--
Soporte para transacciones grandes habilitado
```

Ver también

[DisableLongTransactions](#)

8.21.5 LockRow

LockRow — Configura el bloqueo/autorización para una fila específica de la tabla

Synopsis

```
integer LockRow(text a_schema_name, text a_table_name, text a_row_key, text an_auth_token, timestamp expire_dt);
integer LockRow(text a_table_name, text a_row_key, text an_auth_token, timestamp expire_dt);
integer LockRow(text a_table_name, text a_row_key, text an_auth_token);
```

Descripción

Configura el bloqueo/autorización para una fila específica de la tabla <authid> es un valor de texto, <expires> es un valor de tiempo que por defecto es now()+1hora. Devuelve 1 si se asignó el bloqueo, 0 en otro caso (ya bloqueado por otra autorización)

Disponibilidad: 1.1.3

Ejemplos

```
SELECT LockRow('public', 'towns', '2', 'joey');
LockRow
-----
1

--Joey ya ha bloqueado el registro y Priscilla no tiene suerte
SELECT LockRow('public', 'towns', '2', 'priscilla');
LockRow
-----
0
```

Ver también

[UnlockRows](#)

8.21.6 UnlockRows

UnlockRows — Removes all locks held by an authorization token.

Synopsis

```
integer UnlockRows(text auth_token);
```

Descripción

Retira todos los bloqueos mantenidos por el id de la autorización especificada. Devuelve el número de bloqueos liberados.

Disponibilidad: 1.1.3

Ejemplos

```
SELECT LockRow('towns', '353', 'priscilla');
       SELECT LockRow('towns', '2', 'priscilla');
       SELECT UnLockRows('priscilla');
       UnLockRows
       -----
       2
```

Ver también

[LockRow](#)

8.22 Version Functions

8.22.1 PostGIS_Extensions_Upgrade

PostGIS_Extensions_Upgrade — Packages and upgrades PostGIS extensions (e.g. `postgis_raster`, `postgis_topology`, `postgis_sfcgal`) to latest available version.

Synopsis

text **PostGIS_Extensions_Upgrade()**;

Description

Packages and upgrades PostGIS extensions to latest version. Only extensions you have installed in the database will be packaged and upgraded if needed. Reports full PostGIS version and build configuration infos after. This is short-hand for doing multiple `CREATE EXTENSION .. FROM unpackaged` and `ALTER EXTENSION .. UPDATE` for each PostGIS extension. Currently only tries to upgrade extensions `postgis`, `postgis_raster`, `postgis_sfcgal`, `postgis_topology`, and `postgis_tiger_geocoder`.

Availability: 2.5.0



Note

Changed: 3.3.0 support for upgrades from any PostGIS version. Does not work on all systems.
 Changed: 3.0.0 to repackage loose extensions and support `postgis_raster`.

Examples

```
SELECT PostGIS_Extensions_Upgrade();
```

```
NOTICE:  Packaging extension postgis
NOTICE:  Packaging extension postgis_raster
NOTICE:  Packaging extension postgis_sfcgal
NOTICE:  Extension postgis_topology is not available or not packagable for some reason
NOTICE:  Extension postgis_tiger_geocoder is not available or not packagable for some reason
          reason

          postgis_extensions_upgrade
-----
Upgrade completed, run SELECT postgis_full_version(); for details
(1 row)
```

See Also

Section 3.4, [PostGIS_GEOS_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_Version](#)

8.22.2 PostGIS_Full_Version

`PostGIS_Full_Version` — Reports full PostGIS version and build configuration infos.

Synopsis

```
text PostGIS_Full_Version();
```

Description

Reports full PostGIS version and build configuration infos. Also informs about synchronization between libraries and scripts suggesting upgrades as needed.

Examples

```
SELECT PostGIS_Full_Version();
```

	postgis_full_version
POSTGIS="3.0.0dev r17211" [EXTENSION] PGSQL="110" GEOS="3.8.0dev-CAPI-1.11.0 df24b6bb" ↔	
SFCGAL="1.3.6" PROJ="Rel. 5.2.0, September 15th, 2018"	
GDAL="GDAL 2.3.2, released 2018/09/21" LIBXML="2.9.9" LIBJSON="0.13.1" LIBPROTOBUF="1.3.1" ↔	
WAGYU="0.4.3 (Internal)" TOPOLOGY RASTER	
(1 row)	

See Also

Section 3.4, [PostGIS_GEOS_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_Wagyu_V](#), [PostGIS_Version](#)

8.22.3 PostGIS_GEOS_Version

`PostGIS_GEOS_Version` — Returns the version number of the GEOS library.

Synopsis

```
text PostGIS_GEOS_Version();
```

Description

Returns the version number of the GEOS library, or NULL if GEOS support is not enabled.

Examples

```
SELECT PostGIS_GEOS_Version();
```

	postgis_geos_version
	3.1.0-CAPI-1.5.0
(1 row)	

See Also

[PostGIS_Full_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_Version](#)

8.22.4 PostGIS_Liblwgeom_Version

`PostGIS_Liblwgeom_Version` — Returns the version number of the liblwgeom library. This should match the version of PostGIS.

Synopsis

```
text PostGIS_Liblwgeom_Version();
```

Description

Returns the version number of the liblwgeom library/

Examples

```
SELECT PostGIS_Liblwgeom_Version();
postgis_liblwgeom_version
-----
2.3.3 r15473
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_Version](#)

8.22.5 PostGIS_LibXML_Version

`PostGIS_LibXML_Version` — Returns the version number of the libxml2 library.

Synopsis

```
text PostGIS_LibXML_Version();
```

Description

Returns the version number of the LibXML2 library.

Availability: 1.5

Examples

```
SELECT PostGIS_LibXML_Version();
postgis_libxml_version
-----
2.7.6
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_Lib_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_GEOS_Version](#), [PostGIS_Version](#)

8.22.6 PostGIS_Lib_Build_Date

`PostGIS_Lib_Build_Date` — Returns build date of the PostGIS library.

Synopsis

`text PostGIS_Lib_Build_Date();`

Description

Returns build date of the PostGIS library.

Examples

```
SELECT PostGIS_Lib_Build_Date();
 postgis_lib_build_date
-----
2008-06-21 17:53:21
(1 row)
```

8.22.7 PostGIS_Lib_Version

`PostGIS_Lib_Version` — Returns the version number of the PostGIS library.

Synopsis

`text PostGIS_Lib_Version();`

Description

Returns the version number of the PostGIS library.

Examples

```
SELECT PostGIS_Lib_Version();
 postgis_lib_version
-----
1.3.3
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_GEOS_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_Version](#)

8.22.8 PostGIS_PROJ_Version

PostGIS_PROJ_Version — Returns the version number of the PROJ4 library.

Synopsis

```
text PostGIS_PROJ_Version();
```

Description

Returns the version number of the PROJ4 library, or NULL if PROJ4 support is not enabled.

Examples

```
SELECT PostGIS_PROJ_Version();
 postgis_proj_version
-----
Rel. 4.4.9, 29 Oct 2004
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_GEOS_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_Version](#)

8.22.9 PostGIS_Wagyu_Version

PostGIS_Wagyu_Version — Returns the version number of the internal Wagyu library.

Synopsis

```
text PostGIS_Wagyu_Version();
```

Description

Returns the version number of the internal Wagyu library, or NULL if Wagyu support is not enabled.

Examples

```
SELECT PostGIS_Wagyu_Version();
 postgis_wagyu_version
-----
0.4.3 (Internal)
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_GEOS_Version](#), [PostGIS_PROJ_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_Version](#)

8.22.10 PostGIS_Scripts_Build_Date

PostGIS_Scripts_Build_Date — Returns build date of the PostGIS scripts.

Synopsis

text **PostGIS_Scripts_Build_Date()**;

Description

Returns build date of the PostGIS scripts.

Availability: 1.0.0RC1

Examples

```
SELECT PostGIS_Scripts_Build_Date();
 postgis_scripts_build_date
-----
2007-08-18 09:09:26
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_GEOS_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_Version](#)

8.22.11 PostGIS_Scripts_Installed

PostGIS_Scripts_Installed — Returns version of the PostGIS scripts installed in this database.

Synopsis

text **PostGIS_Scripts_Installed()**;

Description

Returns version of the PostGIS scripts installed in this database.



Note

If the output of this function doesn't match the output of [PostGIS_Scripts_Released](#) you probably missed to properly upgrade an existing database. See the [Upgrading](#) section for more info.

Availability: 0.9.0

Examples

```
SELECT PostGIS_Scripts_Installed();
 postgis_scripts_installed
-----
1.5.0SVN
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_Scripts_Released](#), [PostGIS_Version](#)

8.22.12 PostGIS_Scripts_Released

`PostGIS_Scripts_Released` — Returns the version number of the `postgis.sql` script released with the installed PostGIS lib.

Synopsis

text `PostGIS_Scripts_Released()`;

Description

Returns the version number of the `postgis.sql` script released with the installed PostGIS lib.

**Note**

Starting with version 1.1.0 this function returns the same value of [PostGIS_Lib_Version](#). Kept for backward compatibility.

Availability: 0.9.0

Examples

```
SELECT PostGIS_Scripts_Released();
 postgis_scripts_released
-----
1.3.4SVN
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_Scripts_Installed](#), [PostGIS_Lib_Version](#)

8.22.13 PostGIS_Version

`PostGIS_Version` — Returns PostGIS version number and compile-time options.

Synopsis

text `PostGIS_Version()`;

Description

Returns PostGIS version number and compile-time options.

Examples

```
SELECT PostGIS_Version();
               postgis_version
-----
1.3 USE_GEOS=1 USE_PROJ=1 USE_STATS=1
(1 row)
```

See Also

[PostGIS_Full_Version](#), [PostGIS_GEOS_Version](#), [PostGIS_Lib_Version](#), [PostGIS_LibXML_Version](#), [PostGIS_PROJ_Version](#)

8.23 Grand Unified Custom Variables (GUCs)

8.23.1 postgis.backend

`postgis.backend` — The backend to service a function where GEOS and SFCGAL overlap. Options: `geos` or `sfcgal`. Defaults to `geos`.

Descripción

This GUC is only relevant if you compiled PostGIS with `sfcgal` support. By default `geos` backend is used for functions where both GEOS and SFCGAL have the same named function. This variable allows you to override and make `sfcgal` the backend to service the request.

Disponibilidad: 2.1.0

Ejemplos

Sets backend just for life of connection

```
set postgis.backend = sfcgal;
```

Sets backend for new connections to database

```
ALTER DATABASE mygisdb SET postgis.backend = sfcgal;
```

Ver también

Section [8.20](#)

8.23.2 postgis.gdal_datapath

`postgis.gdal_datapath` — A configuration option to assign the value of GDAL's `GDAL_DATA` option. If not set, the environmentally set `GDAL_DATA` variable is used.

Descripción

A PostgreSQL GUC variable for setting the value of GDAL's GDAL_DATA option. The `postgis.gdal_datapath` value should be the complete physical path to GDAL's data files.

This configuration option is of most use for Windows platforms where GDAL's data files path is not hard-coded. This option should also be set when GDAL's data files are not located in GDAL's expected path.



Note

This option can be set in PostgreSQL's configuration file `postgresql.conf`. It can also be set by connection or transaction.

Disponibilidad: 2.2.0



Note

Additional information about GDAL_DATA is available at GDAL's [Configuration Options](#).

Ejemplos

Set and reset `postgis.gdal_datapath`

```
SET postgis.gdal_datapath TO '/usr/local/share/gdal.hidden';  
SET postgis.gdal_datapath TO default;
```

Setting on windows for a particular database

```
ALTER DATABASE gisdb  
SET postgis.gdal_datapath = 'C:/Program Files/PostgreSQL/9.3/gdal-data';
```

Ver también

[PostGIS_GDAL_Version](#), [ST_Transform](#)

8.23.3 postgis.gdal_enabled_drivers

`postgis.gdal_enabled_drivers` — A configuration option to set the enabled GDAL drivers in the PostGIS environment. Affects the GDAL configuration variable GDAL_SKIP.

Descripción

A configuration option to set the enabled GDAL drivers in the PostGIS environment. Affects the GDAL configuration variable GDAL_SKIP. This option can be set in PostgreSQL's configuration file: `postgresql.conf`. It can also be set by connection or transaction.

The initial value of `postgis.gdal_enabled_drivers` may also be set by passing the environment variable `POSTGIS_GDAL_ENABLED_DRIVERS` with the list of enabled drivers to the process starting PostgreSQL.

Enabled GDAL specified drivers can be specified by the driver's short-name or code. Driver short-names or codes can be found at [GDAL Raster Formats](#). Multiple drivers can be specified by putting a space between each driver.

Note

There are three special codes available for `postgis.gdal_enabled_drivers`. The codes are case-sensitive.

- `DISABLE_ALL` disables all GDAL drivers. If present, `DISABLE_ALL` overrides all other values in `postgis.gdal_enabled_drivers`.
- `ENABLE_ALL` enables all GDAL drivers.
- `VSICURL` enables GDAL's `/vsicurl/` virtual file system.

When `postgis.gdal_enabled_drivers` is set to `DISABLE_ALL`, attempts to use out-db rasters, `ST_FromGDALRaster()`, `ST_AsGDALRaster()`, `ST_AsTIFF()`, `ST_AsJPEG()` and `ST_AsPNG()` will result in error messages.

**Note**

In the standard PostGIS installation, `postgis.gdal_enabled_drivers` is set to `DISABLE_ALL`.

**Note**

Additional information about `GDAL_SKIP` is available at GDAL's [Configuration Options](#).

Disponibilidad: 2.2.0

Ejemplos

Set and reset `postgis.gdal_enabled_drivers`

Sets backend for all new connections to database

```
ALTER DATABASE mygisdb SET postgis.gdal_enabled_drivers TO 'GTiff PNG JPEG';
```

Sets default enabled drivers for all new connections to server. Requires super user access and PostgreSQL 9.4+. Also note that database, session, and user settings override this.

```
ALTER SYSTEM SET postgis.gdal_enabled_drivers TO 'GTiff PNG JPEG';
SELECT pg_reload_conf();
```

```
SET postgis.gdal_enabled_drivers TO 'GTiff PNG JPEG';
SET postgis.gdal_enabled_drivers = default;
```

Enable all GDAL Drivers

```
SET postgis.gdal_enabled_drivers = 'ENABLE_ALL';
```

Disable all GDAL Drivers

```
SET postgis.gdal_enabled_drivers = 'DISABLE_ALL';
```

Ver también

[ST_FromGDALRaster](#), [ST_AsGDALRaster](#), [ST_AsTIFF](#), [ST_AsPNG](#), [ST_AsJPEG](#), [postgis.enable_outdb_rasters](#)

8.23.4 postgis.enable_outdb_rasters

postgis.enable_outdb_rasters — A boolean configuration option to enable access to out-db raster bands.

Descripción

A boolean configuration option to enable access to out-db raster bands. This option can be set in PostgreSQL's configuration file: postgresql.conf. It can also be set by connection or transaction.

The initial value of `postgis.enable_outdb_rasters` may also be set by passing the environment variable `POSTGIS_ENABLE_OUTDB_RASTERS` with a non-zero value to the process starting PostgreSQL.

**Note**

Even if `postgis.enable_outdb_rasters` is `True`, the GUC `postgis.gdal_enabled_drivers` determines the accessible raster formats.

**Note**

In the standard PostGIS installation, `postgis.enable_outdb_rasters` is set to `False`.

Disponibilidad: 2.2.0

Ejemplos

Set and reset `postgis.enable_outdb_rasters` for current session

```
SET postgis.enable_outdb_rasters TO True;
SET postgis.enable_outdb_rasters = default;
SET postgis.enable_outdb_rasters = True;
SET postgis.enable_outdb_rasters = False;
```

Set for specific database

```
ALTER DATABASE gisdb SET postgis.enable_outdb_rasters = true;
```

Setting for whole database cluster. You need to reconnect to the database for changes to take effect.

```
--writes to postgres.auto.conf
ALTER SYSTEM postgis.enable_outdb_rasters = true;
--Reloads postgres conf
SELECT pg_reload_conf();
```

Ver también

[postgis.gdal_enabled_drivers](#) [postgis.gdal_config_options](#)

8.23.5 postgis.gdal_config_options

postgis.gdal_config_options — A string configuration to set options used when working with an out-db raster.

Descripción

A string configuration to set options used when working with an out-db raster. **Configuration options** control things like how much space GDAL allocates to local data cache, whether to read overviews, and what access keys to use for remote out-db data sources.

Disponibilidad: 2.2.0

Ejemplos

Set `postgis.gdal_vsi_options` for current session:

```
SET postgis.gdal_config_options = 'AWS_ACCESS_KEY_ID=xxxxxxxxxxxxxxxxx AWS_SECRET_ACCESS_KEY= ↵
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYY';
```

Set `postgis.gdal_vsi_options` just for the *current transaction* using the `LOCAL` keyword:

```
SET LOCAL postgis.gdal_config_options = 'AWS_ACCESS_KEY_ID=xxxxxxxxxxxxxxxxx ↵
AWS_SECRET_ACCESS_KEY=YYYYYYYYYYYYYYYYYYYYYYYYYYYYYY';
```

Ver también

`postgis.enable_outdb_rasters` `postgis.gdal_enabled_drivers`

8.24 Troubleshooting Functions

8.24.1 PostGIS_AddBBox

`PostGIS_AddBBox` — Add bounding box to the geometry.

Synopsis

geometry **PostGIS_AddBBox**(geometry geomA);

Description

Add bounding box to the geometry. This would make bounding box based queries faster, but will increase the size of the geometry.



Note

Bounding boxes are automatically added to geometries so in general this is not needed unless the generated bounding box somehow becomes corrupted or you have an old install that is lacking bounding boxes. Then you need to drop the old and readd.



This method supports Circular Strings and Curves

Examples

```
UPDATE sometable
SET geom = PostGIS_AddBBox(geom)
WHERE PostGIS_HasBBox(geom) = false;
```


See Also

[PostGIS_DropBBox](#), [PostGIS_HasBBox](#)

8.24.2 PostGIS_DropBBox

PostGIS_DropBBox — Drop the bounding box cache from the geometry.

Synopsis

```
geometry PostGIS_DropBBox(geometry geomA);
```

Description

Drop the bounding box cache from the geometry. This reduces geometry size, but makes bounding-box based queries slower. It is also used to drop a corrupt bounding box. A tale-tell sign of a corrupt cached bounding box is when your ST_Intersects and other relation queries leave out geometries that rightfully should return true.

Note

Bounding boxes are automatically added to geometries and improve speed of queries so in general this is not needed unless the generated bounding box somehow becomes corrupted or you have an old install that is lacking bounding boxes. Then you need to drop the old and readd. This kind of corruption has been observed in 8.3-8.3.6 series whereby cached bboxes were not always recalculated when a geometry changed and upgrading to a newer version without a dump reload will not correct already corrupted boxes. So one can manually correct using below and readd the bbox or do a dump reload.



This method supports Circular Strings and Curves

Examples

```
--This example drops bounding boxes where the cached box is not correct
--The force to ST_AsBinary before applying Box2D forces a ↵
    recalculation of the box, and Box2D applied to the table ↵
    geometry always
-- returns the cached bounding box.
UPDATE sometable
SET geom = PostGIS_DropBBox(geom)
WHERE Not (Box2D(ST_AsBinary(geom)) = Box2D(geom));

UPDATE sometable
SET geom = PostGIS_AddBBox(geom)
WHERE Not PostGIS_HasBBOX(geom);
```

See Also

[PostGIS_AddBBox](#), [PostGIS_HasBBox](#), [Box2D](#)

8.24.3 PostGIS_HasBBox

PostGIS_HasBBox — Returns TRUE if the bbox of this geometry is cached, FALSE otherwise.

Synopsis

boolean **PostGIS_HasBBox**(geometry geomA);

Description

Returns TRUE if the bbox of this geometry is cached, FALSE otherwise. Use **PostGIS_AddBBox** and **PostGIS_DropBBox** to control caching.



This method supports Circular Strings and Curves

Examples

```
SELECT geom
FROM sometable WHERE PostGIS_HasBBox(geom) = false;
```

See Also

PostGIS_AddBBox, **PostGIS_DropBBox**

Chapter 9

Preguntas frecuentes sobre PostGIS

1. Donde puedo encontrar tutoriales, guías y talleres de trabajo con PostGIS

A step by step tutorial guide workshop [Introduction to PostGIS](#). It includes packaged data as well as intro to working with OpenGeo Suite. It is probably the best tutorial on PostGIS. BostonGIS también tiene un [PostGIS casi de idiotas guía sobre cómo empezar](#). Que está más centrado en el usuario de Windows.

2. Mis aplicaciones y herramientas funcionaban con PostGIS 1.5, pero no funcionan con PostGIS 2.0. ¿Como puedo solucionarlo?

Muchas funciones rechazadas se han eliminado del código fuente de PostGIS en PostGIS 2.0. Esto ha afectado a aplicaciones o herramientas de terceros como Geoserver, Mapserver, QuanrumGIS y OpenJump por mencionar algunas. Hay varias formas de resolver esto. Para las aplicaciones de terceros, puedes intentar actualizar a la ultima version de la aplicación que tiene muchos de estos errores resueltos. Para tu propio código, puedes cambiar tu código para que no utilice las funciones eliminadas. Muchas de estas funciones no son ST_alias de ST_Union, ST_Length etc. y como ultimo recurso instala el fichero `legacy.sql` completo o solo las partes del fichero `legacy.sql` que necesites. El fichero `legacy.sql` esta ubicado en la misma carpeta que `postgis.sql`. Puedes instalar este fichero después de haber instalado `postgis.sql` y `spatial_ref_sys.sql` para volver a tener disponibles las mas o menos 200 funciones que hemos eliminado.

3. Cuando cargo los datos de OpenStreetMap con `osm2pgsql`, estoy obteniendo un error fallido: `ERROR: la clase de operador "gist_geometry_ops" no existe para el método de acceso "GIST" error ocurrido. Esto funcionó bien en PostGIS 1.5.`

En PostGIS 2, la clase de operador de geometría predeterminada `gist_geometry_ops` fue cambiado a `gist_geometry_ops_2d` y el `gist_geometry_ops` fue eliminado por completo. Esto se hizo porque PostGIS 2 también presenta Nd índices espaciales de soporte 3D y el nombre antiguo fue considerada confuso y erróneo. Algunas aplicaciones antiguas que como parte del proceso crean tablas e índices, se hace referencia explícitamente al nombre de clase del operador. Esto no era necesario si desea el índice predeterminado 2D. Así que si maneja la buena pronunciación, cambie la creación de índices de: MAL:

```
CREATE INDEX idx_my_table_geom ON my_table USING gist (geom gist_geometry_ops);
```

a BIEN:

```
CREATE INDEX idx_my_table_geom ON my_table USING gist (geom);
```

El único caso donde usted tendrá que especificar la clase de operador es si usted desea un índice espacial 3D como el siguiente:

```
CREATE INDEX idx_my_super3d_geom ON my_super3d USING gist (geom gist_geometry_ops_nd);
```

Si usted es desafortunado para ser atrapado con código compilado que no se puede cambiar que tiene el antiguo `gist_geometry_ops` de código duro, entonces usted puede crear la antigua clase utilizando el `legacy_gist.sql` empaquetado en PostGIS 2.0.2+. Sin embargo, si utiliza esta corrección, se le aconseja que en un punto posterior elimine el índice y lo recree sin la clase de operador. Esto le ahorrará problemas en el futuro cuando necesite actualizar de nuevo.

4. *¿Esto utilizando la version PostgreSQL 9.0 y no puedo leer/escribir geometrías en OpenJump, Safe FME, y otras herramientas?*

En PostgreSQL 9.0+, la codificación por defecto ha sido cambiada a hex y algunos drivers antiguos de JDBC siguen asumiendo el formato espacio. Esto ha afectado a algunas aplicaciones como aplicaciones Java utilizando viejos drivers JDBC o aplicaciones .NET que utilizan el driver npgsql antiguo que espera el comportamiento de ST_AsBinary antiguo. Hay dos soluciones para corregir esto. Puedes actualizar el driver JDBC a la ultima version PostgreSQL 9.0 que puedes obtener en <http://jdbc.postgresql.org/download.html> Si estas utilizando una aplicación en .NET, puedes utilizar Npgsql 2.0.11 o superior, que puedes descargar desde http://pgfoundry.org/frs/?group_id=1000140 y se describe en [Francisco Figueiredo's Npgsql 2.0.11 released blog entry](#) Si actualizar tu driver PostgreSQL no es una opción, entonces se puede establecer el valor predeterminado otra vez al viejo comportamiento con el siguiente cambio:

```
ALTER DATABASE mypostgisdb SET bytea_output='escape';
```

5. *He intentado utilizar PgAdmin para ver mis columnas de geometría y esta en blanco, ¿qué ocurre?*

PgAdmin no muestra nada en geometrías muy largas. La mejor forma de verificar tienes datos en tus columnas de geometrías es:

```
-- Esto debería devolver ningún registro si todos los campos geom están llenos
SELECT somefield FROM mytable WHERE geom IS NULL;
```

```
-- Para saber como es de larga tu geometría haz una consulta de forma
-- que te de el mayor numero de puntos que tienes en cualquier columna de geometrías
SELECT MAX(ST_NPoints(geom)) FROM sometable;
```

6. *¿Qué tipo de objetos geométricos puedo almacenar?*

Puede almacenar geometrías Point, LineString, Polygon, MultiPoint, MultiLineString, MultiPolygon y GeometryCollection. En PostGIS 2.0 y superior también se pueden almacenar TINS y superficies poliédricas en el tipo de geometría básica. Éstos se especifican en el Formato de texto bien conocido de GIS abierto (con extensiones Z, M y ZM). Actualmente hay tres tipos de datos soportados. El tipo de datos de geometría OGC estándar que utiliza un sistema de coordenadas planar para la medición, el tipo de datos geográficos que utiliza un sistema de coordenadas geodésicas, con cálculos en una esfera o en esferoide. El más reciente miembro de la familia de tipo espacial en PostGIS es raster para almacenar y analizar los datos raster. Raster tiene su propia FAQ. Refierase a Chapter 13 y Chapter 12 para más detalle.

7. *Estoy confundido. ¿Que tipo de datos debo utilizar? ¿geométricos o geográficos?*

Respuesta corta: geography es un tipo de datos más reciente que admite mediciones de distancias de largo alcance, pero la mayoría de los cálculos en él son más lentos de lo que son en geometry. Si utiliza la geography, no necesita aprender mucho sobre sistemas de coordenadas planas. Geography es generalmente mejor si lo único que le importa es medir distancias y longitudes y tiene datos de todo el mundo. El tipo de datos geometry es un tipo de datos antiguo que tiene muchas más funciones que lo soportan, disfruta de un mayor soporte de herramientas de terceros, y las operaciones en él son generalmente más rápidas --a veces hasta 10 veces más rápidas para geometrías más grandes. Geometry es mejor si se siente cómodo con los sistemas de referencia espacial o si se trata de datos localizados en los que todos sus datos encajan en un solo **sistema de referencia espacial (SRID)**, o si usted necesita hacer un montón de procesamiento espacial. Es bastante fácil de hacer one-off entre los dos tipos de conversiones para obtener los beneficios de cada uno. Consulte Section 15.11 para ver lo que actualmente se soporta y lo que no. Respuesta larga: Te invitamos a nuestro largo debate en Section 4.3.3 y **Matriz funciones tipos**.

8. *Tengo preguntas mas complejas sobre el typo geógrafo, como por ejemplo, como de grande es la región que puedo almacenar en una columna geográfica y tener respuestas razonables. ¿Hay limitaciones como por ejemplo los polos, todo el contenido del campo debe estar en un hemisferio (como ocurre con con SQL Server 2008), velocidad etc?*

Tu pregunta es demasiado compleja y extensa, para obtener una respuesta en esta sección. Puedes ver la respuesta en Section 4.3.4.

9. *¿Como puedo insertar objetos SIG en la base de datos?*

Primero, necesitas crear una tabla con una columna de tipo "geometría" o "geografía" para almacenar tus datos SIG. Almacenar datos de tipo geográfico es un poco diferente que almacenar geometrías. Para obtener detalles de como se almacenan los tipos geográficos ves a Section 4.3. Para geometrías: Conéctate a tu base de datos con psql e intenta ejecutar el siguiente comando SQL:

```
CREATE TABLE gtest (id serial primary key, name varchar(20), geom geometry(LINESTRING)) ↵
;
```

Si falla la definición de la columna de geometría, es probable que no haya cargado las funciones y los objetos de PostGIS en esta base de datos o que esté utilizando una versión de PostGIS anterior a la 2.0. Vea el [Section 2.2](#). Entonces, podrás insertar geometrías en la tabla utilizando la sentencia SQL insert. El objeto SIG tiene el formato OpenGIS Consortium "well-known text":

```
INSERT INTO gtest (ID, NAME, GEOM)
VALUES (
  1,
  'First Geometry',
  ST_GeomFromText('LINESTRING(2 3,4 5,6 5,7 8)')
);
```

Para mas información sobre otros objetos SIG, mira en [object reference](#). Para ver datos SIG en la tabla:

```
SELECT id, name, ST_AsText(geom) AS geom FROM gtest;
```

El resultado devuelto debería parecerse a algo así:

```
id | name           | geom
---+-----+-----
  1 | First Geometry | LINESTRING(2 3,4 5,6 5,7 8)
(1 row)
```

10. ¿Como puedo construir una consulta espacial?

De la misma manera que construyes cualquier consulta en la base datos, como una combinación de valores, funciones y test booleanos a devolver en SQL. Para las consultas espaciales, hay dos problemas importantes que hay que tener en cuenta mientras se construyen las consultas: ¿Hay índices espaciales que puedo utilizar? y ¿Estoy haciendo cálculos pesados en un gran numero de geometrías? En general, querrás utilizar el operador "intersects" (&&) que comprueba que los límites de los objetos geograficos intersectan. La razón por la que el operador && es útil, es por que si un índice espacial esta disponible para aumentar la velocidad de calculo, el operador && lo utilizará. Esto puede hacer las consultas mucho mucho mas rápidas. También puedes utilizar las funciones espaciales, tales como Distance(), ST_Intersects(), ST_Contains() y ST_Within(), y muchas otras, para obtener los resultados de tu búsqueda. Muchas de las consultas espaciales, incluyen tests de índices y funciones espaciales. El test de índices sirve para limitar el número de tuplas devuelto a las tupas que *deben* cumplir las condiciones que nos interesan. Las funciones espaciales utilizadas para probar la condición exacta.

```
SELECT id, geom
FROM thetable
WHERE
  ST_Contains(geom, 'POLYGON((0 0, 0 10, 10 10, 10 0, 0 0))');
```

11. ¿Como puedo aumentar la velocidad de las consultas espaciales en tagalas grandes?

Consultas rápidas en tablas grandes es la *razón de ser* de las bases de datos espaciales (con soporte de transacciones), así que tener buenos índices es importante. Para construir un índice en una tabla con una columna geometry, utiliza la función "CREATE INDEX" como en este ejemplo:

```
CREATE INDEX [indexname] ON [tablename] USING GIST ( [geometrycolumn] );
```

La opción "USING GIST" le dice al servidor que utilice un índice GiST (Arbol de búsqueda generalizado).



Note

Los índices GiST se supone que son "lossy". Los índices "lossy" utilizan un objeto proxy (en el caso espacial, las cajas) para construir el índice.

También debes estar seguro que el planificador de consultas de PostgreSQL tiene suficiente información sobre tus índices para tomar una decisión racional de cuando utilizarlos. Para ello, tienes que "recopilar las estadísticas" de tus tablas geométricas. Para PostgreSQL 8.0.x o superior, solo tienes que ejecutar el comando **VACUUM ANALYZE**. Para PostgreSQL 7.4.x o anteriores, ejecuta el comando **SELECT UPDATE_GEOMETRY_STATS()**.

12. *¿Por que no están soportados los índices R-Tree de PostgreSQL?*

En las primeras versiones de PostGIS se utilizaban los índices R-Tree de PostgreSQL. Sin embargo, desde la versión 0.6 han sido descartados los índices R-Tree de PostgreSQL, y la indexación espacial esta provista de un esquema R-Tree-over-GiST. Nuestros test han demostrado que la velocidad de búsqueda por índices nativos R-Tree y GiST son comparables. El índice nativo R-Tree de PostgreSQL tiene dos limitaciones no lo hacen apto para su uso con elementos GIS (estas limitaciones son debidas a la implementación nativa actual de R-Tree de PostgreSQL, no del concepto R-Tree en general):

- Los índices R-Tree en PostgreSQL no pueden manejar elementos mayores de 8K de tamaño. Los índices GiST pueden, utilizando el truco "lossy" para substituir la caja del elemento en si mismo.
- Los índices r-Tree de PostgreSQL no son seguros con valores nulos, así que construir un índice en una columna de geometrías que contiene valores nulos fallará.

13. *¿Por que debería utilizar la función `AddGeometryColumn()` y todas las herramientas OpenGIS?*

Si no quieres utilizar el soporte de funciones OpenGIS, no tienes por que hacerlo. Simplemente crea tablas como en versiones anteriores, definiendo tus columnas de geometrías en el comando CREATE. Todas tus geometrías tendrán un valor de -1 en el SRID, y las tablas de metadatos OpenGIS *no* se cumplimentaran correctamente. De todas formas, esto hará que muchas de las aplicaciones basadas en PostGIS fallen, y generalmente se sugiere que debes utilizar `AddGeometryColumn()` para crear tablas geométricas. MapServer es una aplicación que hace uso de los metadatos de la tabla `geometry_columns`. Especificamente, MapServer puede utilizar el SRID de la columna de geometrías para hacer reproyecciones al vuelo de los elementos en la proyección correcta del mapa.

14. *¿Cual es la mejor manera de encontrar objetos en el radio de otro objeto?*

Para utilizar la base de datos de la forma mas eficiente, lo mejor para hacer consultas por radio es combinar los test de radio y el test de cajas: los test de cajas utilizan los índices espaciales, dando un acceso rápido a los subconjuntos de datos a los cuales se les aplica los test de radio. La función `ST_DWithin(geometry, geometry, distance)` es una forma practica de hacer consultas de búsqueda de distancia indexada. Funciona creando un rectángulo de búsqueda lo suficientemente grande para abarcar el radio de distancia, y después haciendo una búsqueda exacta de distancia en el índice del subconjunto de resultados. Por ejemplo, para encontrar todos los objetos a 100 metros del punto `POINT(1000 1000)`, la siguiente consulta funcionara correctamente:

```
SELECT * FROM geotable
WHERE ST_DWithin(geocolumn, 'POINT(1000 1000)', 100.0);
```

15. *¿Como puedo realizar una reproyección como parte de una consulta?*

To perform a reprojection, both the source and destination coordinate systems must be defined in the `SPATIAL_REF_SYS` table, and the geometries being reprojected must already have an SRID set on them. Once that is done, a reprojection is as simple as referring to the desired destination SRID. The below projects a geometry to NAD 83 long lat. The below will only work if the srid of geom is not -1 (not undefined spatial ref)

```
SELECT ST_Transform(geom, 4269) FROM geotable;
```

16. *He hecho un `ST_AsEWKT` y un `ST_AsText` en una geometría bastante grande y me devuelve un campo en blanco. ¿Que a pasado?*

Probablemente estes utilizando PgAdmin o otra herramienta que no es capaz de mostrar texto largo. Si tu geometría es lo suficientemente grande, aparecerá en blanco en estas herramientas. Utiliza PSQL si realmente necesitas ver o extraer la geometría en WKT.

```
--To check number of geometries are really blank
SELECT count(gid) FROM geotable WHERE geom IS NULL;
```

17. *Cuando hago un `ST_Intersects`, me dice que mis dos geometrías no se intersectan cuando SE QUE SI LO HACEN. ¿Que esta pasando?*

Esto ocurre generalmente en dos casos comunes. Tu geometría no es valida -- check `ST_IsValid` o estas asumiendo que se interceptan por que `ST_AsText` recorta el numero de decimales y tienes un montón de decimales después que no se muestran.

18. *Estoy desarrollando software que utiliza PostGIS, ¿quiere decir esto que mi software debe tener licencia GPL como PostGIS? ¿Tengo que liberar todo mi código si utilizo PostGIS?*

Casi seguro que no. Como ejemplo, considere la base de datos Oracle ejecutandose en Linux. Linux es GPL, Oracle no: ¿Oracle tiene que ser distribuido usando la GPL? No. De manera similar, su software puede usar una base de datos PostgreSQL / PostGIS tanto como lo desee y estar bajo la licencia que desee. La única excepción sería si realizó cambios en el código fuente de PostGIS y *distribuyó su versión modificada* de PostGIS. En ese caso, tendría que compartir el código de su PostGIS modificado (pero no el código de las aplicaciones que se ejecutan sobre él). Incluso en este caso limitado, solo tendría que distribuir el código fuente a las personas a las que distribuyó binarios. La GPL no requiere que *publique* su código fuente, solo que lo comparta con la gente a la que le da binarios. Lo anterior sigue siendo cierto incluso si utiliza PostGIS junto con las funciones opcionales habilitadas para CGAL. Algunas partes de CGAL son GPL, pero también lo es todo PostGIS: usar CGAL no hace que PostGIS sea más GPL de lo que era para comenzar.

19. *Why are the results of overlay operations and spatial predicates sometimes inconsistent?*

This is usually presented as a specific case, such as

- Why is `ST_Contains(A, ST_Intersection(A, B))` false ?
- Why is `ST_Contains(ST_Union(A, B), A)` false ?
- Why is `ST_Union(A, ST_Difference(A, B))` not equal to A ?
- Why does `ST_Difference(A, B)` intersect the interior of B ?

The reason is that PostGIS represents geometry and performs operations using finite-precision floating-point numbers. This provides the illusion of computing using real numbers - but it's only an illusion. Inevitably, small inaccuracies occur, which cause results of different operations to be slightly inconsistent. Furthermore, PostGIS operations contain error-prevention code which may perturb input geometries by tiny amounts in order to prevent robustness errors from occurring. These minor alterations also may produce computed results which are not fully consistent. The discrepancy between results should always be very small. But queries should not rely on exact consistency when comparing overlay results. Instead, consider using an area or distance-based tolerance in geometric comparisons.

Chapter 10

Topology

Los tipos y funciones de PostGIS Topology son usados para manejar objetos topológicos tales como caras, bordes y nodos.

La presentación de Sandro Santilli en la conferencia PostGIS Day Paris 2011 da una buena sinopsis de la Topología PostGIS y hacia donde se dirige [Topology with PostGIS 2.0 slide deck](#).

Vincent Picavet provides a good synopsis and overview of what is Topology, how is it used, and various FOSS4G tools that support it in [PostGIS Topology PGConf EU 2012](#).

Un ejemplo de una base de datos SIG basado topologicamente en la base de datos del [Sistema de Codificación y Referencia Geográfica Topologicamente Integrado del Censo de US \(TIGER\)](#). Si desea experimentar con la topología de PostGIS y necesita algunos datos, ver [Topology_Load_Tiger](#).

El módulo de topología ha existido en versiones anteriores de PostGIS pero nunca hizo parte de la documentación oficial. En PostGIS 2.0.0 una limpieza a gran escala está teniendo lugar con el fin de eliminar el uso de todas las funciones obsoletas, solucionar los problemas de usabilidad conocidos, documentar mejor las características y funciones, agregar nuevas funciones y mejorarlo para satisfacer más de cerca los estándares SQL-MM.

Detalles de este proyecto pueden encontrarse en [PostGIS Topology Wiki](#)

Todas las funciones y tablas asociadas con este módulo son instaladas en un esquema llamado `topology`

Las funciones que son definidas bajo el estandar SQL/MM son prefijadas con `ST_` y las funciones específicas a PostGIS no son prefijadas.

El soporte de topología se crea de manera predeterminada a partir de PostGIS 2.0, y se puede deshabilitar especificando la opción de configuración `--without-topology` en tiempo de compilación como se describe en [Chapter 2](#)

10.1 Tipos en Topology

10.1.1 `getfaceedges_returntype`

`getfaceedges_returntype` — Un tipo compuesto que necesita un número de secuencia y un número de eje.

Descripción

Un tipo compuesto que consiste de un número de secuencia y de un número de eje. Es el tipo devuelto por las funciones `ST_GetFaceEdges` y `GetNodeEdges`.

1. `sequence` es un entero: Se refiere a una topología definida en la tabla `topology.topology` la cual define el esquema y el srid de la topología.
 2. `edge` es un entero. El identificador de un borde.
-

10.1.2 TopoGeometry

TopoGeometry — Un tipo compuesto que representa una geometría topológicamente definida.

Descripción

Un tipo compuesto que se refiere a una geometría de topología en una capa específica de la topología, con un tipo y un id específicos. Los elementos de una TopoGeometry son las propiedades: topology_id, layer_id, id integer, type integer.

1. `topology_id` es un entero: Se refiere a una topología definida en la tabla `topology.topology`, la cual define el esquema y el `srid` de la topología.
2. `layer_id` es un entero: El `layer_id` en la tabla `layers` a la que pertenece TopoGeometry. La combinación de `topology_id` y `layer_id` provee una referencia única en la tabla `topology.layers`.
3. `id` es un entero: El `id` es el número autogenerated secuencialmente que define de manera única la topogeometría en la respectiva capa de topología.
4. `type` entero entre 1 y 4 que define el tipo de geometría: 1:[multi]punto, 2:[multi]línea, 3:[multi]polinomio, 4:colección.

Comportamiento de la conversión de tipos de dato

Esta sección lista las conversiones tanto automáticas como explícitas para este tipo de datos.

Convertir a	Comportamiento
geometría	automática

Ver también

[CreateTopoGeom](#)

10.1.3 validate_topology_returntype

`validate_topology_returntype` — Un tipo compuesto que consta de un mensaje de error e `id1` e `id2` para denotar la ubicación del error. Este es el tipo de valor devuelto por `ValidateTopology`.

Descripción

Un tipo compuesto que consiste de un mensaje de error y dos enteros. La función [ValidateTopology](#) devuelve un conjunto de estos para indicar errores en la validación y el `id1` e `id2` para indicar los identificadores de los objetos topológicos involucrados en el error.

1. `error` es varchar: Indica el tipo de error.
Los descriptores de error actuales son: nodos coincidentes, edge crosses node, borde no simple, edge end node geometry mis-match, edge start node geometry mismatch, cara solapada, cara dentro de cara,
2. `id1` es un integer: Indica el identificador del borde / cara / nodo en error.
3. `id2` es un integer: Para errores que involucren 2 objetos indica el borde o nodo secundario.

Ver también

[ValidateTopology](#)

10.2 Dominios de Topology

10.2.1 TopoElement

TopoElement — Una matriz de 2 enteros usada generalmente para identificar un componente TopoGeometry

Descripción

Una matriz de 2 enteros usada para representar un componente de una **TopoGeometry** simple o jerárquica.

En el caso de una simple TopoGeometry el primer elemento de la matriz representa el identificador de una primitiva topológica y el segundo elemento representa su tipo (1: nodo, 2: borde, 3: cara). En el caso de una TopoGeometry jerárquica el primer elemento de la matriz representa el identificador de una TopoGeometry hijo y el segundo elemento representa su identificador de capa.



Note

Para cualquier TopoGeometry jerárquica dada todos los elementos TopoGeometry secundarios vendrán de la misma capa secundaria, tal como se especifica en el registro topology.layer para la capa de la TopoGeometry que se está definiendo.

Ejemplos

```
SELECT te[1] AS id, te[2] AS type FROM
( SELECT ARRAY[1,2]::topology.topoelement AS te ) f;
 id | type
-----+-----
  1 |    2
```

```
SELECT ARRAY[1,2]::topology.topoelement;
      te
-----
 {1,2}
```

```
--Ejemplo de lo que sucede cuando intenta incluir en este caso una matriz de 3 elementos a topoelement ←
-- NOTA: topoement tiene que ser una matriz de 2 elementos por lo cual falla el control de ←
-- dimensión.
SELECT ARRAY[1,2,3]::topology.topoelement;
ERROR:  value for domain topology.topoelement violates check constraint "dimensions"
```

Ver también

[GetTopoGeomElements](#), [TopoElementArray](#), [TopoGeometry](#), [TopoGeom_addElement](#), [TopoGeom_remElement](#)

10.2.2 TopoElementArray

TopoElementArray — Matriz de objetos TopoElement.

Descripción

Una matriz de 1 o más objetos TopoElement, generalmente usada para pasar al rededor de componentes de objetos TopoGeometry.

Ejemplos

```
SELECT '{{1,2},{4,3}}'::topology.topoelementarray As tea;
      tea
-----
{{1,2},{4,3}}

-- more verbose equivalent --
SELECT ARRAY[ARRAY[1,2], ARRAY[4,3]]::topology.topoelementarray As tea;
      tea
-----
{{1,2},{4,3}}

--using the array agg function packaged with topology --
SELECT topology.TopoElementArray_Agg(ARRAY[e,t]) As tea
  FROM generate_series(1,4) As e CROSS JOIN generate_series(1,3) As t;
      tea
-----
{{1,1},{1,2},{1,3},{2,1},{2,2},{2,3},{3,1},{3,2},{3,3},{4,1},{4,2},{4,3}}
```

```
SELECT '{{1,2,4},{3,4,5}}'::topology.topoelementarray As tea;
ERROR:  value for domain topology.topoelementarray violates check constraint "dimensions"
```

Ver también

[TopoElement](#), [GetTopoGeomElementArray](#), [TopoElementArray_Agg](#)

10.3 Topología y Gestión de TopoGeometría

10.3.1 AddTopoGeometryColumn

AddTopoGeometryColumn — Agrega una columna topogeometry a una tabla existente, registra esta nueva columna como una capa en topology.layer y devuelve el nuevo layer_id

Synopsis

```
integer AddTopoGeometryColumn(varchar topology_name, varchar schema_name, varchar table_name, varchar column_name,
varchar feature_type);
integer AddTopoGeometryColumn(varchar topology_name, varchar schema_name, varchar table_name, varchar column_name,
varchar feature_type, integer child_layer);
```

Descripción

Cada objeto TopoGeometry pertenece a una capa específica de una topología específica. Antes de crear un objeto TopoGeometry usted necesita crear un TopologyLayer. Una capa de topología es una asociación de una tabla de características con la topología. También contiene información de tipo y jerarquía. Se crea una capa usando la función AddTopoGeometryColumn()

Esta función agregará la columna solicitada a la tabla y agregará un registro a la tabla topology.layer con toda la información dada.

Si no especifica [child_layer] (o lo establece en NULL), esta capa contendrá TopoGeometría Básicas (compuesta por elementos de topología primitiva). De lo contrario, esta capa contendrá TopoGeometrias jerárquicas (compuestas por TopoGeometrias de la child_layer).

Una vez creada la capa (su id es devuelto por la función `AddTopoGeometryColumn`), ya está listo para construir objetos Topo-Geometry

Los `feature_types` válidos son: POINT, LINE, POLYGON, COLLECTION

Availability: 1.1

Ejemplos

```
-- Nota para este ejemplo hemos creado nuestra nueva tabla en el esquema ma_topo
-- aunque podríamos haberlo creado en un esquema diferente
-- en cuyo caso topology_name y schema_name serían diferentes
CREATE SCHEMA ma;
CREATE TABLE ma.parcels(gid serial, parcel_id varchar(20) PRIMARY KEY, address text);
SELECT topology.AddTopoGeometryColumn('ma_topo', 'ma', 'parcels', 'topo', 'POLYGON');

CREATE SCHEMA ri;
CREATE TABLE ri.roads(gid serial PRIMARY KEY, road_name text);
SELECT topology.AddTopoGeometryColumn('ri_topo', 'ri', 'roads', 'topo', 'LINE');
```

Ver también

[DropTopoGeometryColumn](#), [toTopoGeom](#), [CreateTopology](#), [CreateTopoGeom](#)

10.3.2 DropTopology

`DropTopology` — Usar con precaución: Permite eliminar un esquema de topología y elimina su referencia de la tabla `topology.topology` y referencias a las tablas en ese esquema desde la tabla `geometry_columns`

Synopsis

integer **DropTopology**(varchar topology_schema_name);

Descripción

Permite eliminar un esquema de topología y elimina esta referencia de la tabla `topology.topology` y referencias a tablas en este esquema desde la tabla `geometry_columns`. Esta función se debe USAR CON PRECAUCION, ya que podría destruir los datos que le interesan. Si el esquema no existe, simplemente elimina las entradas de referencia del esquema nombrado.

Availability: 1.1

Ejemplos

Elimina en cascada el esquema `ma_topo` y remueve todas las referencias a él en `topology.topology` y `geometry_columns`.

```
SELECT topology.DropTopology('ma_topo');
```

Ver también

[DropTopoGeometryColumn](#)

10.3.3 DropTopoGeometryColumn

DropTopoGeometryColumn — Elimina la columna topogeometry de la tabla nombrada en `table_name` en el esquema `schema_name` y anula el registro de las columnas de la tabla `topology.layer`.

Synopsis

text **DropTopoGeometryColumn**(varchar `schema_name`, varchar `table_name`, varchar `column_name`);

Descripción

Borra la columna de topogeometría de la tabla denominada `table_name` en el esquema `schema_name` y anula el registro de las columnas de la tabla `topology.layer`. Devuelve el resumen del estado de la eliminación. **NOTA:** Primero establece todos los valores en NULL antes de eliminar para omitir comprobaciones de integridad referencial.

Availability: 1.1

Ejemplos

```
SELECT topology.DropTopoGeometryColumn('ma_topo', 'parcel_topo', 'topo');
```

Ver también

[AddTopoGeometryColumn](#)

10.3.4 Populate_Topology_Layer

Populate_Topology_Layer — Agrega entradas faltantes a la tabla `topology.layer` mediante la lectura de metadatos de las tablas de topo.

Synopsis

setof record **Populate_Topology_Layer**();

Descripción

Agrega las entradas faltantes a la tabla `topology.layer` inspeccionando las restricciones de topología en las tablas. Esta función es útil para arreglar las entradas de catálogo de topología después de la restauración de esquemas con datos topo.

Devuelve la lista de entradas creadas. Las columnas devueltas son `schema_name`, `table_name`, `feature_column`.

Disponibilidad: 2.3.0

Ejemplos

```
SELECT CreateTopology('strk_topo');
CREATE SCHEMA strk;
CREATE TABLE strk.parcels(gid serial, parcel_id varchar(20) PRIMARY KEY, address text);
SELECT topology.AddTopoGeometryColumn('strk_topo', 'strk', 'parcels', 'topo', 'POLYGON');
-- Esto no devolverá registros porque esta característica ya está registrada
SELECT *
FROM topology.Populate_Topology_Layer();
```

```
-- vamos a reconstruir
TRUNCATE TABLE topology.layer;

SELECT *
  FROM topology.Populate_Topology_Layer();

SELECT topology_id, layer_id, schema_name As sn, table_name As tn, feature_column As fc
FROM topology.layer;
```

```
schema_name | table_name | feature_column
-----+-----+-----
strk        | parcels    | topo
(1 row)

topology_id | layer_id | sn | tn | fc
-----+-----+-----+-----+-----
2 | 2 | strk | parcels | topo
(1 row)
```

Ver también

[AddTopoGeometryColumn](#)

10.3.5 TopologySummary

TopologySummary — Toma un nombre de topología y proporciona totales de resumen de tipos de objetos en la topología.

Synopsis

text **TopologySummary**(varchar topology_schema_name);

Descripción

Toma un nombre de topología y proporciona totales de resumen de tipos de objetos en la topología.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT topology.topologysummary('city_data');
          topologysummary
-----
Topology city_data (329), SRID 4326, precision: 0
22 nodes, 24 edges, 10 faces, 29 topogeoms in 5 layers
Layer 1, type Polygonal (3), 9 topogeoms
  Deploy: features.land_parcels.feature
Layer 2, type Puntal (1), 8 topogeoms
  Deploy: features.traffic_signs.feature
Layer 3, type Lineal (2), 8 topogeoms
  Deploy: features.city_streets.feature
Layer 4, type Polygonal (3), 3 topogeoms
  Hierarchy level 1, child layer 1
  Deploy: features.big_parcels.feature
Layer 5, type Puntal (1), 1 topogeoms
  Hierarchy level 1, child layer 2
  Deploy: features.big_signs.feature
```

Ver también[Topology_Load_Tiger](#)**10.3.6 ValidateTopology**

ValidateTopology — Devuelve un conjunto de objetos `validatetopology_returntype` que detallan problemas con la topología.

Synopsis

```
setof validatetopology_returntype ValidateTopology(varchar toponame, geometry bbox);
```

Descripción

Returns a set of `validatetopology_returntype` objects detailing issues with topology, optionally limiting the check to the area specified by the `bbox` parameter.

List of possible errors, what they mean and what the returned ids represent are displayed below:

Error	id1	id2	Meaning
coincident nodes	Identifier of first node.	Identifier of second node.	Two nodes have the same geometry.
Borde curza nodo	Identifier of the edge.	Identifier of the node.	An edge has a node in its interior. See ST_Relate .
borde inválido	Identifier of the edge.		An edge geometry is invalid. See ST_IsValid .
borde no simple	Identifier of the edge.		An edge geometry has self-intersections. See ST_IsSimple .
borde cruza borde	Identifier of first edge.	Identifier of second edge.	Two edges have an interior intersection. See ST_Relate .
No coincide la geometría del nodo inicial de la arista	Identifier of the edge.	Identifier of the indicated start node.	The geometry of the node indicated as the starting node for an edge does not match the first point of the edge geometry. See ST_StartPoint .
No coincide la geometría del nodo final de la arista	Identifier of the edge.	Identifier of the indicated end node.	The geometry of the node indicated as the ending node for an edge does not match the last point of the edge geometry. See ST_EndPoint .
Cara sin bordes	Identifier of the orphaned face.		No edge reports an existing face on either of its sides (<code>left_face</code> , <code>right_face</code>).
cara no tiene anillos	Identifier of the partially-defined face.		Edges reporting a face on their sides do not form a ring.
face has wrong mbr	Identifier of the face with wrong mbr cache.		Minimum bounding rectangle of a face does not match minimum bounding box of the collection of edges reporting the face on their sides.

Error	id1	id2	Meaning
hole not in advertised face	Signed identifier of an edge, identifying the ring. See GetRingEdges .		A ring of edges reporting a face on its exterior is contained in different face.
not-isolated node has not-containing_face	Identifier of the ill-defined node.		A node which is reported as being on the boundary of one or more edges is indicating a containing face.
isolated node has containing_face	Identifier of the ill-defined node.		A node which is not reported as being on the boundary of any edges is lacking the indication of a containing face.
isolated node has wrong containing_face	Identifier of the misrepresented node.		A node which is not reported as being on the boundary of any edges indicates a containing face which is not the actual face containing it. See GetFaceContainingPoint .
invalid next_right_edge	Identifier of the misrepresented edge.	Signed id of the edge which should be indicated as the next right edge.	The edge indicated as the next edge encountered walking on the right side of an edge is wrong.
invalid next_left_edge	Identifier of the misrepresented edge.	Signed id of the edge which should be indicated as the next left edge.	The edge indicated as the next edge encountered walking on the left side of an edge is wrong.
mixed face labeling in ring	Signed identifier of an edge, identifying the ring. See GetRingEdges .		Edges in a ring indicate conflicting faces on the walking side. This is also known as a "Side Location Conflict".
non-closed ring	Signed identifier of an edge, identifying the ring. See GetRingEdges .		A ring of edges formed by following next_left_edge/next_right_edge attributes starts and ends on different nodes.
face has multiple shells	Identifier of the contended face.	Signed identifier of an edge, identifying the ring. See GetRingEdges .	More than a one ring of edges indicate the same face on its interior.

Disponibilidad: 1.0.0

Mejorado: 2.0.0 detección de cruces de borde más eficiente y corrección de falsos positivos que existían en versiones anteriores.

Modificado: 2.2.0 los valores para id1 e id2 se intercambiaron para 'borde cruza nodo' para ser consistente con la descripción del error.

Changed: 3.2.0 added optional bbox parameter, perform face labeling and edge linking checks.

Ejemplos

```
SELECT * FROM topology.ValidateTopology('ma_topo');
      error      | id1 | id2
-----+-----+-----
face without edges |    1 |
```


Ver también

[validateTopology_returntype](#), [Topology_Load_Tiger](#)

10.3.7 ValidateTopologyRelation

ValidateTopologyRelation — Returns info about invalid topology relation records

Synopsis

setof record **ValidateTopologyRelation**(varchar toponame);

Descripción

Returns a set records giving information about invalidities in the relation table of the topology.

Availability: 3.2.0

Ver también

[ValidateTopology](#)

10.3.8 FindTopology

FindTopology — Returns a topology record by different means.

Synopsis

topology **FindTopology**(TopoGeometry topogeom);
topology **FindTopology**(regclass layerTable, name layerColumn);
topology **FindTopology**(name layerSchema, name layerTable, name layerColumn);
topology **FindTopology**(text topoName);
topology **FindTopology**(int id);

Descripción

Takes a topology identifier or the identifier of a topology-related object and returns a topology.topology record.

Availability: 3.2.0

Ejemplos

```
SELECT name(findTopology('features.land_parcel', 'feature'));
 name
-----
city_data
(1 row)
```

Ver también

[FindLayer](#)

10.3.9 FindLayer

FindLayer — Returns a topology.layer record by different means.

Synopsis

```
topology.layer FindLayer(TopoGeometry tg);  
topology.layer FindLayer(regclass layer_table, name feature_column);  
topology.layer FindLayer(name schema_name, name table_name, name feature_column);  
topology.layer FindLayer(integer topology_id, integer layer_id);
```

Descripción

Takes a layer identifier or the identifier of a topology-related object and returns a topology.layer record.

Availability: 3.2.0

Ejemplos

```
SELECT layer_id(findLayer('features.land_parcels', 'feature'));  
 layer_id  
-----  
         1  
(1 row)
```

Ver también

[FindTopology](#)

10.4 Topology Statistics Management

Adding elements to a topology triggers many database queries for finding existing edges that will be split, adding nodes and updating edges that will node with the new linework. For this reason it is useful that statistics about the data in the topology tables are up-to-date.

PostGIS Topology population and editing functions do not automatically update the statistics because a updating stats after each and every change in a topology would be overkill, so it is the caller's duty to take care of that.



Note

That the statistics updated by autovacuum will NOT be visible to transactions which started before autovacuum process completed, so long-running transactions will need to run ANALYZE themselves, to use updated statistics.

10.5 Constructores de Topología

10.5.1 CreateTopology

CreateTopology — Crea un nuevo esquema de topología y se registra este nuevo esquema en la tabla topology.topology

Synopsis

```
integer CreateTopology(varchar topology_schema_name);
integer CreateTopology(varchar topology_schema_name, integer srid);
integer CreateTopology(varchar topology_schema_name, integer srid, double precision prec);
integer CreateTopology(varchar topology_schema_name, integer srid, double precision prec, boolean hasz);
```

Descripción

Crea a nuevo esquema con el nombre `topology_name` que consiste en tablas (`edge_data`, `face`, `node`, `relation` y registra esta nueva topología en la tabla `topology.topology`. Devuelve el identificador de la topología en la tabla `topology`. El SRID es la referencia espacial identificada como se define en la tabla `spatial_ref_sys` para esa topología. Las topologías deben tener un nombre único. La tolerancia se mide en las unidades del sistema de referencia espacial. Si la tolerancia (`prec`) no está especificada por defecto es 0.

Esto es similar a SQL/MM [ST_InitTopoGeo](#) pero un poco más funcional.. `hasz` por defecto es falso si no se especifica.

Availability: 1.1

Enhanced: 2.0 added the signature accepting `hasZ`

Ejemplos

En este ejemplo se crea un nuevo esquema denominado `ma_topo` que almacenará aristas, caras y relaciones de Massachusetts en State Plane meters. La tolerancia representa 1/2 metros ya que el sistema de referencia espacial es un sistema de referencia espacial basado en metros

```
SELECT topology.CreateTopology('ma_topo', 26986, 0.5);
```

Crear topología de Rhode Island en State Plane ft

```
SELECT topology.CreateTopology('ri_topo', 3438) As topoid;
topoid
-----
2
```

Ver también

Section [4.5](#), [ST_InitTopoGeo](#), [Topology_Load_Tiger](#)

10.5.2 CopyTopology

CopyTopology — Hace una copia de una estructura de topología (nodos, bordes, caras, capas y TopoGeometries).

Synopsis

```
integer CopyTopology(varchar existing_topology_name, varchar new_name);
```

Descripción

Crea una nueva topología con el nombre `new_topology_name` y SRID y precisión tomada de `existing_topology_name`, copia todos los nodos, bordes y caras allí, copia capas y sus TopoGeometries también.

**Note**

Las nuevas filas en topology.layer contendrán valores sintetizados para schema_name, table_name y feature_column. Esto se debe a que la TopoGeometry sólo existirá como una definición, pero no estará disponible en ninguna tabla de nivel de usuario.

Disponibilidad: 2.0.0

Ejemplos

Este ejemplo hace una copia de seguridad de una topología llamada ma_topo

```
SELECT topology.CopyTopology('ma_topo', 'ma_topo_backup');
```

Ver también

Section [4.5](#), [CreateTopology](#)

10.5.3 ST_InitTopoGeo

ST_InitTopoGeo — Crea un nuevo esquema de topología y registra este nuevo esquema en la tabla topology.topology y el resumen de los detalles del proceso.

Synopsis

text **ST_InitTopoGeo**(varchar topology_schema_name);

Descripción

Se trata de un equivalente de SQL-MM de CreateTopology pero carece de las opciones de referencia espacial y tolerancia de CreateTopology y emite una descripción de texto de la creación en lugar del identificador de topología.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM 3 Topo-Geo y Topo-Net 3: Detalles de la rutina: X.3.17

Ejemplos

```
SELECT topology.ST_InitTopoGeo('topo_schema_to_create') AS topocreation;
               astopocreation
-----
Topology-Geometry 'topo_schema_to_create' (id:7) created.
```

Ver también

[CreateTopology](#)

10.5.4 ST_CreateTopoGeo

ST_CreateTopoGeo — Agrega una colección de geometrías a una topología vacía dada y devuelve un mensaje que detalla el éxito.

Synopsis

text **ST_CreateTopoGeo**(varchar atopology, geometry acollection);

Descripción

Agrega una colección de geometrías a una topología vacía dada y devuelve un mensaje que detalla el éxito.

Útil para rellenar una topología vacía.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de la rutina -- X.3.18

Ejemplos

```
-- Rellenar la topología --
SELECT topology.ST_CreateTopoGeo('ri_topo',
  ST_GeomFromText('MULTILINESTRING((384744 236928,384750 236923,384769 236911,384799 ↵
    236895,384811 236890,384833 236884,
    384844 236882,384866 236881,384879 236883,384954 236898,385087 236932,385117 236938,
    385167 236938,385203 236941,385224 236946,385233 236950,385241 236956,385254 236971,
    385260 236979,385268 236999,385273 237018,385273 237037,385271 237047,385267 237057,
    385225 237125,385210 237144,385192 237161,385167 237192,385162 237202,385159 237214,
    385159 237227,385162 237241,385166 237256,385196 237324,385209 237345,385234 237375,
    385237 237383,385238 237399,385236 237407,385227 237419,385213 237430,385193 237439,
    385174 237451,385170 237455,385169 237460,385171 237475,385181 237503,385190 237521,
    385200 237533,385206 237538,385213 237541,385221 237542,385235 237540,385242 237541,
    385249 237544,385260 237555,385270 237570,385289 237584,385292 237589,385291 ↵
    237596,385284 237630))',3438)
  );

      st_createtopogeo
-----
Topology ri_topo populated

-- Crear tablas y geometrías topográficas --
CREATE TABLE ri.roads(gid serial PRIMARY KEY, road_name text);

SELECT topology.AddTopoGeometryColumn('ri_topo', 'ri', 'roads', 'topo', 'LINE');
```

Ver también

[AddTopoGeometryColumn](#), [CreateTopology](#), [DropTopology](#)

10.5.5 TopoGeo_AddPoint

TopoGeo_AddPoint — Agrega un punto a una topología existente utilizando una tolerancia y posiblemente dividiendo un borde existente.

Synopsis

integer **TopoGeo_AddPoint**(varchar atopology, geometry apoint, float8 tolerance);

Descripción

Agrega un punto a una topología existente y devuelve su identificador. El punto dado se ajustará a los nodos o aristas existentes dentro de la tolerancia dada. Una arista existente se puede dividir por el punto de ajuste.

Disponibilidad: 2.0.0

Ver también

[TopoGeo_AddLineString](#), [TopoGeo_AddPolygon](#), [AddNode](#), [CreateTopology](#)

10.5.6 TopoGeo_AddLineString

TopoGeo_AddLineString — Agrega una cadena de línea a una topología existente utilizando una tolerancia y posiblemente dividiendo las aristas/caras existentes. Devuelve identificadores de borde.

Synopsis

SETOF integer **TopoGeo_AddLineString**(varchar atopology, geometry aline, float8 tolerance);

Descripción

Agrega una cadena de línea a una topología existente y devuelve un conjunto de identificadores de borde que la forman. La línea dada se ajustará a los nodos o aristas existentes dentro de la tolerancia dada. Las aristas y caras existentes se pueden dividir por la línea.



Note

Updating statistics about topologies being loaded via this function is up to caller, see [maintaining statistics during topology editing and population](#).

Disponibilidad: 2.0.0

Ver también

[TopoGeo_AddPoint](#), [TopoGeo_AddPolygon](#), [AddEdge](#), [CreateTopology](#)

10.5.7 TopoGeo_AddPolygon

TopoGeo_AddPolygon — Agrega un polígono a una topología existente utilizando una tolerancia y posiblemente dividiendo las aristas/caras existentes. Devuelve identificadores de cara.

Synopsis

SETOF integer **TopoGeo_AddPolygon**(varchar atopology, geometry apoly, float8 tolerance);

Descripción

Agrega un polígono a una topología existente y devuelve un conjunto de identificadores de cara que lo forman. El límite del polígono dado se ajustará a los nodos o aristas existentes dentro de la tolerancia dada. Las aristas y caras existentes se pueden dividir por el límite del nuevo polígono.



Note

Updating statistics about topologies being loaded via this function is up to caller, see [maintaining statistics during topology editing and population](#).

Disponibilidad: 2.0.0

Ver también

[TopoGeo_AddPoint](#), [TopoGeo_AddLineString](#), [AddFace](#), [CreateTopology](#)

10.6 Editores de Topología

10.6.1 ST_AddIsoNode

ST_AddIsoNode — Agrega un nodo aislado a una cara de una topología y devuelve el identificador de nodo del nuevo nodo. Si la cara es nula, el nodo es creado de todas maneras.

Synopsis

```
integer ST_AddIsoNode(varchar atopology, integer aface, geometry apoint);
```

Descripción

Agrega un nodo aislado con la localización del punto `apoint` a una cara existente con identificador de cara `aface` a una topología `atopology` y devuelve el identificador de nodo de el nuevo nodo.

Si el sistema de referencia espacial (SRID) de la geometría de punto no es el mismo que el de la topología, el `apoint` no es una geometría de punto, el punto es nulo, o el punto intersecta un borde existente (incluso en los límites) entonces una excepción es lanzada. Si el punto ya existe como un nodo, se produce una excepción.

Si `aface` no es nulo y el `apoint` no está dentro de la cara, entonces una excepción es lanzada.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM: Topo-Net Rutinas: X+1.3.1

Ejemplos

Ver también

[AddNode](#), [CreateTopology](#), [DropTopology](#), [ST_Intersects](#)

10.6.2 ST_AddIsoEdge

ST_AddIsoEdge — Agrega un borde aislado definido por la geometría `alinestring` a una topología que conecta dos nodos aislados existentes `anode` y `anothernode` y devuelve el identificador de borde del nuevo borde.

Synopsis

integer **ST_AddIsoEdge**(varchar atopology, integer anode, integer anothernode, geometry alinestring);

Descripción

Agrega un borde aislado definido por la geometría `alinestring` a una topología que conecta dos nodos aislados existentes `anode` y `anothernode` y devuelve el identificador de borde del nuevo borde.

Si el sistema de referencia espacial (SRID) de la geometría `alinestring` no es el mismo que la topología, cualquiera de los argumentos de entrada son nulos, o los nodos se contienen en más de una cara, o los nodos son el inicio o fin de los nodos de un borde existente, entonces una excepción es lanzada.

Si el `alinestring` no está dentro de la cara de la cara a la que pertenece `anode` y `anothernode`, entonces una excepción es lanzada.

Si el `anode` y `anothernode` no son los puntos de inicio y final de la `alinestring` entonces una excepción es lanzada.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de rutina: X.3.4

Ejemplos

Ver también

[ST_AddIsoNode](#), [ST_IsSimple](#), [ST_Within](#)

10.6.3 ST_AddEdgeNewFaces

ST_AddEdgeNewFaces — Agrega un nuevo borde y, si al hacerlo divide una cara, se elimina la cara original y es reemplazada con dos nuevas caras. Devuelve el identificador del borde recientemente agregado.

Synopsis

integer **ST_AddEdgeNewFaces**(varchar atopology, integer anode, integer anothernode, geometry acurve);

Descripción

Agrega un nuevo borde y, si al hacerlo divide una cara, se elimina la cara original y es reemplazada con dos nuevas caras. Devuelve el identificador del borde recientemente agregado.

Actualiza todos los bordes unidos y relaciones en consecuencia existentes.

Si cualquier argumento es nulo, los nodos dados son desconocidos (ya deben existir en la tabla `node` del esquema de topología), el `acurve` no es un `LINESTRING`, el `anode` y `anothernode` no son el punto de inicio y final de `acurve` entonces un error es lanzado.

Si el sistema de referencia espacial (SRID) de la geometría `acurve` no es el mismo que la topología se lanza una excepción.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.12

Ejemplos

Ver también

[ST_RemEdgeNewFace](#)

[ST_AddEdgeModFace](#)

10.6.4 ST_AddEdgeModFace

ST_AddEdgeModFace — Añada un nuevo borde y, si al hacerlo, divide una cara, modifica la cara original y añade una nueva cara.

Synopsis

integer **ST_AddEdgeModFace**(varchar atopology, integer anode, integer anothernode, geometry acurve);

Descripción

Añade un nuevo borde y, si al hacerlo, se divide una cara, modifica la cara original y añade una nueva.



Note

Si es posible, la nueva cara se creará en el lado izquierdo del nuevo borde. Esto no será posible si la cara del lado izquierdo necesita ser Universe face (sin límites).

Devuelve el identificador del borde recientemente añadido.

Actualiza todos los bordes unidos y relaciones en consecuencia existentes.

Si cualquier argumento es nulo, los nodos dados son desconocidos (ya deben existir en la tabla `node` del esquema de topología), el `acurve` no es un `LINESTRING`, el `anode` y `anothernode` no son el punto de inicio y final de `acurve` entonces un error es lanzado.

Si el sistema de referencia espacial (SRID) de la geometría `acurve` no es el mismo que la topología se lanza una excepción.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalle de Rutina: X.3.13

Ejemplos

Ver también

[ST_RemEdgeModFace](#)

[ST_AddEdgeNewFaces](#)

10.6.5 ST_RemEdgeNewFace

ST_RemEdgeNewFace — Elimina un borde y, si el borde eliminado separa dos caras, borra las caras originales y las reemplaza con una nueva cara.

Synopsis

integer **ST_RemEdgeNewFace**(varchar atopology, integer anedge);

Descripción

Elimina un borde y, si el borde eliminado separa dos caras, borra las caras originales y las reemplaza con una nueva cara.

Devuelve el identificador de una cara creada recientemente o NULL, si no se crea ninguna nueva cara. No se crea ninguna nueva cara cuando el borde eliminado está colgando o aislado o confinado con la cara del universo (posiblemente haciendo que el universo se inunde en la cara del otro lado).

Actualiza todos los bordes unidos y relaciones en consecuencia existentes.

Se niega a eliminar un borde que participa en la definición de un TopoGeometry existente. Se niega a sanear dos caras si cualquier TopoGeometry es definido por sólo uno de ellos (y no el otro).

Si algún argumento es null, se desconoce el borde dado (debe existir ya en la tabla `edge` del esquema de topología), el nombre de la topología no es válido entonces se produce un error.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.14

Ejemplos

Ver también

[ST_RemEdgeModFace](#)

[ST_AddEdgeNewFaces](#)

10.6.6 ST_RemEdgeModFace

ST_RemEdgeModFace — Elimina un borde y, si el borde eliminado separa dos caras, elimina una de ellas y modifica la otra para tomar el espacio de ambas.

Synopsis

integer **ST_RemEdgeModFace**(varchar atopology, integer anedge);

Descripción

Elimina un borde y, si el borde eliminado separa dos caras, elimina una de ellas y modifica la otra para tomar el espacio de ambas. Preferentemente mantiene la cara a la derecha, para ser simétrica con `ST_AddEdgeModFace` también manteniéndola. Devuelve el identificador de la cara restante en lugar del borde eliminado.

Actualiza todos los bordes unidos y relaciones en consecuencia existentes.

Se niega a eliminar un borde participante en la definición de una TopoGeometría existente. Se niega a curar dos caras si alguna TopoGeometría está definida por sólo una de ellas (y no la otra).

Si algún argumento es null, se desconoce el borde dado (debe existir ya en la tabla `edge` del esquema de topología), el nombre de la topología no es válido entonces se produce un error.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.15

Ejemplos

Ver también

[ST_AddEdgeModFace](#)

[ST_RemEdgeNewFace](#)

10.6.7 ST_ChangeEdgeGeom

ST_ChangeEdgeGeom — Cambia la forma de un borde sin afectar la estructura de la topología.

Synopsis

integer **ST_ChangeEdgeGeom**(varchar atopology, integer anedge, geometry acurve);

Descripción

Cambia la forma de un borde sin afectar la estructura de la topología.

If any arguments are null, the given edge does not exist in the `edge` table of the topology schema, the `acurve` is not a `LINESTRING`, or the modification would change the underlying topology then an error is thrown.

Si el sistema de referencia espacial (SRID) de la geometría `acurve` no es el mismo que la topología se lanza una excepción.

Si el nuevo `acurve` no es simple, entonces un error es lanzado.

Si al mover el borde de la vieja a la nueva posición golpease un obstáculo entonces se produce un error.

Disponibilidad: 1.1.0

Mejorado: 2.0.0 agrega aplicación de consistencia topológica



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalle de Rutina X.3.6

Ejemplos

```
SELECT topology.ST_ChangeEdgeGeom('ma_topo', 1,
    ST_GeomFromText('LINESTRING(227591.9 893900.4,227622.6 893844.3,227641.6
    893816.6, 227704.5 893778.5)', 26986) );
-----
Edge 1 changed
```

Ver también

[ST_AddEdgeModFace](#)

[ST_RemEdgeModFace](#)

[ST_ModEdgeSplit](#)

10.6.8 ST_ModEdgeSplit

ST_ModEdgeSplit — Dividir un borde creando un nuevo nodo a lo largo de un borde existente, modificando el borde original y agregando un nuevo borde.

Synopsis

integer **ST_ModEdgeSplit**(varchar atopology, integer anedge, geometry apoint);

Descripción

Dividir un borde creando un nuevo nodo a lo largo de un borde existente, modificando el borde original y agregando un nuevo borde. Actualiza todos los bordes unidos existentes y relaciones en consecuencia. Devuelve el identificador del nodo recientemente agregado.

Availability: 1.1

Cambiado: 2.0 - En versiones anteriores, esto fue mal llamado ST_ModEdgesSplit



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.9

Ejemplos

```
-- Agregar un borde --
SELECT topology.AddEdge('ma_topo', ST_GeomFromText('LINESTRING(227592 893910, 227600 893910)', 26986) ) As edgeid;

-- edgeid-
3

-- Divide el borde --
SELECT topology.ST_ModEdgeSplit('ma_topo', 3, ST_SetSRID(ST_Point(227594,893910),26986) ) As node_id;
      node_id
-----
7
```

Ver también

[ST_NewEdgesSplit](#), [ST_ModEdgeHeal](#), [ST_NewEdgeHeal](#), [AddEdge](#)

10.6.9 ST_ModEdgeHeal

ST_ModEdgeHeal — Cura dos aristas eliminando el nodo que las conecta, modificando la primera arista y eliminando la segunda arista. Devuelve el identificador del nodo eliminado.

Synopsis

```
int ST_ModEdgeHeal(varchar atopology, integer anedge, integer anotheredge);
```

Descripción

Cura dos aristas eliminando el nodo que las conecta, modificando la primera arista y eliminando la segunda arista. Devuelve el identificador del nodo eliminado. Actualiza todos los bordes y relaciones unidos existentes en consecuencia.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.9

Ver también

[ST_ModEdgeSplit](#) [ST_NewEdgesSplit](#)

10.6.10 ST_NewEdgeHeal

ST_NewEdgeHeal — Cura dos aristas eliminando el nodo que las conecta, eliminando ambas aristas y sustituyéndolas por una arista cuya dirección sea la misma que la primera arista proporcionada.

Synopsis

```
int ST_NewEdgeHeal(varchar atopology, integer anedge, integer anotheredge);
```

Descripción

Cura dos aristas eliminando el nodo que las conecta, eliminando ambas aristas y sustituyéndolas por una arista cuya dirección sea la misma que la primera arista proporcionada. Devuelve el identificador de la nueva aristas reemplazante de las curadas. Actualiza todas las aristas y relaciones unidos existentes en consecuencia.

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.9

Ver también

[ST_ModEdgeHeal](#) [ST_ModEdgeSplit](#) [ST_NewEdgesSplit](#)

10.6.11 ST_MoveIsoNode

ST_MoveIsoNode — Mueve un nodo aislado en una topología de un punto a otro. Si la nueva geometría `apoint` existe como nodo se lanza un error. Devuelve la descripción del movimiento.

Synopsis

```
text ST_MoveIsoNode(varchar atopology, integer anode, geometry apoint);
```

Descripción

Mueve un nodo aislado en una topología de un punto a otro. Si la nueva geometría `apoint` existe como un nodo un error es lanzado.

If any arguments are null, the `apoint` is not a point, the existing node is not isolated (is a start or end point of an existing edge), new node location intersects an existing edge (even at the end points) or the new location is in a different face (since 3.2.0) then an exception is thrown.

Si el sistema de referencia espacial (SRID) de la geometría de punto no es el mismo que el de la topología se lanza una excepción.

Disponibilidad: 2.0.0

Enhanced: 3.2.0 ensures the nod cannot be moved in a different face



This method implements the SQL/MM specification. SQL-MM: Topo-Net Rutina: X.3.2

Ejemplos

```
-- Agregar un nodo aislado sin cara --
SELECT topology.ST_AddIsoNode('ma_topo', NULL, ST_GeomFromText('POINT(227579 893916)', 26986) ) As nodeid;
nodeid
-----
7
-- Mover el nuevo nodo --
SELECT topology.ST_MoveIsoNode('ma_topo', 7, ST_GeomFromText('POINT(227579.5 893916.5)', 26986) ) As descrip;
descrip
-----
Isolated Node 7 moved to location 227579.5,893916.5
```

Ver también

[ST_AddIsoNode](#)

10.6.12 ST_NewEdgesSplit

ST_NewEdgesSplit — Divide un borde creando un nuevo nodo a lo largo de un borde existente, eliminando el borde original y reemplazándolo con dos bordes nuevos. Devuelve el identificador del nuevo nodo creado que une los nuevos bordes.

Synopsis

integer **ST_NewEdgesSplit**(varchar atopology, integer anedge, geometry apoint);

Descripción

Divide un borde con el identificador de borde `anedge` creando un nodo nuevo con la localización del punto `apoint` a lo largo del borde actual, eliminando el borde original y reemplazando con dos bordes nuevos. Devuelve el identificador del nuevo nodo creado que une los nuevos bordes. Actualiza todos los bordes unidos existentes y relaciones en consecuencia.

Si el sistema de referencia espacial (SRID) de la geometría de punto no es el mismo que el de la topología, el `apoint` no es una geometría de punto, el punto es nulo, el punto ya existe como un nodo, el borde no corresponde a un borde existente o el punto no está dentro del borde entonces se lanza una excepción.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM: Topo-Net Rutina: X.3.8

Ejemplos

```
-- Agrega un borde --
SELECT topology.AddEdge('ma_topo', ST_GeomFromText('LINESTRING(227575 893917,227592 893900)', 26986) ) As edgeid;
-- result-
edgeid
-----
2
-- Divide el borde nuevo --
SELECT topology.ST_NewEdgesSplit('ma_topo', 2, ST_GeomFromText('POINT(227578.5 893913.5)', 26986) ) As newnodeid;
newnodeid
-----
6
```

Ver también

[ST_ModEdgeSplit](#) [ST_ModEdgeHeal](#) [ST_NewEdgeHeal](#) [AddEdge](#)

10.6.13 ST_RemoveIsoNode

ST_RemoveIsoNode — Elimina un nodo aislado y devuelve la descripción de la acción. Si el nodo no está aislado (es el inicio o el final de un borde), entonces se lanza una excepción.

Synopsis

text **ST_RemoveIsoNode**(varchar atopology, integer anode);

Descripción

Elimina un nodo aislado y devuelve la descripción de la acción. Si el nodo no está aislado (es el inicio o el final de un borde), entonces se lanza una excepción.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X+1.3.3

Ejemplos

```
-- Elimina un nodo aislado sin cara --
SELECT topology.ST_RemoveIsoNode('ma_topo', 7) As result;
      result
-----
Isolated node 7 removed
```

Ver también

[ST_AddIsoNode](#)

10.6.14 ST_RemoveIsoEdge

ST_RemoveIsoEdge — Elimina un borde aislado y devuelve la descripción de la acción. Si el borde no está aislado, se lanza una excepción.

Synopsis

text **ST_RemoveIsoEdge**(varchar atopology, integer anedge);

Descripción

Elimina un borde aislado y devuelve la descripción de la acción. Si el borde no está aislado, se lanza una excepción.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X+1.3.3

Ejemplos

```
-- Elimina un nodo aislado sin cara --
SELECT topology.ST_RemoveIsoNode('ma_topo', 7 ) As result;
      result
-----
Isolated node 7 removed
```

Ver también

[ST_AddIsoNode](#)

10.7 Accesores de Topología

10.7.1 GetEdgeByPoint

GetEdgeByPoint — Busca el identificador de arista de una arista que cruza un punto determinado.

Synopsis

integer **GetEdgeByPoint**(varchar atopology, geometry apoint, float8 toll);

Descripción

Recupera el identificador de una arista que cruza con un point.

La función devuelve un entero (identificador de borde) dada una topología, un POINT y una tolerancia. Si la tolerancia = 0 el punto tiene que intersectar el borde.

Si un apoint no intersecta una arista, devuelve 0 (cero).

Si se usa tolerancia > 0 y hay más de un borde cerca del punto, entonces se lanza una excepción.



Note

Si la tolerancia = 0, la función utiliza ST_Intersects de otra manera utiliza ST_DWithin.

Realizado por el módulo GEOS.

Disponibilidad: 2.0.0

Ejemplos

Estos ejemplos utilizan los bordes que hemos creado en [AddEdge](#)

```
SELECT topology.GetEdgeByPoint('ma_topo',geom, 1) As withlmtol, topology.GetEdgeByPoint(' ←
      ma_topo',geom,0) As withnotol
FROM ST_GeomFromEWKT('SRID=26986;POINT(227622.6 893843)') As geom;
withlmtol | withnotol
-----+-----
          | 2 | 0
```



```
SELECT topology.GetEdgeByPoint('ma_topo',geom, 1) As nearnode
FROM ST_GeomFromEWKT('SRID=26986;POINT(227591.9 893900.4)') As geom;

-- get error --
ERROR:  Two or more edges found
```

Ver también

[AddEdge](#), [GetNodeByPoint](#), [GetFaceByPoint](#)

10.7.2 GetFaceByPoint

GetFaceByPoint — Finds face intersecting a given point.

Synopsis

integer **GetFaceByPoint**(varchar atopology, geometry apoint, float8 toll);

Descripción

Finds a face referenced by a Point, with given tolerance.

The function will effectively look for a face intersecting a circle having the point as center and the tolerance as radius.

If no face intersects the given query location, 0 is returned (universal face).

If more than one face intersect the query location an exception is thrown.

Disponibilidad: 2.0.0

Enhanced: 3.2.0 more efficient implementation and clearer contract, stops working with invalid topologies.

Ejemplos

```
SELECT topology.GetFaceByPoint('ma_topo',geom, 10) As with1mtol, topology.GetFaceByPoint('ma_topo',geom,0) As withnotol
FROM ST_GeomFromEWKT('POINT(234604.6 899382.0)') As geom;

with1mtol | withnotol
-----+-----
1 | 0
```

```
SELECT topology.GetFaceByPoint('ma_topo',geom, 1) As nearnode
FROM ST_GeomFromEWKT('POINT(227591.9 893900.4)') As geom;

-- get error --
ERROR:  Two or more faces found
```

Ver también

[GetFaceContainingPoint](#), [AddFace](#), [GetNodeByPoint](#), [GetEdgeByPoint](#)

10.7.3 GetFaceContainingPoint

GetFaceContainingPoint — Finds the face containing a point.

Synopsis

integer **GetFaceContainingPoint**(text atopology, geometry apoint);

Descripción

Returns the id of the face containing a point.

An exception is thrown if the point falls on a face boundary.



Note

The function relies on a valid topology, using edge linking and face labeling.

Availability: 3.2.0

Ver también

[ST_GetFaceGeometry](#)

10.7.4 GetNodeByPoint

GetNodeByPoint — Busca el identificador de nodo de un nodo en un punto de ubicación.

Synopsis

integer **GetNodeByPoint**(varchar atopology, geometry apoint, float8 tol1);

Descripción

Recupera el identificador de un nodo en un punto de ubicación.

La función devuelve un entero (identificador de nodo) dada una topología, un POINT y una tolerancia. Si la tolerancia es 0 significa intersección exacta, de lo contrario recupera el nodo de un intervalo.

Si `apoint` no intersecta un nodo, devuelve 0 (cero).

Si utiliza tolerancia > 0 y hay más de un nodo cerca del punto, se produce una excepción.



Note

Si la tolerancia = 0, la función utiliza ST_Intersects de otra manera utiliza ST_DWithin.

Realizado por el módulo GEOS.

Disponibilidad: 2.0.0

Ejemplos

Estos ejemplos utilizan los bordes que hemos creado en [AddEdge](#)

```
SELECT topology.GetNodeByPoint('ma_topo',geom, 1) As nearnode
FROM ST_GeomFromEWKT('SRID=26986;POINT(227591.9 893900.4)') As geom;
nearnode
-----
2
```

```
SELECT topology.GetNodeByPoint('ma_topo',geom, 1000) As too_much_tolerance
FROM ST_GeomFromEWKT('SRID=26986;POINT(227591.9 893900.4)') As geom;

----get error--
ERROR:  Two or more nodes found
```

Ver también

[AddEdge](#), [GetEdgeByPoint](#), [GetFaceByPoint](#)

10.7.5 GetTopologyID

GetTopologyID — Devuelve el identificador de una topología en la tabla topology.topology dado el nombre de la topología.

Synopsis

integer **GetTopologyID**(varchar toponame);

Descripción

Devuelve el identificador de una topología en la tabla topology.topology dado el nombre de la topología.

Availability: 1.1

Ejemplos

```
SELECT topology.GetTopologyID('ma_topo') As topo_id;
topo_id
-----
1
```

Ver también

[CreateTopology](#), [DropTopology](#), [GetTopologyName](#), [GetTopologySRID](#)

10.7.6 GetTopologySRID

GetTopologySRID — Devuelve el SRID de una topología en la tabla topology.topology dado el nombre de la topología.

Synopsis

integer **GetTopologyID**(varchar toponame);

Descripción

Devuelve el identificador del sistema de referencia de una topología en la tabla topology.topology dado el nombre de la topología.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT topology.GetTopologySRID('ma_topo') As SRID;
SRID
-----
4326
```

Ver también

[CreateTopology](#), [DropTopology](#), [GetTopologyName](#), [GetTopologyID](#)

10.7.7 GetTopologyName

GetTopologyName — Devuelve el nombre de una topología (esquema) dado el identificador de la topología.

Synopsis

varchar **GetTopologyName**(integer topology_id);

Descripción

Devuelve el nombre de topología (esquema) de una topología de la tabla topology.topology dado el identificador de topología de la topología.

Availability: 1.1

Ejemplos

```
SELECT topology.GetTopologyName(1) As topo_name;
topo_name
-----
ma_topo
```

Ver también

[CreateTopology](#), [DropTopology](#), [GetTopologyID](#), [GetTopologySRID](#)

10.7.8 ST_GetFaceEdges

ST_GetFaceEdges — Devuelve un conjunto de bordes ordenados que ligan aface.

Synopsis

getfaceedges_returntype **ST_GetFaceEdges**(varchar atopology, integer aface);

Descripción

Devuelve un conjunto de bordes ordenados que ligan aface. Cada salida consta de una secuencia e identificador de borde. Los números de secuencia comienzan con el valor 1.

La enumeración de los bordes de cada anillo comienza desde el borde con el identificador más pequeño. El orden de los bordes sigue la regla de la izquierda (la cara enmarcada está a la izquierda de cada borde dirigido).

Disponibilidad: 2.0



This method implements the SQL/MM specification. SQL-MM 3 Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.5

Ejemplos

```
-- Devuelve los bordes que limitan la cara 1
SELECT (topology.ST_GetFaceEdges('tt', 1)).*;
-- result --
sequence | edge
-----+-----
1 | -4
2 | 5
3 | 7
4 | -6
5 | 1
6 | 2
7 | 3
(7 rows)
```

```
-- Devuelve la secuencia, identificador de borde
-- y la geometría de los bordes que unen la cara 1
-- Si se necesitan geom y seq, puede utilizar ST_GetFaceGeometry
SELECT t.seq, t.edge, geom
FROM topology.ST_GetFaceEdges('tt',1) As t(seq,edge)
INNER JOIN tt.edge AS e ON abs(t.edge) = e.edge_id;
```

Ver también

[GetRingEdges](#), [AddFace](#), [ST_GetFaceGeometry](#)

10.7.9 ST_GetFaceGeometry

ST_GetFaceGeometry — Devuelve el polígono en la topología dada con el identificador de la cara especificada.

Synopsis

geometry **ST_GetFaceGeometry**(varchar atopology, integer aface);

Descripción

Devuelve el polígono en la topología dada con el identificador de cara especificado. Construye el polígono de los bordes que componen la cara.

Availability: 1.1



This method implements the SQL/MM specification. SQL-MM 3 Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.16

Ejemplos

```
-- Devuelve el WKT del polígono agregado con AddFace
SELECT ST_AsText(topology.ST_GetFaceGeometry('ma_topo', 1)) As facegeomwkt;
-- result --
        facegeomwkt

-----
POLYGON((234776.9 899563.7,234896.5 899456.7,234914 899436.4,234946.6 899356.9,
234872.5 899328.7,234891 899285.4,234992.5 899145,234890.6 899069,
234755.2 899255.4,234612.7 899379.4,234776.9 899563.7))
```

Ver también

[AddFace](#)

10.7.10 GetRingEdges

GetRingEdges — Devuelve el conjunto ordenado de identificadores de borde con signo asignado al caminar en un lado de borde dado.

Synopsis

getfaceedges_returntype **GetRingEdges**(varchar atopoology, integer aring, integer max_edges=null);

Descripción

Devuelve el conjunto ordenado de identificadores de borde con signo asignado al caminar en un lado de borde dado. Cada salida consta de una secuencia y un identificador de borde con signo. Los números de secuencia comienzan con el valor 1.

Si pasa un identificador de borde positivo, la caminata comienza en el lado izquierdo del borde correspondiente y sigue la dirección del borde. Si pasa un identificador de borde negativo, el paseo comienza en el lado derecho de la misma y retrocede.

Si `max_edges` no es nulo no más que esos registros son devueltos por esa función. Esto se supone que es un parámetro de seguridad cuando se trata de topologías posiblemente inválidas.



Note

Esta función utiliza metadatos enlazados de anillo de borde.

Disponibilidad: 2.0.0

Ver también

[ST_GetFaceEdges](#), [GetNodeEdges](#)

10.7.11 GetNodeEdges

GetNodeEdges — Devuelve un conjunto ordenado de aristas incidente al nodo dado.

Synopsis

`getfaceedges_returntype` **GetNodeEdges**(varchar atopology, integer anode);

Descripción

Devuelve un conjunto ordenado de aristas incidente al nodo dado. Cada salida consta de una secuencia y un identificador de arista con signo. Los números de secuencia comienzan con el valor 1. Una arista positiva comienza en el nodo dado. Una arista negativa termina en el nodo dado. Las aristas cerradas aparecerán dos veces (con ambos signos). El orden es en sentido horario empezando desde el norte.



Note

Esta función calcula pedidos en lugar de derivar de metadatos y es así útil para construir el bode de anillo de vinculación.

Disponibilidad: 2.0

Ver también

`getfaceedges_returntype`, `GetRingEdges`, `ST_Azimuth`

10.8 Procesamiento de Topología

10.8.1 Polygonize

Polygonize — Busca y registra todas las caras definidas por aristas de topología.

Synopsis

text **Polygonize**(varchar toponame);

Descripción

Registra todas las caras que se pueden crear como primitivas de borde de topología.

Se supone que la topología de destino no contiene bordes que se intersectan a sí mismos.



Note

Se reconocen caras ya conocidas, por lo que es seguro llamar a Polygonize varias veces en la misma topología.



Note

Esta función no utiliza ni establece los campos `next_left_edge` y `next_right_edge` de la tabla `Edge`.

Disponibilidad: 2.0.0

Ver también[AddFace](#), [ST_Polygonize](#)**10.8.2 AddNode**

AddNode — Agrega un nodo de punto a la tabla de nodos del esquema de topología especificado y devuelve el identificador de nodo del nuevo nodo. Si el punto ya existe como nodo, se devuelve el identificador de nodo existente.

Synopsis

```
integer AddNode(varchar toponame, geometry apoint, boolean allowEdgeSplitting=false, boolean computeContainingFace=false);
```

Descripción

Agrega un nodo de punto a la tabla de nodos en el esquema de topología especificado. La función [AddEdge](#) agrega automáticamente los puntos de inicio y fin de una arista cuando se le llama por lo tanto no es necesario agregar nodos de arista de forma explícita.

Si se encuentra alguna arista que cruza el nodo, se produce una excepción o se divide la arista, dependiendo del valor del parámetro `allowEdgeSplitting`.

Si `computeContainingFace` es verdadero un nodo recién añadido obtendrá la cara de contención correcta calculada.

**Note**

Si la geometría `apoint` ya existe como nodo, el nodo no se agrega pero se devuelve el identificador del nodo existente.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT topology.AddNode('ma_topo', ST_GeomFromText('POINT(227641.6 893816.5)', 26986) ) As nodeid;
-- result --
nodeid
-----
4
```

Ver también[AddEdge](#), [CreateTopology](#)**10.8.3 AddEdge**

AddEdge — Agrega una arista de `LineString` a la tabla de arista y los puntos de inicio y fin asociados a la tabla nodos de puntos del esquema de topología usando la geometría `LineString` especificada y devuelve el identificador de arista de la arista nueva (o existente).

Synopsis

integer **AddEdge**(varchar toponame, geometry aline);

Descripción

Agrega un borde a la tabla arista y los nodos asociados a la tabla nodos del esquema `toponame` especificado usando la geometría `LineString` especificada y devuelve el identificador de arista del registro nuevo o existente. El borde recién añadido tiene la cara de "universo" en ambos lados y enlaces a sí mismo.



Note

Si la geometría `aline` se cruza, se superpone, contiene o está contenida por un borde de cadena de línea existente, entonces se genera un error y no se agrega el borde.



Note

La geometría de `aline` debe tener el mismo `srid` que el definido para la topología de lo contrario se lanzará un error de sistema de referencia espacial no válido.

Realizado por el módulo GEOS.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT topology.AddEdge('ma_topo', ST_GeomFromText('LINESTRING(227575.8 893917.2,227591.9 893900.4)', 26986) ) As edgeid;
-- result-
edgeid
-----
1

SELECT topology.AddEdge('ma_topo', ST_GeomFromText('LINESTRING(227591.9 893900.4,227622.6 893844.2,227641.6 893816.5, 227704.5 893778.5)', 26986) ) As edgeid;
-- result --
edgeid
-----
2

SELECT topology.AddEdge('ma_topo', ST_GeomFromText('LINESTRING(227591.2 893900, 227591.9 893900.4, 227704.5 893778.5)', 26986) ) As edgeid;
-- gives error --
ERROR:  Edge intersects (not on endpoints) with existing edge 1
```

Ver también

[TopoGeo_AddLineString](#), [CreateTopology](#), [Section 4.5](#)

10.8.4 AddFace

AddFace — Registra una primitiva de cara a una topología y obtiene su identificador.

Synopsis

integer **AddFace**(varchar toponame, geometry apolygon, boolean force_new=false);

Descripción

Registra una primitiva de cara a una topología y obtiene su identificador.

Para una cara recién agregada, los bordes que forman sus límites y los contenidos en la cara se actualizarán para tener valores correctos en los campos `left_face` y `right_face`. Los nodos aislados contenidos en la cara también se actualizarán para tener un valor del campo `containing_face`.



Note

Esta función no utiliza ni establece los campos `next_left_edge` y `next_right_edge` de la tabla `Edge`.

Se supone que la topología de destino es válida (que no contiene aristas de intersección). Se plantea una excepción si: el límite del polígono no está definido completamente por los bordes existentes o el polígono se superpone con una cara existente.

Si la geometría `apolygon` ya existe como cara, entonces: si `force_new` es falso (el valor predeterminado) se devuelve el id de cara de la cara existente; si `force_new` es verdadero; , se asignará un nuevo identificador a la cara recién registrada.



Note

Cuando se realiza un nuevo registro de una cara existente (`force_new=true`), no se tomará ninguna acción para resolver las referencias pendientes a la cara existente en la arista, nodo y a tablas de relación, ni se actualizará el campo MBR del registro de cara existente. Depende de la persona que llama hacerse cargo de ello.



Note

La geometría `apolygon` debe tener el mismo `srid` que el definido para la topología de lo contrario se lanzará un error de sistema de referencia espacial no válido.

Disponibilidad: 2.0.0

Ejemplos

```
-- Primero se agregarán las aristas que se usarán para generar series como un iterador (el ←
  abajo
-- trabajara solo para polígonos con < 10000 puntos debido a nuestro máximo en gs)
SELECT topology.AddEdge('ma_topo', ST_MakeLine(ST_PointN(geom,i), ST_PointN(geom, i + 1) )) ←
  As edgeid
FROM (SELECT ST_NPoints(geom) AS npt, geom
      FROM
        (SELECT ST_Boundary(ST_GeomFromText('POLYGON((234896.5 899456.7,234914 ←
          899436.4,234946.6 899356.9,234872.5 899328.7,
          234891 899285.4,234992.5 899145, 234890.6 899069,234755.2 899255.4,
          234612.7 899379.4,234776.9 899563.7,234896.5 899456.7))', 26986) ) As geom
        ) As geoms) As facen CROSS JOIN generate_series(1,10000) As i
      WHERE i < npt;
-- result --
edgeid
-----
3
```

```

4
5
6
7
8
9
10
11
12
(10 rows)
-- then add the face -

SELECT topology.AddFace('ma_topo',
    ST_GeomFromText('POLYGON((234896.5 899456.7,234914 899436.4,234946.6 899356.9,234872.5  ←
    899328.7,
    234891 899285.4,234992.5 899145, 234890.6 899069,234755.2 899255.4,
    234612.7 899379.4,234776.9 899563.7,234896.5 899456.7))', 26986) ) As faceid;
-- result --
faceid
-----
1

```

Ver también

[AddEdge](#), [CreateTopology](#), [Section 4.5](#)

10.8.5 ST_Simplify

ST_Simplify — Devuelve una versión "simplificada" de la geometría de la TopoGeometry dada usando el algoritmo de Douglas-Peucker.

Synopsis

geometry **ST_Simplify**(TopoGeometry tg, float8 tolerance);

Descripción

Devuelve una versión "simplificada" de la geometría de la TopoGeometry dada usando el algoritmo de Douglas-Peucker en cada arista componente.



Note

La geometría devuelta puede ser no simple o no válida.
Dividir las aristas de los componentes puede ayudar a conservar la simplicidad/validez.

Realizado por el módulo GEOS.

Disponibilidad: 2.1.0

Ver también

Geometría [ST_Simplify](#), [ST_IsSimple](#), [ST_IsValid](#), [ST_ModEdgeSplit](#)

10.8.6 RemoveUnusedPrimitives

RemoveUnusedPrimitives — Removes topology primitives which not needed to define existing TopoGeometry objects.

Synopsis

```
int RemoveUnusedPrimitives(text topology_name, geometry bbox);
```

Descripción

Finds all primitives (nodes, edges, faces) that are not strictly needed to represent existing TopoGeometry objects and removes them, maintaining topology validity (edge linking, face labeling) and TopoGeometry space occupation.

No new primitive identifiers are created, but rather existing primitives are expanded to include merged faces (upon removing edges) or healed edges (upon removing nodes).

Availability: 3.3.0

Ver también

[ST_ModEdgeHeal](#), [ST_RemEdgeModFace](#)

10.9 Constructores de Geometría Topográfica

10.9.1 CreateTopoGeom

CreateTopoGeom — Crea un nuevo objeto de geometría topo de la matriz de elementos topo - `tg_type`: 1:[multi]point, 2:[multi]line, 3:[multi]poly, 4:collection

Synopsis

```
topogeometry CreateTopoGeom(varchar toponame, integer tg_type, integer layer_id, topoelementarray tg_objs);
topogeometry CreateTopoGeom(varchar toponame, integer tg_type, integer layer_id);
```

Descripción

Crea un objeto de topogeometría para la capa indicada por `layer_id` y lo registra en la tabla `relations` del esquema `toponame`.

`tg_type` es un entero: 1:[multi]point (puncetal), 2:[multi]line (lineal), 3:[multi]poly (areal), 4:collection. `layer_id` es el identificador de capa de la tabla `topology.layer`.

las capas puntuales se forman a partir de un conjunto de nodos, las capas lineales se forman a partir de un conjunto de aristas, las capas de área se forman a partir de un conjunto de caras, y las colecciones se pueden formar a partir de una mezcla de nodos, aristas y caras.

Omitir la matriz de componentes genera un objeto TopoGeometry vacío.

Availability: 1.1

Ejemplos: formulario de aristas existentes

Crea un topogeom en el esquema `ri_topo` para la capa 2 (nuestra `ri_roads`), de tipo (2) LINE, para el primer borde (cargamos en `ST_CreateTopoGeo`).

```
INSERT INTO ri.ri_roads(road_name, topo) VALUES('Unknown', topology.CreateTopoGeom('ri_topo' ←
    ',2,2, '{{1,2}}'::topology.topoelementarray);
```

Ejemplos: Convierte una geometría de área a una topogeometría

Digamos que tenemos geometrías que deben ser formadas a partir de una colección de caras. Tenemos por ejemplo la tabla `blockgroups` y queremos conocer la geometría topo de cada grupo de bloques. Si nuestros datos estuvieran perfectamente alineados, podríamos hacer esto:

```
-- crear nuestra columna de geometría topo --
SELECT topology.AddTopoGeometryColumn(
    'topo_boston',
    'boston', 'blockgroups', 'topo', 'POLYGON');

-- addtopogeometrycolumn --
1

-- actualizar nuestra columna asumiendo que
-- todo está perfectamente alineado con nuestras aristas
UPDATE boston.blockgroups AS bg
    SET topo = topology.CreateTopoGeom('topo_boston'
    ,3,1
    , foo.bfaces)
FROM (SELECT b.gid, topology.TopoElementArray_Agg(ARRAY[f.face_id,3]) As bfaces
    FROM boston.blockgroups As b
        INNER JOIN topo_boston.face As f ON b.geom && f.mbr
        WHERE ST_Covers(b.geom, topology.ST_GetFaceGeometry('topo_boston', f.face_id))
        GROUP BY b.gid) As foo
WHERE foo.gid = bg.gid;
```

```
--el mundo rara vez es perfecto permitir algún error
--contar la cara si el 50% de ella cae
-- dentro de lo que creemos que es nuestro límite de bloques
UPDATE boston.blockgroups AS bg
    SET topo = topology.CreateTopoGeom('topo_boston'
    ,3,1
    , foo.bfaces)
FROM (SELECT b.gid, topology.TopoElementArray_Agg(ARRAY[f.face_id,3]) As bfaces
    FROM boston.blockgroups As b
        INNER JOIN topo_boston.face As f ON b.geom && f.mbr
        WHERE ST_Covers(b.geom, topology.ST_GetFaceGeometry('topo_boston', f.face_id))
        OR
        ( ST_Intersects(b.geom, topology.ST_GetFaceGeometry('topo_boston', f.face_id))
            AND ST_Area(ST_Intersection(b.geom, topology.ST_GetFaceGeometry('topo_boston', f.face_id))) >
                ST_Area(topology.ST_GetFaceGeometry('topo_boston', f.face_id))*0.5
            )
        GROUP BY b.gid) As foo
WHERE foo.gid = bg.gid;

-- y si quisiéramos convertir nuestra topogeometría de nuevo
-- ~a una geometría no normalizados alineados con nuestras caras y aristas
-- convertir la topografía en una geometría
-- Lo realmente genial es que mis nuevas geometrías
-- ahora están alineadas con mis ejes de calles tigre
UPDATE boston.blockgroups SET new_geom = topo::geometry;
```

Ver también

[AddTopoGeometryColumn](#), [toTopoGeom](#) [ST_CreateTopoGeo](#), [ST_GetFaceGeometry](#), [TopoElementArray](#), [TopoElementArray_Agg](#)

10.9.2 toTopoGeom

toTopoGeom — Convierte un Geometry simple en una geometría topo.

Synopsis

```
topogeometry toTopoGeom(geometry geom, varchar toponame, integer layer_id, float8 tolerance);
topogeometry toTopoGeom(geometry geom, topogeometry topogeom, float8 tolerance);
```

Descripción

Convierte una geometría simple en un **TopoGeometry**.

Las primitivas topológicas necesarias para representar la geometría de entrada se añadirán a la topología subyacente, posiblemente dividiendo los existentes, y se asociarán con la salida TopoGeometry en la tabla `relation`.

Los objetos TopoGeometry existentes (con la posible excepción de `topogeoms` si se les da) conservarán sus formas.

Cuando se da la `tolerance` se usará para ajustar la geometría de entrada a las primitivas existentes.

En la primera forma se creará un nuevo TopoGeometry para la capa dada (`layer_id`) de la topología dada (`toponame`).

En la segunda forma las primitivas resultantes de la conversión se añadirán a la TopoGeometry preexistente (`topogeom`), añadiendo posiblemente espacio a su forma final. Para que la nueva forma Reemplace completamente la antigua ver **clearTopoGeom**.

Disponibilidad: 2.0

Mejorado: 2.1.0 agrega la versión tomando una TopoGeometry existente.

Ejemplos

Se trata de un flujo de trabajo autónomo completo

```
-- Haga esto si no tiene una configuración de topología
-- crea topología que no permita ninguna tolerancia
SELECT topology.CreateTopology('topo_boston_test', 2249);
-- crear una tabla nueva
CREATE TABLE nei_topo(gid serial primary key, nei varchar(30));
-- agregar una columna topogeometry a la misma
SELECT topology.AddTopoGeometryColumn('topo_boston_test', 'public', 'nei_topo', 'topo', 'MULTIPOLYGON') As new_layer_id;
new_layer_id
-----
1

-- Utiliza el nuevo identificador de capa para rellenar la nueva columna topogeometry
-- añadimos los topogeoms a la nueva capa con 0 tolerancia
INSERT INTO nei_topo(nei, topo)
SELECT nei, topology.toTopoGeom(geom, 'topo_boston_test', 1)
FROM neighborhoods
WHERE gid BETWEEN 1 and 15;

-- utilizar para verificar lo que ha sucedido --
SELECT * FROM
    topology.TopologySummary('topo_boston_test');

-- summary--
Topology topo_boston_test (5), SRID 2249, precision 0
61 nodes, 87 edges, 35 faces, 15 topogeoms in 1 layers
Layer 1, type Polygonal (3), 15 topogeoms
Deploy: public.nei_topo.topo
```

```
-- Reducir todos los polígonos de TopoGeometry por 10 metros
UPDATE nei_topo SET topo = ST_Buffer(clearTopoGeom(topo), -10);

-- Obtener el no-one-lands dejado por la operación anterior
-- Pensando en GRASS esta se llama "polygon0 layer"
SELECT ST_GetFaceGeometry('topo_boston_test', f.face_id)
  FROM topo_boston_test.face f
 WHERE f.face_id
> 0 -- don't consider the universe face
 AND NOT EXISTS ( -- check that no TopoGeometry references the face
   SELECT * FROM topo_boston_test.relation
   WHERE layer_id = 1 AND element_id = f.face_id
 );
```

Ver también

[CreateTopology](#), [AddTopoGeometryColumn](#), [CreateTopoGeom](#), [TopologySummary](#), [clearTopoGeom](#)

10.9.3 TopoElementArray_Agg

TopoElementArray_Agg — Devuelve un `topoelementarray` para un conjunto de `element_id`, matriz de tipo (`topoelements`).

Synopsis

`topoelementarray` **TopoElementArray_Agg**(`topoelement set tefield`);

Descripción

Usado para crear una [TopoElementArray](#) desde un conjunto de [TopoElement](#).

Disponibilidad: 2.0.0

Ejemplos

```
SELECT topology.TopoElementArray_Agg(ARRAY[e,t]) As tea
  FROM generate_series(1,3) As e CROSS JOIN generate_series(1,4) As t;
tea
-----
{{1,1},{1,2},{1,3},{1,4},{2,1},{2,2},{2,3},{2,4},{3,1},{3,2},{3,3},{3,4}}
```

Ver también

[TopoElement](#), [TopoElementArray](#)

10.10 Editores TopoGeometry

10.10.1 clearTopoGeom

clearTopoGeom — Borra el contenido de una `topo geometry`.

Synopsis

topogeometry **clearTopoGeom**(topogeometry topogeom);

Descripción

Borra el contenido de un **TopoGeometry** convirtiéndolo en uno vacío. Sobre todo útil en conjunción con **toTopoGeom** para substituir la forma de objetos existentes y de cualquier objeto dependiente en niveles jerárquicos más altos.

Disponibilidad: 2.1

Ejemplos

```
-- Reduce todos los polígonos TopoGeometry por 10 metros
UPDATE nei_topo SET topo = ST_Buffer(clearTopoGeom(topo), -10);
```

Ver también

toTopoGeom

10.10.2 TopoGeom_addElement

TopoGeom_addElement — Agrega un elemento a la definición de una TopoGeometry.

Synopsis

topogeometry **TopoGeom_addElement**(topogeometry tg, topoelement el);

Descripción

Agrega un **TopoElement** a la definición de un objeto TopoGeometry. No se produce un error si el elemento ya forma parte de la definición.

Disponibilidad: 2.3

Ejemplos

```
-- Agrega el borde 5 a la TopoGeometry tg
UPDATE mylayer SET tg = TopoGeom_addElement(tg, '{5,2}');
```

Ver también

TopoGeom_remElement, **CreateTopoGeom**

10.10.3 TopoGeom_remElement

TopoGeom_remElement — Quita un elemento de la definición de una TopoGeometry.

Synopsis

topogeometry **TopoGeom_remElement**(topogeometry tg, topoelement el);

Descripción

Elimina un **TopoElement** de la definición de un objeto TopoGeometry.

Disponibilidad: 2.3

Ejemplos

```
-- Quite la cara 43 de TopoGeometry tg
UPDATE mylayer SET tg = TopoGeom_remElement(tg, '{43,3}');
```

Ver también

[TopoGeom_addElement](#), [CreateTopoGeom](#)

10.10.4 TopoGeom_addTopoGeom

TopoGeom_addTopoGeom — Adds element of a TopoGeometry to the definition of another TopoGeometry.

Synopsis

topogeometry **TopoGeom_addTopoGeom**(topogeometry tgt, topogeometry src);

Descripción

Adds the elements of a **TopoGeometry** to the definition of another TopoGeometry, possibly changing its cached type (type attribute) to a collection, if needed to hold all elements in the source object.

The two TopoGeometry objects need be defined against the **same** topology and, if hierarchically defined, need be composed by elements of the same child layer.

Availability: 3.2

Ejemplos

```
-- Set an "overall" TopoGeometry value to be composed by all
-- elements of specific TopoGeometry values
UPDATE mylayer SET tg_overall = TopoGeom_addTopogeom(
    TopoGeom_addTopoGeom(
        clearTopoGeom(tg_overall),
        tg_specific1
    ),
    tg_specific2
);
```

Ver también

[TopoGeom_addElement](#), [clearTopoGeom](#), [CreateTopoGeom](#)

10.10.5 toTopoGeom

toTopoGeom — Agrega una forma de geometría a una geometría topográfica existente.

Descripción

Consulte [toTopoGeom](#).

10.11 Descriptores de Geometría Topográfica

10.11.1 GetTopoGeomElementArray

`GetTopoGeomElementArray` — Devuelve un `topoelementarray` (una matriz de `topoelements`) que contiene los elementos topológicos y el tipo de la `TopoGeometry` (elementos primitivos) especificados.

Synopsis

```
topoelementarray GetTopoGeomElementArray(varchar toponame, integer layer_id, integer tg_id);  
topoelementarray topoelement GetTopoGeomElementArray(topogeometry tg);
```

Descripción

Devuelve un [TopoElementArray](#) que contiene los elementos topológicos y el tipo de los `TopoGeometry` dados (elementos primitivos). Esto es similar a `GetTopoGeomElements`, excepto que devuelve los elementos como un array en lugar de un conjunto de datos.

`tg_id` es el identificador `topogeometry` del objeto `topogeometry` en la topología de la capa denotada por `layer_id` en la tabla `topology.layer`.

Availability: 1.1

Ejemplos

Ver también

[GetTopoGeomElements](#), [TopoElementArray](#)

10.11.2 GetTopoGeomElements

`GetTopoGeomElements` — Devuelve un conjunto de objetos `topoelement` que contienen el `element_id` topológico, `element_type` de la `TopoGeometry` (elementos primitivos) especificados.

Synopsis

```
setof topoelement GetTopoGeomElements(varchar toponame, integer layer_id, integer tg_id);  
setof topoelement GetTopoGeomElements(topogeometry tg);
```

Descripción

Returns a set of `element_id,element_type` (`topoelements`) corresponding to primitive topology elements [TopoElement](#) (1: nodes, 2: edges, 3: faces) that a given `topogeometry` object in `toponame` schema is composed of.

`tg_id` es el identificador `topogeometry` del objeto `topogeometry` en la topología de la capa denotada por `layer_id` en la tabla `topology.layer`.

Disponibilidad: 2.0.0

Ejemplos

Ver también

[GetTopoGeomElementArray](#), [TopoElement](#), [TopoGeom_addElement](#), [TopoGeom_remElement](#)

10.11.3 ST_SRID

ST_SRID — Returns the spatial reference identifier for a topogeometry.

Synopsis

integer **ST_SRID**(topogeometry tg);

Descripción

Returns the spatial reference identifier for the ST_Geometry as defined in spatial_ref_sys table. Section [4.5](#)



Note

spatial_ref_sys table is a table that catalogs all spatial reference systems known to PostGIS and is used for transformations from one spatial reference system to another. So verifying you have the right spatial reference system identifier is important if you plan to ever transform your geometries.

Availability: 3.2.0



This method implements the SQL/MM specification. SQL-MM 3: 14.1.5

Ejemplos

```
SELECT ST_SRID(ST_GeomFromText('POINT(-71.1043 42.315)', 4326));
--result
4326
```

Ver también

Section [4.5](#), [ST_SetSRID](#), [ST_Transform](#), [ST_SRID](#)

10.12 Salidas de Geometría Topográfica

10.12.1 AsGML

AsGML — Devuelve una representación GML de una geometría topográfica.

Synopsis

```
text AsGML(topogeometry tg);
text AsGML(topogeometry tg, text nsrefix_in);
text AsGML(topogeometry tg, regclass visitedTable);
text AsGML(topogeometry tg, regclass visitedTable, text nsrefix);
text AsGML(topogeometry tg, text nsrefix_in, integer precision, integer options);
text AsGML(topogeometry tg, text nsrefix_in, integer precision, integer options, regclass visitedTable);
text AsGML(topogeometry tg, text nsrefix_in, integer precision, integer options, regclass visitedTable, text idprefix);
text AsGML(topogeometry tg, text nsrefix_in, integer precision, integer options, regclass visitedTable, text idprefix, int gm-
lversion);
```

Descripción

Devuelve la representación GML de un topogeometry en formato de versión GML3. Si no se especifica ningún `nsrefix_in` entonces se utiliza `gml`. Pase una cadena vacía a `nsrefix` para obtener un espacio de nombre no cualificado. Los parámetros de precisión (predeterminado: 15) y opciones (predeterminado 1), si se dan, se pasan sin tocar a la llamada subyacente a `ST_AsGML`.

El parámetro `visitedTable` se utiliza para realizar un seguimiento de los elementos de nodo y arista visitados de modo que se utilicen referencias cruzadas (`xlink:xref`) en lugar de duplicar las definiciones. Se espera que la tabla tenga (al menos) dos campos enteros: `'element_type'` y `'element_id'`. El usuario que llama debe tener privilegios de lectura y escritura en la tabla dada. Para el mejor funcionamiento, un índice se debe definir en `element_type` y `element_id`, en ese orden. Dicho índice se crearía automáticamente añadiendo una restricción única a los campos. Ejemplo:

```
CREATE TABLE visited (
  element_type integer, element_id integer,
  unique(element_type, element_id)
);
```

El parámetro `idprefix`, si se da, se añadirá a los identificadores de etiquetas Edge y Node.

El parámetro `gmlver`, si se da, se pasará al `ST_AsGML` subyacente. Valor predeterminado a 3.

Disponibilidad: 2.0.0

Ejemplos

Este usa la geometría topográfica creada en [CreateTopoGeom](#)

```
SELECT topology.AsGML(topo) As rdgml
FROM ri.roads
WHERE road_name = 'Unknown';

-- rdgml--
<gml:TopoCurve>
  <gml:directedEdge>
    <gml:Edge gml:id="E1">
      <gml:directedNode orientation="-">
        <gml:Node gml:id="N1"/>
      </gml:directedNode>
      <gml:directedNode>
    </gml:directedNode>
    <gml:curveProperty>
      <gml:Curve srsName="urn:ogc:def:crs:EPSG::3438">
        <gml:segments>
          <gml:LineStringSegment>
            <gml:posList srsDimension="2">
>384744 236928 384750 236923 384769 236911 384799 236895 384811 236890
```

```

384833 236884 384844 236882 384866 236881 384879 236883 384954 ←
236898 385087 236932 385117 236938
385167 236938 385203 236941 385224 236946 385233 236950 385241 ←
236956 385254 236971
385260 236979 385268 236999 385273 237018 385273 237037 385271 ←
237047 385267 237057 385225 237125
385210 237144 385192 237161 385167 237192 385162 237202 385159 ←
237214 385159 237227 385162 237241
385166 237256 385196 237324 385209 237345 385234 237375 385237 ←
237383 385238 237399 385236 237407
385227 237419 385213 237430 385193 237439 385174 237451 385170 ←
237455 385169 237460 385171 237475
385181 237503 385190 237521 385200 237533 385206 237538 385213 ←
237541 385221 237542 385235 237540 385242 237541
385249 237544 385260 237555 385270 237570 385289 237584 385292 ←
237589 385291 237596 385284 237630</gml:posList>
    </gml:LineStringSegment>
  </gml:segments>
</gml:Curve>
</gml:curveProperty>
</gml:Edge>
</gml:directedEdge>
</gml:TopoCurve
>

```

Mismo ejercicio que el anterior sin espacio de nombre.

```

SELECT topology.AsGML(topo, '') As rdgml
FROM ri.roads
WHERE road_name = 'Unknown';

-- rdgml--
<TopoCurve>
  <directedEdge>
    <Edge id="E1">
      <directedNode orientation="--">
        <Node id="N1"/>
      </directedNode>
      <directedNode
></directedNode>
      <curveProperty>
        <Curve srsName="urn:ogc:def:crs:EPSG::3438">
          <segments>
            <LineStringSegment>
              <posList srsDimension="2"
>384744 236928 384750 236923 384769 236911 384799 236895 384811 236890
384833 236884 384844 236882 384866 236881 384879 236883 384954 ←
236898 385087 236932 385117 236938
385167 236938 385203 236941 385224 236946 385233 236950 385241 ←
236956 385254 236971
385260 236979 385268 236999 385273 237018 385273 237037 385271 ←
237047 385267 237057 385225 237125
385210 237144 385192 237161 385167 237192 385162 237202 385159 ←
237214 385159 237227 385162 237241
385166 237256 385196 237324 385209 237345 385234 237375 385237 ←
237383 385238 237399 385236 237407
385227 237419 385213 237430 385193 237439 385174 237451 385170 ←
237455 385169 237460 385171 237475
385181 237503 385190 237521 385200 237533 385206 237538 385213 ←
237541 385221 237542 385235 237540 385242 237541
385249 237544 385260 237555 385270 237570 385289 237584 385292 ←
237589 385291 237596 385284 237630</posList>

```

```

        </LineStringSegment>
      </segments>
    </Curve>
  </curveProperty>
</Edge>
</directedEdge>
</TopoCurve
>

```

Ver también

[CreateTopoGeom](#), [ST_CreateTopoGeo](#)

10.12.2 AsTopoJSON

AsTopoJSON — Devuelve la representación TopoJSON de una topogeometry.

Synopsis

```
text AsTopoJSON(topogeometry tg, regclass edgeMapTable);
```

Descripción

Devuelve la representación TopoJSON de un topogeometry. Si `edgeMapTable` no es nulo, se utilizará como una asignación de búsqueda/almacenamiento de identificadores de arista para los índices de arco.. Esto es para poder permitir un array compacto de "arcos" en el documento final.

Se espera que la tabla, si se da, tenga un campo "arc_id" de tipo "serial" y un "edge_id" de tipo entero; el código consultará la tabla para "edge_id", por lo que se recomienda agregar un índice en ese campo.



Note

Los índices de arco en la salida TopoJSON son de base 0, pero están en base 1 en la tabla "edgeMapTable".

Un documento completo de TopoJSON será necesario contener, además de los fragmentos devueltos por esta función, los arcos reales más algunos encabezados. Ver también la [especificación TopoJSON](#).

Disponibilidad: 2.1.0

Mejora: 2.2.1 agrega soporte para entradas puntuales.

Ver también

[ST_AsGeoJSON](#)

Ejemplos

```

CREATE TEMP TABLE edgemap(arc_id serial, edge_id int unique);

-- encabezado
SELECT '{ "type": "Topology", "transform": { "scale": [1,1], "translate": [0,0] }, "objects ←
      ": {'

```

```

-- objetos
UNION ALL SELECT ' ' || feature_name || ' ': ' || AsTopoJSON(feature, 'edgemap')
FROM features.big_parcelas WHERE feature_name = 'P3P4';

-- arcos
WITH edges AS (
  SELECT m.arc_id, e.geom FROM edgemap m, city_data.edge e
  WHERE e.edge_id = m.edge_id
), points AS (
  SELECT arc_id, (st_dumppoints(geom)).* FROM edges
), compare AS (
  SELECT p2.arc_id,
    CASE WHEN p1.path IS NULL THEN p2.geom
    ELSE ST_Translate(p2.geom, -ST_X(p1.geom), -ST_Y(p1.geom))
  END AS geom
  FROM points p2 LEFT OUTER JOIN points p1
  ON ( p1.arc_id = p2.arc_id AND p2.path[1] = p1.path[1]+1 )
  ORDER BY arc_id, p2.path
), arcsdump AS (
  SELECT arc_id, (regexp_matches( ST_AsGeoJSON(geom), '\[.*\]'))[1] as t
  FROM compare
), arcs AS (
  SELECT arc_id, '[' || array_to_string(array_agg(t), ',') || ']' as a FROM arcsdump
  GROUP BY arc_id
  ORDER BY arc_id
)
SELECT '}', "arcs": [' UNION ALL
SELECT array_to_string(array_agg(a), E',\n') from arcs

-- pie
UNION ALL SELECT '}}':::text as t;

-- Resultado:
{ "type": "Topology", "transform": { "scale": [1,1], "translate": [0,0] }, "objects": {
"P3P4": { "type": "MultiPolygon", "arcs": [[[-1]], [[6,5,-5,-4,-3,1]]]
}, "arcs": [
  [[25,30],[6,0],[0,10],[-14,0],[0,-10],[8,0]],
  [[35,6],[0,8]],
  [[35,6],[12,0]],
  [[47,6],[0,8]],
  [[47,14],[0,8]],
  [[35,22],[12,0]],
  [[35,14],[0,8]]
]]
}

```

10.13 Relaciones espaciales de topología

10.13.1 Equals

Equals — Devuelve true si dos topogeometries están compuestas de las mismas primitivas topológicas.

Synopsis

boolean **Equals**(topogeometry tg1, topogeometry tg2);

Descripción

Devuelve verdadero si dos topogeometries se componen de las mismas primitivas de topología: caras, aristas, nodos.

**Note**

Esta función no es compatible con topogeometries que son colecciones de geometría. Tampoco puede comparar topogeometries de diferentes topologías.

Disponibilidad: 1.1.0



This function supports 3d and will not drop the z-index.

Ejemplos**Ver también**

[GetTopoGeomElements](#), [ST_Equals](#)

10.13.2 Intersects

Intersects — Devuelve verdadero si cualquier par de primitivas de las dos topogeometries se intersectan.

Synopsis

boolean **Intersects**(topogeometry tg1, topogeometry tg2);

Descripción

Devuelve verdadero si cualquier par de primitivas de las dos topogeometries se intersectan.

**Note**

Esta función no es compatible con topogeometries que son colecciones de geometría. Tampoco puede comparar topogeometries de diferentes topologías. También no se admite actualmente para topogeometrías jerárquicas (topogeometrías compuestas de otras topogeometrías).

Disponibilidad: 1.1.0



This function supports 3d and will not drop the z-index.

Ejemplos**Ver también**

[ST_Intersects](#)

10.14 Importing and exporting Topologies

Once you have created topologies, and maybe associated topological layers, you might want to export them into a file-based format for backup or transfer into another database.

Using the standard dump/restore tools of PostgreSQL is problematic because topologies are composed by a set of tables (4 for primitives, an arbitrary number for layers) and records in metadata tables (topology.topology and topology.layer). Additionally, topology identifiers are not univoque across databases so that parameter of your topology will need to be changes upon restoring it.

In order to simplify export/restore of topologies a pair of executables are provided: `pgtopo_export` and `pgtopo_import`. Example usage:

```
pgtopo_export dev_db topol | pgtopo_import topol | psql staging_db
```

10.14.1 Using the Topology exporter

The `pgtopo_export` script takes the name of a database and a topology and outputs a dump file which can be used to import the topology (and associated layers) into a new database.

By default `pgtopo_export` writes the dump file to the standard output so that it can be piped to `pgtopo_import` or redirected to a file (refusing to write to terminal). You can optionally specify an output filename with the `-f` commandline switch.

By default `pgtopo_export` includes a dump of all layers defined against the given topology. This may be more data than you need, or may be non-working (in case your layer tables have complex dependencies) in which case you can request skipping the layers with the `--skip-layers` switch and deal with those separately.

Invoking `pgtopo_export` with the `--help` (or `-h` for short) switch will always print short usage string.

The dump file format is a compressed tar archive of a `pgtopo_export` directory containing at least a `pgtopo_dump_version` file with format version info. As of version 1 the directory contains tab-delimited CSV files with data of the topology primitive tables (node, edge_data, face, relation), the topology and layer records associated with it and (unless `--skip-layers` is given) a custom-format PostgreSQL dump of tables reported as being layers of the given topology.

10.14.2 Using the Topology importer

The `pgtopo_import` script takes a `pgtopo_export` format topology dump and a name to give to the topology to be created and outputs an SQL script reconstructing the topology and associated layers.

The generated SQL file will contain statements that create a topology with the given name, load primitive data in it, restores and registers all topology layers by properly linking all TopoGeometry values to their correct topology.

By default `pgtopo_import` reads the dump from the standard input so that it can be used in conjunction with `pgtopo_export` in a pipeline. You can optionally specify an input filename with the `-f` commandline switch.

By default `pgtopo_import` includes in the output SQL file the code to restore all layers found in the dump.

This may be unwanted or non-working in case your target database already have tables with the same name as the ones in the dump. In that case you can request skipping the layers with the `--skip-layers` switch and deal with those separately (or later).

SQL to only load and link layers to a named topology can be generated using the `--only-layers` switch. This can be useful to load layers AFTER resolving the naming conflicts or to link layers to a different topology (say a spatially-simplified version of the starting topology).

Chapter 11

Gestión, Consulta y Aplicaciones de Datos Raster

11.1 Cargando y Creando Rasters

En la mayoría de casos, crearás rasters PostGIS cargando un fichero raster utilizando el paquete de carga raster `raster2pgsql`.

11.1.1 Utilizar el paquete `raster2pgsql` para cargar rasters

El ejecutable `raster2pgsql` es un cargador de datos raster que carga formatos raster soportados por GDAL en una consulta sql para ejecutarla en una tabla PostGIS. Es capaz de cargar carpetas de ficheros raster y crear previsualizaciones de los raster.

Since the `raster2pgsql` is compiled as part of PostGIS most often (unless you compile your own GDAL library), the raster types supported by the executable will be the same as those compiled in the GDAL dependency library. To get a list of raster types your particular `raster2pgsql` supports use the `-G` switch. These should be the same as those provided by your PostGIS install documented here [ST_GDALDrivers](#) if you are using the same GDAL library for both.



Note

La versión mas antigua de esta herramienta era un script python. El ejecutable ha reemplazado el script python. Si todavía necesitas Ejemplos del Script Python del ejecutable en python los puedes encontrar en [GDAL PostGIS Raster Driver Usage](#). Fijate que el script python `raster2pgsql` no funcionará en versiones futuras de PostGIS raster y no sera soportado.



Note

Cuando creamos previsualizaciones de un factor específico de un conjunto de rasters que están alineados, es posible que las previsualizaciones no estén alineadas. Visita <http://trac.osgeo.org/postgis/ticket/1764> para un ejemplo donde las previsualizaciones no se alinean.

EJEMPLO DE USO:

```
raster2pgsql aquí_van_opciones_raster fichero_raster nombre_esquema.nombre_tabla > salida. ↵
sql
```

-? Muestra la pantalla de ayuda. También se mostrará la ayuda si no incluyes ningún argumento.

-G Imprime los formatos raster soportados.

(claldlp) Estas opciones son exclusivas de forma mutua:

- c Crea una nueva tabla y la rellena con el raster(s). *Esta es la opción por defecto.*
- a Añade el/los raster/s a una tabla existente.
- d Borra la tabla, crea una nueva y la rellena con el/los raster(s)
- p Modo preparación, solo crea la tabla.

Procesamiento Raster: Añade condiciones para registrar de forma limpia en el catalogo raster

- C Añade restricciones raster --srid, tamaño del pixel, etc. para asegurar que el raster es registrado de forma correcta en la vista `raster_columns`.
- x Desactiva la opción de restricción de maxima extensión. Solo se aplica si la opción -C esta en uso.
- r Establezca las restricciones (espacialmente única y tesela de cobertura) para el bloqueo regular. Sólo se aplica si la la bandera -C también está en uso.

Procesado Raster: Parámetros opcionales utilizados para manipular la entrada de datos raster

- s <SRID> Asigna un SRID específico al raster de salida. Si no se especifica o es igual a 0, se comprueban los metadatos del raster para determinar un SRID apropiado.
- b **BAND** Índice (en base 1) de la banda para extraer del raster. Para índices de mas de una banda, separalo con comas(.). Si no se especifica, se extraerán todas las bandas del raster.
- t **TILE_SIZE** Cortar el ráster en teselas para ser insertadas una por una en registros de la tabla. `TILE_SIZE` se expresa como `ANCHOxALTO` o establecer el valor "auto" para permitir que se cargue a la computadora en un tamaño de tesela apropiado utilizando el primer ráster y aplicarlo a todos los rásters.
- P Pad right-most and bottom-most tiles to guarantee that all tiles have the same width and height.
- R, --register Registra el raster como un fichero de sistema (out-db) raster.
Solo los metadatos del raster y el camino de acceso al raster se almacenan en la base de datos (no los pixeles).
- l **OVERVIEW_FACTOR** Crear una previsualización del ráster. Para más de un factor, separar con coma(.). El nombre de la tabla de la previsualización sigue el patrón `o_factor de previsualización_tabla`, donde `factor previsualización` es un marcador de posición para el factor de previsualización numérica y `tabla` se reemplaza con el nombre de la tabla base. La previsualización creada es almacenada en la base de datos y no se afecta por -R. Tenga en cuenta que su archivo sql generado contendrá ambas, la tabla principal y las tablas de previsualización.
- N **NODATA** Valor NODATA para utilizar en bandas con valores NODATA.

Parametros opcionales para manipular objetos de la base de datos

- f **COLUMN** Especifica el nombre de la columna raster de destino , por defecto es 'rast'
- F Añade una columna con el nombre del fichero
- n **COLUMN** Specify the name of the filename column. Implies -F.
- q Wrap PostgreSQL identifiers in quotes.
- I Crea un indice GiST de la columna raster.
- M Ejecuta Vacuum analyze en la tabla raster.
- k Keeps empty tiles and skips NODATA value checks for each raster band. Note you save time in checking, but could end up with far more junk rows in your database and those junk rows are not marked as empty tiles.
- T **tablespace** Especifica el "tablespace" de la nueva tabla. Observa que los indices (incluyendo el de clave primaria) seguirá utilizando en "tablespace" a menos que se utilice también la opción -X.
- X **tablespace** Especifica el "tablespace" para el nuevo indice de la tabla. Esto se aplica a los indices de claves primarias y indices espaciales si la opción -I se esta usando.
- Y **max_rows_per_copy=50** Use copy statements instead of insert statements. Optionally specify `max_rows_per_copy`; default 50 when not specified.

- e Ejecuta cada comando de forma individual, no utiliza transacciones.

-E ENDIAN Controla el formato en el que se almacenan los datos de más de un byte (endianness) de la salida binaria generada del raster; especifica 0 para XDR y 1 para NDR (por defecto); solo las salidas NDR están soportadas actualmente.

-V versión Especifica la version del formato de salida. Por defecto es 0. Solo 0 esta soportado actualmente.

Un ejemplo de sesión utilizando el cargador para crear un fichero de entrada y cargarlo cortado en teselas de 100x100 debería parecerse a:



Note

Puedes omitir el nombre del esquema, por ejemplo `demelevation` en vez de `public.demelevation` creará la tabla raster en el esquema por defecto de la base de datos del usuario.

```
raster2pgsql -s 4326 -I -C -M *.tif -F -t 100x100 public.demelevation
> elev.sql
psql -d gisdb -f elev.sql
```

Se puede hacer una conversion y carga en un solo paso con el caracter "|" en sistemas UNIX:

```
raster2pgsql -s 4326 -I -C -M *.tif -F -t 100x100 public.demelevation | psql -d gisdb
```

Carga las teselas planas métricas aéreas de los Raster del estado Massachusetts en un esquema denominado `aerial` y crear una vista completa, y prevvisualizaciones de niveles 2 y 4, utiliza el modo de copia para insertar (sin archivo intermedio sólo directamente a db), y `-e` no fuerces todo en una transacción (bueno si quieres ver datos en tablas de inmediato sin tener que esperar). Divide los raster en teselas de 128x128 píxeles y aplica las restricciones de raster. Utiliza el modo copia en lugar de insertar en la tabla. `(-F)` Incluye un campo llamado nombre de archivo para contener el nombre del archivo de las teselas de donde proceden los cortes.

```
raster2pgsql -I -C -e -Y -F -s 26986 -t 128x128 -l 2,4 bostonaerials2008/*.jpg aerials. ←
boston | psql -U postgres -d gisdb -h localhost -p 5432
```

```
-- obtener una lista de los tipos de raster soportados:
raster2pgsql -G
```

El comando `-G` extrae una lista similar a esta:

```
Available GDAL raster formats:
Virtual Raster
GeoTIFF
National Imagery Transmission Format
Raster Product Format TOC format
ECRG TOC format
Erdas Imagine Images (.img)
CEOS SAR Image
CEOS Image
JAXA PALSAR Product Reader (Level 1.1/1.5)
Ground-based SAR Applications Testbed File Format (.gff)
ELAS
Arc/Info Binary Grid
Arc/Info ASCII Grid
GRASS ASCII Grid
SDTS Raster
DTED Elevation Raster
Portable Network Graphics
JPEG JFIF
In Memory Raster
Japanese DEM (.mem)
Graphics Interchange Format (.gif)
Graphics Interchange Format (.gif)
```

Envisat Image Format
Maptech BSB Nautical Charts
X11 Pixmap Format
MS Windows Device Independent Bitmap
SPOT DIMAP
AirSAR Polarimetric Image
RadarSat 2 XML Product
PCIDSK Database File
PCRaster Raster File
ILWIS Raster Map
SGI Image File Format 1.0
SRTMHGT File Format
Leveller heightfield
Terragen heightfield
USGS Astrogeology ISIS cube (Version 3)
USGS Astrogeology ISIS cube (Version 2)
NASA Planetary Data System
EarthWatch .TIL
ERMapper .ers Labelled
NOAA Polar Orbiter Level 1b Data Set
FIT Image
GRidded Binary (.grb)
Raster Matrix Format
EUMETSAT Archive native (.nat)
Idrisi Raster A.1
Intergraph Raster
Golden Software ASCII Grid (.grd)
Golden Software Binary Grid (.grd)
Golden Software 7 Binary Grid (.grd)
COSAR Annotated Binary Matrix (TerraSAR-X)
TerraSAR-X Product
DRDC COASP SAR Processor Raster
R Object Data Store
Portable Pixmap Format (netpbm)
USGS DOQ (Old Style)
USGS DOQ (New Style)
ENVI .hdr Labelled
ESRI .hdr Labelled
Generic Binary (.hdr Labelled)
PCI .aux Labelled
Vexcel MFF Raster
Vexcel MFF2 (HKV) Raster
Fuji BAS Scanner Image
GSC Geogrid
EOSAT FAST Format
VTP .bt (Binary Terrain) 1.3 Format
Erdas .LAN/.GIS
Convair PolGASP
Image Data and Analysis
NLAPS Data Format
Erdas Imagine Raw
DIPEX
FARSITE v.4 Landscape File (.lcp)
NOAA Vertical Datum .GTX
NADCON .los/.las Datum Grid Shift
NTv2 Datum Grid Shift
ACE2
Snow Data Assimilation System
Swedish Grid RIK (.rik)
USGS Optional ASCII DEM (and CDED)
GeoSoft Grid Exchange Format
Northwood Numeric Grid Format .grd/.tab

```

Northwood Classified Grid Format .grc/.tab
ARC Digitized Raster Graphics
Standard Raster Product (ASRP/USRP)
Magellan topo (.blx)
SAGA GIS Binary Grid (.sdatt)
Kml Super Overlay
ASCII Gridded XYZ
HF2/HFZ heightfield raster
OziExplorer Image File
USGS LULC Composite Theme Grid
Arc/Info Export E00 GRID
ZMap Plus Grid
NOAA NGS Geoid Height Grids

```

11.1.2 Crear rastres utilizando las funciones raster de PostGIS

En muchas ocasiones, querrás crear tablas raster en la base de datos. Existen una gran cantidad de funciones para hacerlo. Los pasos generales a seguir.

1. Crear una tabla con una columna raster para almacenar los nuevos registros raster se puede hacer de la siguiente manera:

```
CREATE TABLE myrasters(rid serial primary key, rast raster);
```

2. Existen muchas funciones de ayuda. Si no estas creando rasters con derivados de otro raster, entonces deberías comenzar con: **ST_MakeEmptyRaster**, seguido de **ST_AddBand**

También puedes crear rasters a partir de geometrias. Para conseguir esto deberás utilizar **ST_AsRaster** quizás acompañado de otras funciones como **ST_Union** o **ST_MapAlgebraFct** o cualquier otra de la familia de funciones de álgebra de mapas.

Incluso hay muchas más opciones para crear nuevas tablas raster a partir de las tablas existentes. Por ejemplo, puede crear una tabla raster en una proyección diferente de una existente utilizando **ST_Transform**

3. Una vez que hayas terminado de llenar la tabla, tendrás que crear un índice espacial en la columna raster con algo similar a:

```
CREATE INDEX myrasters_rast_st_convexhull_idx ON myrasters USING gist( ST_ConvexHull( ↔
rast) );
```

Observa que utilizamos **ST_ConvexHull** ya que muchas de las operaciones raster se basan en la envolvente convexa del raster.



Note

En versiones anteriores a PostGIS 2.0 los raster se basaban en la envolvente y no en la envolvente convexa. Para que los índices espaciales funcionen correctamente necesitaras borrarlos y reemplazarlos por los índices basados en la envolvente convexa.

4. Aplica las restricciones raster con **AddRasterConstraints**

11.1.3 Using "out db" cloud rasters

The `raster2pgsql` tool uses GDAL to access raster data, and can take advantage of a key GDAL feature: the ability to read from rasters that are **stored remotely** in cloud "object stores" (e.g. AWS S3, Google Cloud Storage).

Efficient use of cloud stored rasters requires the use of a "cloud optimized" format. The most well-known and widely used is the **"cloud optimized GeoTIFF"** format. Using a non-cloud format, like a JPEG, or an un-tiled TIFF will result in very poor performance, as the system will have to download the entire raster each time it needs to access a subset.

First, load your raster into the cloud storage of your choice. Once it is loaded, you will have a URI to access it with, either an "http" URI, or sometimes a URI specific to the service. (e.g., "s3://bucket/object"). To access non-public buckets, you will need to supply GDAL config options to authenticate your connection. Note that this command is *reading* from the cloud raster and *writing* to the database.

```
AWS_ACCESS_KEY_ID=xxxxxxxxxxxxxxxxxxxxxx \
AWS_SECRET_ACCESS_KEY=xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx \
raster2pgsql \
-s 990000 \
-t 256x256 \
-I \
-R \
/vsis3/your.bucket.com/your_file.tif \
your_table \
| psql your_db
```

Once the table is loaded, you need to give the database permission to read from remote rasters, by setting two permissions, `postgis.enable_outdb_rasters` and `postgis.gdal_enabled_drivers`.

```
SET postgis.enable_outdb_rasters = true;
SET postgis.gdal_enabled_drivers TO 'ENABLE_ALL';
```

To make the changes sticky, set them directly on your database. You will need to re-connect to experience the new settings.

```
ALTER DATABASE your_db SET postgis.enable_outdb_rasters = true;
ALTER DATABASE your_db SET postgis.gdal_enabled_drivers TO 'ENABLE_ALL';
```

For non-public rasters, you may have to provide access keys to read from the cloud rasters. The same keys you used to write the `raster2pgsql` call can be set for use inside the database, with the `postgis.gdal_config_options` configuration. Note that multiple options can be set by space-separating the key=value pairs.

```
SET postgis.gdal_vsi_options = 'AWS_ACCESS_KEY_ID=xxxxxxxxxxxxxxxxxxxxxx
AWS_SECRET_ACCESS_KEY=xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx';
```

Once you have the data loaded and permissions set you can interact with the raster table like any other raster table, using the same functions. The database will handle all the mechanics of connecting to the cloud data when it needs to read pixel data.

11.2 Catalogos raster

Existen dos vistas de catalogo raster que vienen en el paquete PostGIS. Ambas vistas utilizan información de las restricciones de las tablas raster. Como resultado, las vistas de catálogo tienen siempre consistencia con los datos raster de las tablas mientras que las restricciones son reforzadas.

1. La vista `raster_columns` cataloga todas las columnas raster de todas las tablas de la base de datos.
2. La vista `raster_overviews` cataloga todas las columnas raster de las tablas de la base de datos que sirven como previsualizaciones de tablas de grano más fino. Las tablas de este tipo se generan cuando utilizas la opción `-l` durante la carga.

11.2.1 Catalogo de columnas raster

El catálogo `raster_columns` es un catálogo de todas las columnas de la tablas raster en la base de datos que son de tipo raster. Es una vista que utiliza las restricciones de las tablas por lo que la información es siempre consistente, incluso si se restaura una tabla raster de una copia de seguridad de otra base de datos. Existen las siguientes columnas en el catálogo `raster_columns`.

Si has creado tus tablas sin el cargador o has olvidado especificar la variable `-C` del comando de carga durante la carga, puedes hacer cumplir las restricciones por defecto utilizando `AddRasterConstraints`, de este modo el catálogo `raster_columns` guardará la información mas común de tus teselas raster.

- `r_table_catalog` Contienen la tabla de la base de datos. Esto siempre leerá la base de datos actual.
- `r_table_schema` Esquema al que pertenece la tabla.
- `r_table_name` tabla raster
- `r_raster_column` Columna de la tabla `r_table_name` que es de tipo raster. No hay nada en PostGIS que impida tener múltiples columnas raster por tabla así que es posible tener varias veces la misma tabla raster en la lista con diferentes columnas cada vez.
- `srid` El identificador del sistema de referencia espacial del raster. Debe ser una de las entradas de la tabla [Section 4.5](#).
- `scale_x` Escala entre las coordenadas espaciales geométricas y el pixel. Esto esta disponible únicamente si todas las teselas de la columna raster tienen el mismo valor `scale_x` y se aplica la restricción. Para mas detalles visita [ST_ScaleX](#).
- `scale_y` Escala entre las coordenadas espaciales geométricas y el pixel. Esto esta disponible únicamente si todas las teselas de la columna raster tienen el mismo valor `scale_y` y se aplica la restricción `scale_y`. Para mas detalles visita [ST_ScaleY](#).
- `blocksize_x` Es el ancho (numero de pixeles en horizontal) de cada tesela raster. Para mas detalles visita [ST_Width](#).
- `blocksize_y` Es el ancho (numero de pixeles en vertical hacia abajo) de cada tesela raster. Para mas detalles visita [ST_Height](#).
- `same_alignment` Valor booleano que valdrá "True" si todas las teselas raster tienen el mismo alineamiento. Visita [ST_SameAlignment](#) para más información.
- `regular_blocking` Si la columna del ráster tiene las limitaciones de espacio único y de cobertura de tesela, el valor es TRUE. De lo contrario, será FALSE.
- `num_bands` Numero de bandas por tesela del conjunto de rasters. Es la misma información que la devuelta por [ST_NumBands](#)
- `pixel_types` Un array definiendo el tipo de pixel de cada banda. Tendrás el mismo numero de elementos en este array que el numero de bandas. Los `pixel_types` son uno de los definidos en [ST_BandPixelType](#).
- `nodata_values` Un array de números de doble precisión que define el valor `nodata_value` de cada banda. En este array deberás tener el mismo numero de elementos que el numero de bandas. Este numero define el valor de los pixeles de cada banda que deben ignorarse para la mayoría de operaciones. Esta información es similar a la proporcionada por [ST_BandNoDataValue](#).
- `out_db` Una colección de banderas booleanas indican si los datos de las bandas del ráster se mantienen fuera de la base de datos. Se tendrá el mismo número de elementos en esta colección como se tiene número de bandas.
- `extent` Esta es la extensión de todas las columnas raster en tu conjunto raster. Si planeas cargar mas datos que cambiarán la extensión del conjunto, deberás ejecutar la función [DropRasterConstraints](#) antes de la carga y después de la carga restablecer las restricciones con [AddRasterConstraints](#).
- `spatial_index` Un boolean es verdadero si la columna del ráster tiene un índice espacial.

11.2.2 Previsualizaciones raster

`raster_overviews` Los catálogos de información acerca de las columnas de tablas ráster utilizadas para las previsualizaciones e información adicional de ellos que son útiles para conocer cuando utilizar vistas generales. Las tablas de previsualización Overview tables están catalogados tanto en `raster_columns` y `raster_overviews` porque son rásters en su propio derecho pero también sirven a un propósito especial adicional de ser una caricatura de resolución baja o de una tabla de resolución alta. Estos se generan a lo largo de la tabla ráster principal cuando se utiliza el `-l` interruptor en la carga del ráster o se puede generar manualmente utilizando [AddOverviewConstraints](#).

Las tablas de previsualización contienen las mismas restricciones que cualquier tabla raster además de restricciones adicionales específicas a las previsualizaciones.

**Note**

La información de la tabla `raster_overviews` no duplica la información de `raster_columns`. Si necesitas información sobre una tabla de previsualizaciones pobremente en `raster_columns` puedes unir la tabla `raster_overviews` a `raster_columns` para obtener toda la información que necesitas.

Las dos principales razones de crear previsualizaciones son:

1. Tener una representación de baja resolución de las tablas principales para tener una respuesta rápida en operaciones de zoom-out.
2. Los cálculos son generalmente más rápidos en las previsualizaciones que en las imágenes de mayor resolución porque hay menos registros y cada pixel cubre más territorio. Aunque los cálculos no son tan precisos como en las tablas de alta resolución de las que provienen, pueden ser suficientes en muchos cálculos empíricos.

El catálogo `raster_overviews` contiene las siguientes columnas de información.

- `o_table_catalog` La base de datos a la cual pertenece la tabla de previsualizaciones. Esto siempre leerá la base de datos actual.
- `o_table_schema` El esquema de la base de datos al cual pertenece la tabla de previsualizaciones.
- `o_table_name` El nombre de la tala de previsualizaciones.
- `o_raster_column` La columna raster de la tabla de previsualizaciones.
- `r_table_catalog` La base de datos de la tabla raster para la cual esta previsualización sirve. Esto siempre va a leer la base de datos actual.
- `r_table_schema` El esquema de la base de datos de la tabla ráster al cual pertenecen estas previsualizaciones.
- `r_table_name` tabla raster para la cual sirven las previsualizaciones.
- `r_raster_column` la columna raster para la cual sirven estas previsualizaciones.
- `overview_factor` - este es el nivel de pirámide de la tabla de previsualizaciones . Cuanto más alto sea el número, más baja es la resolución de la tabla. Si se le da una carpeta de imágenes al comando `raster2pgsql`, se calcularán previsualizaciones de cada archivo de imagen y se cargarán por separado. El Nivel 1 supone siempre el archivo original. Nivel 2 tendrá cada tesela representada por 4 de la original. Por ejemplo, si tienes una carpeta de archivos de imagen de 5000x5000 pixeles que decidiste dividir en imágenes de 125x125 , para presentar cada imagen tu tabla base tendrá $(5000*5000)/(125*125)=1.600$ registros , tu tabla ($l=2$) `o_2` tendrá un tope de $(1600/Potencia(2,2))=400$ filas , tu ($l=3$) `o_3` tendrá un tope de $(1600/Potencia(2,3)) = 200$ filas. Si los píxeles no son divisibles por el tamaño de tus teselas , obtendrás algunas de relleno (teselas no completamente llenas) . Ten en cuenta que cada tesela de previsualización generada por el comando `raster2pgsql` tiene el mismo número de pixeles que la tesela de origen , pero es de menor resolución que cada pixel de la que representa ($Potencia(2,factor_de_previsualizacion)$ pixeles del original) .

11.3 Contruyendo aplicaciones personalizadas con PostGIS Raster

The fact that PostGIS raster provides you with SQL functions to render rasters in known image formats gives you a lot of options for rendering them. For example you can use OpenOffice / LibreOffice for rendering as demonstrated in [Rendering PostGIS Raster graphics with LibreOffice Base Reports](#). In addition you can use a wide variety of languages as demonstrated in this section.

11.3.1 Ejemplo de salida utilizando ST_AsPNG junto con otras opciones raster en PHP

En esta sección, mostraremos como utilizar el driver PHP PostgreSQL y la familia de funciones **ST_AsGDALRaster** para extraer las bandas 1,2,3 de un raster a una consulta PHP que puede incluirse como una marca html img src.

La consulta de ejemplo muestra cómo combinar un montón de funciones de mapa de bits juntos para obtener todas las teselas que se cruzan con un cuadro delimitador en wgs84 en particular y luego unimos las teselas que intersectan con **ST_Union** devolviendo todas las bandas, transformadas al sistema de proyección específico del usuario con **ST_Transform**, y luego enviamos el resultado como un png con **ST_AsPNG**.

Se podría llamar a la continuación utilizando

```
http://mywebserver/test_raster.php?srid=2249
```

para obtener la imagen raster en pies del estado de Massachusetts.

```
<?php
/** contents of test_raster.php */
$conn_str = 'dbname=mydb host=localhost port=5432 user=myuser password=mypwd';
$dbconn = pg_connect($conn_str);
header('Content-Type: image/png');
/**If a particular projection was requested use it otherwise use mass state plane meters ←
**/
if (!empty( $_REQUEST['srid'] ) && is_numeric( $_REQUEST['srid'] ) ){
    $input_srid = intval($_REQUEST['srid']);
}
else { $input_srid = 26986; }
/** The set bytea_output may be needed for PostgreSQL 9.0+, but not for 8.4 **/
$sql = "set bytea_output='escape';
SELECT ST_AsPNG(ST_Transform(
    ST_AddBand(ST_Union(rast,1), ARRAY[ST_Union(rast,2),ST_Union(rast ←
    ,3]))
    , $input_srid) ) As new_rast
FROM aerials.boston
WHERE
    ST_Intersects(rast, ST_Transform(ST_MakeEnvelope(-71.1217, 42.227, -71.1210, ←
    42.218,4326),26986) )";
$result = pg_query($sql);
$row = pg_fetch_row($result);
pg_free_result($result);
if ($row === false) return;
echo pg_unescape_bytea($row[0]);
?>
```

11.3.2 Ejemplo de salida utilizando ST_AsPNG junto con otras opciones raster en ASP.NET C#

En esta sección, mostraremos como utilizar el driver Npgsql PostgreSQL .NET y la familia de funciones **ST_AsGDALRaster** para extraer las bandas 1,2,3 de un raster a una consulta PHP que puede incluirse como una marca html imgv src.

Necesitarás el driver npgsql .NET PostgreSQL para este ejercicio que puedes obtener en <http://npgsql.projects.postgresql.org/> en su última versión. Simplemente descarga la última versión y cópialo en tu carpeta bin de ASP.NET y ya estarás listo para seguir.

La consulta de ejemplo muestra cómo combinar un montón de funciones de mapa de bits juntos para obtener todas las teselas que se cruzan con un cuadro delimitador en wgs84 en particular y luego unimos las teselas que intersectan con **ST_Union** devolviendo todas las bandas, transformadas al sistema de proyección específico del usuario con **ST_Transform**, y luego enviamos el resultado como un png con **ST_AsPNG**.

Este ejemplo es el mismo que el ejemplo Section 11.3.1 salvo que este esta implementado en C#.

Puedes llamar a este método utilizando

```
http://mywebserver/TestRaster.ashx?srid=2249
```

para obtener la imagen raster en coordenadas planas en pies del estado de Massachusetts.

```
-- web.config connection string section --
<connectionStrings>
  <add name="DSN"
    connectionString="server=localhost;database=mydb;Port=5432;User Id=myuser;password= ↵
    mypwd"/>
</connectionStrings>
```

```
// Code for TestRaster.ashx
<%@ WebHandler Language="C#" Class="TestRaster" %>
using System;
using System.Data;
using System.Web;
using Npgsql;

public class TestRaster : IHttpHandler
{
    public void ProcessRequest(HttpContext context)
    {
        context.Response.ContentType = "image/png";
        context.Response.BinaryWrite(GetResults(context));
    }

    public bool IsReusable {
        get { return false; }
    }

    public byte[] GetResults(HttpContext context)
    {
        byte[] result = null;
        NpgsqlCommand command;
        string sql = null;
        int input_srid = 26986;
        try {
            using (NpgsqlConnection conn = new NpgsqlConnection(System. ↵
                Configuration.ConfigurationManager.ConnectionStrings["DSN"]. ↵
                ConnectionString)) {
                conn.Open();

                if (context.Request["srid"] != null)
                {
                    input_srid = Convert.ToInt32(context.Request["srid"]);
                }
                sql = @"SELECT ST_AsPNG(
                    ST_Transform(
                        ST_AddBand(
                            ST_Union(rast,1), ARRAY[ST_Union(rast,2),ST_Union(rast,3)] )
                            ,:input_srid) ) As new_rast
                FROM aerials.boston
                WHERE
                    ST_Intersects(rast,
                        ST_Transform(ST_MakeEnvelope(-71.1217, 42.227, ↵
                            -71.1210, 42.218,4326),26986) )";
                command = new NpgsqlCommand(sql, conn);
                command.Parameters.Add(new NpgsqlParameter("input_srid", input_srid));

                result = (byte[]) command.ExecuteScalar();
                conn.Close();
            }
        }
    }
}
```

```

    }

    }
    catch (Exception ex)
    {
        result = null;
        context.Response.Write(ex.Message.Trim());
    }
    return result;
}
}

```

11.3.3 Aplicación de consola Java que extrae un raster como un fichero de imagen

Esta es una aplicación simple de la consola java que toma una consulta y devuelve una imagen y la extrae a un fichero especificado.

Puedes descargar el último driver PostgreSQL JDBC desde <http://jdbc.postgresql.org/download.html>

Puedes compilar el siguiente código utilizando un comando similar a este:

```

set env CLASSPATH ../../postgresql-9.0-801.jdbc4.jar
javac SaveQueryImage.java
jar cfm SaveQueryImage.jar Manifest.txt *.class

```

Y llamarlo desde la linea de comandos de forma similar a:

```

java -jar SaveQueryImage.jar "SELECT ST_AsPNG(ST_AsRaster(ST_Buffer(ST_Point(1,5),10, ' ↵
quad_segs=2'),150, 150, '8BUI',100));" "test.png"

```

```

-- Manifest.txt --
Class-Path: postgresql-9.0-801.jdbc4.jar
Main-Class: SaveQueryImage

```

```

// Code for SaveQueryImage.java
import java.sql.Connection;
import java.sql.SQLException;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.io.*;

public class SaveQueryImage {
    public static void main(String[] argv) {
        System.out.println("Checking if Driver is registered with DriverManager.");

        try {
            //java.sql.DriverManager.registerDriver (new org.postgresql.Driver());
            Class.forName("org.postgresql.Driver");
        }
        catch (ClassNotFoundException cnfe) {
            System.out.println("Couldn't find the driver!");
            cnfe.printStackTrace();
            System.exit(1);
        }

        Connection conn = null;

        try {
            conn = DriverManager.getConnection("jdbc:postgresql://localhost:5432/mydb","myuser ↵
            ", "mypwd");

```

```

conn.setAutoCommit(false);

PreparedStatement sGetImg = conn.prepareStatement(argv[0]);

ResultSet rs = sGetImg.executeQuery();

    FileOutputStream fout;
    try
    {
        rs.next();
        /** Output to file name requested by user */
        fout = new FileOutputStream(new File(argv[1]) );
        fout.write(rs.getBytes(1));
        fout.close();
    }
    catch(Exception e)
    {
        System.out.println("Can't create file");
        e.printStackTrace();
    }

    rs.close();
    sGetImg.close();
    conn.close();
}
catch (SQLException se) {
    System.out.println("Couldn't connect: print out a stack trace and exit.");
    se.printStackTrace();
    System.exit(1);
}
}
}

```

11.3.4 Utilizar PLPython para extraer imágenes vía SQL

Este es una función de almacenamiento plpython que crea un archivo en el directorio del servidor por cada registro. Requiere que tenga instalado plpython. Deberá trabajar bien con ambos plpythonu y plpython3u.

```

CREATE OR REPLACE FUNCTION write_file (param_bytes bytea, param_filepath text)
RETURNS text
AS $$
f = open(param_filepath, 'wb+')
f.write(param_bytes)
return param_filepath
$$ LANGUAGE plpythonu;

```

```

--write out 5 images to the PostgreSQL server in varying sizes
-- note the postgresql daemon account needs to have write access to folder
-- this echos back the file names created;
SELECT write_file(ST_AsPNG(
    ST_AsRaster(ST_Buffer(ST_Point(1,5),j*5, 'quad_segs=2'),150*j, 150*j, '8BUI',100)),
    'C:/temp/slices'|| j || '.png')
FROM generate_series(1,5) As j;

write_file
-----
C:/temp/slices1.png
C:/temp/slices2.png
C:/temp/slices3.png
C:/temp/slices4.png

```

C:/temp/slices5.png

11.3.5 Extraer un raster con PSQL

Sadly PSQL doesn't have easy to use built-in functionality for outputting binaries. This is a bit of a hack that piggy backs on PostgreSQL somewhat legacy large object support. To use first launch your psql commandline connected to your database.

A diferencia del enfoque de python, este, crea el fichero en tu equipo local.

```
SELECT oid, lowrite(lo_open(oid, 131072), png) As num_bytes
FROM
( VALUES (lo_create(0),
  ST_AsPNG( (SELECT rast FROM aerals.boston WHERE rid=1) )
) ) As v(oid,png);
-- you'll get an output something like --
oid      | num_bytes
-----+-----
2630819 |      74860

-- next note the oid and do this replacing the c:/test.png to file path location
-- on your local computer
\lo_export 2630819 'C:/temp/aerial_samp.png'

-- this deletes the file from large object storage on db
SELECT lo_unlink(2630819);
```

Chapter 12

Raster Reference

The functions given below are the ones which a user of PostGIS Raster is likely to need and which are currently available in PostGIS Raster. There are other functions which are required support functions to the raster objects which are not of use to a general user.

`raster` is a new PostGIS type for storing and analyzing raster data.

For loading rasters from raster files please refer to Section 11.1

For the examples in this reference we will be using a raster table of dummy rasters - Formed with the following code

```
CREATE TABLE dummy_rast(rid integer, rast raster);
INSERT INTO dummy_rast(rid, rast)
VALUES (1,
('01' -- little endian (uint8 ndr)
||
'0000' -- version (uint16 0)
||
'0000' -- nBands (uint16 0)
||
'000000000000000040' -- scaleX (float64 2)
||
'0000000000000000840' -- scaleY (float64 3)
||
'000000000000E03F' -- ipX (float64 0.5)
||
'000000000000E03F' -- ipY (float64 0.5)
||
'0000000000000000' -- skewX (float64 0)
||
'0000000000000000' -- skewY (float64 0)
||
'00000000' -- SRID (int32 0)
||
'0A00' -- width (uint16 10)
||
'1400' -- height (uint16 20)
)::rast
),
-- Raster: 5 x 5 pixels, 3 bands, PT_8BUI pixel type, NODATA = 0
(2, ('01000003009A9999999999A93F9A9999999999A9BF000000E02B274A' ||
'410000000077195641000000000000000000000000000000000000000000000000 ←
FFFFFFFFFF050005000400FDFFDFEFDFEFDFEFDF9FAFEF' ||
' ←
EFCF9FBFDFEFDFCFEFEFEFE04004E627AADD16076B4F9FE6370A9F5FE59637AB0E54F58617087040046566487A1506C
')::rast);
```

12.1 Raster Support Data types

12.1.1 geomval

geomval — A spatial datatype with two fields - **geom** (holding a geometry object) and **val** (holding a double precision pixel value from a raster band).

Description

geomval is a compound data type consisting of a geometry object referenced by the **.geom** field and **val**, a double precision value that represents the pixel value at a particular geometric location in a raster band. It is used by the **ST_DumpAsPolygon** and Raster intersection family of functions as an output type to explode a raster band into geometry polygons.

See Also

Section [15.6](#)

12.1.2 addbandarg

addbandarg — A composite type used as input into the **ST_AddBand** function defining the attributes and initial value of the new band.

Description

A composite type used as input into the **ST_AddBand** function defining the attributes and initial value of the new band.

index integer 1-based value indicating the position where the new band will be added amongst the raster's bands. If NULL, the new band will be added at the end of the raster's bands.

pixeltype text Pixel type of the new band. One of defined pixel types as described in [ST_BandPixelType](#).

initialvalue double precision Initial value that all pixels of new band will be set to.

nodataval double precision NODATA value of the new band. If NULL, the new band will not have a NODATA value assigned.

See Also

[ST_AddBand](#)

12.1.3 rastbandarg

rastbandarg — A composite type for use when needing to express a raster and a band index of that raster.

Description

A composite type for use when needing to express a raster and a band index of that raster.

rast raster The raster in question/

nband integer 1-based value indicating the band of raster

See Also

[ST_MapAlgebra \(callback function version\)](#)

12.1.4 raster

raster — raster spatial data type.

Description

raster is a spatial data type used to represent raster data such as those imported from JPEGs, TIFFs, PNGs, digital elevation models. Each raster has 1 or more bands each having a set of pixel values. Rasters can be georeferenced.



Note Requires PostGIS be compiled with GDAL support. Currently rasters can be implicitly converted to geometry type, but the conversion returns the [ST_ConvexHull](#) of the raster. This auto casting may be removed in the near future so don't rely on it.

Casting Behavior

This section lists the automatic as well as explicit casts allowed for this data type

Cast To	Behavior
geometry	automatic

See Also

Chapter [12](#)

12.1.5 reclassarg

reclassarg — A composite type used as input into the ST_Reclass function defining the behavior of reclassification.

Description

A composite type used as input into the ST_Reclass function defining the behavior of reclassification.

nband integer The band number of band to reclassify.

reclassexpr text range expression consisting of comma delimited range:map_range mappings. : to define mapping that defines how to map old band values to new band values. (means >,) means less than,] < or equal, [means > or equal

1.

[a-b] = a <= x <= b
2.

(a-b) = a < x <= b
3.

[a-b) = a <= x < b
4.

(a-b) = a < x < b

(notation is optional so a-b means the same as (a-b)

pixeltype text One of defined pixel types as described in [ST_BandPixelType](#)

nodataval double precision Value to treat as no data. For image outputs that support transparency, these will be blank.

Example: Reclassify band 2 as an 8BUI where 255 is nodata value

```
SELECT ROW(2, '0-100:1-10, 101-500:11-150,501 - 10000: 151-254', '8BUI', 255)::reclassarg;
```

Example: Reclassify band 1 as an 1BB and no nodata value defined

```
SELECT ROW(1, '0-100]:0, (100-255:1', '1BB', NULL)::reclassarg;
```

See Also

[ST_Reclass](#)

12.1.6 summarystats

summarystats — A composite type returned by the [ST_SummaryStats](#) and [ST_SummaryStatsAgg](#) functions.

Description

A composite type returned by the [ST_SummaryStats](#) and [ST_SummaryStatsAgg](#) functions.

count integer Number of pixels counted for the summary statistics.

sum double precision Sum of all counted pixel values.

mean double precision Arithmetic mean of all counted pixel values.

stddev double precision Standard deviation of all counted pixel values.

min double precision Minimum value of counted pixel values.

max double precision Maximum value of counted pixel values.

See Also

[ST_SummaryStats](#), [ST_SummaryStatsAgg](#)

12.1.7 unionarg

unionarg — A composite type used as input into the [ST_Union](#) function defining the bands to be processed and behavior of the UNION operation.

Description

A composite type used as input into the [ST_Union](#) function defining the bands to be processed and behavior of the UNION operation.

nband integer 1-based value indicating the band of each input raster to be processed.

uniontype text Type of UNION operation. One of defined types as described in [ST_Union](#).

See Also

[ST_Union](#)

12.2 Raster Management

12.2.1 AddRasterConstraints

AddRasterConstraints — Adds raster constraints to a loaded raster table for a specific column that constrains spatial ref, scaling, blocksize, alignment, bands, band type and a flag to denote if raster column is regularly blocked. The table must be loaded with data for the constraints to be inferred. Returns true if the constraint setting was accomplished and issues a notice otherwise.

Synopsis

```
boolean AddRasterConstraints(name rasttable, name rastcolumn, boolean srid=true, boolean scale_x=true, boolean scale_y=true,
boolean blocksize_x=true, boolean blocksize_y=true, boolean same_alignment=true, boolean regular_blocking=false, boolean
num_bands=true , boolean pixel_types=true , boolean nodata_values=true , boolean out_db=true , boolean extent=true );
boolean AddRasterConstraints(name rasttable, name rastcolumn, text[] VARIADIC constraints);
boolean AddRasterConstraints(name rastschema, name rasttable, name rastcolumn, text[] VARIADIC constraints);
boolean AddRasterConstraints(name rastschema, name rasttable, name rastcolumn, boolean srid=true, boolean scale_x=true,
boolean scale_y=true, boolean blocksize_x=true, boolean blocksize_y=true, boolean same_alignment=true, boolean regular_blocking=false,
boolean num_bands=true, boolean pixel_types=true, boolean nodata_values=true , boolean out_db=true , boolean extent=true );
```

Description

Generates constraints on a raster column that are used to display information in the `raster_columns` raster catalog. The `rastschema` is the name of the table schema the table resides in. The `srid` must be an integer value reference to an entry in the `SPATIAL_REF_SYS` table.

`raster2pgsql` loader uses this function to register raster tables

Valid constraint names to pass in: refer to Section 11.2.1 for more details.

- `blocksize` sets both X and Y blocksize
- `blocksize_x` sets X tile (width in pixels of each tile)
- `blocksize_y` sets Y tile (height in pixels of each tile)
- `extent` computes extent of whole table and applies constraint all rasters must be within that extent
- `num_bands` number of bands
- `pixel_types` reads array of pixel types for each band ensure all band n have same pixel type
- `regular_blocking` sets spatially unique (no two rasters can be spatially the same) and coverage tile (raster is aligned to a coverage) constraints
- `same_alignment` ensures they all have same alignment meaning any two tiles you compare will return true for. Refer to [ST_SameAlignment](#).
- `srid` ensures all have same srid
- More -- any listed as inputs into the above functions



Note

This function infers the constraints from the data already present in the table. As such for it to work, you must create the raster column first and then load it with data.



Note

If you need to load more data in your tables after you have already applied constraints, you may want to run the `DropRasterConstraints` if the extent of your data has changed.

Availability: 2.0.0

Examples: Apply all possible constraints on column based on data

```
CREATE TABLE myrasters(rid SERIAL primary key, rast raster);
INSERT INTO myrasters(rast)
SELECT ST_AddBand(ST_MakeEmptyRaster(1000, 1000, 0.3, -0.3, 2, 2, 0, 0,4326), 1, '8BSI':: ←
    text, -129, NULL);

SELECT AddRasterConstraints('myrasters'::name, 'rast'::name);

-- verify if registered correctly in the raster_columns view --
SELECT srid, scale_x, scale_y, blocksize_x, blocksize_y, num_bands, pixel_types, ←
    nodata_values
FROM raster_columns
WHERE r_table_name = 'myrasters';

srid | scale_x | scale_y | blocksize_x | blocksize_y | num_bands | pixel_types | ←
nodata_values
-----+-----+-----+-----+-----+-----+-----+-----+
4326 |      2 |      2 |      1000 |      1000 |          1 | {8BSI}      | {0}
```

Examples: Apply single constraint

```
CREATE TABLE public.myrasters2(rid SERIAL primary key, rast raster);
INSERT INTO myrasters2(rast)
SELECT ST_AddBand(ST_MakeEmptyRaster(1000, 1000, 0.3, -0.3, 2, 2, 0, 0,4326), 1, '8BSI':: ↵
    text, -129, NULL);

SELECT AddRasterConstraints('public'::name, 'myrasters2'::name, 'rast'::name,' ↵
    regular_blocking', 'blocksize');
-- get notice--
NOTICE: Adding regular blocking constraint
NOTICE: Adding blocksize-X constraint
NOTICE: Adding blocksize-Y constraint
```

See Also

Section 11.2.1, ST_AddBand, ST_MakeEmptyRaster, DropRasterConstraints, ST_BandPixelType, ST_SRID

12.2.2 DropRasterConstraints

DropRasterConstraints — Drops PostGIS raster constraints that refer to a raster table column. Useful if you need to reload data or update your raster column data.

Synopsis

boolean **AddOverviewConstraints**(name ovschema, name ovtable, name ovcolumn, name refschema, name reftable, name refcolumn, int ovfactor);

boolean **AddOverviewConstraints**(name ovtable, name ovcolumn, name reftable, name refcolumn, int ovfactor);

Description

Adds constraints on a raster column that are used to display information in the `raster_overviews` raster catalog.

The `ovfactor` parameter represents the scale multiplier in the overview column: higher overview factors have lower resolution.

When the `ovschema` and `refschema` parameters are omitted, the first table found scanning the `search_path` will be used.

Availability: 2.0.0

Examples

```
CREATE TABLE res1 AS SELECT
ST_AddBand(
  ST_MakeEmptyRaster(1000, 1000, 0, 0, 2),
  1, '8BSI'::text, -129, NULL
) r1;

CREATE TABLE res2 AS SELECT
ST_AddBand(
  ST_MakeEmptyRaster(500, 500, 0, 0, 4),
  1, '8BSI'::text, -129, NULL
) r2;

SELECT AddOverviewConstraints('res2', 'r2', 'res1', 'r1', 2);

-- verify if registered correctly in the raster_overviews view --
SELECT o_table_name ot, o_raster_column oc,
       r_table_name rt, r_raster_column rc,
       overview_factor f
FROM raster_overviews WHERE o_table_name = 'res2';
  ot | oc | rt | rc | f
-----+-----+-----+-----+---
 res2 | r2 | res1 | r1 | 2
(1 row)
```

See Also

Section [11.2.2](#), [DropOverviewConstraints](#), [ST_CreateOverview](#), [AddRasterConstraints](#)

12.2.4 DropOverviewConstraints

DropOverviewConstraints — Untag a raster column from being an overview of another.

Synopsis

boolean **DropOverviewConstraints**(name ovschema, name ovtable, name ovcolumn);

boolean **DropOverviewConstraints**(name ovtable, name ovcolumn);

Description

Remove from a raster column the constraints used to show it as being an overview of another in the `raster_overviews` raster catalog.

When the `ovschema` parameter is omitted, the first table found scanning the `search_path` will be used.

Availability: 2.0.0

See Also

Section [11.2.2](#), [AddOverviewConstraints](#), [DropRasterConstraints](#)

12.2.5 PostGIS_GDAL_Version

`PostGIS_GDAL_Version` — Reports the version of the GDAL library in use by PostGIS.

Synopsis

text `PostGIS_GDAL_Version()`;

Description

Reports the version of the GDAL library in use by PostGIS. Will also check and report if GDAL can find its data files.

Examples

```
SELECT PostGIS_GDAL_Version();
       postgis_gdal_version
-----
GDAL 1.11dev, released 2013/04/13
```

See Also

[postgis.gdal_datapath](#)

12.2.6 PostGIS_Raster_Lib_Build_Date

`PostGIS_Raster_Lib_Build_Date` — Reports full raster library build date.

Synopsis

text `PostGIS_Raster_Lib_Build_Date()`;

Description

Reports raster build date

Examples

```
SELECT PostGIS_Raster_Lib_Build_Date();
postgis_raster_lib_build_date
-----
2010-04-28 21:15:10
```

See Also

[PostGIS_Raster_Lib_Version](#)

12.2.7 PostGIS_Raster_Lib_Version

PostGIS_Raster_Lib_Version — Reports full raster version and build configuration infos.

Synopsis

text **PostGIS_Raster_Lib_Version**();

Description

Reports full raster version and build configuration infos.

Examples

```
SELECT PostGIS_Raster_Lib_Version();
postgis_raster_lib_version
-----
2.0.0
```

See Also

[PostGIS_Lib_Version](#)

12.2.8 ST_GDALDrivers

ST_GDALDrivers — Returns a list of raster formats supported by PostGIS through GDAL. Only those formats with can_write=True can be used by ST_AsGDALRaster

Synopsis

setof record **ST_GDALDrivers**(integer OUT idx, text OUT short_name, text OUT long_name, text OUT can_read, text OUT can_write, text OUT create_options);

Description

Returns a list of raster formats `short_name`, `long_name` and creator options of each format supported by GDAL. Use the `short_name` as input in the `format` parameter of **ST_AsGDALRaster**. Options vary depending on what drivers your libgdal was compiled with. `create_options` returns an xml formatted set of `CreationOptionList/Option` consisting of name and optional `type`, `description` and set of `VALUE` for each creator option for the specific driver.

Changed: 2.5.0 - add `can_read` and `can_write` columns.

Changed: 2.0.6, 2.1.3 - by default no drivers are enabled, unless GUC or Environment variable `gdal_enabled_drivers` is set.

Availability: 2.0.0 - requires GDAL >= 1.6.0.

Examples: List of Drivers

```
SET postgis.gdal_enabled_drivers = 'ENABLE_ALL';
SELECT short_name, long_name, can_write
FROM st_gdaldrivers()
ORDER BY short_name;
```

short_name	long_name	can_write
AAIGrid	Arc/Info ASCII Grid	t
ACE2	ACE2	f
ADRG	ARC Digitized Raster Graphics	f
AIG	Arc/Info Binary Grid	f
AirSAR	AirSAR Polarimetric Image	f
ARG	Azavea Raster Grid format	t
BAG	Bathymetry Attributed Grid	f
BIGGIF	Graphics Interchange Format (.gif)	f
BLX	Magellan topo (.blx)	t
BMP	MS Windows Device Independent Bitmap	f
BSB	Maptech BSB Nautical Charts	f
PAux	PCI .aux Labelled	f
PCIDSK	PCIDSK Database File	f
PCRaster	PCRaster Raster File	f
PDF	Geospatial PDF	f
PDS	NASA Planetary Data System	f
PDS4	NASA Planetary Data System 4	t
PLMOSAIC	Planet Labs Mosaics API	f
PLSCENES	Planet Labs Scenes API	f
PNG	Portable Network Graphics	t
PNM	Portable Pixmap Format (netpbm)	f
PRF	Racurs PHOTOMOD PRF	f
R	R Object Data Store	t
Rasterlite	Rasterlite	t
RDA	DigitalGlobe Raster Data Access driver	f
RIK	Swedish Grid RIK (.rik)	f
RMF	Raster Matrix Format	f
ROI_PAC	ROI_PAC raster	f
RPFTOC	Raster Product Format TOC format	f
RRASTER	R Raster	f
RS2	RadarSat 2 XML Product	f
RST	Idrisi Raster A.1	t
SAFE	Sentinel-1 SAR SAFE Product	f
SAGA	SAGA GIS Binary Grid (.sdat, .sg-grd-z)	t
SAR_CEOS	CEOS SAR Image	f
SDTS	SDTS Raster	f
SENTINEL2	Sentinel 2	f
SGI	SGI Image File Format 1.0	f
SNODAS	Snow Data Assimilation System	f
SRP	Standard Raster Product (ASRP/USRP)	f

SRTMHGT	SRTMHGT File Format	t
Terragen	Terragen heightfield	f
TIL	EarthWatch .TIL	f
TSX	TerraSAR-X Product	f
USGSDEM	USGS Optional ASCII DEM (and CDED)	t
VICAR	MIPL VICAR file	f
VRT	Virtual Raster	t
WCS	OGC Web Coverage Service	f
WMS	OGC Web Map Service	t
WMTS	OGC Web Map Tile Service	t
XPM	X11 PixMap Format	t
XYZ	ASCII Gridded XYZ	t
ZMap	ZMap Plus Grid	t

Example: List of options for each driver

```
-- Output the create options XML column of JPEG as a table --
-- Note you can use these creator options in ST_AsGDALRaster options argument
SELECT (xpath('@name', g.opt))[1]::text As oname,
       (xpath('@type', g.opt))[1]::text As otype,
       (xpath('@description', g.opt))[1]::text As descrip
FROM (SELECT unnest(xpath('/CreationOptionList/Option', create_options::xml)) As opt
FROM st_gdaldrivers()
WHERE short_name = 'JPEG') As g;
```

oname	otype	descrip
PROGRESSIVE	boolean	whether to generate a progressive JPEG
QUALITY	int	good=100, bad=0, default=75
WORLDFILE	boolean	whether to generate a worldfile
INTERNAL_MASK	boolean	whether to generate a validity mask
COMMENT	string	Comment
SOURCE_ICC_PROFILE	string	ICC profile encoded in Base64
EXIF_THUMBNAIL	boolean	whether to generate an EXIF thumbnail(overview). By default its max dimension will be 128
THUMBNAIL_WIDTH	int	Forced thumbnail width
THUMBNAIL_HEIGHT	int	Forced thumbnail height

(9 rows)

```
-- raw xml output for creator options for GeoTiff --
```

```
SELECT create_options
FROM st_gdaldrivers()
WHERE short_name = 'GTiff';

<CreationOptionList>
  <Option name="COMPRESS" type="string-select">
    <Value>NONE</Value>
    <Value>LZW</Value>
    <Value>PACKBITS</Value>
    <Value>JPEG</Value>
    <Value>CCITTRLE</Value>
    <Value>CCITTFAX3</Value>
    <Value>CCITTFAX4</Value>
    <Value>DEFLATE</Value>
  </Option>
  <Option name="PREDICTOR" type="int" description="Predictor Type"/>
  <Option name="JPEG_QUALITY" type="int" description="JPEG quality 1-100" default="75"/>
  <Option name="ZLEVEL" type="int" description="DEFLATE compression level 1-9" default ↵
    ="6"/>
```

```

<Option name="NBITS" type="int" description="BITS for sub-byte files (1-7), sub-uint16 ←
  (9-15), sub-uint32 (17-31)"/>
<Option name="INTERLEAVE" type="string-select" default="PIXEL">
  <Value>BAND</Value>
  <Value>PIXEL</Value>
</Option>
<Option name="TILED" type="boolean" description="Switch to tiled format"/>
<Option name="TFW" type="boolean" description="Write out world file"/>
<Option name="RPB" type="boolean" description="Write out .RPB (RPC) file"/>
<Option name="BLOCKXSIZE" type="int" description="Tile Width"/>
<Option name="BLOCKYSIZE" type="int" description="Tile/Strip Height"/>
<Option name="PHOTOMETRIC" type="string-select">
  <Value>MINISBLACK</Value>
  <Value>MINISWHITE</Value>
  <Value>PALETTE</Value>
  <Value>RGB</Value>
  <Value>CMYK</Value>
  <Value>YCBCR</Value>
  <Value>CIELAB</Value>
  <Value>ICCLAB</Value>
  <Value>ITULAB</Value>
</Option>
<Option name="SPARSE_OK" type="boolean" description="Can newly created files have ←
  missing blocks?" default="FALSE"/>
<Option name="ALPHA" type="boolean" description="Mark first extrasample as being alpha ←
  "/>
<Option name="PROFILE" type="string-select" default="GDALGeoTIFF">
  <Value>GDALGeoTIFF</Value>
  <Value>GeoTIFF</Value>
  <Value>BASELINE</Value>
</Option>
<Option name="PIXELTYPE" type="string-select">
  <Value>DEFAULT</Value>
  <Value>SIGNEDBYTE</Value>
</Option>
<Option name="BIGTIFF" type="string-select" description="Force creation of BigTIFF file ←
  ">
  <Value>YES</Value>
  <Value>NO</Value>
  <Value>IF_NEEDED</Value>
  <Value>IF_SAFER</Value>
</Option>
<Option name="ENDIANNESS" type="string-select" default="NATIVE" description="Force ←
  endianness of created file. For DEBUG purpose mostly">
  <Value>NATIVE</Value>
  <Value>INVERTED</Value>
  <Value>LITTLE</Value>
  <Value>BIG</Value>
</Option>
<Option name="COPY_SRC_OVERVIEWS" type="boolean" default="NO" description="Force copy ←
  of overviews of source dataset (CreateCopy())"/>
</CreationOptionList>

-- Output the create options XML column for GTiff as a table --
SELECT (xpath('@name', g.opt))[1]::text As oname,
       (xpath('@type', g.opt))[1]::text As otype,
       (xpath('@description', g.opt))[1]::text As descrip,
       array_to_string(xpath('Value/text()', g.opt),', ' ') As vals
FROM (SELECT unnest(xpath('/CreationOptionList/Option', create_options::xml)) As opt
FROM st_gdaldrivers())
WHERE short_name = 'GTiff') As g;

```

oname	otype	descrip	vals
COMPRESS	string-select		NONE, LZW, ←
PACKBITS, JPEG, CCITTRLE, CCITTFAX3, CCITTFAX4, DEFLATE			
PREDICTOR	int	Predictor Type	←
JPEG_QUALITY	int	JPEG quality 1-100	←
ZLEVEL	int	DEFLATE compression level 1-9	←
NBITS	int	BITS for sub-byte files (1-7), sub-uint16 (9-15), sub-uint32 (17-31)	←
INTERLEAVE	string-select		BAND, PIXEL
TILED	boolean	Switch to tiled format	←
TFW	boolean	Write out world file	←
RPB	boolean	Write out .RPB (RPC) file	←
BLOCKXSIZE	int	Tile Width	←
BLOCKYSIZE	int	Tile/Strip Height	←
PHOTOMETRIC	string-select		MINISBLACK, ←
MINISWHITE, PALETTE, RGB, CMYK, YCBCR, CIELAB, ICCLAB, ITULAB			
SPARSE_OK	boolean	Can newly created files have missing blocks?	←
ALPHA	boolean	Mark first extrasample as being alpha	←
PROFILE	string-select		GDALGeoTIFF, ←
GeoTIFF, BASELINE			
PIXELTYPE	string-select		DEFAULT, ←
SIGNEDBYTE			
BIGTIFF	string-select	Force creation of BigTIFF file	←
			YES, NO, IF_NEEDED, IF_SAFER
ENDIANNESS	string-select	Force endianness of created file. For DEBUG purpose	←
mostly			NATIVE, INVERTED, LITTLE, BIG
COPY_SRC_OVERVIEWS	boolean	Force copy of overviews of source dataset (CreateCopy	←
(())			

(19 rows)

See Also[ST_AsGDALRaster](#), [ST_SRID](#), [postgis.gdal_enabled_drivers](#)**12.2.9 ST_Contour****ST_Contour** — Generates a set of vector contours from the provided raster band, using the [GDAL contouring algorithm](#).

Synopsis

setof record **ST_Contour**(raster rast, integer bandnumber, double precision level_interval, double precision level_base, double precision[] fixed_levels, boolean polygonize);

Description

Generates a set of vector contours from the provided raster band, using the [GDAL contouring algorithm](#).

When the `fixed_levels` parameter is a non-empty array, the `level_interval` and `level_base` parameters are ignored.

The `polygonize` parameter currently has no effect. Use the [ST_Polygonize](#) function to convert contours into polygons.

Return values are a set of records with the following attributes:

geom The geometry of the contour line.

id A unique identifier given to the contour line by GDAL.

value The raster value the line represents. For an elevation DEM input, this would be the elevation of the output contour.

Availability: 3.2.0

Example

```
WITH c AS (
SELECT (ST_Contour(rast, 1, fixed_levels => ARRAY[100.0, 200.0, 300.0])).*
FROM dem_grid WHERE rid = 1
)
SELECT st_astext(geom), id, value
FROM c;
```

See Also

[ST_InterpolateRaster](#)

12.2.10 ST_InterpolateRaster

ST_InterpolateRaster — Interpolates a gridded surface based on an input set of 3-d points, using the X- and Y-values to position the points on the grid and the Z-value of the points as the surface elevation.

Synopsis

raster **ST_InterpolateRaster**(geometry input_points, text algorithm_options, raster template, integer template_band_num=1);

Description

Interpolates a gridded surface based on an input set of 3-d points, using the X- and Y-values to position the points on the grid and the Z-value of the points as the surface elevation. There are five interpolation algorithms available: inverse distance, inverse distance nearest-neighbor, moving average, nearest neighbor, and linear interpolation. See the [gdal_grid documentation](#) for more details on the algorithms and their parameters. For more information on how interpolations are calculated, see the [GDAL grid tutorial](#).

Input parameters are:

input_points The points to drive the interpolation. Any geometry with Z-values is acceptable, all points in the input will be used.

algorithm_options A string defining the algorithm and algorithm options, in the format used by [gdal_grid](#). For example, for an inverse-distance interpolation with a smoothing of 2, you would use "invdist:smoothing=2.0"

template A raster template to drive the geometry of the output raster. The width, height, pixel size, spatial extent and pixel type will be read from this template.

template_band_num By default the first band in the template raster is used to drive the output raster, but that can be adjusted with this parameter.

Availability: 3.2.0

Example

```
SELECT ST_InterpolateRaster(
  'MULTIPOINT(10.5 9.5 1000, 11.5 8.5 1000, 10.5 8.5 500, 11.5 9.5 500)::geometry,
  'invdist:smoothing=2.0',
  ST_AddBand(ST_MakeEmptyRaster(200, 400, 10, 10, 0.01, -0.005, 0, 0), '16BSI')
)
```

See Also

[ST_Contour](#)

12.2.11 UpdateRasterSRID

UpdateRasterSRID — Change the SRID of all rasters in the user-specified column and table.

Synopsis

```
raster UpdateRasterSRID(name schema_name, name table_name, name column_name, integer new_srid);
raster UpdateRasterSRID(name table_name, name column_name, integer new_srid);
```

Description

Change the SRID of all rasters in the user-specified column and table. The function will drop all appropriate column constraints (extent, alignment and SRID) before changing the SRID of the specified column's rasters.



Note

The data (band pixel values) of the rasters are not touched by this function. Only the raster's metadata is changed.

Availability: 2.1.0

See Also

[UpdateGeometrySRID](#)

12.2.12 ST_CreateOverview

ST_CreateOverview — Create an reduced resolution version of a given raster coverage.

Synopsis

regclass **ST_CreateOverview**(regclass tab, name col, int factor, text algo='NearestNeighbor');

Description

Create an overview table with resampled tiles from the source table. Output tiles will have the same size of input tiles and cover the same spatial extent with a lower resolution (pixel size will be 1/factor of the original in both directions).

The overview table will be made available in the `raster_overviews` catalog and will have raster constraints enforced.

Algorithm options are: 'NearestNeighbor', 'Bilinear', 'Cubic', 'CubicSpline', and 'Lanczos'. Refer to: [GDAL Warp resampling methods](#) for more details.

Availability: 2.2.0

Example

Output to generally better quality but slower to product format

```
SELECT ST_CreateOverview('mydata.mytable'::regclass, 'rast', 2, 'Lanczos');
```

Output to faster to process default nearest neighbor

```
SELECT ST_CreateOverview('mydata.mytable'::regclass, 'rast', 2);
```

See Also

[ST_Retile](#), [AddOverviewConstraints](#), [AddRasterConstraints](#), [Section 11.2.2](#)

12.3 Raster Constructors

12.3.1 ST_AddBand

ST_AddBand — Returns a raster with the new band(s) of given type added with given initial value in the given index location. If no index is specified, the band is added to the end.

Synopsis

- (1) raster **ST_AddBand**(raster rast, addbandarg[] addbandargset);
- (2) raster **ST_AddBand**(raster rast, integer index, text pixeltype, double precision initialvalue=0, double precision nodataval=NULL);
- (3) raster **ST_AddBand**(raster rast, text pixeltype, double precision initialvalue=0, double precision nodataval=NULL);
- (4) raster **ST_AddBand**(raster torast, raster fromrast, integer fromband=1, integer torastindex=at_end);
- (5) raster **ST_AddBand**(raster torast, raster[] fromrasts, integer fromband=1, integer torastindex=at_end);
- (6) raster **ST_AddBand**(raster rast, integer index, text outdbfile, integer[] outdbindex, double precision nodataval=NULL);
- (7) raster **ST_AddBand**(raster rast, text outdbfile, integer[] outdbindex, integer index=at_end, double precision nodataval=NULL);

Examples: Multiple New Bands

```

SELECT
  *
FROM ST_BandMetadata(
  ST_AddBand(
    ST_MakeEmptyRaster(10, 10, 0, 0, 1, -1, 0, 0, 0),
    ARRAY[
      ROW(NULL, '8BUI', 255, 0),
      ROW(NULL, '16BUI', 1, 2),
      ROW(2, '32BUI', 100, 12),
      ROW(2, '32BF', 3.14, -1)
    ]::addbandarg[]
  ),
  ARRAY[]::integer[]
);

```

bandnum	pixeltype	nodatavalue	isoutdb	path
1	8BUI	0	f	
2	32BF	-1	f	
3	32BUI	12	f	
4	16BUI	2	f	

```

-- Aggregate the 1st band of a table of like rasters into a single raster
-- with as many bands as there are test_types and as many rows (new rasters) as there are ←
mice
-- NOTE: The ORDER BY test_type is only supported in PostgreSQL 9.0+
-- For 8.4 and below it usually works to order your data in a subselect (but not guaranteed ←
)
-- The resulting raster will have a band for each test_type alphabetical by test_type
-- For mouse lovers: No mice were harmed in this exercise
SELECT
  mouse,
  ST_AddBand(NULL, array_agg(rast ORDER BY test_type), 1) As rast
FROM mice_studies
GROUP BY mouse;

```

Examples: New Out-db band

```

SELECT
  *
FROM ST_BandMetadata(
  ST_AddBand(
    ST_MakeEmptyRaster(10, 10, 0, 0, 1, -1, 0, 0, 0),
    '/home/raster/mytestraster.tif'::text, NULL::int[]
  ),
  ARRAY[]::integer[]
);

```

bandnum	pixeltype	nodatavalue	isoutdb	path
1	8BUI		t	/home/raster/mytestraster.tif
2	8BUI		t	/home/raster/mytestraster.tif
3	8BUI		t	/home/raster/mytestraster.tif

See Also

[ST_BandMetaData](#), [ST_BandPixelType](#), [ST_MakeEmptyRaster](#), [ST_MetaData](#), [ST_NumBands](#), [ST_Reclass](#)

12.3.2 ST_AsRaster

ST_AsRaster — Converts a PostGIS geometry to a PostGIS raster.

Synopsis

```
raster ST_AsRaster(geometry geom, raster ref, text pixeltype, double precision value=1, double precision nodataval=0, boolean touched=false);
raster ST_AsRaster(geometry geom, raster ref, text[] pixeltype=ARRAY['8BUI'], double precision[] value=ARRAY[1], double precision[] nodataval=ARRAY[0], boolean touched=false);
raster ST_AsRaster(geometry geom, double precision scalex, double precision scaley, double precision gridx, double precision gridy, text pixeltype, double precision value=1, double precision nodataval=0, double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, double precision scalex, double precision scaley, double precision gridx=NULL, double precision gridy=NULL, text[] pixeltype=ARRAY['8BUI'], double precision[] value=ARRAY[1], double precision[] nodataval=ARRAY[0], double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, double precision scalex, double precision scaley, text pixeltype, double precision value=1, double precision nodataval=0, double precision upperleftx=NULL, double precision upperlefty=NULL, double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, double precision scalex, double precision scaley, text[] pixeltype, double precision[] value=ARRAY[1], double precision[] nodataval=ARRAY[0], double precision upperleftx=NULL, double precision upperlefty=NULL, double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, integer width, integer height, double precision gridx, double precision gridy, text pixeltype, double precision value=1, double precision nodataval=0, double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, integer width, integer height, double precision gridx=NULL, double precision gridy=NULL, text[] pixeltype=ARRAY['8BUI'], double precision[] value=ARRAY[1], double precision[] nodataval=ARRAY[0], double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, integer width, integer height, text pixeltype, double precision value=1, double precision nodataval=0, double precision upperleftx=NULL, double precision upperlefty=NULL, double precision skewx=0, double precision skewy=0, boolean touched=false);
raster ST_AsRaster(geometry geom, integer width, integer height, text[] pixeltype, double precision[] value=ARRAY[1], double precision[] nodataval=ARRAY[0], double precision upperleftx=NULL, double precision upperlefty=NULL, double precision skewx=0, double precision skewy=0, boolean touched=false);
```

Description

Converts a PostGIS geometry to a PostGIS raster. The many variants offers three groups of possibilities for setting the alignment and pixel size of the resulting raster.

The first group, composed of the two first variants, produce a raster having the same alignment (*scalex*, *scaley*, *gridx* and *gridy*), pixel type and nodata value as the provided reference raster. You generally pass this reference raster by joining the table containing the geometry with the table containing the reference raster.

The second group, composed of four variants, let you set the dimensions of the raster by providing the parameters of a pixel size (*scalex* & *scaley* and *skewx* & *skewy*). The width & height of the resulting raster will be adjusted to fit the extent of the geometry. In most cases, you must cast integer *scalex* & *scaley* arguments to double precision so that PostgreSQL choose the right variant.

The third group, composed of four variants, let you fix the dimensions of the raster by providing the dimensions of the raster (*width* & *height*). The parameters of the pixel size (*scalex* & *scaley* and *skewx* & *skewy*) of the resulting raster will be adjusted to fit the extent of the geometry.

The two first variants of each of those two last groups let you specify the alignment with an arbitrary corner of the alignment grid (*gridx* & *gridy*) and the two last variants takes the upper left corner (*upperleftx* & *upperlefty*).

Each group of variant allows producing a one band raster or a multiple bands raster. To produce a multiple bands raster, you must provide an array of pixel types (*pixeltype*[]), an array of initial values (*value*) and an array of nodata values (*nodataval*). If not provided pixeltyped defaults to 8BUI, values to 1 and nodataval to 0.

The output raster will be in the same spatial reference as the source geometry. The only exception is for variants with a reference raster. In this case the resulting raster will get the same SRID as the reference raster.

The optional `touched` parameter defaults to false and maps to the GDAL `ALL_TOUCHED` rasterization option, which determines if pixels touched by lines or polygons will be burned. Not just those on the line render path, or whose center point is within the polygon.

This is particularly useful for rendering jpegs and pngs of geometries directly from the database when using in combination with `ST_AsPNG` and other `ST_AsGDALRaster` family of functions.

Availability: 2.0.0 - requires GDAL >= 1.6.0.

**Note**

Not yet capable of rendering complex geometry types such as curves, TINS, and PolyhedralSurfaces, but should be able too once GDAL can.

Examples: Output geometries as PNG files

black circle

```
-- this will output a black circle taking up 150 x 150 pixels --  
SELECT ST_AsPNG(ST_AsRaster(ST_Buffer(ST_Point(1,5),10),150, 150));
```



example from buffer rendered with just PostGIS

```
-- the bands map to RGB bands - the value (118,154,118) - teal --  
SELECT ST_AsPNG(  
  ST_AsRaster(  
    ST_Buffer(  
      ST_GeomFromText('LINESTRING(50 50,150 150,150 50)'), 10,'join=bevel'),  
      200,200,ARRAY['8BUI', '8BUI', '8BUI'], ARRAY[118,154,118], ARRAY[0,0,0]));
```

See Also

[ST_BandPixelType](#), [ST_Buffer](#), [ST_GDALDrivers](#), [ST_AsGDALRaster](#), [ST_AsPNG](#), [ST_AsJPEG](#), [ST_SRID](#)

12.3.3 ST_Band

ST_Band — Returns one or more bands of an existing raster as a new raster. Useful for building new rasters from existing rasters.

Synopsis

```
raster ST_Band(raster rast, integer[] nbands = ARRAY[1]);
raster ST_Band(raster rast, integer nband);
raster ST_Band(raster rast, text nbands, character delimiter=,);
```

Description

Returns one or more bands of an existing raster as a new raster. Useful for building new rasters from existing rasters or export of only selected bands of a raster or rearranging the order of bands in a raster. If no band is specified or any of specified bands does not exist in the raster, then all bands are returned. Used as a helper function in various functions such as for deleting a band.

**Warning**

For the `nbands` as text variant of function, the default delimiter is `,`, which means you can ask for `'1,2,3'` and if you wanted to use a different delimiter you would do `ST_Band(rast, '1@2@3', '@')`. For asking for multiple bands, we strongly suggest you use the array form of this function e.g. `ST_Band(rast, '{1,2,3}'::int[])`; since the `text` list of bands form may be removed in future versions of PostGIS.

Availability: 2.0.0

Examples

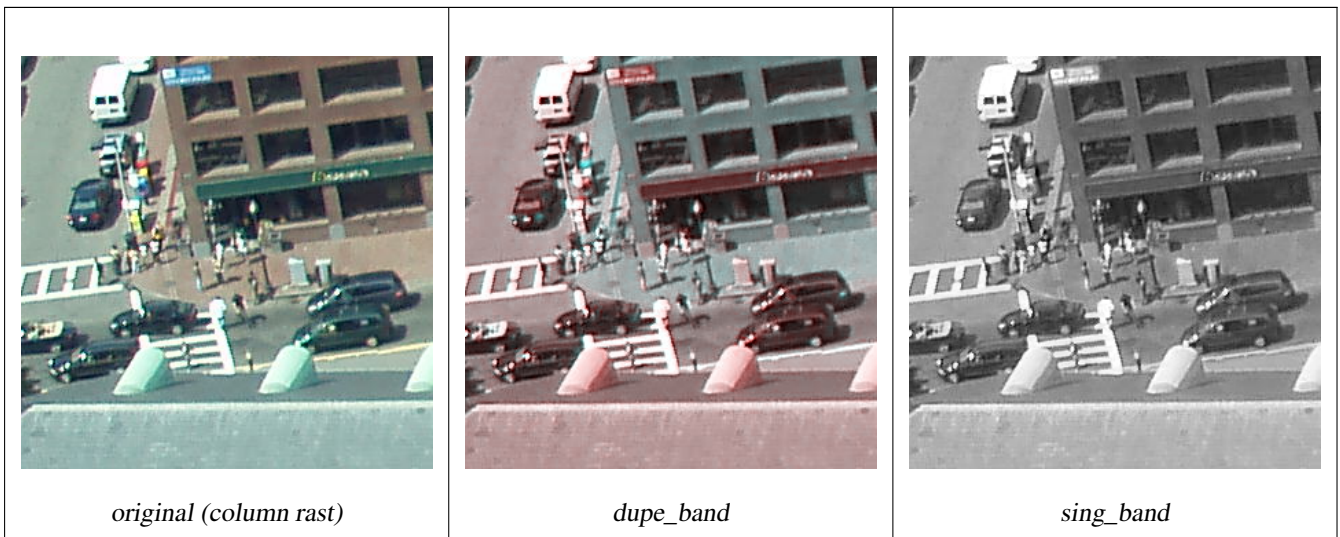
```
-- Make 2 new rasters: 1 containing band 1 of dummy, second containing band 2 of dummy and ←
  then reclassified as a 2BUI
SELECT ST_NumBands(rast1) As numb1, ST_BandPixelType(rast1) As pix1,
       ST_NumBands(rast2) As numb2, ST_BandPixelType(rast2) As pix2
FROM (
  SELECT ST_Band(rast) As rast1, ST_Reclass(ST_Band(rast,3), '100-200':1, [200-254:2', '2 ←
    BUI') As rast2
  FROM dummy_rast
  WHERE rid = 2) As foo;
```

```
numb1 | pix1 | numb2 | pix2
-----+-----+-----+-----
      1 | 8BUI |      1 | 2BUI
```

```
-- Return bands 2 and 3. Using array cast syntax
SELECT ST_NumBands(ST_Band(rast, '{2,3}'::int[])) As num_bands
FROM dummy_rast WHERE rid=2;
```

```
num_bands
-----
2
```

```
-- Return bands 2 and 3. Use array to define bands
SELECT ST_NumBands(ST_Band(rast, ARRAY[2,3])) As num_bands
FROM dummy_rast
WHERE rid=2;
```



```
--Make a new raster with 2nd band of original and 1st band repeated twice,
and another with just the third band
SELECT rast, ST_Band(rast, ARRAY[2,1,1]) As dupe_band,
       ST_Band(rast, 3) As sing_band
FROM samples.than_chunked
WHERE rid=35;
```

See Also

[ST_AddBand](#), [ST_NumBands](#), [ST_Reclass](#), Chapter 12

12.3.4 ST_MakeEmptyCoverage

ST_MakeEmptyCoverage — Cover georeferenced area with a grid of empty raster tiles.

Synopsis

raster **ST_MakeEmptyCoverage**(integer tilewidth, integer tileheight, integer width, integer height, double precision upperleftx, double precision upperlefty, double precision scalex, double precision scaley, double precision skewx, double precision skewy, integer srid=unknown);

Description

Create a set of raster tiles with **ST_MakeEmptyRaster**. Grid dimension is width & height. Tile dimension is tilewidth & tileheight. The covered georeferenced area is from upper left corner (upperleftx, upperlefty) to lower right corner (upperleftx + width * scalex, upperlefty + height * scaley).



Note

Note that scaley is generally negative for rasters and scalex is generally positive. So lower right corner will have a lower y value and higher x value than the upper left corner.

Availability: 2.4.0

Examples Basic

Create 16 tiles in a 4x4 grid to cover the WGS84 area from upper left corner (22, 77) to lower right corner (55, 33).

```
SELECT (ST_MetaData(tile)).* FROM ST_MakeEmptyCoverage(1, 1, 4, 4, 22, 33, (55 - 22)/(4)::float, (33 - 77)/(4)::float, 0., 0., 4326) tile;
```

upperleftx upperlefty width height scalex scaley skewx skewy srid numbands	
22 33 1 1 8.25 -11 0 0 4326	↔
30.25 0 33 1 8.25 -11 0 0 4326	↔
38.5 0 33 1 8.25 -11 0 0 4326	↔
46.75 0 33 1 8.25 -11 0 0 4326	↔
22 0 22 1 8.25 -11 0 0 4326	↔
30.25 0 22 1 8.25 -11 0 0 4326	↔
38.5 0 22 1 8.25 -11 0 0 4326	↔
46.75 0 22 1 8.25 -11 0 0 4326	↔
22 0 11 1 8.25 -11 0 0 4326	↔
30.25 0 11 1 8.25 -11 0 0 4326	↔
38.5 0 11 1 8.25 -11 0 0 4326	↔
46.75 0 11 1 8.25 -11 0 0 4326	↔
22 0 0 1 8.25 -11 0 0 4326	↔
30.25 0 0 1 8.25 -11 0 0 4326	↔
38.5 0 0 1 8.25 -11 0 0 4326	↔
46.75 0 0 1 8.25 -11 0 0 4326	↔

See Also

[ST_MakeEmptyRaster](#)

12.3.5 ST_MakeEmptyRaster

ST_MakeEmptyRaster — Returns an empty raster (having no bands) of given dimensions (width & height), upperleft X and Y, pixel size and rotation (scalex, scaley, skewx & skewy) and reference system (srid). If a raster is passed in, returns a new raster with the same size, alignment and SRID. If srid is left out, the spatial ref is set to unknown (0).

Synopsis

```
raster ST_MakeEmptyRaster(raster rast);
raster ST_MakeEmptyRaster(integer width, integer height, float8 upperleftx, float8 upperlefty, float8 scalex, float8 scaley, float8 skewx, float8 skewy, integer srid=unknown);
raster ST_MakeEmptyRaster(integer width, integer height, float8 upperleftx, float8 upperlefty, float8 pixelsize);
```

Description

Returns an empty raster (having no band) of given dimensions (width & height) and georeferenced in spatial (or world) coordinates with upper left X (upperleftx), upper left Y (upperlefty), pixel size and rotation (scalex, scaley, skewx & skewy) and reference system (srid).

The last version use a single parameter to specify the pixel size (pixelsize). scalex is set to this argument and scaley is set to the negative value of this argument. skewx and skewy are set to 0.

If an existing raster is passed in, it returns a new raster with the same meta data settings (without the bands).

If no srid is specified it defaults to 0. After you create an empty raster you probably want to add bands to it and maybe edit it. Refer to [ST_AddBand](#) to define bands and [ST_SetValue](#) to set initial pixel values.

Examples

```
INSERT INTO dummy_rast(rid,rast)
VALUES(3, ST_MakeEmptyRaster( 100, 100, 0.0005, 0.0005, 1, 1, 0, 0, 4326) );

--use an existing raster as template for new raster
INSERT INTO dummy_rast(rid,rast)
SELECT 4, ST_MakeEmptyRaster(rast)
FROM dummy_rast WHERE rid = 3;

-- output meta data of rasters we just added
SELECT rid, (md).*
FROM (SELECT rid, ST_MetaData(rast) As md
      FROM dummy_rast
      WHERE rid IN(3,4)) As foo;
```

rid	upperleftx	upperlefty	width	height	scalex	scaley	skewx	skewy	srid	↵
3	0.0005	0.0005	100	100	1	1	0	0	0	↵
	4326	0								
4	0.0005	0.0005	100	100	1	1	0	0	0	↵
	4326	0								

See Also

[ST_AddBand](#), [ST_MetaData](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_SetValue](#), [ST_SkewX](#), , [ST_SkewY](#)

12.3.6 ST_Tile

ST_Tile — Returns a set of rasters resulting from the split of the input raster based upon the desired dimensions of the output rasters.

Synopsis

setof raster **ST_Tile**(raster rast, int[] nband, integer width, integer height, boolean padwithnodata=FALSE, double precision nodataval=NULL);
setof raster **ST_Tile**(raster rast, integer nband, integer width, integer height, boolean padwithnodata=FALSE, double precision nodataval=NULL);
setof raster **ST_Tile**(raster rast, integer width, integer height, boolean padwithnodata=FALSE, double precision nodataval=NULL);

Description

Returns a set of rasters resulting from the split of the input raster based upon the desired dimensions of the output rasters.

If `padwithnodata = FALSE`, edge tiles on the right and bottom sides of the raster may have different dimensions than the rest of the tiles. If `padwithnodata = TRUE`, all tiles will have the same dimensions with the possibility that edge tiles being padded with NODATA values. If raster band(s) do not have NODATA value(s) specified, one can be specified by setting `nodataval`.



Note

If a specified band of the input raster is out-of-db, the corresponding band in the output rasters will also be out-of-db.

Availability: 2.1.0

Examples

```
WITH foo AS (
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 10, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 3, 0, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 20, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 6, 0, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 30, 0) AS rast UNION ALL

  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, -3, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 40, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 3, -3, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 50, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 6, -3, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 60, 0) AS rast UNION ALL

  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, -6, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 70, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 3, -6, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 80, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 6, -6, 1, -1, 0, 0, 0), 1, '8BUI', 1, 0), 2, '8BUI', 90, 0) AS rast
), bar AS (
  SELECT ST_Union(rast) AS rast FROM foo
), baz AS (
  SELECT ST_Tile(rast, 3, 3, TRUE) AS rast FROM bar
)
SELECT
  ST_DumpValues(rast)
FROM baz;
```

st_dumpvalues

```
-----
(1,"{{1,1,1},{1,1,1},{1,1,1}}")
(2,"{{10,10,10},{10,10,10},{10,10,10}}")
(1,"{{2,2,2},{2,2,2},{2,2,2}}")
(2,"{{20,20,20},{20,20,20},{20,20,20}}")
(1,"{{3,3,3},{3,3,3},{3,3,3}}")
(2,"{{30,30,30},{30,30,30},{30,30,30}}")
(1,"{{4,4,4},{4,4,4},{4,4,4}}")
(2,"{{40,40,40},{40,40,40},{40,40,40}}")
(1,"{{5,5,5},{5,5,5},{5,5,5}}")
```



```
(2, "{{50,50,50},{50,50,50},{50,50,50}}")
(1, "{{6,6,6},{6,6,6},{6,6,6}}")
(2, "{{60,60,60},{60,60,60},{60,60,60}}")
(1, "{{7,7,7},{7,7,7},{7,7,7}}")
(2, "{{70,70,70},{70,70,70},{70,70,70}}")
(1, "{{8,8,8},{8,8,8},{8,8,8}}")
(2, "{{80,80,80},{80,80,80},{80,80,80}}")
(1, "{{9,9,9},{9,9,9},{9,9,9}}")
(2, "{{90,90,90},{90,90,90},{90,90,90}}")
(18 rows)
```

```
WITH foo AS (
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0), 1, '8BUI', ←
    1, 0), 2, '8BUI', 10, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 3, 0, 1, -1, 0, 0, 0), 1, '8BUI', ←
    2, 0), 2, '8BUI', 20, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 6, 0, 1, -1, 0, 0, 0), 1, '8BUI', ←
    3, 0), 2, '8BUI', 30, 0) AS rast UNION ALL

  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, -3, 1, -1, 0, 0, 0), 1, '8BUI' ←
    ', 4, 0), 2, '8BUI', 40, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 3, -3, 1, -1, 0, 0, 0), 1, '8BUI' ←
    ', 5, 0), 2, '8BUI', 50, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 6, -3, 1, -1, 0, 0, 0), 1, '8BUI' ←
    ', 6, 0), 2, '8BUI', 60, 0) AS rast UNION ALL

  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, -6, 1, -1, 0, 0, 0), 1, '8BUI' ←
    ', 7, 0), 2, '8BUI', 70, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 3, -6, 1, -1, 0, 0, 0), 1, '8BUI' ←
    ', 8, 0), 2, '8BUI', 80, 0) AS rast UNION ALL
  SELECT ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 6, -6, 1, -1, 0, 0, 0), 1, '8BUI' ←
    ', 9, 0), 2, '8BUI', 90, 0) AS rast
), bar AS (
  SELECT ST_Union(rast) AS rast FROM foo
), baz AS (
  SELECT ST_Tile(rast, 3, 3, 2) AS rast FROM bar
)
SELECT
  ST_DumpValues(rast)
FROM baz;

      st_dumpvalues
-----
(1, "{{10,10,10},{10,10,10},{10,10,10}}")
(1, "{{20,20,20},{20,20,20},{20,20,20}}")
(1, "{{30,30,30},{30,30,30},{30,30,30}}")
(1, "{{40,40,40},{40,40,40},{40,40,40}}")
(1, "{{50,50,50},{50,50,50},{50,50,50}}")
(1, "{{60,60,60},{60,60,60},{60,60,60}}")
(1, "{{70,70,70},{70,70,70},{70,70,70}}")
(1, "{{80,80,80},{80,80,80},{80,80,80}}")
(1, "{{90,90,90},{90,90,90},{90,90,90}}")
(9 rows)
```

See Also

[ST_Union](#), [ST_Retile](#)

12.3.7 ST_Retile

ST_Retile — Return a set of configured tiles from an arbitrarily tiled raster coverage.

Synopsis

setof raster **ST_Retile**(regclass tab, name col, geometry ext, float8 sfx, float8 sfy, int tw, int th, text algo='NearestNeighbor');

Description

Return a set of tiles having the specified scale (*sfx*, *sfy*) and max size (*tw*, *th*) and covering the specified extent (*ext*) with data coming from the specified raster coverage (*tab*, *col*).

Algorithm options are: 'NearestNeighbor', 'Bilinear', 'Cubic', 'CubicSpline', and 'Lanczos'. Refer to: [GDAL Warp resampling methods](#) for more details.

Availability: 2.2.0

See Also

[ST_CreateOverview](#)

12.3.8 ST_FromGDALRaster

ST_FromGDALRaster — Returns a raster from a supported GDAL raster file.

Synopsis

raster **ST_FromGDALRaster**(bytea gdaldata, integer srid=NULL);

Description

Returns a raster from a supported GDAL raster file. *gdaldata* is of type *bytea* and should be the contents of the GDAL raster file.

If *srid* is NULL, the function will try to automatically assign the SRID from the GDAL raster. If *srid* is provided, the value provided will override any automatically assigned SRID.

Availability: 2.1.0

Examples

```
WITH foo AS (
  SELECT ST_AsPNG(ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 0.1, ←
    -0.1, 0, 0, 4326), 1, '8BUI', 1, 0), 2, '8BUI', 2, 0), 3, '8BUI', 3, 0)) AS png
),
bar AS (
  SELECT 1 AS rid, ST_FromGDALRaster(png) AS rast FROM foo
  UNION ALL
  SELECT 2 AS rid, ST_FromGDALRaster(png, 3310) AS rast FROM foo
)
SELECT
  rid,
  ST_Metadata(rast) AS metadata,
  ST_SummaryStats(rast, 1) AS stats1,
```

```
ST_SummaryStats(rast, 2) AS stats2,
ST_SummaryStats(rast, 3) AS stats3
FROM bar
ORDER BY rid;
```

rid	metadata	stats1	stats2	stats3
1	(0,0,2,2,1,-1,0,0,0,3)	(4,4,1,0,1,1)	(4,8,2,0,2,2)	(4,12,3,0,3,3)
2	(0,0,2,2,1,-1,0,0,3310,3)	(4,4,1,0,1,1)	(4,8,2,0,2,2)	(4,12,3,0,3,3)

(2 rows)

See Also

[ST_AsGDALRaster](#)

12.4 Raster Accessors

12.4.1 ST_GeoReference

ST_GeoReference — Returns the georeference meta data in GDAL or ESRI format as commonly seen in a world file. Default is GDAL.

Synopsis

```
text ST_GeoReference(raster rast, text format=GDAL);
```

Description

Returns the georeference meta data including carriage return in GDAL or ESRI format as commonly seen in a [world file](#). Default is GDAL if no type specified. type is string 'GDAL' or 'ESRI'.

Difference between format representations is as follows:

GDAL:

```
scalex
skewy
skewx
scaley
upperleftx
upperlefty
```

ESRI:

```
scalex
skewy
skewx
scaley
upperleftx + scalex*0.5
upperlefty + scaley*0.5
```

Examples

```
SELECT ST_GeoReference(rast, 'ESRI') As esri_ref, ST_GeoReference(rast, 'GDAL') As gdal_ref
FROM dummy_rast WHERE rid=1;
```

esri_ref	gdal_ref
2.0000000000	2.0000000000
0.0000000000	0.0000000000
0.0000000000	0.0000000000
3.0000000000	3.0000000000
1.5000000000	0.5000000000
2.0000000000	0.5000000000

See Also

[ST_SetGeoReference](#), [ST_ScaleX](#), [ST_ScaleY](#)

12.4.2 ST_Height

ST_Height — Returns the height of the raster in pixels.

Synopsis

integer **ST_Height**(raster rast);

Description

Returns the height of the raster.

Examples

```
SELECT rid, ST_Height(rast) As rastheight
FROM dummy_rast;
```

rid	rastheight
1	20
2	5

See Also

[ST_Width](#)

12.4.3 ST_IsEmpty

ST_IsEmpty — Returns true if the raster is empty (width = 0 and height = 0). Otherwise, returns false.

Synopsis

boolean **ST_IsEmpty**(raster rast);

Description

Returns true if the raster is empty (width = 0 and height = 0). Otherwise, returns false.

Availability: 2.0.0

Examples

```
SELECT ST_IsEmpty(ST_MakeEmptyRaster(100, 100, 0, 0, 0, 0, 0, 0))
st_isempty |
-----+
f          |
```

```
SELECT ST_IsEmpty(ST_MakeEmptyRaster(0, 0, 0, 0, 0, 0, 0, 0))
st_isempty |
-----+
t          |
```

See Also

[ST_HasNoBand](#)

12.4.4 ST_MemSize

ST_MemSize — Returns the amount of space (in bytes) the raster takes.

Synopsis

integer **ST_MemSize**(raster rast);

Description

Returns the amount of space (in bytes) the raster takes.

This is a nice compliment to PostgreSQL built in functions `pg_column_size`, `pg_size_pretty`, `pg_relation_size`, `pg_total_relation_size`.

**Note**

`pg_relation_size` which gives the byte size of a table may return byte size lower than `ST_MemSize`. This is because `pg_relation_size` does not add toasted table contribution and large geometries are stored in TOAST tables. `pg_column_size` might return lower because it returns the compressed size. `pg_total_relation_size` - includes, the table, the toasted tables, and the indexes.

Availability: 2.2.0

Examples

```
SELECT ST_MemSize(ST_AsRaster(ST_Buffer(ST_Point(1,5),10,1000),150, 150, '8BUI')) As  ↵
      rast_mem;

      rast_mem
      -----
      22568
```

See Also

12.4.5 ST_MetaData

ST_MetaData — Returns basic meta data about a raster object such as pixel size, rotation (skew), upper, lower left, etc.

Synopsis

record **ST_MetaData**(raster rast);

Description

Returns basic meta data about a raster object such as pixel size, rotation (skew), upper, lower left, etc. Columns returned: upperleftx | upperlefty | width | height | scalex | scaley | skewx | skewy | srid | numbands

Examples

```
SELECT rid, (foo.md).*
FROM (SELECT rid, ST_MetaData(rast) As md
FROM dummy_rast) As foo;
```

rid	upperleftx	upperlefty	width	height	scalex	scaley	skewx	skewy	srid	↔
numbands										
1	0.5	0.5	10	20	2	3	0	0	0	↔
0										
2	3427927.75	5793244	5	5	0.05	-0.05	0	0	0	↔
3										

See Also

[ST_BandMetaData](#), [ST_NumBands](#)

12.4.6 ST_NumBands

ST_NumBands — Returns the number of bands in the raster object.

Synopsis

integer **ST_NumBands**(raster rast);

Description

Returns the number of bands in the raster object.

Examples

```
SELECT rid, ST_NumBands(rast) As numbands
FROM dummy_rast;
```

rid	numbands
1	0
2	3

See Also

[ST_Value](#)

12.4.7 ST_PixelHeight

ST_PixelHeight — Returns the pixel height in geometric units of the spatial reference system.

Synopsis

double precision **ST_PixelHeight**(raster rast);

Description

Returns the height of a pixel in geometric units of the spatial reference system. In the common case where there is no skew, the pixel height is just the scale ratio between geometric coordinates and raster pixels.

Refer to [ST_PixelWidth](#) for a diagrammatic visualization of the relationship.

Examples: Rasters with no skew

```
SELECT ST_Height(rast) As rastheight, ST_PixelHeight(rast) As pixheight,
       ST_ScaleX(rast) As scalex, ST_ScaleY(rast) As scaley, ST_SkewX(rast) As skewx,
       ST_SkewY(rast) As skewy
FROM dummy_rast;
```

rastheight	pixheight	scalex	scaley	skewx	skewy
20	3	2	3	0	0
5	0.05	0.05	-0.05	0	0

Examples: Rasters with skew different than 0

```
SELECT ST_Height(rast) As rastheight, ST_PixelHeight(rast) As pixheight,
       ST_ScaleX(rast) As scalex, ST_ScaleY(rast) As scaley, ST_SkewX(rast) As skewx,
       ST_SkewY(rast) As skewy
FROM (SELECT ST_SetSKew(rast,0.5,0.5) As rast
      FROM dummy_rast) As skewed;
```

rastheight	pixheight	scalex	scaley	skewx	skewy
20	3.04138126514911	2	3	0.5	0.5
5	0.502493781056044	0.05	-0.05	0.5	0.5

See Also

[ST_PixelWidth](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_SkewX](#), [ST_SkewY](#)

12.4.8 ST_PixelWidth

ST_PixelWidth — Returns the pixel width in geometric units of the spatial reference system.

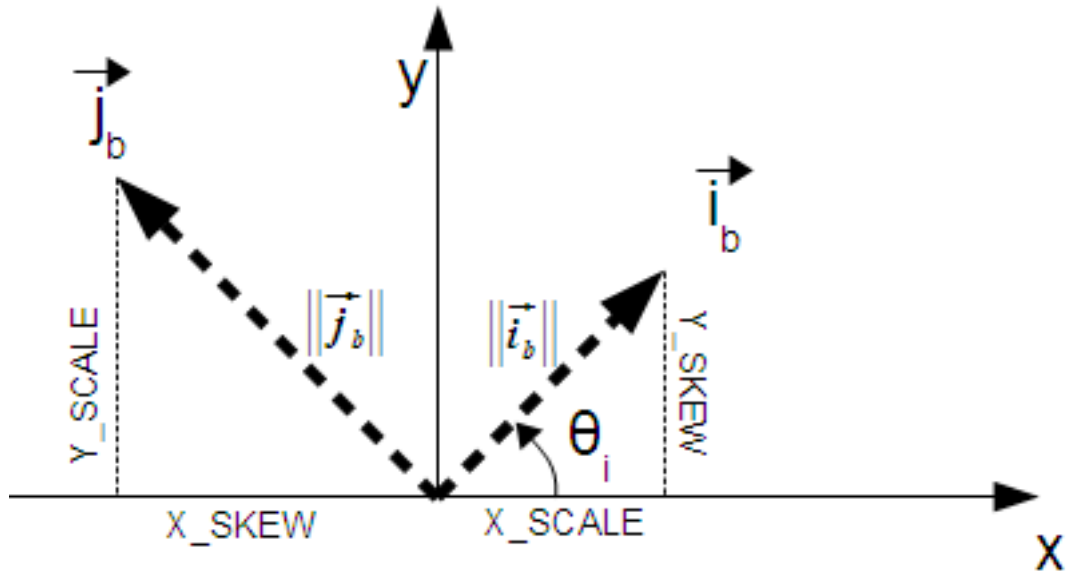
Synopsis

double precision **ST_PixelWidth**(raster rast);

Description

Returns the width of a pixel in geometric units of the spatial reference system. In the common case where there is no skew, the pixel width is just the scale ratio between geometric coordinates and raster pixels.

The following diagram demonstrates the relationship:



Pixel Width: Pixel size in the i direction
Pixel Height: Pixel size in the j direction

Examples: Rasters with no skew

```
SELECT ST_Width(rast) As rastwidth, ST_PixelWidth(rast) As pixwidth,
       ST_ScaleX(rast) As scalex, ST_ScaleY(rast) As scaley, ST_SkewX(rast) As skewx,
       ST_SkewY(rast) As skewy
FROM dummy_rast;
```

rastwidth	pixwidth	scalex	scaley	skewx	skewy
10	2	2	3	0	0
5	0.05	0.05	-0.05	0	0

Examples: Rasters with skew different than 0

```
SELECT ST_Width(rast) As rastwidth, ST_PixelWidth(rast) As pixwidth,
       ST_ScaleX(rast) As scalex, ST_ScaleY(rast) As scaley, ST_SkewX(rast) As skewx,
       ST_SkewY(rast) As skewy
FROM (SELECT ST_SetSkew(rast,0.5,0.5) As rast
FROM dummy_rast) As skewed;
```

rastwidth	pixwidth	scalex	scaley	skewx	skewy
10	2.06155281280883	2	3	0.5	0.5
5	0.502493781056044	0.05	-0.05	0.5	0.5

See Also

[ST_PixelHeight](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_SkewX](#), [ST_SkewY](#)

12.4.9 ST_ScaleX

ST_ScaleX — Returns the X component of the pixel width in units of coordinate reference system.

Synopsis

float8 **ST_ScaleX**(raster rast);

Description

Returns the X component of the pixel width in units of coordinate reference system. Refer to [World File](#) for more details.
Changed: 2.0.0. In WKTRaster versions this was called ST_PixelSizeX.

Examples

```
SELECT rid, ST_ScaleX(rast) As rastpixwidth
FROM dummy_rast;
```

rid	rastpixwidth
1	2
2	0.05

See Also

[ST_Width](#)

12.4.10 ST_ScaleY

ST_ScaleY — Returns the Y component of the pixel height in units of coordinate reference system.

Synopsis

float8 **ST_ScaleY**(raster rast);

Description

Returns the Y component of the pixel height in units of coordinate reference system. May be negative. Refer to [World File](#) for more details.

Changed: 2.0.0. In WKTRaster versions this was called ST_PixelSizeY.

Examples

```
SELECT rid, ST_ScaleY(rast) As rastpixheight
FROM dummy_rast;
```

rid	rastpixheight
1	3
2	-0.05

See Also

[ST_Height](#)

12.4.11 ST_RasterToWorldCoord

ST_RasterToWorldCoord — Returns the raster's upper left corner as geometric X and Y (longitude and latitude) given a column and row. Column and row starts at 1.

Synopsis

record **ST_RasterToWorldCoord**(raster rast, integer xcolumn, integer yrow);

Description

Returns the upper left corner as geometric X and Y (longitude and latitude) given a column and row. Returned X and Y are in geometric units of the georeferenced raster. Numbering of column and row starts at 1 but if either parameter is passed a zero, a negative number or a number greater than the respective dimension of the raster, it will return coordinates outside of the raster assuming the raster's grid is applicable outside the raster's bounds.

Availability: 2.1.0

Examples

```
-- non-skewed raster
SELECT
    rid,
    (ST_RasterToWorldCoord(rast,1, 1)).*,
    (ST_RasterToWorldCoord(rast,2, 2)).*
FROM dummy_rast
```

rid	longitude	latitude	longitude	latitude
1	0.5	0.5	2.5	3.5
2	3427927.75	5793244	3427927.8	5793243.95

```
-- skewed raster
SELECT
    rid,
    (ST_RasterToWorldCoord(rast, 1, 1)).*,
    (ST_RasterToWorldCoord(rast, 2, 3)).*
FROM (
    SELECT
        rid,
        ST_SetSkew(rast, 100.5, 0) As rast
    FROM dummy_rast
) As foo

rid | longitude | latitude | longitude | latitude
-----+-----+-----+-----+-----
1 | 0.5 | 0.5 | 203.5 | 6.5
2 | 3427927.75 | 5793244 | 3428128.8 | 5793243.9
```

See Also

[ST_RasterToWorldCoordX](#), [ST_RasterToWorldCoordY](#), [ST_SetSkew](#)

12.4.12 ST_RasterToWorldCoordX

ST_RasterToWorldCoordX — Returns the geometric X coordinate upper left of a raster, column and row. Numbering of columns and rows starts at 1.

Synopsis

```
float8 ST_RasterToWorldCoordX(raster rast, integer xcolumn);
float8 ST_RasterToWorldCoordX(raster rast, integer xcolumn, integer yrow);
```

Description

Returns the upper left X coordinate of a raster column row in geometric units of the georeferenced raster. Numbering of columns and rows starts at 1 but if you pass in a negative number or number higher than number of columns in raster, it will give you coordinates outside of the raster file to left or right with the assumption that the skew and pixel sizes are same as selected raster.



Note For non-skewed rasters, providing the X column is sufficient. For skewed rasters, the georeferenced coordinate is a function of the ST_ScaleX and ST_SkewX and row and column. An error will be raised if you give just the X column for a skewed raster.

Changed: 2.1.0 In prior versions, this was called ST_Raster2WorldCoordX

Examples

```
-- non-skewed raster providing column is sufficient
SELECT rid, ST_RasterToWorldCoordX(rast,1) As x1coord,
    ST_RasterToWorldCoordX(rast,2) As x2coord,
    ST_ScaleX(rast) As pixelx
FROM dummy_rast;
```

rid	x1coord	x2coord	pixelx
1	0.5	2.5	2
2	3427927.75	3427927.8	0.05

```
-- for fun lets skew it
SELECT rid, ST_RasterToWorldCoordX(rast, 1, 1) As x1coord,
       ST_RasterToWorldCoordX(rast, 2, 3) As x2coord,
       ST_ScaleX(rast) As pixelx
FROM (SELECT rid, ST_SetSkew(rast, 100.5, 0) As rast FROM dummy_rast) As foo;
```

rid	x1coord	x2coord	pixelx
1	0.5	203.5	2
2	3427927.75	3428128.8	0.05

See Also

[ST_ScaleX](#), [ST_RasterToWorldCoordY](#), [ST_SetSkew](#), [ST_SkewX](#)

12.4.13 ST_RasterToWorldCoordY

ST_RasterToWorldCoordY — Returns the geometric Y coordinate upper left corner of a raster, column and row. Numbering of columns and rows starts at 1.

Synopsis

```
float8 ST_RasterToWorldCoordY(raster rast, integer yrow);
float8 ST_RasterToWorldCoordY(raster rast, integer xcolumn, integer yrow);
```

Description

Returns the upper left Y coordinate of a raster column row in geometric units of the georeferenced raster. Numbering of columns and rows starts at 1 but if you pass in a negative number or number higher than number of columns/rows in raster, it will give you coordinates outside of the raster file to left or right with the assumption that the skew and pixel sizes are same as selected raster tile.



Note

For non-skewed rasters, providing the Y column is sufficient. For skewed rasters, the georeferenced coordinate is a function of the `ST_ScaleY` and `ST_SkewY` and row and column. An error will be raised if you give just the Y row for a skewed raster.

Changed: 2.1.0 In prior versions, this was called `ST_Raster2WorldCoordY`

Examples

```
-- non-skewed raster providing row is sufficient
SELECT rid, ST_RasterToWorldCoordY(rast,1) As y1coord,
       ST_RasterToWorldCoordY(rast,3) As y2coord,
       ST_ScaleY(rast) As pixely
FROM dummy_rast;
```

```
rid | ylcoord | y2coord | pixely
-----+-----+-----+-----
1 | 0.5 | 6.5 | 3
2 | 5793244 | 5793243.9 | -0.05
```

```
-- for fun lets skew it
SELECT rid, ST_RasterToWorldCoordY(rast,1,1) As ylcoord,
       ST_RasterToWorldCoordY(rast,2,3) As y2coord,
       ST_ScaleY(rast) As pixely
FROM (SELECT rid, ST_SetSkew(rast,0,100.5) As rast FROM dummy_rast) As foo;
```

```
rid | ylcoord | y2coord | pixely
-----+-----+-----+-----
1 | 0.5 | 107 | 3
2 | 5793244 | 5793344.4 | -0.05
```

See Also

[ST_ScaleY](#), [ST_RasterToWorldCoordX](#), [ST_SetSkew](#), [ST_SkewY](#)

12.4.14 ST_Rotation

ST_Rotation — Returns the rotation of the raster in radian.

Synopsis

float8 **ST_Rotation**(raster rast);

Description

Returns the uniform rotation of the raster in radian. If a raster does not have uniform rotation, NaN is returned. Refer to [World File](#) for more details.

Examples

```
SELECT rid, ST_Rotation(ST_SetScale(ST_SetSkew(rast, sqrt(2)), sqrt(2))) as rot FROM ↵
dummy_rast;
```

```
rid |      rot
-----+-----
1 | 0.785398163397448
2 | 0.785398163397448
```

See Also

[ST_SetRotation](#), [ST_SetScale](#), [ST_SetSkew](#)

12.4.15 ST_SkewX

ST_SkewX — Returns the georeference X skew (or rotation parameter).

Synopsis

float8 **ST_SkewX**(raster rast);

Description

Returns the georeference X skew (or rotation parameter). Refer to [World File](#) for more details.

Examples

```
SELECT rid, ST_SkewX(rast) As skewx, ST_SkewY(rast) As skewy,
       ST_GeoReference(rast) as georef
FROM dummy_rast;
```

rid	skewx	skewy	georef
-----+-----+-----+-----			
1	0	0	2.0000000000
			: 0.0000000000
			: 0.0000000000
			: 3.0000000000
			: 0.5000000000
			: 0.5000000000
2	0	0	: 0.0500000000
			: 0.0000000000
			: 0.0000000000
			: -0.0500000000
			: 3427927.7500000000
			: 5793244.0000000000

See Also

[ST_GeoReference](#), [ST_SkewY](#), [ST_SetSkew](#)

12.4.16 ST_SkewY

ST_SkewY — Returns the georeference Y skew (or rotation parameter).

Synopsis

float8 **ST_SkewY**(raster rast);

Description

Returns the georeference Y skew (or rotation parameter). Refer to [World File](#) for more details.

Examples

```
SELECT rid, ST_SkewX(rast) As skewx, ST_SkewY(rast) As skewy,
       ST_GeoReference(rast) as georef
FROM dummy_rast;
```

rid	skewx	skewy	georef
-----	-------	-------	--------

```
-----+-----+-----+-----
 1 |      0 |      0 | 2.0000000000
      : 0.0000000000
      : 0.0000000000
      : 3.0000000000
      : 0.5000000000
      : 0.5000000000
      :
 2 |      0 |      0 | 0.0500000000
      : 0.0000000000
      : 0.0000000000
      : -0.0500000000
      : 3427927.7500000000
      : 5793244.0000000000
```

See Also

[ST_GeoReference](#), [ST_SkewX](#), [ST_SetSkew](#)

12.4.17 ST_SRID

ST_SRID — Returns the spatial reference identifier of the raster as defined in spatial_ref_sys table.

Synopsis

integer **ST_SRID**(raster rast);

Description

Returns the spatial reference identifier of the raster object as defined in the spatial_ref_sys table.



Note
From PostGIS 2.0+ the srid of a non-georeferenced raster/geometry is 0 instead of the prior -1.

Examples

```
SELECT ST_SRID(rast) As srid
FROM dummy_rast WHERE rid=1;

srid
-----
0
```

See Also

Section [4.5](#), [ST_SRID](#)

12.4.18 ST_Summary

ST_Summary — Returns a text summary of the contents of the raster.

Synopsis

text **ST_Summary**(raster rast);

Description

Returns a text summary of the contents of the raster.

Availability: 2.1.0

Examples

```
SELECT ST_Summary(
  ST_AddBand(
    ST_AddBand(
      ST_AddBand(
        ST_MakeEmptyRaster(10, 10, 0, 0, 1, -1, 0, 0, 0)
        , 1, '8BUI', 1, 0
      )
      , 2, '32BF', 0, -9999
    )
    , 3, '16BSI', 0, NULL
  )
);
```

st_summary
Raster of 10x10 pixels has 3 bands and extent of BOX(0 -10,10 0)+ band 1 of pixtype 8BUI is in-db with NODATA value of 0 + band 2 of pixtype 32BF is in-db with NODATA value of -9999 + band 3 of pixtype 16BSI is in-db with no NODATA value (1 row)

See Also

[ST_MetaData](#), [ST_BandMetaData](#), [ST_Summary](#) [ST_Extent](#)

12.4.19 ST_UpperLeftX

ST_UpperLeftX — Returns the upper left X coordinate of raster in projected spatial ref.

Synopsis

float8 **ST_UpperLeftX**(raster rast);

Description

Returns the upper left X coordinate of raster in projected spatial ref.

Examples

```
SELECT rid, ST_UpperLeftX(rast) As ulx
FROM dummy_rast;
```

rid	ulx
1	0.5
2	3427927.75

See Also

[ST_UpperLeftY](#), [ST_GeoReference](#), [Box3D](#)

12.4.20 ST_UpperLeftY

ST_UpperLeftY — Returns the upper left Y coordinate of raster in projected spatial ref.

Synopsis

```
float8 ST_UpperLeftY(raster rast);
```

Description

Returns the upper left Y coordinate of raster in projected spatial ref.

Examples

```
SELECT rid, ST_UpperLeftY(rast) As uly
FROM dummy_rast;
```

rid	uly
1	0.5
2	5793244

See Also

[ST_UpperLeftX](#), [ST_GeoReference](#), [Box3D](#)

12.4.21 ST_Width

ST_Width — Returns the width of the raster in pixels.

Synopsis

```
integer ST_Width(raster rast);
```

Description

Returns the width of the raster in pixels.

Examples

```
SELECT ST_Width(rast) As rastwidth
FROM dummy_rast WHERE rid=1;

rastwidth
-----
10
```

See Also

[ST_Height](#)

12.4.22 ST_WorldToRasterCoord

ST_WorldToRasterCoord — Returns the upper left corner as column and row given geometric X and Y (longitude and latitude) or a point geometry expressed in the spatial reference coordinate system of the raster.

Synopsis

record **ST_WorldToRasterCoord**(raster rast, geometry pt);
record **ST_WorldToRasterCoord**(raster rast, double precision longitude, double precision latitude);

Description

Returns the upper left corner as column and row given geometric X and Y (longitude and latitude) or a point geometry. This function works regardless of whether or not the geometric X and Y or point geometry is outside the extent of the raster. Geometric X and Y must be expressed in the spatial reference coordinate system of the raster.

Availability: 2.1.0

Examples

```
SELECT
    rid,
    (ST_WorldToRasterCoord(rast, 3427927.8, 20.5)).*,
    (ST_WorldToRasterCoord(rast, ST_GeomFromText('POINT(3427927.8 20.5)', ST_SRID(rast)))).*
FROM dummy_rast;
```

rid	columnx	rowy	columnx	rowy
1	1713964	7	1713964	7
2	2	115864471	2	115864471

See Also

[ST_WorldToRasterCoordX](#), [ST_WorldToRasterCoordY](#), [ST_RasterToWorldCoordX](#), [ST_RasterToWorldCoordY](#), [ST_SRID](#)

12.4.23 ST_WorldToRasterCoordX

ST_WorldToRasterCoordX — Returns the column in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw) represented in world spatial reference system of raster.

Synopsis

```
integer ST_WorldToRasterCoordX(raster rast, geometry pt);
integer ST_WorldToRasterCoordX(raster rast, double precision xw);
integer ST_WorldToRasterCoordX(raster rast, double precision xw, double precision yw);
```

Description

Returns the column in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw). A point, or (both xw and yw world coordinates are required if a raster is skewed). If a raster is not skewed then xw is sufficient. World coordinates are in the spatial reference coordinate system of the raster.

Changed: 2.1.0 In prior versions, this was called ST_World2RasterCoordX

Examples

```
SELECT rid, ST_WorldToRasterCoordX(rast,3427927.8) As xcoord,
       ST_WorldToRasterCoordX(rast,3427927.8,20.5) As xcoord_xwyw,
       ST_WorldToRasterCoordX(rast,ST_GeomFromText('POINT(3427927.8 20.5)',ST_SRID(rast))) ↔
       As ptxcoord
FROM dummy_rast;
```

rid	xcoord	xcoord_xwyw	ptxcoord
1	1713964	1713964	1713964
2	1	1	1

See Also

[ST_RasterToWorldCoordX](#), [ST_RasterToWorldCoordY](#), [ST_SRID](#)

12.4.24 ST_WorldToRasterCoordY

ST_WorldToRasterCoordY — Returns the row in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw) represented in world spatial reference system of raster.

Synopsis

```
integer ST_WorldToRasterCoordY(raster rast, geometry pt);
integer ST_WorldToRasterCoordY(raster rast, double precision xw);
integer ST_WorldToRasterCoordY(raster rast, double precision xw, double precision yw);
```

Description

Returns the row in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw). A point, or (both xw and yw world coordinates are required if a raster is skewed). If a raster is not skewed then xw is sufficient. World coordinates are in the spatial reference coordinate system of the raster.

Changed: 2.1.0 In prior versions, this was called ST_World2RasterCoordY

Examples

```
SELECT rid, ST_WorldToRasterCoordY(rast,20.5) As ycoord,
        ST_WorldToRasterCoordY(rast,3427927.8,20.5) As ycoord_xwyw,
        ST_WorldToRasterCoordY(rast,ST_GeomFromText('POINT(3427927.8 20.5)',ST_SRID(rast))) As ptycoord
FROM dummy_rast;
```

rid	ycoord	ycoord_xwyw	ptycoord
1	7	7	7
2	115864471	115864471	115864471

See Also

[ST_RasterToWorldCoordX](#), [ST_RasterToWorldCoordY](#), [ST_SRID](#)

12.5 Raster Band Accessors

12.5.1 ST_BandMetaData

ST_BandMetaData — Returns basic meta data for a specific raster band. band num 1 is assumed if none-specified.

Synopsis

- (1) record **ST_BandMetaData**(raster rast, integer band=1);
- (2) record **ST_BandMetaData**(raster rast, integer[] band);

Description

Returns basic meta data about a raster band. Columns returned: pixeltype, nodatavalue, isoutdb, path, outdbbandnum, filesize, filetimestamp.



Note
If raster contains no bands then an error is thrown.



Note
If band has no NODATA value, nodatavalue are NULL.



Note
If isoutdb is False, path, outdbbandnum, filesize and filetimestamp are NULL. If outdb access is disabled, filesize and filetimestamp will also be NULL.

Enhanced: 2.5.0 to include *outdbbandnum*, *filesize* and *filetimestamp* for outdb rasters.

Examples: Variant 1

```
SELECT
    rid,
    (foo.md).*
FROM (
    SELECT
        rid,
        ST_BandMetaData(rast, 1) AS md
    FROM dummy_rast
    WHERE rid=2
) As foo;
```

rid	pixeltype	nodatavalue	isoutdb	path	outdbbandnum
2	8BUI		0	f	

Examples: Variant 2

```
WITH foo AS (
    SELECT
        ST_AddBand(NULL::raster, '/home/pele/devel/geo/postgis-git/raster/test/regress/ ↵
        loader/Projected.tif', NULL::int[]) AS rast
)
SELECT
    *
FROM ST_BandMetadata(
    (SELECT rast FROM foo),
    ARRAY[1,3,2]::int[]
);
```

bandnum	pixeltype	nodatavalue	isoutdb	path ↵	outdbbandnum	filesize	filetimestamp
1	8BUI		t	/home/pele/devel/geo/postgis-git/raster/test ↵	1	12345	1521807257
3	8BUI		t	/home/pele/devel/geo/postgis-git/raster/test ↵	3	12345	1521807257
2	8BUI		t	/home/pele/devel/geo/postgis-git/raster/test ↵	2	12345	1521807257

See Also

[ST_MetaData](#), [ST_BandPixelType](#)

12.5.2 ST_BandNoDataValue

ST_BandNoDataValue — Returns the value in a given band that represents no data. If no band num 1 is assumed.

Synopsis

double precision **ST_BandNoDataValue**(raster rast, integer bandnum=1);

Description

Returns the value that represents no data for the band

Examples

```
SELECT ST_BandNoDataValue(rast,1) As bnval1,
       ST_BandNoDataValue(rast,2) As bnval2, ST_BandNoDataValue(rast,3) As bnval3
FROM dummy_rast
WHERE rid = 2;
```

bnval1	bnval2	bnval3
0	0	0

See Also

[ST_NumBands](#)

12.5.3 ST_BandIsNoData

ST_BandIsNoData — Returns true if the band is filled with only nodata values.

Synopsis

boolean **ST_BandIsNoData**(raster rast, integer band, boolean forceChecking=true);
boolean **ST_BandIsNoData**(raster rast, boolean forceChecking=true);

Description

Returns true if the band is filled with only nodata values. Band 1 is assumed if not specified. If the last argument is TRUE, the entire band is checked pixel by pixel. Otherwise, the function simply returns the value of the isnodata flag for the band. The default value for this parameter is FALSE, if not specified.

Availability: 2.0.0



Note
If the flag is dirty (this is, the result is different using TRUE as last parameter and not using it) you should update the raster to set this flag to true, by using ST_SetBandIsNodata(), or ST_SetBandNodataValue() with TRUE as last argument. See [ST_SetBandIsNoData](#).

Examples

```
-- Create dummy table with one raster column
create table dummy_rast (rid integer, rast raster);

-- Add raster with two bands, one pixel/band. In the first band, nodatavalue = pixel value ←
= 3.
-- In the second band, nodatavalue = 13, pixel value = 4
insert into dummy_rast values(1,
(
'01' -- little endian (uint8 ndr)
```

```

||
'0000' -- version (uint16 0)
||
'0200' -- nBands (uint16 0)
||
'17263529ED684A3F' -- scaleX (float64 0.000805965234044584)
||
'F9253529ED684ABF' -- scaleY (float64 -0.00080596523404458)
||
'1C9F33CE69E352C0' -- ipX (float64 -75.5533328537098)
||
'718F0E9A27A44840' -- ipY (float64 49.2824585505576)
||
'ED50EB853EC32B3F' -- skewX (float64 0.000211812383858707)
||
'7550EB853EC32B3F' -- skewY (float64 0.000211812383858704)
||
'E6100000' -- SRID (int32 4326)
||
'0100' -- width (uint16 1)
||
'0100' -- height (uint16 1)
||
'6' -- hasnodatavalue and isnodata value set to true.
||
'2' -- first band type (4BUI)
||
'03' -- novalue==3
||
'03' -- pixel(0,0)==3 (same that nodata)
||
'0' -- hasnodatavalue set to false
||
'5' -- second band type (16BSI)
||
'0D00' -- novalue==13
||
'0400' -- pixel(0,0)==4
)::raster
);

select st_bandisnodata(rast, 1) from dummy_rast where rid = 1; -- Expected true
select st_bandisnodata(rast, 2) from dummy_rast where rid = 1; -- Expected false

```

See Also

[ST_BandNoDataValue](#), [ST_NumBands](#), [ST_SetBandNoDataValue](#), [ST_SetBandIsNoData](#)

12.5.4 ST_BandPath

ST_BandPath — Returns system file path to a band stored in file system. If no bandnum specified, 1 is assumed.

Synopsis

text **ST_BandPath**(raster rast, integer bandnum=1);

Description

Returns system file path to a band. Throws an error if called with an in db band.

Examples**See Also****12.5.5 ST_BandFileSize**

ST_BandFileSize — Returns the file size of a band stored in file system. If no bandnum specified, 1 is assumed.

Synopsis

```
bigint ST_BandFileSize(raster rast, integer bandnum=1);
```

Description

Returns the file size of a band stored in file system. Throws an error if called with an in db band, or if outdb access is not enabled.

This function is typically used in conjunction with **ST_BandPath()** and **ST_BandFileTimestamp()** so a client can determine if the filename of a outdb raster as seen by it is the same as the one seen by the server.

Availability: 2.5.0

Examples

```
SELECT ST_BandFileSize(rast,1) FROM dummy_rast WHERE rid = 1;

 st_bandfilesize
-----
          240574
```

12.5.6 ST_BandFileTimestamp

ST_BandFileTimestamp — Returns the file timestamp of a band stored in file system. If no bandnum specified, 1 is assumed.

Synopsis

```
bigint ST_BandFileTimestamp(raster rast, integer bandnum=1);
```

Description

Returns the file timestamp (number of seconds since Jan 1st 1970 00:00:00 UTC) of a band stored in file system. Throws an error if called with an in db band, or if outdb access is not enabled.

This function is typically used in conjunction with **ST_BandPath()** and **ST_BandFileSize()** so a client can determine if the filename of a outdb raster as seen by it is the same as the one seen by the server.

Availability: 2.5.0

Examples

```
SELECT ST_BandFileTimestamp(rast,1) FROM dummy_rast WHERE rid = 1;

 st_bandfiletimestamp
-----
          1521807257
```

12.5.7 ST_BandPixelType

ST_BandPixelType — Returns the type of pixel for given band. If no bandnum specified, 1 is assumed.

Synopsis

text **ST_BandPixelType**(raster rast, integer bandnum=1);

Description

Returns name describing data type and size of values stored in each cell of given band.
There are 11 pixel types. Pixel Types supported are as follows:

- 1BB - 1-bit boolean
- 2BUI - 2-bit unsigned integer
- 4BUI - 4-bit unsigned integer
- 8BSI - 8-bit signed integer
- 8BUI - 8-bit unsigned integer
- 16BSI - 16-bit signed integer
- 16BUI - 16-bit unsigned integer
- 32BSI - 32-bit signed integer
- 32BUI - 32-bit unsigned integer
- 32BF - 32-bit float
- 64BF - 64-bit float

Examples

```
SELECT ST_BandPixelType(rast,1) As btype1,
       ST_BandPixelType(rast,2) As btype2, ST_BandPixelType(rast,3) As btype3
FROM dummy_rast
WHERE rid = 2;

 btype1 | btype2 | btype3
-----+-----+-----
   8BUI |   8BUI |   8BUI
```

See Also

[ST_NumBands](#)

12.5.8 ST_MinPossibleValue

ST_MinPossibleValue — Returns the minimum value this pixeltype can store.

Synopsis

integer **ST_MinPossibleValue**(text pixeltype);

Description

Returns the minimum value this pixeltype can store.

Examples

```
SELECT ST_MinPossibleValue('16BSI');

 st_minpossiblevalue
-----
                -32768

SELECT ST_MinPossibleValue('8BUI');

 st_minpossiblevalue
-----
                   0
```

See Also

[ST_BandPixelType](#)

12.5.9 ST_HasNoBand

ST_HasNoBand — Returns true if there is no band with given band number. If no band number is specified, then band number 1 is assumed.

Synopsis

boolean **ST_HasNoBand**(raster rast, integer bandnum=1);

Description

Returns true if there is no band with given band number. If no band number is specified, then band number 1 is assumed.

Availability: 2.0.0

Examples

```
SELECT rid, ST_HasNoBand(rast) As hb1, ST_HasNoBand(rast,2) as hb2,
ST_HasNoBand(rast,4) as hb4, ST_NumBands(rast) As numbands
FROM dummy_rast;
```

rid	hb1	hb2	hb4	numbands
1	t	t	t	0
2	f	f	t	3

See Also

[ST_NumBands](#)

12.6 Raster Pixel Accessors and Setters

12.6.1 ST_PixelAsPolygon

ST_PixelAsPolygon — Returns the polygon geometry that bounds the pixel for a particular row and column.

Synopsis

geometry **ST_PixelAsPolygon**(raster rast, integer columnx, integer rowy);

Description

Returns the polygon geometry that bounds the pixel for a particular row and column.

Availability: 2.0.0

Examples

```
-- get raster pixel polygon
SELECT i,j, ST_AsText(ST_PixelAsPolygon(foo.rast, i,j)) As blpgeom
FROM dummy_rast As foo
      CROSS JOIN generate_series(1,2) As i
      CROSS JOIN generate_series(1,1) As j
WHERE rid=2;
```

i	j	blpgeom
1	1	POLYGON((3427927.75 5793244,3427927.8 5793244,3427927.8 5793243.95,...
2	1	POLYGON((3427927.8 5793244,3427927.85 5793244,3427927.85 5793243.95, ..

See Also

[ST_DumpAsPolygons](#), [ST_PixelAsPolygons](#), [ST_PixelAsPoint](#), [ST_PixelAsPoints](#), [ST_PixelAsCentroid](#), [ST_PixelAsCentroids](#), [ST_Intersection](#), [ST_AsText](#)

12.6.2 ST_PixelAsPolygons

ST_PixelAsPolygons — Returns the polygon geometry that bounds every pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel.

Synopsis

setof record ST_PixelAsPolygons(raster rast, integer band=1, boolean exclude_nodata_value=TRUE);

Description

Returns the polygon geometry that bounds every pixel of a raster band along with the value (double precision), the X and the Y raster coordinates (integers) of each pixel.

Return record format: *geom* **geometry**, *val* double precision, *x* integer, *y* integers.



Note
When *exclude_nodata_value* = TRUE, only those pixels whose values are not NODATA are returned as points.



Note
ST_PixelAsPolygons returns one polygon geometry for every pixel. This is different than ST_DumpAsPolygons where each geometry represents one or more pixels with the same pixel value.

Availability: 2.0.0
Enhanced: 2.1.0 *exclude_nodata_value* optional argument was added.
Changed: 2.1.1 Changed behavior of *exclude_nodata_value*.

Examples

```
-- get raster pixel polygon
SELECT (gv).x, (gv).y, (gv).val, ST_AsText((gv).geom) geom
FROM (SELECT ST_PixelAsPolygons(
    ST_SetValue(ST_SetValue(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 0.001, 0.001, 0.001, 0.001, 4269),
    '8BUI'::text, 1, 0),
    2, 2, 10),
    1, 1, NULL)
) gv
) foo;
```

x	y	val	geom
1	1		POLYGON((0 0,0.001 0.001,0.002 0,0.001 -0.001,0 0))
1	2	1	POLYGON((0.001 -0.001,0.002 0,0.003 -0.001,0.002 -0.002,0.001 -0.001))
2	1	1	POLYGON((0.001 0.001,0.002 0.002,0.003 0.001,0.002 0,0.001 0.001))
2	2	10	POLYGON((0.002 0,0.003 0.001,0.004 0,0.003 -0.001,0.002 0))

See Also

[ST_DumpAsPolygons](#), [ST_PixelAsPolygon](#), [ST_PixelAsPoint](#), [ST_PixelAsPoints](#), [ST_PixelAsCentroid](#), [ST_PixelAsCentroids](#), [ST_AsText](#)

12.6.3 ST_PixelAsPoint

ST_PixelAsPoint — Returns a point geometry of the pixel's upper-left corner.

Synopsis

geometry **ST_PixelAsPoint**(raster rast, integer columnx, integer rowy);

Description

Returns a point geometry of the pixel's upper-left corner.

Availability: 2.1.0

Examples

```
SELECT ST_AsText(ST_PixelAsPoint(rast, 1, 1)) FROM dummy_rast WHERE rid = 1;

 st_astext
-----
POINT(0.5 0.5)
```

See Also

[ST_DumpAsPolygons](#), [ST_PixelAsPolygon](#), [ST_PixelAsPolygons](#), [ST_PixelAsPoints](#), [ST_PixelAsCentroid](#), [ST_PixelAsCentroids](#)

12.6.4 ST_PixelAsPoints

ST_PixelAsPoints — Returns a point geometry for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The coordinates of the point geometry are of the pixel's upper-left corner.

Synopsis

setof record **ST_PixelAsPoints**(raster rast, integer band=1, boolean exclude_nodata_value=TRUE);

Description

Returns a point geometry for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The coordinates of the point geometry are of the pixel's upper-left corner.

Return record format: *geom* **geometry**, *val* double precision, *x* integer, *y* integers.



Note

When `exclude_nodata_value = TRUE`, only those pixels whose values are not NODATA are returned as points.

Availability: 2.1.0

Changed: 2.1.1 Changed behavior of `exclude_nodata_value`.

Examples

```
SELECT x, y, val, ST_AsText(geom) FROM (SELECT (ST_PixelAsPoints(rast, 1)).* FROM ↵
dummy_rast WHERE rid = 2) foo;
```

x	y	val	st_astext
1	1	253	POINT(3427927.75 5793244)
2	1	254	POINT(3427927.8 5793244)
3	1	253	POINT(3427927.85 5793244)
4	1	254	POINT(3427927.9 5793244)
5	1	254	POINT(3427927.95 5793244)
1	2	253	POINT(3427927.75 5793243.95)
2	2	254	POINT(3427927.8 5793243.95)
3	2	254	POINT(3427927.85 5793243.95)
4	2	253	POINT(3427927.9 5793243.95)
5	2	249	POINT(3427927.95 5793243.95)
1	3	250	POINT(3427927.75 5793243.9)
2	3	254	POINT(3427927.8 5793243.9)
3	3	254	POINT(3427927.85 5793243.9)
4	3	252	POINT(3427927.9 5793243.9)
5	3	249	POINT(3427927.95 5793243.9)
1	4	251	POINT(3427927.75 5793243.85)
2	4	253	POINT(3427927.8 5793243.85)
3	4	254	POINT(3427927.85 5793243.85)
4	4	254	POINT(3427927.9 5793243.85)
5	4	253	POINT(3427927.95 5793243.85)
1	5	252	POINT(3427927.75 5793243.8)
2	5	250	POINT(3427927.8 5793243.8)
3	5	254	POINT(3427927.85 5793243.8)
4	5	254	POINT(3427927.9 5793243.8)
5	5	254	POINT(3427927.95 5793243.8)

See Also

[ST_DumpAsPolygons](#), [ST_PixelAsPolygon](#), [ST_PixelAsPolygons](#), [ST_PixelAsPoint](#), [ST_PixelAsCentroid](#), [ST_PixelAsCentroids](#)

12.6.5 ST_PixelAsCentroid

ST_PixelAsCentroid — Returns the centroid (point geometry) of the area represented by a pixel.

Synopsis

geometry **ST_PixelAsCentroid**(raster rast, integer x, integer y);

Description

Returns the centroid (point geometry) of the area represented by a pixel.

Enhanced: 3.2.0 Faster now implemented in C.

Availability: 2.1.0

Examples

```
SELECT ST_AsText(ST_PixelAsCentroid(rast, 1, 1)) FROM dummy_rast WHERE rid = 1;

  st_astext
-----
POINT(1.5 2)
```

See Also

[ST_DumpAsPolygons](#), [ST_PixelAsPolygon](#), [ST_PixelAsPolygons](#), [ST_PixelAsPoint](#), [ST_PixelAsPoints](#), [ST_PixelAsCentroids](#)

12.6.6 ST_PixelAsCentroids

ST_PixelAsCentroids — Returns the centroid (point geometry) for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The point geometry is the centroid of the area represented by a pixel.

Synopsis

setof record **ST_PixelAsCentroids**(raster rast, integer band=1, boolean exclude_nodata_value=TRUE);

Description

Returns the centroid (point geometry) for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The point geometry is the centroid of the area represented by a pixel.

Return record format: *geom* **geometry**, *val* double precision, *x* integer, *y* integers.



Note
When *exclude_nodata_value* = TRUE, only those pixels whose values are not NODATA are returned as points.

Enhanced: 3.2.0 Faster now implemented in C.

Changed: 2.1.1 Changed behavior of *exclude_nodata_value*.

Availability: 2.1.0

Examples

```
--LATERAL syntax requires PostgreSQL 9.3+
SELECT x, y, val, ST_AsText(geom)
  FROM (SELECT dp.* FROM dummy_rast, LATERAL ST_PixelAsCentroids(rast, 1) AS dp WHERE rid <=
    = 2) foo;
 x | y | val |          st_astext
---+---+---+-----
 1 | 1 | 253 | POINT(3427927.775 5793243.975)
 2 | 1 | 254 | POINT(3427927.825 5793243.975)
 3 | 1 | 253 | POINT(3427927.875 5793243.975)
 4 | 1 | 254 | POINT(3427927.925 5793243.975)
 5 | 1 | 254 | POINT(3427927.975 5793243.975)
 1 | 2 | 253 | POINT(3427927.775 5793243.925)
 2 | 2 | 254 | POINT(3427927.825 5793243.925)
 3 | 2 | 254 | POINT(3427927.875 5793243.925)
```

```

4 | 2 | 253 | POINT(3427927.925 5793243.925)
5 | 2 | 249 | POINT(3427927.975 5793243.925)
1 | 3 | 250 | POINT(3427927.775 5793243.875)
2 | 3 | 254 | POINT(3427927.825 5793243.875)
3 | 3 | 254 | POINT(3427927.875 5793243.875)
4 | 3 | 252 | POINT(3427927.925 5793243.875)
5 | 3 | 249 | POINT(3427927.975 5793243.875)
1 | 4 | 251 | POINT(3427927.775 5793243.825)
2 | 4 | 253 | POINT(3427927.825 5793243.825)
3 | 4 | 254 | POINT(3427927.875 5793243.825)
4 | 4 | 254 | POINT(3427927.925 5793243.825)
5 | 4 | 253 | POINT(3427927.975 5793243.825)
1 | 5 | 252 | POINT(3427927.775 5793243.775)
2 | 5 | 250 | POINT(3427927.825 5793243.775)
3 | 5 | 254 | POINT(3427927.875 5793243.775)
4 | 5 | 254 | POINT(3427927.925 5793243.775)
5 | 5 | 254 | POINT(3427927.975 5793243.775)

```

See Also

[ST_DumpAsPolygons](#), [ST_PixelAsPolygon](#), [ST_PixelAsPolygons](#), [ST_PixelAsPoint](#), [ST_PixelAsPoints](#), [ST_PixelAsCentroid](#)

12.6.7 ST_Value

ST_Value — Returns the value of a given band in a given columnx, rowy pixel or at a particular geometric point. Band numbers start at 1 and assumed to be 1 if not specified. If `exclude_nodata_value` is set to false, then all pixels include `nodata` pixels are considered to intersect and return value. If `exclude_nodata_value` is not passed in then reads it from metadata of raster.

Synopsis

```

double precision ST_Value(raster rast, geometry pt, boolean exclude_nodata_value=true);
double precision ST_Value(raster rast, integer band, geometry pt, boolean exclude_nodata_value=true, text resample='nearest');
double precision ST_Value(raster rast, integer x, integer y, boolean exclude_nodata_value=true);
double precision ST_Value(raster rast, integer band, integer x, integer y, boolean exclude_nodata_value=true);

```

Description

Returns the value of a given band in a given columnx, rowy pixel or at a given geometry point. Band numbers start at 1 and band is assumed to be 1 if not specified.

If `exclude_nodata_value` is set to true, then only non `nodata` pixels are considered. If `exclude_nodata_value` is set to false, then all pixels are considered.

The allowed values of the `resample` parameter are "nearest" which performs the default nearest-neighbor resampling, and "bilinear" which performs a [bilinear interpolation](#) to estimate the value between pixel centers.

Enhanced: 3.2.0 `resample` optional argument was added.

Enhanced: 2.0.0 `exclude_nodata_value` optional argument was added.

Examples


```
-- get raster values at particular postgis geometry points
-- the srid of your geometry should be same as for your raster
SELECT rid, ST_Value(rast, foo.pt_geom) As b1pval, ST_Value(rast, 2, foo.pt_geom) As b2pval
FROM dummy_rast CROSS JOIN (SELECT ST_SetSRID(ST_Point(3427927.77, 5793243.76), 0) As
    pt_geom) As foo
WHERE rid=2;
```

rid	b1pval	b2pval
2	252	79

```
-- general fictitious example using a real table
SELECT rid, ST_Value(rast, 3, sometable.geom) As b3pval
FROM sometable
WHERE ST_Intersects(rast, sometable.geom);
```

```
SELECT rid, ST_Value(rast, 1, 1, 1) As b1pval,
    ST_Value(rast, 2, 1, 1) As b2pval, ST_Value(rast, 3, 1, 1) As b3pval
FROM dummy_rast
WHERE rid=2;
```

rid	b1pval	b2pval	b3pval
2	253	78	70

```
--- Get all values in bands 1,2,3 of each pixel ---
SELECT x, y, ST_Value(rast, 1, x, y) As b1val,
    ST_Value(rast, 2, x, y) As b2val, ST_Value(rast, 3, x, y) As b3val
FROM dummy_rast CROSS JOIN
generate_series(1, 1000) As x CROSS JOIN generate_series(1, 1000) As y
WHERE rid = 2 AND x <= ST_Width(rast) AND y <= ST_Height(rast);
```

x	y	b1val	b2val	b3val
1	1	253	78	70
1	2	253	96	80
1	3	250	99	90
1	4	251	89	77
1	5	252	79	62
2	1	254	98	86
2	2	254	118	108
:				
:				

```
--- Get all values in bands 1,2,3 of each pixel same as above but returning the upper left
point point of each pixel ---
SELECT ST_AsText(ST_SetSRID(
    ST_Point(ST_UpperLeftX(rast) + ST_ScaleX(rast)*x,
        ST_UpperLeftY(rast) + ST_ScaleY(rast)*y),
    ST_SRID(rast))) As uplpt
    , ST_Value(rast, 1, x, y) As b1val,
    ST_Value(rast, 2, x, y) As b2val, ST_Value(rast, 3, x, y) As b3val
FROM dummy_rast CROSS JOIN
generate_series(1,1000) As x CROSS JOIN generate_series(1,1000) As y
WHERE rid = 2 AND x <= ST_Width(rast) AND y <= ST_Height(rast);
```

uplpt	b1val	b2val	b3val
POINT(3427929.25 5793245.5)	253	78	70

```
POINT(3427929.25 5793247) | 253 | 96 | 80
POINT(3427929.25 5793248.5) | 250 | 99 | 90
:
```

```
--- Get a polygon formed by union of all pixels
    that fall in a particular value range and intersect particular polygon --
SELECT ST_AsText(ST_Union(pixpolyg)) As shadow
FROM (SELECT ST_Translate(ST_MakeEnvelope(
    ST_UpperLeftX(rast), ST_UpperLeftY(rast),
    ST_UpperLeftX(rast) + ST_ScaleX(rast),
    ST_UpperLeftY(rast) + ST_ScaleY(rast), 0
    ), ST_ScaleX(rast)*x, ST_ScaleY(rast)*y
    ) As pixpolyg, ST_Value(rast, 2, x, y) As b2val
    FROM dummy_rast CROSS JOIN
generate_series(1,1000) As x CROSS JOIN generate_series(1,1000) As y
WHERE rid = 2
    AND x <= ST_Width(rast) AND y <= ST_Height(rast)) As foo
WHERE
    ST_Intersects(
        pixpolyg,
        ST_GeomFromText('POLYGON((3427928 5793244,3427927.75 5793243.75,3427928 5793243.75,3427928 5793244))',0)
    ) AND b2val != 254;

-----
shadow
-----
MULTIPOLYGON(((3427928 5793243.9,3427928 5793243.85,3427927.95 5793243.85,3427927.95 5793243.9,
3427927.95 5793243.95,3427928 5793243.95,3427928.05 5793243.95,3427928.05 5793243.9,3427928 5793243.9),
((3427927.95 5793243.9,3427927.95 5793243.85,3427927.9 5793243.85,3427927.9 5793243.9,3427927.9 5793243.95,
3427927.95 5793243.95,3427927.95 5793243.9),
((3427927.85 5793243.75,3427927.85 5793243.7,3427927.8 5793243.7,3427927.8 5793243.75,
3427927.8 5793243.8,3427927.8 5793243.85,3427927.85 5793243.85,3427927.85 5793243.8,3427927.85 5793243.75)),
((3427928.05 5793243.75,3427928.05 5793243.7,3427928 5793243.7,3427927.95 5793243.7,3427927.95 5793243.75,
3427927.95 5793243.8,3427927.95 5793243.85,3427928 5793243.85,3427928 5793243.8,3427928.05 5793243.8,
3427928.05 5793243.75)),
((3427927.95 5793243.75,3427927.95 5793243.7,3427927.9 5793243.7,3427927.9 5793243.75,3427927.9 5793243.8,
3427927.85 5793243.8,3427927.85 5793243.85,3427927.85 5793243.85,3427927.9 5793243.85,
3427927.95 5793243.85,3427927.95 5793243.8,3427927.95 5793243.75)))
```

```
--- Checking all the pixels of a large raster tile can take a long time.
--- You can dramatically improve speed at some lose of precision by orders of magnitude
-- by sampling pixels using the step optional parameter of generate_series.
-- This next example does the same as previous but by checking 1 for every 4 (2x2) pixels ←
and putting in the last checked
-- putting in the checked pixel as the value for subsequent 4
```

```
SELECT ST_AsText(ST_Union(pixpolyg)) As shadow
FROM (SELECT ST_Translate(ST_MakeEnvelope(
    ST_UpperLeftX(rast), ST_UpperLeftY(rast),
    ST_UpperLeftX(rast) + ST_ScaleX(rast)*2,
    ST_UpperLeftY(rast) + ST_ScaleY(rast)*2, 0
    ), ST_ScaleX(rast)*x, ST_ScaleY(rast)*y
    ) As pixpolyg, ST_Value(rast, 2, x, y) As b2val
    FROM dummy_rast CROSS JOIN
generate_series(1,1000,2) As x CROSS JOIN generate_series(1,1000,2) As y
```

```

WHERE rid = 2
  AND x <= ST_Width(rast)  AND y <= ST_Height(rast)  ) As foo
WHERE
  ST_Intersects(
    pixpolyg,
    ST_GeomFromText('POLYGON((3427928 5793244,3427927.75 5793243.75,3427928  ←
      5793243.75,3427928 5793244))',0)
  ) AND b2val != 254;

-----
MULTIPOLYGON(((3427927.9 5793243.85,3427927.8 5793243.85,3427927.8 5793243.95,
3427927.9 5793243.95,3427928 5793243.95,3427928.1 5793243.95,3427928.1 5793243.85,3427928  ←
  5793243.85,3427927.9 5793243.85))),
((3427927.9 5793243.65,3427927.8 5793243.65,3427927.8 5793243.75,3427927.8  ←
  5793243.85,3427927.9 5793243.85,
3427928 5793243.85,3427928 5793243.75,3427928.1 5793243.75,3427928.1 5793243.65,3427928  ←
  5793243.65,3427927.9 5793243.65)))

```

See Also

[ST_SetValue](#), [ST_DumpAsPolygons](#), [ST_NumBands](#), [ST_PixelAsPolygon](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_UpperLeftX](#), [ST_UpperLeftY](#), [ST_SRID](#), [ST_AsText](#), [ST_Point](#), [ST_MakeEnvelope](#), [ST_Intersects](#), [ST_Intersection](#)

12.6.8 ST_NearestValue

ST_NearestValue — Returns the nearest non-NODATA value of a given band's pixel specified by a columnx and rowy or a geometric point expressed in the same spatial reference coordinate system as the raster.

Synopsis

```

double precision ST_NearestValue(raster rast, integer bandnum, geometry pt, boolean exclude_nodata_value=true);
double precision ST_NearestValue(raster rast, geometry pt, boolean exclude_nodata_value=true);
double precision ST_NearestValue(raster rast, integer bandnum, integer columnx, integer rowy, boolean exclude_nodata_value=true);
double precision ST_NearestValue(raster rast, integer columnx, integer rowy, boolean exclude_nodata_value=true);

```

Description

Returns the nearest non-NODATA value of a given band in a given columnx, rowy pixel or at a specific geometric point. If the columnx, rowy pixel or the pixel at the specified geometric point is NODATA, the function will find the nearest pixel to the columnx, rowy pixel or geometric point whose value is not NODATA.

Band numbers start at 1 and bandnum is assumed to be 1 if not specified. If `exclude_nodata_value` is set to false, then all pixels include nodata pixels are considered to intersect and return value. If `exclude_nodata_value` is not passed in then reads it from metadata of raster.

Availability: 2.1.0



Note

ST_NearestValue is a drop-in replacement for **ST_Value**.

Examples

```
-- pixel 2x2 has value
SELECT
    ST_Value(rast, 2, 2) AS value,
    ST_NearestValue(rast, 2, 2) AS nearestvalue
FROM (
    SELECT
        ST_SetValue(
            ST_SetValue(
                ST_SetValue(
                    ST_SetValue(
                        ST_SetValue(
                            ST_AddBand(
                                ST_MakeEmptyRaster(5, 5, -2, 2, 1, -1, 0, 0, 0),
                                '8BUI'::text, 1, 0
                            ),
                            1, 1, 0.
                        ),
                        2, 3, 0.
                    ),
                    3, 5, 0.
                ),
                4, 2, 0.
            ),
            5, 4, 0.
        ) AS rast
    ) AS foo

value | nearestvalue
-----+-----
1 | 1
```

```
-- pixel 2x3 is NODATA
SELECT
    ST_Value(rast, 2, 3) AS value,
    ST_NearestValue(rast, 2, 3) AS nearestvalue
FROM (
    SELECT
        ST_SetValue(
            ST_SetValue(
                ST_SetValue(
                    ST_SetValue(
                        ST_SetValue(
                            ST_AddBand(
                                ST_MakeEmptyRaster(5, 5, -2, 2, 1, -1, 0, 0, 0),
                                '8BUI'::text, 1, 0
                            ),
                            1, 1, 0.
                        ),
                        2, 3, 0.
                    ),
                    3, 5, 0.
                ),
                4, 2, 0.
            ),
            5, 4, 0.
        ) AS rast
    ) AS foo

value | nearestvalue
```

```
-----+-----
      |           1
```

See Also

[ST_Neighborhood](#), [ST_Value](#)

12.6.9 ST_SetZ

ST_SetZ — Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimension using the requested resample algorithm.

Synopsis

geometry **ST_SetZ**(raster rast, geometry geom, text resample=nearest, integer band=1);

Description

Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimensions using the requested resample algorithm.

The `resample` parameter can be set to "nearest" to copy the values from the cell each vertex falls within, or "bilinear" to use [bilinear interpolation](#) to calculate a value that takes neighboring cells into account also.

Availability: 3.2.0

Examples

```
--
-- 2x2 test raster with values
--
-- 10 50
-- 40 20
--
WITH test_raster AS (
SELECT
ST_SetValues(
  ST_AddBand(
    ST_MakeEmptyRaster(width => 2,height => 2,
      upperleftx => 0, upperlefty => 2,
      scalex => 1.0, scaley => -1.0,
      skewx => 0, skewy => 0, srid => 4326),
    index => 1, pixeltype => '16BSI',
    initialvalue => 0,
    nodataval => -999),
  1,1,1,
  newvalueset =>ARRAY[ARRAY[10.0::float8, 50.0::float8], ARRAY[40.0::float8, 20.0::float8] ←
    ]) AS rast
)
SELECT
ST_AsText(
  ST_SetZ(
    rast,
    band => 1,
    geom => 'SRID=4326;LINESTRING(1.0 1.9, 1.0 0.2)::geometry,
    resample => 'bilinear'
```

```

))
FROM test_raster

          st_astext
-----
LINESTRING Z (1 1.9 38,1 0.2 27)

```

See Also

[ST_Value](#), [ST_SetM](#)

12.6.10 ST_SetM

ST_SetM — Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimension using the requested resample algorithm.

Synopsis

geometry **ST_SetM**(raster rast, geometry geom, text resample=nearest, integer band=1);

Description

Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimensions using the requested resample algorithm.

The `resample` parameter can be set to "nearest" to copy the values from the cell each vertex falls within, or "bilinear" to use [bilinear interpolation](#) to calculate a value that takes neighboring cells into account also.

Availability: 3.2.0

Examples

```

--
-- 2x2 test raster with values
--
-- 10 50
-- 40 20
--
WITH test_raster AS (
SELECT
ST_SetValues(
  ST_AddBand(
    ST_MakeEmptyRaster(width => 2, height => 2,
      upperleftx => 0, upperlefty => 2,
      scalex => 1.0, scaley => -1.0,
      skewx => 0, skewy => 0, srid => 4326),
    index => 1, pixeltype => '16BSI',
    initialvalue => 0,
    nodataval => -999),
  1,1,1,
  newvalueset => ARRAY[ARRAY[10.0::float8, 50.0::float8], ARRAY[40.0::float8, 20.0::float8] ↔
    ]) AS rast
)
SELECT
ST_AsText(
  ST_SetM(

```

```

    rast,
    band => 1,
    geom => 'SRID=4326;LINESTRING(1.0 1.9, 1.0 0.2)::geometry,
    resample => 'bilinear'
))
FROM test_raster

          st_astext
-----
LINESTRING M (1 1.9 38,1 0.2 27)

```

See Also

[ST_Value](#), [ST_SetZ](#)

12.6.11 ST_Neighborhood

ST_Neighborhood — Returns a 2-D double precision array of the non-NODATA values around a given band's pixel specified by either a columnX and rowY or a geometric point expressed in the same spatial reference coordinate system as the raster.

Synopsis

```

double precision[][] ST_Neighborhood(raster rast, integer bandnum, integer columnX, integer rowY, integer distanceX, integer
distanceY, boolean exclude_nodata_value=true);
double precision[][] ST_Neighborhood(raster rast, integer columnX, integer rowY, integer distanceX, integer distanceY, boolean
exclude_nodata_value=true);
double precision[][] ST_Neighborhood(raster rast, integer bandnum, geometry pt, integer distanceX, integer distanceY, boolean
exclude_nodata_value=true);
double precision[][] ST_Neighborhood(raster rast, geometry pt, integer distanceX, integer distanceY, boolean exclude_nodata_value=true);

```

Description

Returns a 2-D double precision array of the non-NODATA values around a given band's pixel specified by either a columnX and rowY or a geometric point expressed in the same spatial reference coordinate system as the raster. The *distanceX* and *distanceY* parameters define the number of pixels around the specified pixel in the X and Y axes, e.g. I want all values within 3 pixel distance along the X axis and 2 pixel distance along the Y axis around my pixel of interest. The center value of the 2-D array will be the value at the pixel specified by the columnX and rowY or the geometric point.

Band numbers start at 1 and *bandnum* is assumed to be 1 if not specified. If *exclude_nodata_value* is set to false, then all pixels include nodata pixels are considered to intersect and return value. If *exclude_nodata_value* is not passed in then reads it from metadata of raster.



Note

The number of elements along each axis of the returning 2-D array is $2 * (\text{distanceX}|\text{distanceY}) + 1$. So for a *distanceX* and *distanceY* of 1, the returning array will be 3x3.



Note

The 2-D array output can be passed to any of the raster processing builtin functions, e.g. *ST_Min4ma*, *ST_Sum4ma*, *ST_Mean4ma*.

Availability: 2.1.0

Examples

```
-- pixel 2x2 has value
SELECT
    ST_Neighborhood(rast, 2, 2, 1, 1)
FROM (
    SELECT
        ST_SetValues(
            ST_AddBand(
                ST_MakeEmptyRaster(5, 5, -2, 2, 1, -1, 0, 0, 0),
                '8BUI'::text, 1, 0
            ),
            1, 1, 1, ARRAY[
                [0, 1, 1, 1, 1],
                [1, 1, 1, 0, 1],
                [1, 0, 1, 1, 1],
                [1, 1, 1, 1, 0],
                [1, 1, 0, 1, 1]
            ]::double precision[],
            1
        ) AS rast
    ) AS foo

    st_neighborhood
-----
{{NULL,1,1},{1,1,1},{1,NULL,1}}
```

```
-- pixel 2x3 is NODATA
SELECT
    ST_Neighborhood(rast, 2, 3, 1, 1)
FROM (
    SELECT
        ST_SetValues(
            ST_AddBand(
                ST_MakeEmptyRaster(5, 5, -2, 2, 1, -1, 0, 0, 0),
                '8BUI'::text, 1, 0
            ),
            1, 1, 1, ARRAY[
                [0, 1, 1, 1, 1],
                [1, 1, 1, 0, 1],
                [1, 0, 1, 1, 1],
                [1, 1, 1, 1, 0],
                [1, 1, 0, 1, 1]
            ]::double precision[],
            1
        ) AS rast
    ) AS foo

    st_neighborhood
-----
{{1,1,1},{1,NULL,1},{1,1,1}}
```

```
-- pixel 3x3 has value
-- exclude_nodata_value = FALSE
SELECT
    ST_Neighborhood(rast, 3, 3, 1, 1, false)
FROM ST_SetValues(
    ST_AddBand(
        ST_MakeEmptyRaster(5, 5, -2, 2, 1, -1, 0, 0, 0),
        '8BUI'::text, 1, 0
    ),
    1, 1, 1, ARRAY[
        [0, 1, 1, 1, 1],
        [1, 1, 1, 0, 1],
        [1, 0, 1, 1, 1],
        [1, 1, 1, 1, 0],
        [1, 1, 0, 1, 1]
    ]::double precision[],
    1
)
```



```
1, 1, 1, ARRAY[
    [0, 1, 1, 1, 1],
    [1, 1, 1, 0, 1],
    [1, 0, 1, 1, 1],
    [1, 1, 1, 1, 0],
    [1, 1, 0, 1, 1]
]::double precision[],
1
) AS rast

st_neighborhood
-----
{{1,1,0},{0,1,1},{1,1,1}}
```

See Also

[ST_NearestValue](#), [ST_Min4ma](#), [ST_Max4ma](#), [ST_Sum4ma](#), [ST_Mean4ma](#), [ST_Range4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.6.12 ST_SetValue

ST_SetValue — Returns modified raster resulting from setting the value of a given band in a given columnx, rowy pixel or the pixels that intersect a particular geometry. Band numbers start at 1 and assumed to be 1 if not specified.

Synopsis

raster **ST_SetValue**(raster rast, integer bandnum, geometry geom, double precision newvalue);
raster **ST_SetValue**(raster rast, geometry geom, double precision newvalue);
raster **ST_SetValue**(raster rast, integer bandnum, integer columnx, integer rowy, double precision newvalue);
raster **ST_SetValue**(raster rast, integer columnx, integer rowy, double precision newvalue);

Description

Returns modified raster resulting from setting the specified pixels' values to new value for the designated band given the raster's row and column or a geometry. If no band is specified, then band 1 is assumed.

Enhanced: 2.1.0 Geometry variant of ST_SetValue() now supports any geometry type, not just point. The geometry variant is a wrapper around the geomval[] variant of ST_SetValues()

Examples

```
-- Geometry example
SELECT (foo.geomval).val, ST_AsText(ST_Union((foo.geomval).geom))
FROM (SELECT ST_DumpAsPolygons(
    ST_SetValue(rast,1,
        ST_Point(3427927.75, 5793243.95),
        50)
    ) As geomval
FROM dummy_rast
where rid = 2) As foo
WHERE (foo.geomval).val < 250
GROUP BY (foo.geomval).val;

val | st_astext
-----+-----
50 | POLYGON((3427927.75 5793244,3427927.75 5793243.95,3427927.8 579324 ...
249 | POLYGON((3427927.95 5793243.95,3427927.95 5793243.85,3427928 57932 ...
```

```
-- Store the changed raster --
UPDATE dummy_rast SET rast = ST_SetValue(rast,1, ST_Point(3427927.75, 5793243.95),100)
WHERE rid = 2 ;
```

See Also

[ST_Value](#), [ST_DumpAsPolygons](#)

12.6.13 ST_SetValues

ST_SetValues — Returns modified raster resulting from setting the values of a given band.

Synopsis

raster **ST_SetValues**(raster rast, integer nband, integer columnx, integer rowy, double precision[][] newvalueset, boolean[][] noset=NULL, boolean keepnodata=FALSE);
raster **ST_SetValues**(raster rast, integer nband, integer columnx, integer rowy, double precision[][] newvalueset, double precision nosetvalue, boolean keepnodata=FALSE);
raster **ST_SetValues**(raster rast, integer nband, integer columnx, integer rowy, integer width, integer height, double precision newvalue, boolean keepnodata=FALSE);
raster **ST_SetValues**(raster rast, integer columnx, integer rowy, integer width, integer height, double precision newvalue, boolean keepnodata=FALSE);
raster **ST_SetValues**(raster rast, integer nband, geomval[] geomvalset, boolean keepnodata=FALSE);

Description

Returns modified raster resulting from setting specified pixels to new value(s) for the designated band. `columnx` and `rowy` are 1-indexed.

If `keepnodata` is TRUE, those pixels whose values are NODATA will not be set with the corresponding value in `newvalueset`.

For Variant 1, the specific pixels to be set are determined by the `columnx`, `rowy` pixel coordinates and the dimensions of the `newvalueset` array. `noset` can be used to prevent pixels with values present in `newvalueset` from being set (due to PostgreSQL not permitting ragged/jagged arrays). See example Variant 1.

Variant 2 is like Variant 1 but with a simple double precision `nosetvalue` instead of a boolean `noset` array. Elements in `newvalueset` with the `nosetvalue` value will be skipped. See example Variant 2.

For Variant 3, the specific pixels to be set are determined by the `columnx`, `rowy` pixel coordinates, `width` and `height`. See example Variant 3.

Variant 4 is the same as Variant 3 with the exception that it assumes that the first band's pixels of `rast` will be set.

For Variant 5, an array of `geomval` is used to determine the specific pixels to be set. If all the geometries in the array are of type POINT or MULTIPOINT, the function uses a shortcut where the longitude and latitude of each point is used to set a pixel directly. Otherwise, the geometries are converted to rasters and then iterated through in one pass. See example Variant 5.

Availability: 2.1.0

Examples: Variant 1

```

/*
The ST_SetValues() does the following...

+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 1 | 1 | 1 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      => | 1 | 9 | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 1 | 9 | 9 |
+ - + - + - +      + - + - + - +

*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
    SELECT
        ST_PixelAsPolygons(
            ST_SetValues(
                ST_AddBand(
                    ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                    1, '8BUI', 1, 0
                ),
                1, 2, 2, ARRAY[[9, 9], [9, 9]]::double precision[][]
            )
        ) AS poly
    ) foo
ORDER BY 1, 2;

 x | y | val
---+---+-----
 1 | 1 |    1
 1 | 2 |    1
 1 | 3 |    1
 2 | 1 |    1
 2 | 2 |    9
 2 | 3 |    9
 3 | 1 |    1
 3 | 2 |    9
 3 | 3 |    9

```

```

/*
The ST_SetValues() does the following...

+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 9 | 9 | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      => | 9 |   | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 9 | 9 | 9 |
+ - + - + - +      + - + - + - +

*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
    SELECT
        ST_PixelAsPolygons(
            ST_SetValues(
                ST_AddBand(

```

```

        ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
        1, '8BUI', 1, 0
    ),
    1, 1, 1, ARRAY[[9, 9, 9], [9, NULL, 9], [9, 9, 9]]::double precision[][])
) AS poly
) foo
ORDER BY 1, 2;

```

x	y	val
1	1	9
1	2	9
1	3	9
2	1	9
2	2	
2	3	9
3	1	9
3	2	9
3	3	9

```

/*
The ST_SetValues() does the following...

```

```

+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 9 | 9 | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      => | 1 |   | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 9 | 9 | 9 |
+ - + - + - +      + - + - + - +
*/

```

```

SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
    SELECT
        ST_PixelAsPolygons(
            ST_SetValues(
                ST_AddBand(
                    ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                    1, '8BUI', 1, 0
                ),
                1, 1, 1,
                ARRAY[[9, 9, 9], [9, NULL, 9], [9, 9, 9]]::double precision[][],
                ARRAY[[false], [true]]::boolean[][])
        ) AS poly
    ) foo
ORDER BY 1, 2;

```

x	y	val
1	1	9
1	2	1
1	3	9
2	1	9
2	2	
2	3	9
3	1	9
3	2	9

```
3 | 3 | 9
```

```
/*
The ST_SetValues() does the following...

+ - + - + - +      + - + - + - +
|   | 1 | 1 |      |   | 9 | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      => | 1 |   | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 9 | 9 | 9 |
+ - + - + - +      + - + - + - +

*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
    SELECT
        ST_PixelAsPolygons(
            ST_SetValues(
                ST_SetValue(
                    ST_AddBand(
                        ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                        1, '8BUI', 1, 0
                    ),
                    1, 1, 1, NULL
                ),
                1, 1, 1,
                ARRAY[[9, 9, 9], [9, NULL, 9], [9, 9, 9]]::double precision[][],
                ARRAY[[false], [true]]::boolean[][],
                TRUE
            )
        ) AS poly
    ) foo
ORDER BY 1, 2;

 x | y | val
---+---+-----
 1 | 1 | 
 1 | 2 |  1
 1 | 3 |  9
 2 | 1 |  9
 2 | 2 | 
 2 | 3 |  9
 3 | 1 |  9
 3 | 2 |  9
 3 | 3 |  9
```

Examples: Variant 2

```
/*
The ST_SetValues() does the following...

+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 1 | 1 | 1 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      => | 1 | 9 | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 1 | 9 | 9 |
```

```

+ - + - + - +          + - + - + - +
*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
SELECT
    ST_PixelAsPolygons(
        ST_SetValues(
            ST_AddBand(
                ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                1, '8BUI', 1, 0
            ),
            1, 1, 1, ARRAY[[-1, -1, -1], [-1, 9, 9], [-1, 9, 9]]::double precision[[]], -1
        )
    ) AS poly
) foo
ORDER BY 1, 2;

```

x	y	val
1	1	1
1	2	1
1	3	1
2	1	1
2	2	9
2	3	9
3	1	1
3	2	9
3	3	9

```

/*
This example is like the previous one. Instead of nosetvalue = -1, nosetvalue = NULL

```

The ST_SetValues() does the following...

```

+ - + - + - +          + - + - + - +
| 1 | 1 | 1 |          | 1 | 1 | 1 |
+ - + - + - +          + - + - + - +
| 1 | 1 | 1 |          => | 1 | 9 | 9 |
+ - + - + - +          + - + - + - +
| 1 | 1 | 1 |          | 1 | 9 | 9 |
+ - + - + - +          + - + - + - +
*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
SELECT
    ST_PixelAsPolygons(
        ST_SetValues(
            ST_AddBand(
                ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                1, '8BUI', 1, 0
            ),
            1, 1, 1, ARRAY[[NULL, NULL, NULL], [NULL, 9, 9], [NULL, 9, 9]]::double ←
                precision[[]], NULL::double precision
        )
    ) AS poly
) foo

```

```
ORDER BY 1, 2;
```

x	y	val
1	1	1
1	2	1
1	3	1
2	1	1
2	2	9
2	3	9
3	1	1
3	2	9
3	3	9

Examples: Variant 3

```
/*
The ST_SetValues() does the following...
```

<pre>+ - + - + - + 1 1 1 + - + - + - + 1 1 1 + - + - + - + 1 1 1 + - + - + - +</pre>	=>	<pre>+ - + - + - + 1 1 1 + - + - + - + 1 9 9 + - + - + - + 1 9 9 + - + - + - +</pre>
--	----	--

```
*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
    SELECT
        ST_PixelAsPolygons(
            ST_SetValues(
                ST_AddBand(
                    ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                    1, '8BUI', 1, 0
                ),
                1, 2, 2, 2, 2, 9
            )
        ) AS poly
    ) foo
ORDER BY 1, 2;
```

x	y	val
1	1	1
1	2	1
1	3	1
2	1	1
2	2	9
2	3	9
3	1	1
3	2	9
3	3	9

```
/*
The ST_SetValues() does the following...
```

```

+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 1 | 1 | 1 |
+ - + - + - +      + - + - + - +
| 1 |   | 1 |      => | 1 |   | 9 |
+ - + - + - +      + - + - + - +
| 1 | 1 | 1 |      | 1 | 9 | 9 |
+ - + - + - +      + - + - + - +
*/
SELECT
    (poly).x,
    (poly).y,
    (poly).val
FROM (
SELECT
    ST_PixelAsPolygons(
        ST_SetValues(
            ST_SetValue(
                ST_AddBand(
                    ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
                    1, '8BUI', 1, 0
                ),
                1, 2, 2, NULL
            ),
            1, 2, 2, 2, 2, 9, TRUE
        )
    ) AS poly
) foo
ORDER BY 1, 2;

 x | y | val
---+---+-----
 1 | 1 |    1
 1 | 2 |    1
 1 | 3 |    1
 2 | 1 |    1
 2 | 2 |
 2 | 3 |    9
 3 | 1 |    1
 3 | 2 |    9
 3 | 3 |    9

```

Examples: Variant 5

```

WITH foo AS (
    SELECT 1 AS rid, ST_AddBand(ST_MakeEmptyRaster(5, 5, 0, 0, 1, -1, 0, 0, 0), 1, '8BUI', ←
        0, 0) AS rast
), bar AS (
    SELECT 1 AS gid, 'SRID=0;POINT(2.5 -2.5)::geometry geom UNION ALL
    SELECT 2 AS gid, 'SRID=0;POLYGON((1 -1, 4 -1, 4 -4, 1 -4, 1 -1))::geometry geom UNION ←
        ALL
    SELECT 3 AS gid, 'SRID=0;POLYGON((0 0, 5 0, 5 -1, 1 -1, 1 -4, 0 -4, 0 0))::geometry ←
        geom UNION ALL
    SELECT 4 AS gid, 'SRID=0;MULTIPOINT(0 0, 4 4, 4 -4)::geometry
)
SELECT
    rid, gid, ST_DumpValues(ST_SetValue(rast, 1, geom, gid))
FROM foo t1
CROSS JOIN bar t2
ORDER BY rid, gid;

```


rid	gid	st_dumpvalues
1	1	{(1, "{NULL, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}, {NULL, NULL, 1, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}}")}
1	2	{(1, "{NULL, NULL, NULL, NULL, NULL}, {NULL, 2, 2, 2, NULL}, {NULL, 2, 2, 2, NULL}, {NULL, 2, 2, 2, NULL}, {NULL, 2, 2, 2, NULL}}")}
1	3	{(1, "{3, 3, 3, 3, 3}, {3, NULL, NULL, NULL, NULL}, {3, NULL, NULL, NULL, NULL}, {3, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}}")}
1	4	{(1, "{4, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, NULL}, {NULL, NULL, NULL, NULL, 4}}")}

(4 rows)

The following shows that geomvals later in the array can overwrite prior geomvals

```
WITH foo AS (
  SELECT 1 AS rid, ST_AddBand(ST_MakeEmptyRaster(5, 5, 0, 0, 1, -1, 0, 0, 0), 1, '8BUI', 0, 0) AS rast
), bar AS (
  SELECT 1 AS gid, 'SRID=0;POINT(2.5 -2.5)::geometry geom UNION ALL
  SELECT 2 AS gid, 'SRID=0;POLYGON((1 -1, 4 -1, 4 -4, 1 -4, 1 -1))::geometry geom UNION ALL
  SELECT 3 AS gid, 'SRID=0;POLYGON((0 0, 5 0, 5 -1, 1 -1, 1 -4, 0 -4, 0 0))::geometry geom UNION ALL
  SELECT 4 AS gid, 'SRID=0;MULTIPOINT(0 0, 4 4, 4 -4)::geometry
)
SELECT
  t1.rid, t2.gid, t3.gid, ST_DumpValues(ST_SetValues(rast, 1, ARRAY[ROW(t2.geom, t2.gid), ROW(t3.geom, t3.gid)]::geomval[]))
FROM foo t1
CROSS JOIN bar t2
CROSS JOIN bar t3
WHERE t2.gid = 1
      AND t3.gid = 2
ORDER BY t1.rid, t2.gid, t3.gid;
```

rid	gid	gid	st_dumpvalues
1	1	2	{(1, "{NULL, NULL, NULL, NULL, NULL}, {NULL, 2, 2, 2, NULL}, {NULL, 2, 2, 2, NULL}, {NULL, 2, 2, 2, NULL}, {NULL, NULL, NULL, NULL, NULL}}")}

(1 row)

This example is the opposite of the prior example

```
WITH foo AS (
  SELECT 1 AS rid, ST_AddBand(ST_MakeEmptyRaster(5, 5, 0, 0, 1, -1, 0, 0, 0), 1, '8BUI', 0, 0) AS rast
), bar AS (
  SELECT 1 AS gid, 'SRID=0;POINT(2.5 -2.5)::geometry geom UNION ALL
  SELECT 2 AS gid, 'SRID=0;POLYGON((1 -1, 4 -1, 4 -4, 1 -4, 1 -1))::geometry geom UNION ALL
  SELECT 3 AS gid, 'SRID=0;POLYGON((0 0, 5 0, 5 -1, 1 -1, 1 -4, 0 -4, 0 0))::geometry geom UNION ALL
  SELECT 4 AS gid, 'SRID=0;MULTIPOINT(0 0, 4 4, 4 -4)::geometry
)
SELECT
  t1.rid, t2.gid, t3.gid, ST_DumpValues(ST_SetValues(rast, 1, ARRAY[ROW(t2.geom, t2.gid), ROW(t3.geom, t3.gid)]::geomval[]))
FROM foo t1
CROSS JOIN bar t2
CROSS JOIN bar t3
```

```
WHERE t2.gid = 2
      AND t3.gid = 1
ORDER BY t1.rid, t2.gid, t3.gid;

rid | gid | gid | st_dumpvalues
-----+-----+-----+-----
1   | 2   | 1   | (1, "{NULL,NULL,NULL,NULL,NULL},{NULL,2,2,2,NULL},{NULL,2,1,2,NULL},{
      NULL,2,2,2,NULL},{NULL,NULL,NULL,NULL,NULL}" )
(1 row)
```

See Also

[ST_Value](#), [ST_SetValue](#), [ST_PixelAsPolygons](#)

12.6.14 ST_DumpValues

ST_DumpValues — Get the values of the specified band as a 2-dimension array.

Synopsis

setof record **ST_DumpValues**(raster rast , integer[] nband=NULL , boolean exclude_nodata_value=true);
double precision[][] **ST_DumpValues**(raster rast , integer nband , boolean exclude_nodata_value=true);

Description

Get the values of the specified band as a 2-dimension array (first index is row, second is column). If nband is NULL or not provided, all raster bands are processed.

Availability: 2.1.0

Examples

```
WITH foo AS (
  SELECT ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
    1, '8BUI'::text, 1, 0), 2, '32BF'::text, 3, -9999), 3, '16BSI', 0, 0) AS rast
)
SELECT
  (ST_DumpValues(rast)).*
FROM foo;

nband | valarray
-----+-----
1 | {{1,1,1},{1,1,1},{1,1,1}}
2 | {{3,3,3},{3,3,3},{3,3,3}}
3 | {{NULL,NULL,NULL},{NULL,NULL,NULL},{NULL,NULL,NULL}}
(3 rows)
```

```
WITH foo AS (
  SELECT ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0),
    1, '8BUI'::text, 1, 0), 2, '32BF'::text, 3, -9999), 3, '16BSI', 0, 0) AS rast
)
SELECT
  (ST_DumpValues(rast, ARRAY[3, 1])).*
FROM foo;
```

```
 nband | valarray
-----+-----
      3 | {{NULL,NULL,NULL},{NULL,NULL,NULL},{NULL,NULL,NULL}}
      1 | {{1,1,1},{1,1,1},{1,1,1}}
(2 rows)
```

```
WITH foo AS (
    SELECT ST_SetValue(ST_AddBand(ST_MakeEmptyRaster(3, 3, 0, 0, 1, -1, 0, 0, 0), 1, '8BUI ←
        ', 1, 0), 1, 2, 5) AS rast
)
SELECT
    (ST_DumpValues(rast, 1))[2][1]
FROM foo;

 st_dumpvalues
-----
              5
(1 row)
```

See Also

[ST_Value](#), [ST_SetValue](#), [ST_SetValues](#)

12.6.15 ST_PixelOfValue

ST_PixelOfValue — Get the columnx, rowy coordinates of the pixel whose value equals the search value.

Synopsis

setof record **ST_PixelOfValue**(raster rast , integer nband , double precision[] search , boolean exclude_nodata_value=true);
setof record **ST_PixelOfValue**(raster rast , double precision[] search , boolean exclude_nodata_value=true);
setof record **ST_PixelOfValue**(raster rast , integer nband , double precision search , boolean exclude_nodata_value=true);
setof record **ST_PixelOfValue**(raster rast , double precision search , boolean exclude_nodata_value=true);

Description

Get the columnx, rowy coordinates of the pixel whose value equals the search value. If no band is specified, then band 1 is assumed.

Availability: 2.1.0

Examples

```
SELECT
    (pixels).*
FROM (
    SELECT
        ST_PixelOfValue(
            ST_SetValue(
                ST_SetValue(
                    ST_SetValue(
                        ST_SetValue(
                            ST_SetValue(
                                ST_AddBand(
```

```

        ST_MakeEmptyRaster(5, 5, -2, 2, 1, -1, 0, 0, 0),
        '8BUI'::text, 1, 0
    ),
    1, 1, 0
),
    2, 3, 0
),
    3, 5, 0
),
    4, 2, 0
),
    5, 4, 255
)
, 1, ARRAY[1, 255]) AS pixels
) AS foo
```

val	x	y
1	1	2
1	1	3
1	1	4
1	1	5
1	2	1
1	2	2
1	2	4
1	2	5
1	3	1
1	3	2
1	3	3
1	3	4
1	4	1
1	4	3
1	4	4
1	4	5
1	5	1
1	5	2
1	5	3
255	5	4
1	5	5

12.7 Raster Editors

12.7.1 ST_SetGeoReference

ST_SetGeoReference — Set Georeference 6 georeference parameters in a single call. Numbers should be separated by white space. Accepts inputs in GDAL or ESRI format. Default is GDAL.

Synopsis

raster **ST_SetGeoReference**(raster rast, text georefcoords, text format=GDAL);
raster **ST_SetGeoReference**(raster rast, double precision upperleftx, double precision upperlefty, double precision scalex, double precision scaley, double precision skewx, double precision skewy);

Description

Set Georeference 6 georeference parameters in a single call. Accepts inputs in 'GDAL' or 'ESRI' format. Default is GDAL. If 6 coordinates are not provided will return null.

Difference between format representations is as follows:

GDAL:

```
scalex skewy skewx scaley upperleftx upperlefty
```

ESRI:

```
scalex skewy skewx scaley upperleftx + scalex*0.5 upperlefty + scaley*0.5
```



Note
If the raster has out-db bands, changing the georeference may result in incorrect access of the band's externally stored data.

Enhanced: 2.1.0 Addition of ST_SetGeoReference(raster, double precision, ...) variant

Examples

```
WITH foo AS (  
    SELECT ST_MakeEmptyRaster(5, 5, 0, 0, 1, -1, 0, 0, 0) AS rast  
)  
SELECT  
    0 AS rid, (ST_Metadata(rast)).*  
FROM foo  
UNION ALL  
SELECT  
    1, (ST_Metadata(ST_SetGeoReference(rast, '10 0 0 -10 0.1 0.1', 'GDAL'))).*  
FROM foo  
UNION ALL  
SELECT  
    2, (ST_Metadata(ST_SetGeoReference(rast, '10 0 0 -10 5.1 -4.9', 'ESRI'))).*  
FROM foo  
UNION ALL  
SELECT  
    3, (ST_Metadata(ST_SetGeoReference(rast, 1, 1, 10, -10, 0.001, 0.001))).*  
FROM foo
```

rid	upperleftx	skewy	srid	numbands	upperlefty	width	height	scalex	scaley	skewx	
0				0		5	5	1	-1	0	↔
1				0		5	5	10	-10	0	↔
2	0.09999999999999996			0		5	5	10	-10	0	↔
3	0.001			0		5	5	10	-10	0.001	↔

See Also

[ST_GeoReference](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_UpperLeftX](#), [ST_UpperLeftY](#)

12.7.2 ST_SetRotation

ST_SetRotation — Set the rotation of the raster in radian.

Synopsis

raster **ST_SetRotation**(raster rast, float8 rotation);

Description

Uniformly rotate the raster. Rotation is in radian. Refer to [World File](#) for more details.

Examples

```
SELECT
  ST_ScaleX(rast1), ST_ScaleY(rast1), ST_SkewX(rast1), ST_SkewY(rast1),
  ST_ScaleX(rast2), ST_ScaleY(rast2), ST_SkewX(rast2), ST_SkewY(rast2)
FROM (
  SELECT ST_SetRotation(rast, 15) AS rast1, rast as rast2 FROM dummy_rast
) AS foo;
```

st_scalex	st_scaley	st_skewx	st_skewy	
st_scalex	st_scaley	st_skewx	st_skewy	
-1.51937582571764	-2.27906373857646	1.95086352047135	1.30057568031423	↔
2	3	0	0	
-0.0379843956429411	-0.0379843956429411	0.0325143920078558	0.0325143920078558	↔
0.05	-0.05	0	0	

See Also

[ST_Rotation](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_SkewX](#), [ST_SkewY](#)

12.7.3 ST_SetScale


ST_SetScale — Sets the X and Y size of pixels in units of coordinate reference system. Number units/pixel width/height.

Synopsis

raster **ST_SetScale**(raster rast, float8 xy);
raster **ST_SetScale**(raster rast, float8 x, float8 y);

Description

Sets the X and Y size of pixels in units of coordinate reference system. Number units/pixel width/height. If only one unit passed in, assumed X and Y are the same number.

**Note**

ST_SetScale is different from [ST_Rescale](#) in that ST_SetScale do not resample the raster to match the raster extent. It only changes the metadata (or georeference) of the raster to correct an originally mis-specified scaling. ST_Rescale results in a raster having different width and height computed to fit the geographic extent of the input raster. ST_SetScale do not modify the width, nor the height of the raster.

Changed: 2.0.0 In WKTRaster versions this was called ST_SetPixelSize. This was changed in 2.0.0.


```
1 |      1 |      2 | 2.0000000000
      : 2.0000000000
      : 1.0000000000
      : 3.0000000000
      : 0.5000000000
      : 0.5000000000
```

```
-- Example 2 set both to same number:
UPDATE dummy_rast SET rast = ST_SetSkew(rast,0) WHERE rid = 1;
SELECT rid, ST_SkewX(rast) As skewx, ST_SkewY(rast) As skewy,
       ST_GeoReference(rast) as georef
FROM dummy_rast WHERE rid = 1;
```

```
rid | skewx | skewy |      georef
-----+-----+-----+-----
1 |      0 |      0 | 2.0000000000
      : 0.0000000000
      : 0.0000000000
      : 3.0000000000
      : 0.5000000000
      : 0.5000000000
```

See Also

[ST_GeoReference](#), [ST_SetGeoReference](#), [ST_SkewX](#), [ST_SkewY](#)

12.7.5 ST_SetSRID

ST_SetSRID — Sets the SRID of a raster to a particular integer srid defined in the spatial_ref_sys table.

Synopsis

raster **ST_SetSRID**(raster rast, integer srid);

Description

Sets the SRID on a raster to a particular integer value.



Note

This function does not transform the raster in any way - it simply sets meta data defining the spatial ref of the coordinate reference system that it's currently in. Useful for transformations later.

See Also

Section [4.5](#), [ST_SRID](#)

12.7.6 ST_SetUpperLeft

ST_SetUpperLeft — Sets the value of the upper left corner of the pixel of the raster to projected X and Y coordinates.

Synopsis

raster **ST_SetUpperLeft**(raster rast, double precision x, double precision y);

Description

Set the value of the upper left corner of raster to the projected X and Y coordinates

Examples

```
SELECT ST_SetUpperLeft (rast, -71.01, 42.37)
FROM dummy_rast
WHERE rid = 2;
```

See Also

[ST_UpperLeftX](#), [ST_UpperLeftY](#)

12.7.7 ST_Resample

ST_Resample — Resample a raster using a specified resampling algorithm, new dimensions, an arbitrary grid corner and a set of raster georeferencing attributes defined or borrowed from another raster.

Synopsis

raster **ST_Resample**(raster rast, integer width, integer height, double precision gridx=NULL, double precision gridy=NULL, double precision skewx=0, double precision skewy=0, text algorithm=NearestNeighbor, double precision maxerr=0.125);
 raster **ST_Resample**(raster rast, double precision scalex=0, double precision scaley=0, double precision gridx=NULL, double precision gridy=NULL, double precision skewx=0, double precision skewy=0, text algorithm=NearestNeighbor, double precision maxerr=0.125);
 raster **ST_Resample**(raster rast, raster ref, text algorithm=NearestNeighbor, double precision maxerr=0.125, boolean usescale=true);
 raster **ST_Resample**(raster rast, raster ref, boolean usescale, text algorithm=NearestNeighbor, double precision maxerr=0.125);

Description

Resample a raster using a specified resampling algorithm, new dimensions (width & height), a grid corner (gridx & gridy) and a set of raster georeferencing attributes (scalex, scaley, skewx & skewy) defined or borrowed from another raster. If using a reference raster, the two rasters must have the same SRID.

New pixel values are computed using the NearestNeighbor (English or American spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor which is the fastest but produce the worst interpolation.

A maxerror percent of 0.125 is used if no `maxerr` is specified.

**Note**

Refer to: [GDAL Warp resampling methods](#) for more details.

Availability: 2.0.0 Requires GDAL 1.6.1+

Changed: 2.1.0 Parameter `srld` removed. Variants with a reference raster no longer applies the reference raster's SRID. Use `ST_Transform()` to reproject raster. Works on rasters with no SRID.

Examples

```
SELECT
    ST_Width(orig) AS orig_width,
    ST_Width(reduce_100) AS new_width
FROM (
    SELECT
        rast AS orig,
        ST_Resample(rast,100,100) AS reduce_100
    FROM aerials.boston
    WHERE ST_Intersects(rast,
        ST_Transform(
            ST_MakeEnvelope(-71.128, 42.2392,-71.1277, 42.2397, 4326),26986)
        )
    LIMIT 1
) AS foo;
```

orig_width	new_width
200	100

See Also

[ST_Rescale](#), [ST_Resize](#), [ST_Transform](#)

12.7.8 ST_Rescale

ST_Rescale — Resample a raster by adjusting only its scale (or pixel size). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.

Synopsis

```
raster ST_Rescale(raster rast, double precision scalexy, text algorithm=NearestNeighbor, double precision maxerr=0.125);
raster ST_Rescale(raster rast, double precision scalex, double precision scaley, text algorithm=NearestNeighbor, double precision maxerr=0.125);
```

Description

Resample a raster by adjusting only its scale (or pixel size). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. The default is NearestNeighbor which is the fastest but results in the worst interpolation.

`scalex` and `scaley` define the new pixel size. `scaley` must often be negative to get well oriented raster.

When the new `scalex` or `scaley` is not a divisor of the raster width or height, the extent of the resulting raster is expanded to encompass the extent of the provided raster. If you want to be sure to retain exact input extent see [ST_Resize](#)

`maxerr` is the threshold for transformation approximation by the resampling algorithm (in pixel units). A default of 0.125 is used if no `maxerr` is specified, which is the same value used in GDAL `gdalwarp` utility. If set to zero, no approximation takes place.



Note

Refer to: [GDAL Warp resampling methods](#) for more details.

**Note**

ST_Rescale is different from [ST_SetScale](#) in that ST_SetScale do not resample the raster to match the raster extent. ST_SetScale only changes the metadata (or georeference) of the raster to correct an originally mis-specified scaling. ST_Rescale results in a raster having different width and height computed to fit the geographic extent of the input raster. ST_SetScale do not modify the width, nor the height of the raster.

Availability: 2.0.0 Requires GDAL 1.6.1+

Changed: 2.1.0 Works on rasters with no SRID

Examples

A simple example rescaling a raster from a pixel size of 0.001 degree to a pixel size of 0.0015 degree.

```
-- the original raster pixel size
SELECT ST_PixelWidth(ST_AddBand(ST_MakeEmptyRaster(100, 100, 0, 0, 0.001, -0.001, 0, 0, ↵
    4269), '8BUI'::text, 1, 0)) width

width
-----
0.001

-- the rescaled raster raster pixel size
SELECT ST_PixelWidth(ST_Rescale(ST_AddBand(ST_MakeEmptyRaster(100, 100, 0, 0, 0.001, ↵
    -0.001, 0, 0, 4269), '8BUI'::text, 1, 0), 0.0015)) width

width
-----
0.0015
```

See Also

[ST_Resize](#), [ST_Resample](#), [ST_SetScale](#), [ST_ScaleX](#), [ST_ScaleY](#), [ST_Transform](#)

12.7.9 ST_Reskew

ST_Reskew — Resample a raster by adjusting only its skew (or rotation parameters). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.

Synopsis

```
raster ST_Reskew(raster rast, double precision skewxy, text algorithm=NearestNeighbor, double precision maxerr=0.125);
raster ST_Reskew(raster rast, double precision skewx, double precision skewy, text algorithm=NearestNeighbor, double precision maxerr=0.125);
```

Description

Resample a raster by adjusting only its skew (or rotation parameters). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. The default is NearestNeighbor which is the fastest but results in the worst interpolation.

`skewx` and `skewy` define the new skew.

The extent of the new raster will encompass the extent of the provided raster.

A maxerror percent of 0.125 if no `maxerr` is specified.

**Note**

Refer to: [GDAL Warp resampling methods](#) for more details.

**Note**

ST_Reskew is different from [ST_SetSkew](#) in that ST_SetSkew do not resample the raster to match the raster extent. ST_SetSkew only changes the metadata (or georeference) of the raster to correct an originally mis-specified skew. ST_Reskew results in a raster having different width and height computed to fit the geographic extent of the input raster. ST_SetSkew do not modify the width, nor the height of the raster.

Availability: 2.0.0 Requires GDAL 1.6.1+

Changed: 2.1.0 Works on rasters with no SRID

Examples

A simple example reskewing a raster from a skew of 0.0 to a skew of 0.0015.

```
-- the original raster non-rotated
SELECT ST_Rotation(ST_AddBand(ST_MakeEmptyRaster(100, 100, 0, 0, 0.001, -0.001, 0, 0, 4269) ←
, '8BUI'::text, 1, 0));

-- result
0

-- the reskewed raster raster rotation
SELECT ST_Rotation(ST_Reskew(ST_AddBand(ST_MakeEmptyRaster(100, 100, 0, 0, 0.001, -0.001, ←
0, 0, 4269), '8BUI'::text, 1, 0), 0.0015));

-- result
-0.982793723247329
```

See Also

[ST_Resample](#), [ST_Rescale](#), [ST_SetSkew](#), [ST_SetRotation](#), [ST_SkewX](#), [ST_SkewY](#), [ST_Transform](#)

12.7.10 ST_SnapToGrid

ST_SnapToGrid — Resample a raster by snapping it to a grid. New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.

Synopsis

```
raster ST_SnapToGrid(raster rast, double precision gridx, double precision gridy, text algorithm=NearestNeighbor, double precision maxerr=0.125, double precision scalex=DEFAULT 0, double precision scaley=DEFAULT 0);
raster ST_SnapToGrid(raster rast, double precision gridx, double precision gridy, double precision scalex, double precision scaley, text algorithm=NearestNeighbor, double precision maxerr=0.125);
raster ST_SnapToGrid(raster rast, double precision gridx, double precision gridy, double precision scalexy, text algorithm=NearestNeighbor, double precision maxerr=0.125);
```

Description

Resample a raster by snapping it to a grid defined by an arbitrary pixel corner (`gridx` & `gridy`) and optionally a pixel size (`scalex` & `scaley`). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. The default is NearestNeighbor which is the fastest but results in the worst interpolation.

`gridx` and `gridy` define any arbitrary pixel corner of the new grid. This is not necessarily the upper left corner of the new raster and it does not have to be inside or on the edge of the new raster extent.

You can optionally define the pixel size of the new grid with `scalex` and `scaley`.

The extent of the new raster will encompass the extent of the provided raster.

A `maxerror` percent of 0.125 if no `maxerr` is specified.



Note

Refer to: [GDAL Warp resampling methods](#) for more details.



Note

Use [ST_Resample](#) if you need more control over the grid parameters.

Availability: 2.0.0 Requires GDAL 1.6.1+

Changed: 2.1.0 Works on rasters with no SRID

Examples

A simple example snapping a raster to a slightly different grid.

```
-- the original raster upper left X
SELECT ST_UpperLeftX(ST_AddBand(ST_MakeEmptyRaster(10, 10, 0, 0, 0.001, -0.001, 0, 0, 4269) ←
, '8BUI'::text, 1, 0));
-- result
0

-- the upper left of raster after snapping
SELECT ST_UpperLeftX(ST_SnapToGrid(ST_AddBand(ST_MakeEmptyRaster(10, 10, 0, 0, 0.001, ←
-0.001, 0, 0, 4269), '8BUI'::text, 1, 0), 0.0002, 0.0002));

--result
-0.0008
```

See Also

[ST_Resample](#), [ST_Rescale](#), [ST_UpperLeftX](#), [ST_UpperLeftY](#)

12.7.11 ST_Resize

`ST_Resize` — Resize a raster to a new width/height

Synopsis

raster **ST_Resize**(raster rast, integer width, integer height, text algorithm=NearestNeighbor, double precision maxerr=0.125);
 raster **ST_Resize**(raster rast, double precision percentwidth, double precision percentheight, text algorithm=NearestNeighbor, double precision maxerr=0.125);
 raster **ST_Resize**(raster rast, text width, text height, text algorithm=NearestNeighbor, double precision maxerr=0.125);

Description

Resize a raster to a new width/height. The new width/height can be specified in exact number of pixels or a percentage of the raster's width/height. The extent of the the new raster will be the same as the extent of the provided raster.

New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. The default is NearestNeighbor which is the fastest but results in the worst interpolation.

Variant 1 expects the actual width/height of the output raster.

Variant 2 expects decimal values between zero (0) and one (1) indicating the percentage of the input raster's width/height.

Variant 3 takes either the actual width/height of the output raster or a textual percentage ("20%") indicating the percentage of the input raster's width/height.

Availability: 2.1.0 Requires GDAL 1.6.1+

Examples

```
WITH foo AS (
SELECT
  1 AS rid,
  ST_Resize(
    ST_AddBand(
      ST_MakeEmptyRaster(1000, 1000, 0, 0, 1, -1, 0, 0, 0)
      , 1, '8BUI', 255, 0
    )
    , '50%', '500') AS rast
UNION ALL
SELECT
  2 AS rid,
  ST_Resize(
    ST_AddBand(
      ST_MakeEmptyRaster(1000, 1000, 0, 0, 1, -1, 0, 0, 0)
      , 1, '8BUI', 255, 0
    )
    , 500, 100) AS rast
UNION ALL
SELECT
  3 AS rid,
  ST_Resize(
    ST_AddBand(
      ST_MakeEmptyRaster(1000, 1000, 0, 0, 1, -1, 0, 0, 0)
      , 1, '8BUI', 255, 0
    )
    , 0.25, 0.9) AS rast
), bar AS (
  SELECT rid, ST_Metadata(rast) AS meta, rast FROM foo
)
SELECT rid, (meta).* FROM bar
```

rid	upperleftx	upperlefty	width	height	scalex	scaley	skewx	skewy	srid	← numbands
-----	------------	------------	-------	--------	--------	--------	-------	-------	------	---------------

1	0	0	500	500	1	-1	0	0	0	↔
2	1	0	0	500	100	1	-1	0	0	↔
3	1	0	0	250	900	1	-1	0	0	↔
(3 rows)										

See Also

[ST_Resample](#), [ST_Rescale](#), [ST_Reskew](#), [ST_SnapToGrid](#)

12.7.12 ST_Transform

ST_Transform — Reprojects a raster in a known spatial reference system to another known spatial reference system using specified resampling algorithm. Options are NearestNeighbor, Bilinear, Cubic, CubicSpline, Lanczos defaulting to NearestNeighbor.

Synopsis

raster **ST_Transform**(raster rast, integer srid, text algorithm=NearestNeighbor, double precision maxerr=0.125, double precision scalex, double precision scaley);
raster **ST_Transform**(raster rast, integer srid, double precision scalex, double precision scaley, text algorithm=NearestNeighbor, double precision maxerr=0.125);
raster **ST_Transform**(raster rast, raster alignto, text algorithm=NearestNeighbor, double precision maxerr=0.125);

Description

Reprojects a raster in a known spatial reference system to another known spatial reference system using specified pixel warping algorithm. Uses 'NearestNeighbor' if no algorithm is specified and maxerror percent of 0.125 if no maxerr is specified.

Algorithm options are: 'NearestNeighbor', 'Bilinear', 'Cubic', 'CubicSpline', and 'Lanczos'. Refer to: [GDAL Warp resampling methods](#) for more details.

ST_Transform is often confused with ST_SetSRID(). ST_Transform actually changes the coordinates of a raster (and resamples the pixel values) from one spatial reference system to another, while ST_SetSRID() simply changes the SRID identifier of the raster.

Unlike the other variants, Variant 3 requires a reference raster as alignto. The transformed raster will be transformed to the spatial reference system (SRID) of the reference raster and be aligned (ST_SameAlignment = TRUE) to the reference raster.

Note

If you find your transformation support is not working right, you may need to set the environment variable PROJSO to the .so or .dll projection library your PostGIS is using. This just needs to have the name of the file. So for example on windows, you would in Control Panel -> System -> Environment Variables add a system variable called PROJSO and set it to libproj.dll (if you are using proj 4.6.1). You'll have to restart your PostgreSQL service/daemon after this change.

Warning

When transforming a coverage of tiles, you almost always want to use a reference raster to insure same alignment and no gaps in your tiles as demonstrated in example: Variant 3.

Availability: 2.0.0 Requires GDAL 1.6.1+

Enhanced: 2.1.0 Addition of ST_Transform(rast, alignto) variant

Examples

```
SELECT ST_Width(mass_stm) As w_before, ST_Width(wgs_84) As w_after,
       ST_Height(mass_stm) As h_before, ST_Height(wgs_84) As h_after
FROM
  ( SELECT rast As mass_stm, ST_Transform(rast,4326) As wgs_84
    , ST_Transform(rast,4326, 'Bilinear') AS wgs_84_bilin
    FROM aerials.o_2_boston
    WHERE ST_Intersects(rast,
      ST_Transform(ST_MakeEnvelope(-71.128, 42.2392,-71.1277, 42.2397, 4326) ↵
        ,26986) )
    LIMIT 1) As foo;
```

w_before	w_after	h_before	h_after
200	228	200	170



Examples: Variant 3

The following shows the difference between using ST_Transform(raster, srid) and ST_Transform(raster, alignto)

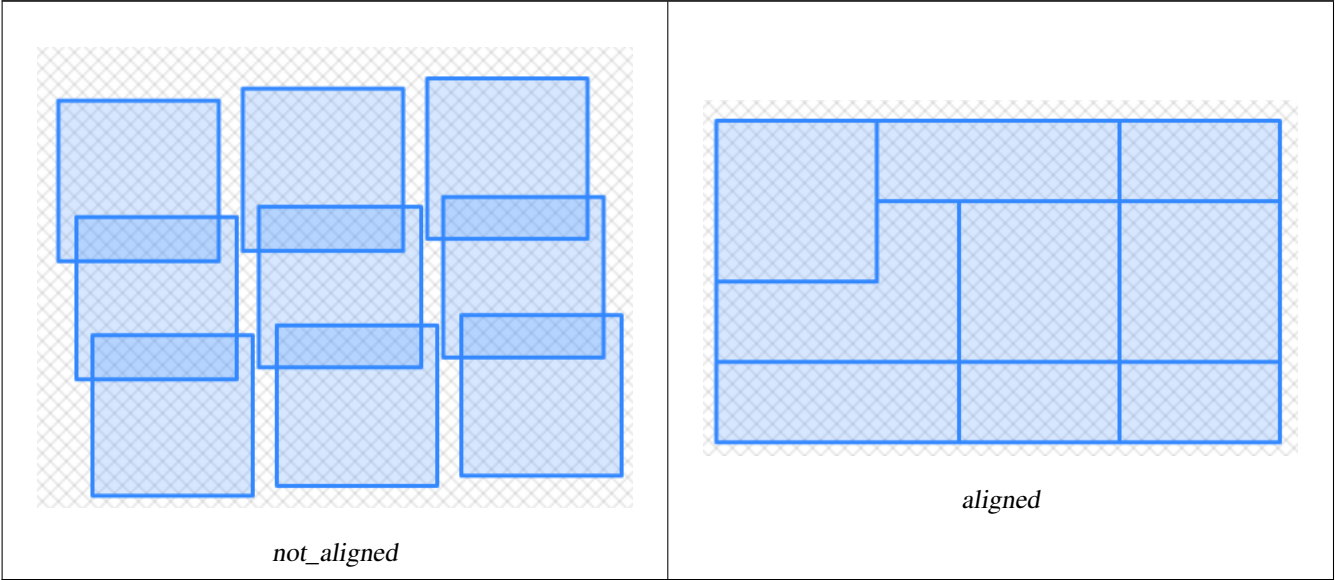
```
WITH foo AS (
  SELECT 0 AS rid, ST_AddBand(ST_MakeEmptyRaster(2, 2, -500000, 600000, 100, -100, 0, 0, ↵
    2163), 1, '16BUI', 1, 0) AS rast UNION ALL
  SELECT 1, ST_AddBand(ST_MakeEmptyRaster(2, 2, -499800, 600000, 100, -100, 0, 0, 2163), ↵
    1, '16BUI', 2, 0) AS rast UNION ALL
  SELECT 2, ST_AddBand(ST_MakeEmptyRaster(2, 2, -499600, 600000, 100, -100, 0, 0, 2163), ↵
    1, '16BUI', 3, 0) AS rast UNION ALL

  SELECT 3, ST_AddBand(ST_MakeEmptyRaster(2, 2, -500000, 599800, 100, -100, 0, 0, 2163), ↵
    1, '16BUI', 10, 0) AS rast UNION ALL
  SELECT 4, ST_AddBand(ST_MakeEmptyRaster(2, 2, -499800, 599800, 100, -100, 0, 0, 2163), ↵
    1, '16BUI', 20, 0) AS rast UNION ALL
  SELECT 5, ST_AddBand(ST_MakeEmptyRaster(2, 2, -499600, 599800, 100, -100, 0, 0, 2163), ↵
    1, '16BUI', 30, 0) AS rast UNION ALL
```



```
SELECT 6, ST_AddBand(ST_MakeEmptyRaster(2, 2, -500000, 599600, 100, -100, 0, 0, 2163), ←
1, '16BUI', 100, 0) AS rast UNION ALL
SELECT 7, ST_AddBand(ST_MakeEmptyRaster(2, 2, -499800, 599600, 100, -100, 0, 0, 2163), ←
1, '16BUI', 200, 0) AS rast UNION ALL
SELECT 8, ST_AddBand(ST_MakeEmptyRaster(2, 2, -499600, 599600, 100, -100, 0, 0, 2163), ←
1, '16BUI', 300, 0) AS rast
), bar AS (
SELECT
ST_Transform(rast, 4269) AS alignto
FROM foo
LIMIT 1
), baz AS (
SELECT
rid,
rast,
ST_Transform(rast, 4269) AS not_aligned,
ST_Transform(rast, alignto) AS aligned
FROM foo
CROSS JOIN bar
)
SELECT
ST_SameAlignment(rast) AS rast,
ST_SameAlignment(not_aligned) AS not_aligned,
ST_SameAlignment(aligned) AS aligned
FROM baz

rast | not_aligned | aligned
-----+-----+-----
t    | f           | t
```



See Also

[ST_Transform](#), [ST_SetSRID](#)

12.8 Raster Band Editors

12.8.1 ST_SetBandNoDataValue

ST_SetBandNoDataValue — Sets the value for the given band that represents no data. Band 1 is assumed if no band is specified. To mark a band as having no nodata value, set the nodata value = NULL.

Synopsis

```
raster ST_SetBandNoDataValue(raster rast, double precision nodatavalue);  
raster ST_SetBandNoDataValue(raster rast, integer band, double precision nodatavalue, boolean forcechecking=false);
```

Description

Sets the value that represents no data for the band. Band 1 is assumed if not specified. This will affect results from **ST_Polygon**, **ST_DumpAsPolygons**, and the **ST_PixelAs...**() functions.

Examples

```
-- change just first band no data value  
UPDATE dummy_rast  
    SET rast = ST_SetBandNoDataValue(rast,1, 254)  
WHERE rid = 2;  
  
-- change no data band value of bands 1,2,3  
UPDATE dummy_rast  
    SET rast =  
        ST_SetBandNoDataValue(  
            ST_SetBandNoDataValue(  
                ST_SetBandNoDataValue(  
                    rast,1, 254)  
                ,2,99),  
                3,108)  
        WHERE rid = 2;  
  
-- wipe out the nodata value this will ensure all pixels are considered for all processing ←  
    functions  
UPDATE dummy_rast  
    SET rast = ST_SetBandNoDataValue(rast,1, NULL)  
WHERE rid = 2;
```

See Also

ST_BandNoDataValue, **ST_NumBands**

12.8.2 ST_SetBandIsNoData

ST_SetBandIsNoData — Sets the isnodata flag of the band to TRUE.

Synopsis

```
raster ST_SetBandIsNoData(raster rast, integer band=1);
```

Description

Sets the isnodata flag for the band to true. Band 1 is assumed if not specified. This function should be called only when the flag is considered dirty. That is, when the result calling **ST_BandIsNoData** is different using TRUE as last argument and without using it

Availability: 2.0.0

Examples

```
-- Create dummy table with one raster column
create table dummy_rast (rid integer, rast raster);

-- Add raster with two bands, one pixel/band. In the first band, nodatavalue = pixel value ←
  = 3.
-- In the second band, nodatavalue = 13, pixel value = 4
insert into dummy_rast values(1,
(
'01' -- little endian (uint8 ndr)
||
'0000' -- version (uint16 0)
||
'0200' -- nBands (uint16 0)
||
'17263529ED684A3F' -- scaleX (float64 0.000805965234044584)
||
'F9253529ED684ABF' -- scaleY (float64 -0.00080596523404458)
||
'1C9F33CE69E352C0' -- ipX (float64 -75.5533328537098)
||
'718F0E9A27A44840' -- ipY (float64 49.2824585505576)
||
'ED50EB853EC32B3F' -- skewX (float64 0.000211812383858707)
||
'7550EB853EC32B3F' -- skewY (float64 0.000211812383858704)
||
'E6100000' -- SRID (int32 4326)
||
'0100' -- width (uint16 1)
||
'0100' -- height (uint16 1)
||
'4' -- hasnodatavalue set to true, isnodata value set to false (when it should be true)
||
'2' -- first band type (4BUI)
||
'03' -- novalue==3
||
'03' -- pixel(0,0)==3 (same that nodata)
||
'0' -- hasnodatavalue set to false
||
'5' -- second band type (16BSI)
||
'0D00' -- novalue==13
||
'0400' -- pixel(0,0)==4
)::raster
);

select st_bandisnodata(rast, 1) from dummy_rast where rid = 1; -- Expected false
```

```
select st_bandisnodata(rast, 1, TRUE) from dummy_rast where rid = 1; -- Expected true

-- The isnodata flag is dirty. We are going to set it to true
update dummy_rast set rast = st_setbandisnodata(rast, 1) where rid = 1;

select st_bandisnodata(rast, 1) from dummy_rast where rid = 1; -- Expected true
```

See Also

[ST_BandNoDataValue](#), [ST_NumBands](#), [ST_SetBandNoDataValue](#), [ST_BandIsNoData](#)

12.8.3 ST_SetBandPath

ST_SetBandPath — Update the external path and band number of an out-db band

Synopsis

raster **ST_SetBandPath**(raster rast, integer band, text outdbpath, integer outdbindex, boolean force=false);

Description

Updates an out-db band's external raster file path and external band number.



Note

If `force` is set to true, no tests are done to ensure compatibility (e.g. alignment, pixel support) between the external raster file and the PostGIS raster. This mode is intended for file system changes where the external raster resides.



Note

Internally, this method replaces the PostGIS raster's band at index `band` with a new band instead of updating the existing path information.

Availability: 2.5.0

Examples

```
WITH foo AS (
  SELECT
    ST_AddBand(NULL::raster, '/home/pele/devel/geo/postgis-git/raster/test/regress/ ↵
      loader/Projected.tif', NULL::int[]) AS rast
)
SELECT
  1 AS query,
  *
FROM ST_BandMetadata(
  (SELECT rast FROM foo),
  ARRAY[1,3,2]::int[]
)
UNION ALL
```

```
SELECT
  2,
  *
FROM ST_BandMetadata (
  (
    SELECT
      ST_SetBandPath(
        rast,
        2,
        '/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected2.tif' ↵
        ',
        1
      ) AS rast
    FROM foo
  ),
  ARRAY[1,3,2]::int[]
)
ORDER BY 1, 2;
```

query	bandnum	pixeltype	nodatavalue	isoutdb	↵	path	↵
outdbbandnum							
1	1	8BUI		t	↵	/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected.tif	1
1	2	8BUI		t	↵	/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected.tif	2
1	3	8BUI		t	↵	/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected.tif	3
2	1	8BUI		t	↵	/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected.tif	1
2	2	8BUI		t	↵	/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected2.tif	1
2	3	8BUI		t	↵	/home/pele/devel/geo/postgis-git/raster/test/regress/loader/Projected.tif	3

See Also

[ST_BandMetaData](#), [ST_SetBandIndex](#)

12.8.4 ST_SetBandIndex

ST_SetBandIndex — Update the external band number of an out-db band

Synopsis

raster **ST_SetBandIndex**(raster rast, integer band, integer outdbindex, boolean force=false);

Description

Updates an out-db band’s external band number. This does not touch the external raster file associated with the out-db band



Note

If `force` is set to true, no tests are done to ensure compatibility (e.g. alignment, pixel support) between the external raster file and the PostGIS raster. This mode is intended for where bands are moved around in the external raster file.



Note
Internally, this method replaces the PostGIS raster's band at index `band` with a new band instead of updating the existing path information.

Availability: 2.5.0

Examples

```
WITH foo AS (
  SELECT
    ST_AddBand(NULL::raster, '/home/pele/devel/geo/postgis-git/raster/test/regress/ ↵
      loader/Projected.tif', NULL::int[]) AS rast
)
SELECT
  1 AS query,
  *
FROM ST_BandMetadata(
  (SELECT rast FROM foo),
  ARRAY[1,3,2]::int[]
)
UNION ALL
SELECT
  2,
  *
FROM ST_BandMetadata(
  (
    SELECT
      ST_SetBandIndex(
        rast,
        2,
        1
      ) AS rast
    FROM foo
  ),
  ARRAY[1,3,2]::int[]
)
ORDER BY 1, 2;
```

query	bandnum	pixeltype	nodatavalue	isoutdb	↵	path	↵
	outdbbandnum						
1	1	8BUI		t		/home/pele/devel/geo/postgis-git/ ↵	
		raster/test/regress/loader/Projected.tif			1		
1	2	8BUI		t		/home/pele/devel/geo/postgis-git/ ↵	
		raster/test/regress/loader/Projected.tif			2		
1	3	8BUI		t		/home/pele/devel/geo/postgis-git/ ↵	
		raster/test/regress/loader/Projected.tif			3		
2	1	8BUI		t		/home/pele/devel/geo/postgis-git/ ↵	
		raster/test/regress/loader/Projected.tif			1		
2	2	8BUI		t		/home/pele/devel/geo/postgis-git/ ↵	
		raster/test/regress/loader/Projected.tif			1		
2	3	8BUI		t		/home/pele/devel/geo/postgis-git/ ↵	
		raster/test/regress/loader/Projected.tif			3		

See Also

[ST_BandMetaData](#), [ST_SetBandPath](#)

12.9 Raster Band Statistics and Analytics

12.9.1 ST_Count

ST_Count — Returns the number of pixels in a given band of a raster or raster coverage. If no band is specified defaults to band 1. If `exclude_nodata_value` is set to true, will only count pixels that are not equal to the nodata value.

Synopsis

`bigint ST_Count(raster rast, integer nband=1, boolean exclude_nodata_value=true);`
`bigint ST_Count(raster rast, boolean exclude_nodata_value);`

Description

Returns the number of pixels in a given band of a raster or raster coverage. If no band is specified `nband` defaults to 1.



Note
If `exclude_nodata_value` is set to true, will only count pixels with value not equal to the `nodata` value of the raster. Set `exclude_nodata_value` to false to get count all pixels

Changed: 3.1.0 - The `ST_Count(rastertable, rastercolumn, ...)` variants removed. Use [ST_CountAgg](#) instead.

Availability: 2.0.0

Examples

```
--example will count all pixels not 249 and one will count all pixels. --
SELECT rid, ST_Count(ST_SetBandNoDataValue(rast,249)) As exclude_nodata,
       ST_Count(ST_SetBandNoDataValue(rast,249),false) As include_nodata
FROM dummy_rast WHERE rid=2;
```

rid	exclude_nodata	include_nodata
2	23	25

See Also

[ST_CountAgg](#), [ST_SummaryStats](#), [ST_SetBandNoDataValue](#)

12.9.2 ST_CountAgg

ST_CountAgg — Aggregate. Returns the number of pixels in a given band of a set of rasters. If no band is specified defaults to band 1. If `exclude_nodata_value` is set to true, will only count pixels that are not equal to the NODATA value.

Synopsis

bigint **ST_CountAgg**(setof raster rast, integer nband, boolean exclude_nodata_value, double precision sample_percent);
 bigint **ST_CountAgg**(setof raster rast, integer nband, boolean exclude_nodata_value);
 bigint **ST_CountAgg**(setof raster rast, boolean exclude_nodata_value);

Description

Returns the number of pixels in a given band of a set of rasters. If no band is specified `nband` defaults to 1.

If `exclude_nodata_value` is set to true, will only count pixels with value not equal to the NODATA value of the raster. Set `exclude_nodata_value` to false to get count all pixels

By default will sample all pixels. To get faster response, set `sample_percent` to value between zero (0) and one (1)

Availability: 2.2.0

Examples

```
WITH foo AS (
  SELECT
    rast.rast
  FROM (
    SELECT ST_SetValue(
      ST_SetValue(
        ST_SetValue(
          ST_AddBand(
            ST_MakeEmptyRaster(10, 10, 10, 10, 2, 2, 0, 0,0)
            , 1, '64BF', 0, 0
          )
          , 1, 1, 1, -10
        )
        , 1, 5, 4, 0
      )
      , 1, 5, 5, 3.14159
    ) AS rast
  ) AS rast
  FULL JOIN (
    SELECT generate_series(1, 10) AS id
  ) AS id
  ON 1 = 1
)
SELECT
  ST_CountAgg(rast, 1, TRUE)
FROM foo;

 st_countagg
-----
          20
(1 row)
```

See Also

[ST_Count](#), [ST_SummaryStats](#), [ST_SetBandNoDataValue](#)

12.9.3 ST_Histogram

ST_Histogram — Returns a set of record summarizing a raster or raster coverage data distribution separate bin ranges. Number of bins are autocomputed if not specified.

Synopsis

setof record **ST_Histogram**(raster rast, integer nband=1, boolean exclude_nodata_value=true, integer bins=autocomputed, double precision[] width=NULL, boolean right=false);
 setof record **ST_Histogram**(raster rast, integer nband, integer bins, double precision[] width=NULL, boolean right=false);
 setof record **ST_Histogram**(raster rast, integer nband, boolean exclude_nodata_value, integer bins, boolean right);
 setof record **ST_Histogram**(raster rast, integer nband, integer bins, boolean right);

Description

Returns set of records consisting of min, max, count, percent for a given raster band for each bin. If no band is specified nband defaults to 1.



Note

By default only considers pixel values not equal to the `nodata` value . Set `exclude_nodata_value` to `false` to get count all pixels.

width **double precision[]** width: an array indicating the width of each category/bin. If the number of bins is greater than the number of widths, the widths are repeated.

Example: 9 bins, widths are [a, b, c] will have the output be [a, b, c, a, b, c, a, b, c]

bins **integer** Number of breakouts -- this is the number of records you'll get back from the function if specified. If not specified then the number of breakouts is autocomputed.

right **boolean** compute the histogram from the right rather than from the left (default). This changes the criteria for evaluating a value x from [a, b) to (a, b]

Changed: 3.1.0 Removed `ST_Histogram(table_name, column_name)` variant.

Availability: 2.0.0

Example: Single raster tile - compute histograms for bands 1, 2, 3 and autocompute bins

```
SELECT band, (stats).*
FROM (SELECT rid, band, ST_Histogram(rast, band) As stats
      FROM dummy_rast CROSS JOIN generate_series(1,3) As band
      WHERE rid=2) As foo;
```

band	min	max	count	percent
1	249	250	2	0.08
1	250	251	2	0.08
1	251	252	1	0.04
1	252	253	2	0.08
1	253	254	18	0.72
2	78	113.2	11	0.44
2	113.2	148.4	4	0.16
2	148.4	183.6	4	0.16
2	183.6	218.8	1	0.04
2	218.8	254	5	0.2
3	62	100.4	11	0.44
3	100.4	138.8	5	0.2
3	138.8	177.2	4	0.16
3	177.2	215.6	1	0.04
3	215.6	254	4	0.16

Example: Just band 2 but for 6 bins

```
SELECT (stats).*
FROM (SELECT rid, ST_Histogram(rast, 2,6) As stats
      FROM dummy_rast
      WHERE rid=2) As foo;
```

min	max	count	percent
78	107.333333	9	0.36
107.333333	136.666667	6	0.24
136.666667	166	0	0
166	195.333333	4	0.16
195.333333	224.666667	1	0.04
224.666667	254	5	0.2

(6 rows)

```
-- Same as previous but we explicitly control the pixel value range of each bin.
SELECT (stats).*
FROM (SELECT rid, ST_Histogram(rast, 2,6,ARRAY[0.5,1,4,100,5]) As stats
      FROM dummy_rast
      WHERE rid=2) As foo;
```

min	max	count	percent
78	78.5	1	0.08
78.5	79.5	1	0.04
79.5	83.5	0	0
83.5	183.5	17	0.0068
183.5	188.5	0	0
188.5	254	6	0.003664

(6 rows)

See Also

[ST_Count](#), [ST_SummaryStats](#), [ST_SummaryStatsAgg](#)

12.9.4 ST_Quantile

ST_Quantile — Compute quantiles for a raster or raster table coverage in the context of the sample or population. Thus, a value could be examined to be at the raster’s 25%, 50%, 75% percentile.

Synopsis

```
setof record ST_Quantile(raster rast, integer nband=1, boolean exclude_nodata_value=true, double precision[] quantiles=NULL);
setof record ST_Quantile(raster rast, double precision[] quantiles);
setof record ST_Quantile(raster rast, integer nband, double precision[] quantiles);
double precision ST_Quantile(raster rast, double precision quantile);
double precision ST_Quantile(raster rast, boolean exclude_nodata_value, double precision quantile=NULL);
double precision ST_Quantile(raster rast, integer nband, double precision quantile);
double precision ST_Quantile(raster rast, integer nband, boolean exclude_nodata_value, double precision quantile);
double precision ST_Quantile(raster rast, integer nband, double precision quantile);
```

Description

Compute quantiles for a raster or raster table coverage in the context of the sample or population. Thus, a value could be examined to be at the raster’s 25%, 50%, 75% percentile.



Note
If `exclude_nodata_value` is set to `false`, will also count pixels with no data.

Changed: 3.1.0 Removed `ST_Quantile(table_name, column_name)` variant.
Availability: 2.0.0

Examples

```
UPDATE dummy_rast SET rast = ST_SetBandNoDataValue(rast,249) WHERE rid=2;
--Example will consider only pixels of band 1 that are not 249 and in named quantiles --

SELECT (pvq).*
FROM (SELECT ST_Quantile(rast, ARRAY[0.25,0.75]) As pvq
      FROM dummy_rast WHERE rid=2) As foo
      ORDER BY (pvq).quantile;
```

quantile	value
0.25	253
0.75	254

```
SELECT ST_Quantile(rast, 0.75) As value
FROM dummy_rast WHERE rid=2;
```

value
254

```
--real live example.  Quantile of all pixels in band 2 intersecting a geometry
SELECT rid, (ST_Quantile(rast,2)).* As pvc
FROM o_4_boston
WHERE ST_Intersects(rast,
                    ST_GeomFromText('POLYGON((224486 892151,224486 892200,224706 892200,224706 892151,224486 892151))',26986)
                    )
ORDER BY value, quantile,rid
;
```

rid	quantile	value
1	0	0
2	0	0
14	0	1
15	0	2
14	0.25	37
1	0.25	42
15	0.25	47
2	0.25	50
14	0.5	56
1	0.5	64
15	0.5	66
2	0.5	77
14	0.75	81
15	0.75	87
1	0.75	94
2	0.75	106

14		1		199
1		1		244
2		1		255
15		1		255

See Also

[ST_Count](#), [ST_SummaryStats](#), [ST_SummaryStatsAgg](#), [ST_SetBandNoDataValue](#)

12.9.5 ST_SummaryStats

ST_SummaryStats — Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. Band 1 is assumed is no band is specified.

Synopsis

summarystats **ST_SummaryStats**(raster rast, boolean exclude_nodata_value);
summarystats **ST_SummaryStats**(raster rast, integer nband, boolean exclude_nodata_value);

Description

Returns **summarystats** consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. If no band is specified nband defaults to 1.



Note
By default only considers pixel values not equal to the `nodata` value. Set `exclude_nodata_value` to `false` to get count of all pixels.



Note
By default will sample all pixels. To get faster response, set `sample_percent` to lower than 1

Changed: 3.1.0 `ST_SummaryStats(rastertable, rastercolumn, ...)` variants are removed. Use [ST_SummaryStatsAgg](#) instead.
Availability: 2.0.0

Example: Single raster tile

```
SELECT rid, band, (stats).*
FROM (SELECT rid, band, ST_SummaryStats(rast, band) As stats
      FROM dummy_rast CROSS JOIN generate_series(1,3) As band
      WHERE rid=2) As foo;
```

rid	band	count	sum	mean	stddev	min	max
2	1	23	5821	253.086957	1.248061	250	254
2	2	25	3682	147.28	59.862188	78	254
2	3	25	3290	131.6	61.647384	62	254

Example: Summarize pixels that intersect buildings of interest

This example took 574ms on PostGIS windows 64-bit with all of Boston Buildings and aerial Tiles (tiles each 150x150 pixels ~ 134,000 tiles), ~102,000 building records

```
WITH
-- our features of interest
  feat AS (SELECT gid As building_id, geom_26986 As geom FROM buildings AS b
    WHERE gid IN(100, 103,150)
  ),
-- clip band 2 of raster tiles to boundaries of builds
-- then get stats for these clipped regions
  b_stats AS
    (SELECT building_id, (stats).*)
FROM (SELECT building_id, ST_SummaryStats(ST_Clip(rast,2,geom)) As stats
  FROM aerials.boston
    INNER JOIN feat
      ON ST_Intersects(feats.geom,rast)
) As foo
)
-- finally summarize stats
SELECT building_id, SUM(count) As num_pixels
  , MIN(min) As min_pval
  , MAX(max) As max_pval
  , SUM(mean*count)/SUM(count) As avg_pval
  FROM b_stats
WHERE count > 0
  GROUP BY building_id
  ORDER BY building_id;
```

building_id	num_pixels	min_pval	max_pval	avg_pval
100	1090	1	255	61.0697247706422
103	655	7	182	70.5038167938931
150	895	2	252	185.642458100559

Example: Raster coverage

```
-- stats for each band --
SELECT band, (stats).*
FROM (SELECT band, ST_SummaryStats('o_4_boston','rast', band) As stats
  FROM generate_series(1,3) As band) As foo;
```

band	count	sum	mean	stddev	min	max
1	8450000	725799	82.7064349112426	45.6800222638537	0	255
2	8450000	700487	81.4197705325444	44.2161184161765	0	255
3	8450000	575943	74.682739408284	44.2143885481407	0	255

```
-- For a table -- will get better speed if set sampling to less than 100%
-- Here we set to 25% and get a much faster answer
SELECT band, (stats).*
FROM (SELECT band, ST_SummaryStats('o_4_boston','rast', band,true,0.25) As stats
  FROM generate_series(1,3) As band) As foo;
```

band	count	sum	mean	stddev	min	max
1	2112500	180686	82.6890480473373	45.6961043857248	0	255
2	2112500	174571	81.448503668639	44.2252623171821	0	255
3	2112500	144364	74.6765884023669	44.2014869384578	0	255

See Also

[summarystats](#), [ST_SummaryStatsAgg](#), [ST_Count](#), [ST_Clip](#)

12.9.6 ST_SummaryStatsAgg

ST_SummaryStatsAgg — Aggregate. Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a set of raster. Band 1 is assumed is no band is specified.

Synopsis

summarystats **ST_SummaryStatsAgg**(setof raster rast, integer nband, boolean exclude_nodata_value, double precision sample_percent);

summarystats **ST_SummaryStatsAgg**(setof raster rast, boolean exclude_nodata_value, double precision sample_percent);

summarystats **ST_SummaryStatsAgg**(setof raster rast, integer nband, boolean exclude_nodata_value);

Description

Returns **summarystats** consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. If no band is specified `nband` defaults to 1.

**Note**

By default only considers pixel values not equal to the `NODATA` value. Set `exclude_nodata_value` to `False` to get count of all pixels.

**Note**

By default will sample all pixels. To get faster response, set `sample_percent` to value between 0 and 1

Availability: 2.2.0

Examples

```
WITH foo AS (
  SELECT
    rast.rast
  FROM (
    SELECT ST_SetValue(
      ST_SetValue(
        ST_SetValue(
          ST_AddBand(
            ST_MakeEmptyRaster(10, 10, 10, 10, 2, 2, 0, 0,0)
            , 1, '64BF', 0, 0
          )
          , 1, 1, 1, -10
        )
        , 1, 5, 4, 0
      )
      , 1, 5, 5, 3.14159
    ) AS rast
  ) AS rast
```

```

FULL JOIN (
    SELECT generate_series(1, 10) AS id
) AS id
    ON 1 = 1
)
SELECT
    (stats).count,
    round((stats).sum::numeric, 3),
    round((stats).mean::numeric, 3),
    round((stats).stddev::numeric, 3),
    round((stats).min::numeric, 3),
    round((stats).max::numeric, 3)
FROM (
    SELECT
        ST_SummaryStatsAgg(rast, 1, TRUE, 1) AS stats
    FROM foo
) bar;

count | round | round | round | round | round
-----+-----+-----+-----+-----+-----
    20 | -68.584 | -3.429 | 6.571 | -10.000 | 3.142
(1 row)

```

See Also

[summarystats](#), [ST_SummaryStats](#), [ST_Count](#), [ST_Clip](#)

12.9.7 ST_ValueCount

ST_ValueCount — Returns a set of records containing a pixel band value and count of the number of pixels in a given band of a raster (or a raster coverage) that have a given set of values. If no band is specified defaults to band 1. By default nodata value pixels are not counted. and all other values in the pixel are output and pixel band values are rounded to the nearest integer.

Synopsis

```

record ST_ValueCount(setof raster rast, integer nband=1, boolean exclude_nodata_value=true, double precision[] searchvalues=NULL, double precision roundto=0, double precision OUT value, integer OUT count);
record ST_ValueCount(setof raster rast, integer nband, double precision[] searchvalues, double precision roundto=0, double precision OUT value, integer OUT count);
record ST_ValueCount(setof raster rast, double precision[] searchvalues, double precision roundto=0, double precision OUT value, integer OUT count);
bigint ST_ValueCount(setof raster rast, double precision searchvalue, double precision roundto=0);
bigint ST_ValueCount(setof raster rast, integer nband, boolean exclude_nodata_value, double precision searchvalue, double precision roundto=0);
bigint ST_ValueCount(setof raster rast, integer nband, double precision searchvalue, double precision roundto=0);
setof record ST_ValueCount(text rastertable, text rastercolumn, integer nband=1, boolean exclude_nodata_value=true, double precision[] searchvalues=NULL, double precision roundto=0, double precision OUT value, integer OUT count);
setof record ST_ValueCount(text rastertable, text rastercolumn, double precision[] searchvalues, double precision roundto=0, double precision OUT value, integer OUT count);
setof record ST_ValueCount(text rastertable, text rastercolumn, integer nband, double precision[] searchvalues, double precision roundto=0, double precision OUT value, integer OUT count);
bigint ST_ValueCount(text rastertable, text rastercolumn, integer nband, boolean exclude_nodata_value, double precision searchvalue, double precision roundto=0);
bigint ST_ValueCount(text rastertable, text rastercolumn, double precision searchvalue, double precision roundto=0);
bigint ST_ValueCount(text rastertable, text rastercolumn, integer nband, double precision searchvalue, double precision roundto=0);

```

Description

Returns a set of records with columns `value` `count` which contain the pixel band value and count of pixels in the raster tile or raster coverage of selected band.

If no band is specified `nband` defaults to 1. If no `searchvalues` are specified, will return all pixel values found in the raster or raster coverage. If one `searchvalue` is given, will return an integer instead of records denoting the count of pixels having that pixel band value



Note

If `exclude_nodata_value` is set to `false`, will also count pixels with no data.

Availability: 2.0.0

Examples

```
UPDATE dummy_rast SET rast = ST_SetBandNoDataValue(rast,249) WHERE rid=2;
--Example will count only pixels of band 1 that are not 249. --
```

```
SELECT (pvc).*
FROM (SELECT ST_ValueCount(rast) As pvc
      FROM dummy_rast WHERE rid=2) As foo
      ORDER BY (pvc).value;
```

value	count
250	2
251	1
252	2
253	6
254	12

```
-- Example will count all pixels of band 1 including 249 --
```

```
SELECT (pvc).*
FROM (SELECT ST_ValueCount(rast,1,false) As pvc
      FROM dummy_rast WHERE rid=2) As foo
      ORDER BY (pvc).value;
```

value	count
249	2
250	2
251	1
252	2
253	6
254	12

```
-- Example will count only non-nodata value pixels of band 2
```

```
SELECT (pvc).*
FROM (SELECT ST_ValueCount(rast,2) As pvc
      FROM dummy_rast WHERE rid=2) As foo
      ORDER BY (pvc).value;
```

value	count
78	1
79	1
88	1


```
89 | 1
96 | 1
97 | 1
98 | 1
99 | 2
112 | 2
:
```

```
--real live example. Count all the pixels in an aerial raster tile band 2 intersecting a
geometry
-- and return only the pixel band values that have a count > 500
SELECT (pvc).value, SUM((pvc).count) As total
FROM (SELECT ST_ValueCount(rast,2) As pvc
      FROM o_4_boston
      WHERE ST_Intersects(rast,
        ST_GeomFromText('POLYGON((224486 892151,224486 892200,224706 892200,224706
        892151,224486 892151))',26986)
      ) As foo
      GROUP BY (pvc).value
      HAVING SUM((pvc).count) > 500
      ORDER BY (pvc).value;

value | total
-----+-----
51 | 502
54 | 521
```

```
-- Just return count of pixels in each raster tile that have value of 100 of tiles that
intersect a specific geometry --
SELECT rid, ST_ValueCount(rast,2,100) As count
FROM o_4_boston
WHERE ST_Intersects(rast,
  ST_GeomFromText('POLYGON((224486 892151,224486 892200,224706 892200,224706
  892151,224486 892151))',26986)
) ;

rid | count
-----+-----
1 | 56
2 | 95
14 | 37
15 | 64
```

See Also

[ST_Count](#), [ST_SetBandNoDataValue](#)

12.10 Raster Inputs

12.10.1 ST_RastFromWKB

ST_RastFromWKB — Return a raster value from a Well-Known Binary (WKB) raster.

JPEG Output Example, multiple tiles as single raster

```
SELECT ST_AsGDALRaster(ST_Union(rast), 'JPEG', ARRAY['QUALITY=50']) As rastjpg
FROM dummy_rast
WHERE rast && ST_MakeEnvelope(10, 10, 11, 11);
```

Using PostgreSQL Large Object Support to export raster

One way to export raster into another format is using [PostgreSQL large object export functions](#). We'll repeat the prior example but also exporting. Note for this you'll need to have super user access to db since it uses server side lo functions. It will also export to path on server network. If you need export locally, use the psql equivalent lo_ functions which export to the local file system instead of the server file system.

```
DROP TABLE IF EXISTS tmp_out ;

CREATE TABLE tmp_out AS
SELECT lo_from_bytea(0,
    ST_AsGDALRaster(ST_Union(rast), 'JPEG', ARRAY['QUALITY=50'])
    ) AS loid
FROM dummy_rast
WHERE rast && ST_MakeEnvelope(10, 10, 11, 11);

SELECT lo_export(lo_id, '/tmp/dummy.jpg')
FROM tmp_out;

SELECT lo_unlink(lo_id)
FROM tmp_out;
```

GTIFF Output Examples

```
SELECT ST_AsGDALRaster(rast, 'GTiff') As rastjpg
FROM dummy_rast WHERE rid=2;

-- Out GeoTiff with jpeg compression, 90% quality
SELECT ST_AsGDALRaster(rast, 'GTiff',
    ARRAY['COMPRESS=JPEG', 'JPEG_QUALITY=90'],
    4269) As rasttiff
FROM dummy_rast WHERE rid=2;
```

See Also

Section [11.3](#), [ST_GDALDrivers](#), [ST_SRID](#)

12.11.4 ST_AsJPEG

ST_AsJPEG — Return the raster tile selected bands as a single Joint Photographic Exports Group (JPEG) image (byte array). If no band is specified and 1 or more than 3 bands, then only the first band is used. If only 3 bands then all 3 bands are used and mapped to RGB.

Synopsis

```
bytea ST_AsJPEG(raster rast, text[] options=NULL);
bytea ST_AsJPEG(raster rast, integer nband, integer quality);
bytea ST_AsJPEG(raster rast, integer nband, text[] options=NULL);
bytea ST_AsJPEG(raster rast, integer[] nbands, text[] options=NULL);
bytea ST_AsJPEG(raster rast, integer[] nbands, integer quality);
```

Description

Returns the selected bands of the raster as a single Joint Photographic Exports Group Image (JPEG). Use **ST_AsGDALRaster** if you need to export as less common raster types. If no band is specified and 1 or more than 3 bands, then only the first band is used. If 3 bands then all 3 bands are used. There are many variants of the function with many options. These are itemized below:

- `nband` is for single band exports.
- `nbands` is an array of bands to export (note that max is 3 for JPEG) and the order of the bands is RGB. e.g `ARRAY[3,2,1]` means map band 3 to Red, band 2 to green and band 1 to blue
- `quality` number from 0 to 100. The higher the number the crisper the image.
- `options` text Array of GDAL options as defined for JPEG (look at `create_options` for JPEG **ST_GDALDrivers**). For JPEG valid ones are `PROGRESSIVE ON` or `OFF` and `QUALITY` a range from 0 to 100 and default to 75. Refer to **GDAL Raster format options** for more details.

Availability: 2.0.0 - requires GDAL >= 1.6.0.

Examples: Output

```
-- output first 3 bands 75% quality
SELECT ST_AsJPEG(rast) As rastjpg
FROM dummy_rast WHERE rid=2;

-- output only first band as 90% quality
SELECT ST_AsJPEG(rast,1,90) As rastjpg
FROM dummy_rast WHERE rid=2;

-- output first 3 bands (but make band 2 Red, band 1 green, and band 3 blue, progressive ↵
and 90% quality
SELECT ST_AsJPEG(rast,ARRAY[2,1,3],ARRAY['QUALITY=90','PROGRESSIVE=ON']) As rastjpg
FROM dummy_rast WHERE rid=2;
```

See Also

Section 11.3, **ST_GDALDrivers**, **ST_AsGDALRaster**, **ST_AsPNG**, **ST_AsTIFF**

12.11.5 ST_AsPNG

ST_AsPNG — Return the raster tile selected bands as a single portable network graphics (PNG) image (byte array). If 1, 3, or 4 bands in raster and no bands are specified, then all bands are used. If more 2 or more than 4 bands and no bands specified, then only band 1 is used. Bands are mapped to RGB or RGBA space.

Synopsis

```
bytea ST_AsPNG(raster rast, text[] options=NULL);
bytea ST_AsPNG(raster rast, integer nband, integer compression);
bytea ST_AsPNG(raster rast, integer nband, text[] options=NULL);
bytea ST_AsPNG(raster rast, integer[] nbands, integer compression);
bytea ST_AsPNG(raster rast, integer[] nbands, text[] options=NULL);
```

Description

Returns the selected bands of the raster as a single Portable Network Graphics Image (PNG). Use [ST_AsGDALRaster](#) if you need to export as less common raster types. If no band is specified, then the first 3 bands are exported. There are many variants of the function with many options. If no `srid` is specified then the `srid` of the raster is used. These are itemized below:

- `nband` is for single band exports.
- `nbands` is an array of bands to export (note that max is 4 for PNG) and the order of the bands is RGBA. e.g. `ARRAY[3,2,1]` means map band 3 to Red, band 2 to green and band 1 to blue
- `compression` number from 1 to 9. The higher the number the greater the compression.
- `options` text Array of GDAL options as defined for PNG (look at `create_options` for PNG of [ST_GDALDrivers](#)). For PNG valid one is only `ZLEVEL` (amount of time to spend on compression -- default 6) e.g. `ARRAY['ZLEVEL=9']`. `WORLDFILE` is not allowed since the function would have to output two outputs. Refer to [GDAL Raster format options](#) for more details.

Availability: 2.0.0 - requires GDAL >= 1.6.0.

Examples

```
SELECT ST_AsPNG(rast) As rastpng
FROM dummy_rast WHERE rid=2;

-- export the first 3 bands and map band 3 to Red, band 1 to Green, band 2 to blue
SELECT ST_AsPNG(rast, ARRAY[3,1,2]) As rastpng
FROM dummy_rast WHERE rid=2;
```

See Also

[ST_AsGDALRaster](#), [ST_ColorMap](#), [ST_GDALDrivers](#), [Section 11.3](#)

12.11.6 ST_AsTIFF

ST_AsTIFF — Return the raster selected bands as a single TIFF image (byte array). If no band is specified or any of specified bands does not exist in the raster, then will try to use all bands.

Synopsis

```
bytea ST_AsTIFF(raster rast, text[] options='', integer srid=sameassource);
bytea ST_AsTIFF(raster rast, text compression='', integer srid=sameassource);
bytea ST_AsTIFF(raster rast, integer[] nbands, text compression='', integer srid=sameassource);
bytea ST_AsTIFF(raster rast, integer[] nbands, text[] options, integer srid=sameassource);
```

Description

Returns the selected bands of the raster as a single Tagged Image File Format (TIFF). If no band is specified, will try to use all bands. This is a wrapper around [ST_AsGDALRaster](#). Use [ST_AsGDALRaster](#) if you need to export as less common raster types. There are many variants of the function with many options. If no spatial reference SRS text is present, the spatial reference of the raster is used. These are itemized below:

- `nbands` is an array of bands to export (note that max is 3 for PNG) and the order of the bands is RGB. e.g. `ARRAY[3,2,1]` means map band 3 to Red, band 2 to green and band 1 to blue

- `compression` Compression expression -- JPEG90 (or some other percent), LZW, JPEG, DEFLATE9.
- `options` text Array of GDAL create options as defined for GTiff (look at `create_options` for GTiff of [ST_GDALDrivers](#)). or refer to [GDAL Raster format options](#) for more details.
- `srid` srid of spatial_ref_sys of the raster. This is used to populate the georeference information

Availability: 2.0.0 - requires GDAL >= 1.6.0.

Examples: Use jpeg compression 90%

```
SELECT ST_AsTIFF(rast, 'JPEG90') As rasttiff
FROM dummy_rast WHERE rid=2;
```

See Also

[ST_GDALDrivers](#), [ST_AsGDALRaster](#), [ST_SRID](#)

12.12 Raster Processing: Map Algebra

12.12.1 ST_Clip

ST_Clip — Returns the raster clipped by the input geometry. If band number not is specified, all bands are processed. If `crop` is not specified or TRUE, the output raster is cropped.

Synopsis

```
raster ST_Clip(raster rast, integer[] nband, geometry geom, double precision[] nodataval=NULL, boolean crop=TRUE);
raster ST_Clip(raster rast, integer nband, geometry geom, double precision nodataval, boolean crop=TRUE);
raster ST_Clip(raster rast, integer nband, geometry geom, boolean crop);
raster ST_Clip(raster rast, geometry geom, double precision[] nodataval=NULL, boolean crop=TRUE);
raster ST_Clip(raster rast, geometry geom, double precision nodataval, boolean crop=TRUE);
raster ST_Clip(raster rast, geometry geom, boolean crop);
```

Description

Returns a raster that is clipped by the input geometry `geom`. If band index is not specified, all bands are processed.

Rasters resulting from `ST_Clip` must have a nodata value assigned for areas clipped, one for each band. If none are provided and the input raster do not have a nodata value defined, nodata values of the resulting raster are set to `ST_MinPossibleValue(ST_BandPixelType(rast, band))`. When the number of nodata value in the array is smaller than the number of band, the last one in the array is used for the remaining bands. If the number of nodata value is greater than the number of band, the extra nodata values are ignored. All variants accepting an array of nodata values also accept a single value which will be assigned to each band.

If `crop` is not specified, true is assumed meaning the output raster is cropped to the intersection of the `geom` and `rast` extents. If `crop` is set to false, the new raster gets the same extent as `rast`.

Availability: 2.0.0

Enhanced: 2.1.0 Rewritten in C

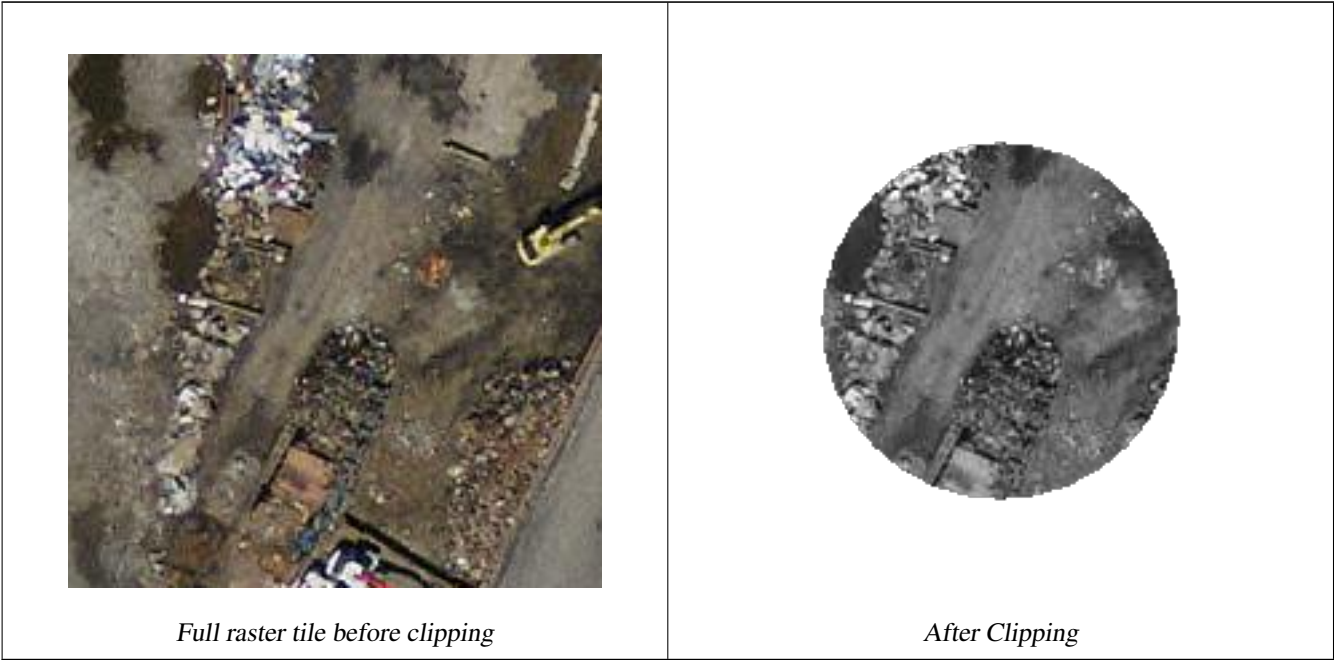
Examples here use Massachusetts aerial data available on MassGIS site [MassGIS Aerial Orthos](#). Coordinates are in Massachusetts State Plane Meters.

Examples: 1 band clipping

```
-- Clip the first band of an aerial tile by a 20 meter buffer.
SELECT ST_Clip(rast, 1,
              ST_Buffer(ST_Centroid(ST_Envelope(rast)),20)
            ) from aerials.boston
WHERE rid = 4;
```

```
-- Demonstrate effect of crop on final dimensions of raster
-- Note how final extent is clipped to that of the geometry
-- if crop = true
SELECT ST_XMax(ST_Envelope(ST_Clip(rast, 1, clipper, true))) As xmax_w_trim,
       ST_XMax(clipper) As xmax_clipper,
       ST_XMax(ST_Envelope(ST_Clip(rast, 1, clipper, false))) As xmax_wo_trim,
       ST_XMax(ST_Envelope(rast)) As xmax_rast_orig
FROM (SELECT rast, ST_Buffer(ST_Centroid(ST_Envelope(rast)),6) As clipper
      FROM aerials.boston
      WHERE rid = 6) As foo;
```

xmax_w_trim	xmax_clipper	xmax_wo_trim	xmax_rast_orig
230657.436173996	230657.436173996	230666.436173996	230666.436173996



Examples: 1 band clipping with no crop and add back other bands unchanged

```
-- Same example as before, but we need to set crop to false to be able to use ST_AddBand
-- because ST_AddBand requires all bands be the same Width and height
SELECT ST_AddBand(ST_Clip(rast, 1,
                          ST_Buffer(ST_Centroid(ST_Envelope(rast)),20),false
                        ), ARRAY[ST_Band(rast,2),ST_Band(rast,3)] ) from aerials.boston
WHERE rid = 6;
```



Full raster tile before clipping



After Clipping - surreal

Examples: Clip all bands

```
-- Clip all bands of an aerial tile by a 20 meter buffer.  
-- Only difference is we don't specify a specific band to clip  
-- so all bands are clipped  
SELECT ST_Clipping(rast,  
    ST_Buffer(ST_Centroid(ST_Envelope(rast)), 20),  
    false  
    ) from aerials.boston  
WHERE rid = 4;
```



Full raster tile before clipping



After Clipping

See Also

[ST_AddBand](#), [ST_MapAlgebra \(callback function version\)](#), [ST_Intersection](#)

12.12.2 ST_ColorMap

ST_ColorMap — Creates a new raster of up to four 8BUI bands (grayscale, RGB, RGBA) from the source raster and a specified band. Band 1 is assumed if not specified.

Synopsis

raster **ST_ColorMap**(raster rast, integer nband=1, text colormap=grayscale, text method=INTERPOLATE);

raster **ST_ColorMap**(raster rast, text colormap, text method=INTERPOLATE);

Description

Apply a `colormap` to the band at `nband` of `rast` resulting a new raster comprised of up to four 8BUI bands. The number of 8BUI bands in the new raster is determined by the number of color components defined in `colormap`.

If `nband` is not specified, then band 1 is assumed.

`colormap` can be a keyword of a pre-defined colormap or a set of lines defining the value and the color components.

Valid pre-defined `colormap` keyword:

- `grayscale` or `greyscale` for a one 8BUI band raster of shades of gray.
- `pseudocolor` for a four 8BUI (RGBA) band raster with colors going from blue to green to red.
- `fire` for a four 8BUI (RGBA) band raster with colors going from black to red to pale yellow.
- `bluered` for a four 8BUI (RGBA) band raster with colors going from blue to pale white to red.

Users can pass a set of entries (one per line) to `colormap` to specify custom colormaps. Each entry generally consists of five values: the pixel value and corresponding Red, Green, Blue, Alpha components (color components between 0 and 255). Percent values can be used instead of pixel values where 0% and 100% are the minimum and maximum values found in the raster band. Values can be separated with commas (','), tabs, colons (':') and/or spaces. The pixel value can be set to *nv*, *null* or *nodata* for the NODATA value. An example is provided below.

```
5 0 0 0 255
4 100:50 55 255
1 150,100 150 255
0% 255 255 255 255
nv 0 0 0 0
```

The syntax of `colormap` is similar to that of the color-relief mode of GDAL [gdaldem](#).

Valid keywords for `method`:

- `INTERPOLATE` to use linear interpolation to smoothly blend the colors between the given pixel values
- `EXACT` to strictly match only those pixels values found in the colormap. Pixels whose value does not match a colormap entry will be set to 0 0 0 0 (RGBA)
- `NEAREST` to use the colormap entry whose value is closest to the pixel value



Note

A great reference for colormaps is [ColorBrewer](#).



Warning

The resulting bands of new raster will have no NODATA value set. Use `ST_SetBandNoDataValue` to set a NODATA value if one is needed.

Availability: 2.1.0

Examples

This is a junk table to play with

```
-- setup test raster table --
DROP TABLE IF EXISTS funky_shapes;
CREATE TABLE funky_shapes(rast raster);

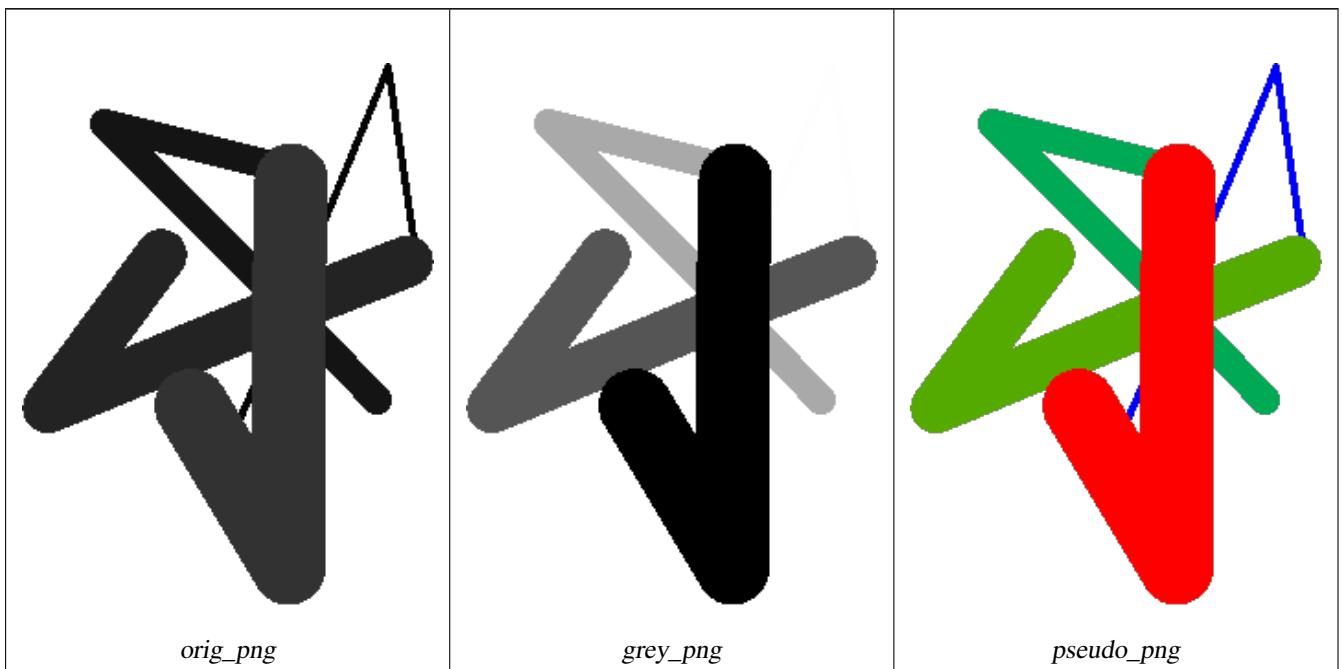
INSERT INTO funky_shapes(rast)
WITH ref AS (
    SELECT ST_MakeEmptyRaster( 200, 200, 0, 200, 1, -1, 0, 0) AS rast
)
SELECT
    ST_Union(rast)
FROM (
    SELECT
        ST_AsRaster(
            ST_Rotate(
                ST_Buffer(
                    ST_GeomFromText('LINESTRING(0 2,50 50,150 150,125 50)'),
                    i*2
                ),
                pi() * i * 0.125, ST_Point(50,50)
            ),
            ref.rast, '8BUI'::text, i * 5
        ) AS rast
    FROM ref
    CROSS JOIN generate_series(1, 10, 3) AS i
) AS shapes;
```

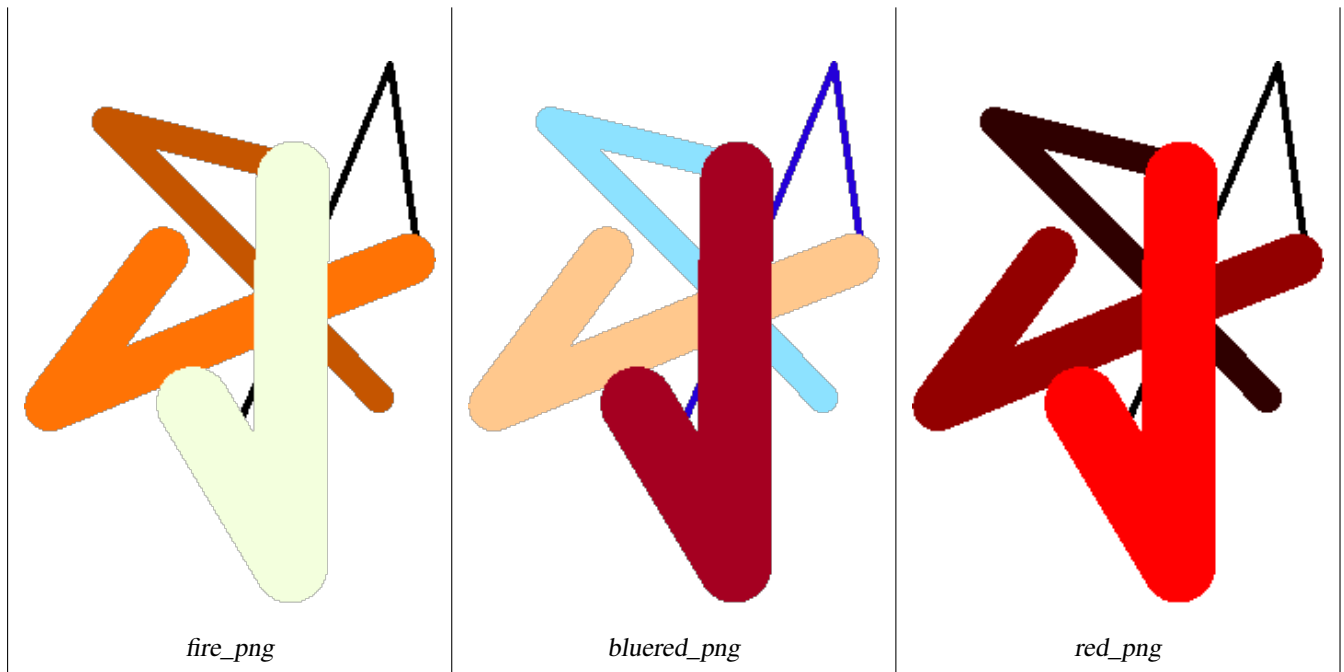
```
SELECT
    ST_NumBands(rast) As n_orig,
    ST_NumBands(ST_ColorMap(rast,1, 'greyscale')) As ngrey,
    ST_NumBands(ST_ColorMap(rast,1, 'pseudocolor')) As npseudo,
    ST_NumBands(ST_ColorMap(rast,1, 'fire')) As nfire,
    ST_NumBands(ST_ColorMap(rast,1, 'bluered')) As nbluered,
    ST_NumBands(ST_ColorMap(rast,1, '
100% 255  0  0
80% 160  0  0
50% 130  0  0
30%  30  0  0
20%  60  0  0
0%   0  0  0
nv 255 255 255
')) As nred
FROM funky_shapes;
```

n_orig	ngrey	npseudo	nfire	nbluered	nred
1	1	4	4	4	3

Examples: Compare different color map looks using ST_AsPNG

```
SELECT
  ST_AsPNG(rast) As orig_png,
  ST_AsPNG(ST_ColorMap(rast,1,'greyscale')) As grey_png,
  ST_AsPNG(ST_ColorMap(rast,1, 'pseudocolor')) As pseudo_png,
  ST_AsPNG(ST_ColorMap(rast,1, 'nfire')) As fire_png,
  ST_AsPNG(ST_ColorMap(rast,1, 'bluered')) As bluered_png,
  ST_AsPNG(ST_ColorMap(rast,1, '
100% 255  0  0
80%  160  0  0
50%  130  0  0
30%   30  0  0
20%   60  0  0
0%    0  0  0
nv 255 255 255
')) As red_png
FROM funky_shapes;
```





See Also

[ST_AsPNG](#), [ST_AsRaster](#) [ST_MapAlgebra](#) (callback function version), [ST_Grayscale](#) [ST_NumBands](#), [ST_Reclass](#), [ST_SetBandNoDataValue](#), [ST_Union](#)

12.12.3 ST_Grayscale

ST_Grayscale — Creates a new one-8BUI band raster from the source raster and specified bands representing Red, Green and Blue

Synopsis

- (1) raster **ST_Grayscale**(raster rast, integer redband=1, integer greenband=2, integer blueband=3, text extenttype=INTERSECTION);
- (2) raster **ST_Grayscale**(rastbandarg[] rastbandargset, text extenttype=INTERSECTION);

Description

Create a raster with one 8BUI band given three input bands (from one or more rasters). Any input band whose pixel type is not 8BUI will be reclassified using [ST_Reclass](#).



Note

This function is not like [ST_ColorMap](#) with the `grayscale` keyword as [ST_ColorMap](#) operates on only one band while this function expects three bands for RGB. This function applies the following equation for converting RGB to Grayscale: $0.2989 * RED + 0.5870 * GREEN + 0.1140 * BLUE$

Availability: 2.5.0

Examples: Variant 1

```
SET postgis.gdal_enabled_drivers = 'ENABLE_ALL';
SET postgis.enable_outdb_rasters = True;

WITH apple AS (
  SELECT ST_AddBand(
    ST_MakeEmptyRaster(350, 246, 0, 0, 1, -1, 0, 0, 0),
    '/tmp/apple.png'::text,
    NULL::int[]
  ) AS rast
)
SELECT
  ST_AsPNG(rast) AS original_png,
  ST_AsPNG(ST_Grayscale(rast)) AS grayscale_png
FROM apple;
```

*original_png**grayscale_png***Examples: Variant 2**

```
SET postgis.gdal_enabled_drivers = 'ENABLE_ALL';
SET postgis.enable_outdb_rasters = True;

WITH apple AS (
  SELECT ST_AddBand(
    ST_MakeEmptyRaster(350, 246, 0, 0, 1, -1, 0, 0, 0),
    '/tmp/apple.png'::text,
    NULL::int[]
  ) AS rast
)
SELECT
  ST_AsPNG(rast) AS original_png,
  ST_AsPNG(ST_Grayscale(
    ARRAY[
      ROW(rast, 1)::rastbandarg, -- red
      ROW(rast, 2)::rastbandarg, -- green
      ROW(rast, 3)::rastbandarg, -- blue
    ]::rastbandarg[]
  )) AS grayscale_png
FROM apple;
```


See Also

[ST_AsPNG](#), [ST_Reclass](#), [ST_ColorMap](#)

12.12.4 ST_Intersection

ST_Intersection — Returns a raster or a set of geometry-pixelvalue pairs representing the shared portion of two rasters or the geometrical intersection of a vectorization of the raster and a geometry.

Synopsis

```
setof geomval ST_Intersection(geometry geom, raster rast, integer band_num=1);
setof geomval ST_Intersection(raster rast, geometry geom);
setof geomval ST_Intersection(raster rast, integer band, geometry geom);
raster ST_Intersection(raster rast1, raster rast2, double precision[] nodataval);
raster ST_Intersection(raster rast1, raster rast2, text returnband, double precision[] nodataval);
raster ST_Intersection(raster rast1, integer band1, raster rast2, integer band2, double precision[] nodataval);
raster ST_Intersection(raster rast1, integer band1, raster rast2, integer band2, text returnband, double precision[] nodataval);
```

Description

Returns a raster or a set of geometry-pixelvalue pairs representing the shared portion of two rasters or the geometrical intersection of a vectorization of the raster and a geometry.

The first three variants, returning a setof geomval, works in vector space. The raster is first vectorized (using [ST_DumpAsPolygons](#)) into a set of geomval rows and those rows are then intersected with the geometry using the [ST_Intersection](#) (geometry, geometry) PostGIS function. Geometries intersecting only with a nodata value area of a raster returns an empty geometry. They are normally excluded from the results by the proper usage of [ST_Intersects](#) in the WHERE clause.

You can access the geometry and the value parts of the resulting set of geomval by surrounding them with parenthesis and adding '.geom' or '.val' at the end of the expression. e.g. (ST_Intersection(rast, geom)).geom

The other variants, returning a raster, works in raster space. They are using the two rasters version of ST_MapAlgebraExpr to perform the intersection.

The extent of the resulting raster corresponds to the geometrical intersection of the two raster extents. The resulting raster includes 'BAND1', 'BAND2' or 'BOTH' bands, following what is passed as the `returnband` parameter. Nodata value areas present in any band results in nodata value areas in every bands of the result. In other words, any pixel intersecting with a nodata value pixel becomes a nodata value pixel in the result.

Rasters resulting from ST_Intersection must have a nodata value assigned for areas not intersecting. You can define or replace the nodata value for any resulting band by providing a `nodataval[]` array of one or two nodata values depending if you request 'BAND1', 'BAND2' or 'BOTH' bands. The first value in the array replace the nodata value in the first band and the second value replace the nodata value in the second band. If one input band do not have a nodata value defined and none are provided as an array, one is chosen using the ST_MinPossibleValue function. All variant accepting an array of nodata value can also accept a single value which will be assigned to each requested band.

In all variants, if no band number is specified band 1 is assumed. If you need an intersection between a raster and geometry that returns a raster, refer to [ST_Clip](#).

**Note**

To get more control on the resulting extent or on what to return when encountering a nodata value, use the two rasters version of [ST_MapAlgebraExpr](#).



Note
To compute the intersection of a raster band with a geometry in raster space, use **ST_Clip**. **ST_Clip** works on multiple bands rasters and does not return a band corresponding to the rasterized geometry.



Note
ST_Intersection should be used in conjunction with **ST_Intersects** and an index on the raster column and/or the geometry column.

Enhanced: 2.0.0 - Intersection in the raster space was introduced. In earlier pre-2.0.0 versions, only intersection performed in vector space were supported.

Examples: Geometry, Raster -- resulting in geometry vals

```
SELECT
  foo.rid,
  foo.gid,
  ST_AsText((foo.geomval).geom) As geomwkt,
  (foo.geomval).val
FROM (
  SELECT
    A.rid,
    g.gid,
    ST_Intersection(A.rast, g.geom) As geomval
  FROM dummy_rast AS A
  CROSS JOIN (
    VALUES
      (1, ST_Point(3427928, 5793243.85) ),
      (2, ST_GeomFromText('LINESTRING(3427927.85 5793243.75,3427927.8 5793243.75,3427927.8 5793243.8)')),
      (3, ST_GeomFromText('LINESTRING(1 2, 3 4)'))
    ) As g(gid,geom)
  WHERE A.rid = 2
) As foo;
```

rid	gid	geomwkt	val
2	1	POINT(3427928 5793243.85)	249
2	1	POINT(3427928 5793243.85)	253
2	2	POINT(3427927.85 5793243.75)	254
2	2	POINT(3427927.8 5793243.8)	251
2	2	POINT(3427927.8 5793243.8)	253
2	2	LINESTRING(3427927.8 5793243.75,3427927.8 5793243.8)	252
2	2	MULTILINESTRING((3427927.8 5793243.8,3427927.8 5793243.75),...)	250
2	3	GEOMETRYCOLLECTION EMPTY	

See Also

[geomval](#), [ST_Intersects](#), [ST_MapAlgebraExpr](#), [ST_Clip](#), [ST_AsText](#)

12.12.5 ST_MapAlgebra (callback function version)

ST_MapAlgebra (callback function version) — Callback function version - Returns a one-band raster given one or more input rasters, band indexes and one user-specified callback function.

Synopsis

```

raster ST_MapAlgebra(rastbandarg[] rastbandargset, regprocedure callbackfunc, text pixeltype=NULL, text extenttype=INTERSECTION,
raster customextent=NULL, integer distancex=0, integer distancey=0, text[] VARIADIC userargs=NULL);
raster ST_MapAlgebra(raster rast, integer[] nband, regprocedure callbackfunc, text pixeltype=NULL, text extenttype=FIRST,
raster customextent=NULL, integer distancex=0, integer distancey=0, text[] VARIADIC userargs=NULL);
raster ST_MapAlgebra(raster rast, integer nband, regprocedure callbackfunc, text pixeltype=NULL, text extenttype=FIRST,
raster customextent=NULL, integer distancex=0, integer distancey=0, text[] VARIADIC userargs=NULL);
raster ST_MapAlgebra(raster rast1, integer nband1, raster rast2, integer nband2, regprocedure callbackfunc, text pixeltype=NULL,
text extenttype=INTERSECTION, raster customextent=NULL, integer distancex=0, integer distancey=0, text[] VARIADIC user-
args=NULL);
raster ST_MapAlgebra(raster rast, integer nband, regprocedure callbackfunc, float8[] mask, boolean weighted, text pixel-
type=NULL, text extenttype=INTERSECTION, raster customextent=NULL, text[] VARIADIC userargs=NULL);

```

Description

Returns a one-band raster given one or more input rasters, band indexes and one user-specified callback function.

rast,rast1,rast2, rastbandargset Rasters on which the map algebra process is evaluated.

`rastbandargset` allows the use of a map algebra operation on many rasters and/or many bands. See example Variant 1.

nband, nband1, nband2 Band numbers of the raster to be evaluated. `nband` can be an integer or integer[] denoting the bands. `nband1` is band on `rast1` and `nband2` is band on `rast2` for the 2 raster/2band case.

callbackfunc The `callbackfunc` parameter must be the name and signature of an SQL or PL/pgSQL function, cast to a regprocedure. An example PL/pgSQL function example is:

```

CREATE OR REPLACE FUNCTION sample_callbackfunc(value double precision[][][], position integer[][], VARIADIC userargs text[])
RETURNS double precision
AS $$
BEGIN
    RETURN 0;
END;
$$ LANGUAGE 'plpgsql' IMMUTABLE;

```

The `callbackfunc` must have three arguments: a 3-dimension double precision array, a 2-dimension integer array and a variadic 1-dimension text array. The first argument `value` is the set of values (as double precision) from all input rasters. The three dimensions (where indexes are 1-based) are: raster #, row y, column x. The second argument `position` is the set of pixel positions from the output raster and input rasters. The outer dimension (where indexes are 0-based) is the raster #. The position at outer dimension index 0 is the output raster's pixel position. For each outer dimension, there are two elements in the inner dimension for X and Y. The third argument `userargs` is for passing through any user-specified arguments.

Passing a regprocedure argument to a SQL function requires the full function signature to be passed, then cast to a regprocedure type. To pass the above example PL/pgSQL function as an argument, the SQL for the argument is:

```
'sample_callbackfunc(double precision[], integer[], text[])':regprocedure
```

Note that the argument contains the name of the function, the types of the function arguments, quotes around the name and argument types, and a cast to a regprocedure.

mask An n-dimensional array (matrix) of numbers used to filter what cells get passed to map algebra call-back function. 0 means a neighbor cell value should be treated as no-data and 1 means value should be treated as data. If `weight` is set to true, then the values, are used as multipliers to multiple the pixel value of that value in the neighborhood position.

weighted boolean (true/false) to denote if a mask value should be weighted (multiplied by original value) or not (only applies to proto that takes a mask).

pixeltype If `pixeltype` is passed in, the one band of the new raster will be of that `pixeltype`. If `pixeltype` is passed NULL or left out, the new raster band will have the same `pixeltype` as the specified band of the first raster (for extent types: INTERSECTION, UNION, FIRST, CUSTOM) or the specified band of the appropriate raster (for extent types: SECOND, LAST). If in doubt, always specify `pixeltype`.

The resulting pixel type of the output raster must be one listed in [ST_BandPixelType](#) or left out or set to NULL.

extenttype Possible values are INTERSECTION (default), UNION, FIRST (default for one raster variants), SECOND, LAST, CUSTOM.

customextent If `extenttype` is CUSTOM, a raster must be provided for `customextent`. See example 4 of Variant 1.

distancex The distance in pixels from the reference cell in x direction. So width of resulting matrix would be $2 \times \text{distancex} + 1$. If not specified only the reference cell is considered (neighborhood of 0).

distancey The distance in pixels from reference cell in y direction. Height of resulting matrix would be $2 \times \text{distancey} + 1$. If not specified only the reference cell is considered (neighborhood of 0).

userargs The third argument to the `callbackfunc` is a variadic text array. All trailing text arguments are passed through to the specified `callbackfunc`, and are contained in the `userargs` argument.



Note

For more information about the VARIADIC keyword, please refer to the PostgreSQL documentation and the "SQL Functions with Variable Numbers of Arguments" section of [Query Language \(SQL\) Functions](#).



Note

The `text[]` argument to the `callbackfunc` is required, regardless of whether you choose to pass any arguments to the callback function for processing or not.

Variant 1 accepts an array of `rastbandarg` allowing the use of a map algebra operation on many rasters and/or many bands. See example Variant 1.

Variants 2 and 3 operate upon one or more bands of one raster. See example Variant 2 and 3.

Variant 4 operate upon two rasters with one band per raster. See example Variant 4.

Availability: 2.2.0: Ability to add a mask

Availability: 2.1.0

Examples: Variant 1

One raster, one band

```
WITH foo AS (
  SELECT 1 AS rid, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, 0, 0, 0), 1, '16BUI', ←
    1, 0) AS rast
)
SELECT
  ST_MapAlgebra(
    ARRAY[ROW(rast, 1)]::rastbandarg[],
    'sample_callbackfunc(double precision[], int[], text[])::regprocedure
  ) AS rast
FROM foo
```

One raster, several bands

```

WITH foo AS (
    SELECT 1 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, 0, 0, 0), 1, '16BUI', 1, 0), 2, '8BUI', 10, 0), 3, '32BUI', 100, 0) AS rast
)
SELECT
    ST_MapAlgebra(
        ARRAY[ROW(rast, 3), ROW(rast, 1), ROW(rast, 3), ROW(rast, 2)]::rastbandarg[],
        'sample_callbackfunc(double precision[], int[], text[])':regprocedure
    ) AS rast
FROM foo

```

Several rasters, several bands

```

WITH foo AS (
    SELECT 1 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, 0, 0, 0), 1, '16BUI', 1, 0), 2, '8BUI', 10, 0), 3, '32BUI', 100, 0) AS rast UNION ALL
    SELECT 2 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, 0, 0, 0), 1, '16BUI', 2, 0), 2, '8BUI', 20, 0), 3, '32BUI', 300, 0) AS rast
)
SELECT
    ST_MapAlgebra(
        ARRAY[ROW(t1.rast, 3), ROW(t2.rast, 1), ROW(t2.rast, 3), ROW(t1.rast, 2)]::rastbandarg[],
        'sample_callbackfunc(double precision[], int[], text[])':regprocedure
    ) AS rast
FROM foo t1
CROSS JOIN foo t2
WHERE t1.rid = 1
    AND t2.rid = 2

```

Complete example of tiles of a coverage with neighborhood. This query only works with PostgreSQL 9.1 or higher.

```

WITH foo AS (
    SELECT 0 AS rid, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, 0, 0, 0), 1, '16BUI', 1, 0) AS rast UNION ALL
    SELECT 1, ST_AddBand(ST_MakeEmptyRaster(2, 2, 2, 0, 1, -1, 0, 0, 0), 1, '16BUI', 2, 0) AS rast UNION ALL
    SELECT 2, ST_AddBand(ST_MakeEmptyRaster(2, 2, 4, 0, 1, -1, 0, 0, 0), 1, '16BUI', 3, 0) AS rast UNION ALL

    SELECT 3, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, -2, 1, -1, 0, 0, 0), 1, '16BUI', 10, 0) AS rast UNION ALL
    SELECT 4, ST_AddBand(ST_MakeEmptyRaster(2, 2, 2, -2, 1, -1, 0, 0, 0), 1, '16BUI', 20, 0) AS rast UNION ALL
    SELECT 5, ST_AddBand(ST_MakeEmptyRaster(2, 2, 4, -2, 1, -1, 0, 0, 0), 1, '16BUI', 30, 0) AS rast UNION ALL

    SELECT 6, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, -4, 1, -1, 0, 0, 0), 1, '16BUI', 100, 0) AS rast UNION ALL
    SELECT 7, ST_AddBand(ST_MakeEmptyRaster(2, 2, 2, -4, 1, -1, 0, 0, 0), 1, '16BUI', 200, 0) AS rast UNION ALL
    SELECT 8, ST_AddBand(ST_MakeEmptyRaster(2, 2, 4, -4, 1, -1, 0, 0, 0), 1, '16BUI', 300, 0) AS rast
)
SELECT
    t1.rid,
    ST_MapAlgebra(
        ARRAY[ROW(ST_Union(t2.rast), 1)]::rastbandarg[],
        'sample_callbackfunc(double precision[], int[], text[])':regprocedure,
        '32BUI',
    ) AS rast

```

```

        'CUSTOM', t1.rast,
        1, 1
    ) AS rast
FROM foo t1
CROSS JOIN foo t2
WHERE t1.rid = 4
      AND t2.rid BETWEEN 0 AND 8
      AND ST_Intersects(t1.rast, t2.rast)
GROUP BY t1.rid, t1.rast

```

Example like the prior one for tiles of a coverage with neighborhood but works with PostgreSQL 9.0.

```

WITH src AS (
    SELECT 0 AS rid, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, 0, 0, 0), 1, '16BUI', 1, 0) AS rast UNION ALL
    SELECT 1, ST_AddBand(ST_MakeEmptyRaster(2, 2, 2, 0, 1, -1, 0, 0, 0), 1, '16BUI', 2, 0) AS rast UNION ALL
    SELECT 2, ST_AddBand(ST_MakeEmptyRaster(2, 2, 4, 0, 1, -1, 0, 0, 0), 1, '16BUI', 3, 0) AS rast UNION ALL

    SELECT 3, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, -2, 1, -1, 0, 0, 0), 1, '16BUI', 10, 0) AS rast UNION ALL
    SELECT 4, ST_AddBand(ST_MakeEmptyRaster(2, 2, 2, -2, 1, -1, 0, 0, 0), 1, '16BUI', 20, 0) AS rast UNION ALL
    SELECT 5, ST_AddBand(ST_MakeEmptyRaster(2, 2, 4, -2, 1, -1, 0, 0, 0), 1, '16BUI', 30, 0) AS rast UNION ALL

    SELECT 6, ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, -4, 1, -1, 0, 0, 0), 1, '16BUI', 100, 0) AS rast UNION ALL
    SELECT 7, ST_AddBand(ST_MakeEmptyRaster(2, 2, 2, -4, 1, -1, 0, 0, 0), 1, '16BUI', 200, 0) AS rast UNION ALL
    SELECT 8, ST_AddBand(ST_MakeEmptyRaster(2, 2, 4, -4, 1, -1, 0, 0, 0), 1, '16BUI', 300, 0) AS rast
)
WITH foo AS (
    SELECT
        t1.rid,
        ST_Union(t2.rast) AS rast
    FROM src t1
    JOIN src t2
        ON ST_Intersects(t1.rast, t2.rast)
        AND t2.rid BETWEEN 0 AND 8
    WHERE t1.rid = 4
    GROUP BY t1.rid
), bar AS (
    SELECT
        t1.rid,
        ST_MapAlgebra(
            ARRAY[ROW(t2.rast, 1)::rastbandarg[],
                'raster_nmapalgebra_test(double precision[], int[], text[])::regprocedure,
                '32BUI',
                'CUSTOM', t1.rast,
                1, 1
            ] AS rast
        FROM src t1
        JOIN foo t2
            ON t1.rid = t2.rid
    )
SELECT
    rid,
    (ST_Metadata(rast)),
    (ST_BandMetadata(rast, 1)),

```

```
ST_Value(rast, 1, 1, 1)
FROM bar;
```

Examples: Variants 2 and 3

One raster, several bands

```
WITH foo AS (
  SELECT 1 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, ↵
    0, 0, 0), 1, '16BUI', 1, 0), 2, '8BUI', 10, 0), 3, '32BUI', 100, 0) AS rast
)
SELECT
  ST_MapAlgebra(
    rast, ARRAY[3, 1, 3, 2]::integer[],
    'sample_callbackfunc(double precision[], int[], text[])'::regprocedure
  ) AS rast
FROM foo
```

One raster, one band

```
WITH foo AS (
  SELECT 1 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, ↵
    0, 0, 0), 1, '16BUI', 1, 0), 2, '8BUI', 10, 0), 3, '32BUI', 100, 0) AS rast
)
SELECT
  ST_MapAlgebra(
    rast, 2,
    'sample_callbackfunc(double precision[], int[], text[])'::regprocedure
  ) AS rast
FROM foo
```

Examples: Variant 4

Two rasters, two bands

```
WITH foo AS (
  SELECT 1 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, ↵
    0, 0, 0), 1, '16BUI', 1, 0), 2, '8BUI', 10, 0), 3, '32BUI', 100, 0) AS rast UNION ↵
  ALL
  SELECT 2 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 1, 1, -1, ↵
    0, 0, 0), 1, '16BUI', 2, 0), 2, '8BUI', 20, 0), 3, '32BUI', 300, 0) AS rast
)
SELECT
  ST_MapAlgebra(
    t1.rast, 2,
    t2.rast, 1,
    'sample_callbackfunc(double precision[], int[], text[])'::regprocedure
  ) AS rast
FROM foo t1
CROSS JOIN foo t2
WHERE t1.rid = 1
  AND t2.rid = 2
```

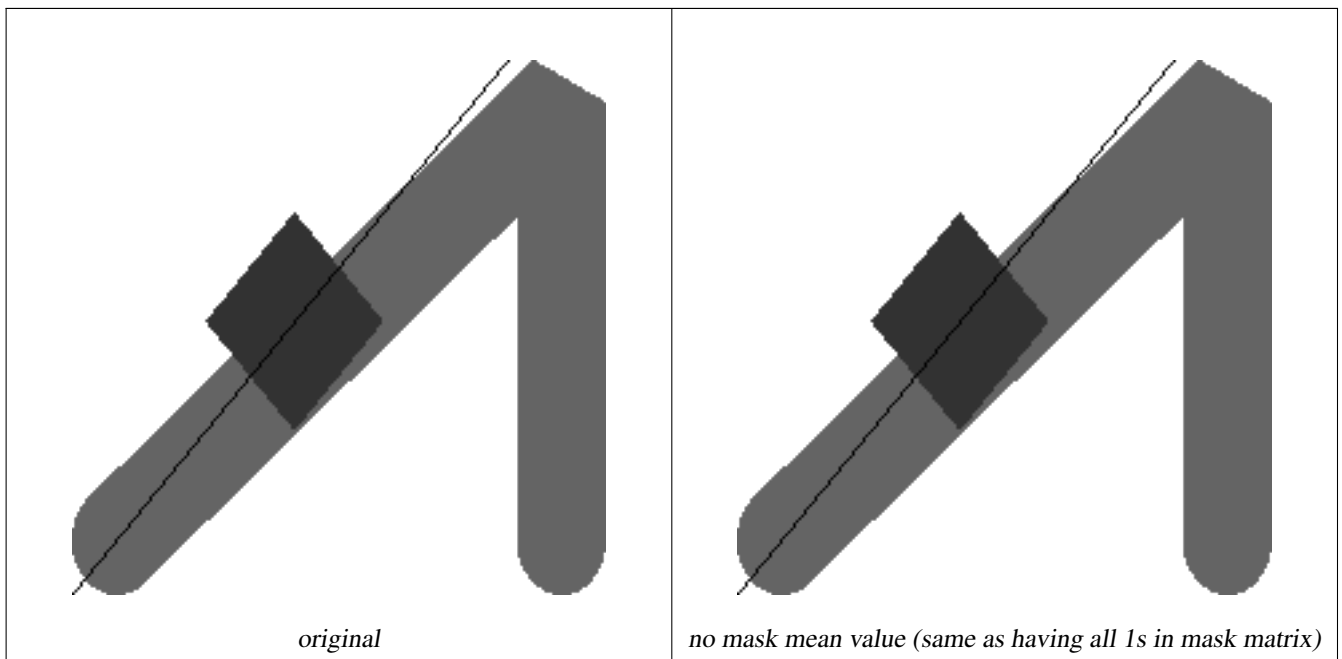
Examples: Using Masks

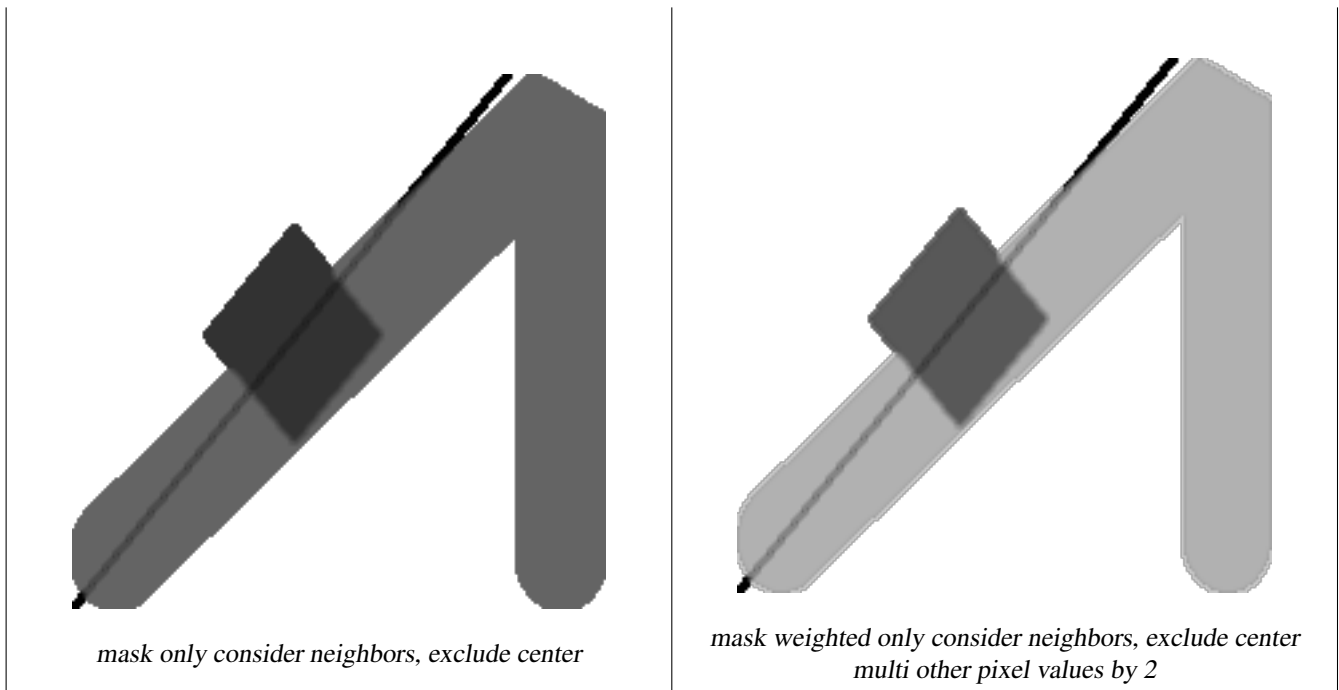
```

WITH foo AS (SELECT
    ST_SetBandNoDataValue(
ST_SetValue(ST_SetValue(ST_AsRaster(
    ST_Buffer(
        ST_GeomFromText('LINESTRING(50 50,100 90,100 50)'), 5,'join=bevel'),
        200,200,ARRAY['8BUI'], ARRAY[100], ARRAY[0]), ST_Buffer('POINT(70 70) ':: geometry,10,'quad_segs=1') ,50),
    'LINESTRING(20 20, 100 100, 150 98) '::geometry,1),0) AS rast )
SELECT 'original' AS title, rast
FROM foo
UNION ALL
SELECT 'no mask mean value' AS title, ST_MapAlgebra(rast,1,'ST_mean4ma(double precision[], ←
    int[], text[]) '::regprocedure) AS rast
FROM foo
UNION ALL
SELECT 'mask only consider neighbors, exclude center' AS title, ST_MapAlgebra(rast,1,' ←
    ST_mean4ma(double precision[], int[], text[]) '::regprocedure,
    '{{1,1,1}, {1,0,1}, {1,1,1}}' ::double precision[], false) As rast
FROM foo

UNION ALL
SELECT 'mask weighted only consider neighbors, exclude center multi otehr pixel values by ←
    2' AS title, ST_MapAlgebra(rast,1,'ST_mean4ma(double precision[], int[], text[]) ':: ←
    regprocedure,
    '{{2,2,2}, {2,0,2}, {2,2,2}}' ::double precision[], true) As rast
FROM foo;

```





See Also

[rastbandarg](#), [ST_Union](#), [ST_MapAlgebra \(expression version\)](#)

12.12.6 ST_MapAlgebra (expression version)

ST_MapAlgebra (expression version) — Expression version - Returns a one-band raster given one or two input rasters, band indexes and one or more user-specified SQL expressions.

Synopsis

```
raster ST_MapAlgebra(raster rast, integer nband, text pixeltype, text expression, double precision nodataval=NULL);
raster ST_MapAlgebra(raster rast, text pixeltype, text expression, double precision nodataval=NULL);
raster ST_MapAlgebra(raster rast1, integer nband1, raster rast2, integer nband2, text expression, text pixeltype=NULL, text
extenttype=INTERSECTION, text nodata1expr=NULL, text nodata2expr=NULL, double precision nodatanodataval=NULL);
raster ST_MapAlgebra(raster rast1, raster rast2, text expression, text pixeltype=NULL, text extenttype=INTERSECTION, text
nodata1expr=NULL, text nodata2expr=NULL, double precision nodatanodataval=NULL);
```

Description

Expression version - Returns a one-band raster given one or two input rasters, band indexes and one or more user-specified SQL expressions.

Availability: 2.1.0

Description: Variants 1 and 2 (one raster)

Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation defined by the `expression` on the input raster (`rast`). If `nband` is not provided, band 1 is assumed. The new raster will have the same georeference, width, and height as the original raster but will only have one band.

If `pixeltype` is passed in, then the new raster will have a band of that pixeltype. If `pixeltype` is passed NULL, then the new raster band will have the same pixeltype as the input `rast` band.

- Keywords permitted for `expression`

1. `[rast]` - Pixel value of the pixel of interest
2. `[rast.val]` - Pixel value of the pixel of interest
3. `[rast.x]` - 1-based pixel column of the pixel of interest
4. `[rast.y]` - 1-based pixel row of the pixel of interest

Description: Variants 3 and 4 (two raster)

Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation to the two bands defined by the `expression` on the two input raster bands `rast1`, (`rast2`). If no `band1`, `band2` is specified band 1 is assumed. The resulting raster will be aligned (scale, skew and pixel corners) on the grid defined by the first raster. The resulting raster will have the extent defined by the `extenttype` parameter.

expression A PostgreSQL algebraic expression involving the two rasters and PostgreSQL defined functions/operators that will define the pixel value when pixels intersect. e.g. `(([rast1] + [rast2])/2.0)::integer`

pixeltype The resulting pixel type of the output raster. Must be one listed in [ST_BandPixelType](#), left out or set to NULL. If not passed in or set to NULL, will default to the pixeltype of the first raster.

extenttype Controls the extent of resulting raster

1. `INTERSECTION` - The extent of the new raster is the intersection of the two rasters. This is the default.
2. `UNION` - The extent of the new raster is the union of the two rasters.
3. `FIRST` - The extent of the new raster is the same as the one of the first raster.
4. `SECOND` - The extent of the new raster is the same as the one of the second raster.

nodata1expr An algebraic expression involving only `rast2` or a constant that defines what to return when pixels of `rast1` are nodata values and spatially corresponding `rast2` pixels have values.

nodata2expr An algebraic expression involving only `rast1` or a constant that defines what to return when pixels of `rast2` are nodata values and spatially corresponding `rast1` pixels have values.

nodatanodataval A numeric constant to return when spatially corresponding `rast1` and `rast2` pixels are both nodata values.

- Keywords permitted in `expression`, `nodata1expr` and `nodata2expr`

1. `[rast1]` - Pixel value of the pixel of interest from `rast1`
2. `[rast1.val]` - Pixel value of the pixel of interest from `rast1`
3. `[rast1.x]` - 1-based pixel column of the pixel of interest from `rast1`
4. `[rast1.y]` - 1-based pixel row of the pixel of interest from `rast1`
5. `[rast2]` - Pixel value of the pixel of interest from `rast2`
6. `[rast2.val]` - Pixel value of the pixel of interest from `rast2`
7. `[rast2.x]` - 1-based pixel column of the pixel of interest from `rast2`
8. `[rast2.y]` - 1-based pixel row of the pixel of interest from `rast2`

Examples: Variants 1 and 2

```
WITH foo AS (
  SELECT ST_AddBand(ST_MakeEmptyRaster(10, 10, 0, 0, 1, 1, 0, 0, 0), '32BF'::text, 1, -1) ←
    AS rast
)
SELECT
  ST_MapAlgebra(rast, 1, NULL, 'ceil([rast]*[rast.x]/[rast.y]+[rast.val])')
FROM foo;
```

Examples: Variant 3 and 4

```

WITH foo AS (
    SELECT 1 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, -1, ←
        0, 0, 0), 1, '16BUI', 1, 0), 2, '8BUI', 10, 0), 3, '32BUI'::text, 100, 0) AS rast ←
    UNION ALL
    SELECT 2 AS rid, ST_AddBand(ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(2, 2, 0, 0, 1, 1, -1, ←
        0, 0, 0), 1, '16BUI', 2, 0), 2, '8BUI', 20, 0), 3, '32BUI'::text, 300, 0) AS rast
)
SELECT
    ST_MapAlgebra(
        t1.rast, 2,
        t2.rast, 1,
        '([rast2] + [rast1.val]) / 2'
    ) AS rast
FROM foo t1
CROSS JOIN foo t2
WHERE t1.rid = 1
    AND t2.rid = 2;

```

See Also

[rastbandarg](#), [ST_Union](#), [ST_MapAlgebra \(callback function version\)](#)

12.12.7 ST_MapAlgebraExpr

ST_MapAlgebraExpr — 1 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified.

Synopsis

raster **ST_MapAlgebraExpr**(raster rast, integer band, text pixeltype, text expression, double precision nodataval=NULL);
raster **ST_MapAlgebraExpr**(raster rast, text pixeltype, text expression, double precision nodataval=NULL);

Description**Warning**

ST_MapAlgebraExpr is deprecated as of 2.1.0. Use [ST_MapAlgebra \(expression version\)](#) instead.

Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation defined by the `expression` on the input raster (`rast`). If no band is specified band 1 is assumed. The new raster will have the same georeference, width, and height as the original raster but will only have one band.

If `pixeltype` is passed in, then the new raster will have a band of that pixeltype. If `pixeltype` is passed NULL, then the new raster band will have the same pixeltype as the input `rast` band.

In the expression you can use the term `[rast]` to refer to the pixel value of the original band, `[rast.x]` to refer to the 1-based pixel column index, `[rast.y]` to refer to the 1-based pixel row index.

Availability: 2.0.0

Examples

Create a new 1 band raster from our original that is a function of modulo 2 of the original raster band.

```
ALTER TABLE dummy_rast ADD COLUMN map_rast raster;
UPDATE dummy_rast SET map_rast = ST_MapAlgebraExpr(rast,NULL,'mod([rast]::numeric,2)') ←
    WHERE rid = 2;

SELECT
    ST_Value(rast,1,i,j) As origval,
    ST_Value(map_rast, 1, i, j) As mapval
FROM dummy_rast
CROSS JOIN generate_series(1, 3) AS i
CROSS JOIN generate_series(1,3) AS j
WHERE rid = 2;
```

origval	mapval
253	1
254	0
253	1
253	1
254	0
254	0
250	0
254	0
254	0

Create a new 1 band raster of pixel-type 2BUI from our original that is reclassified and set the nodata value to be 0.

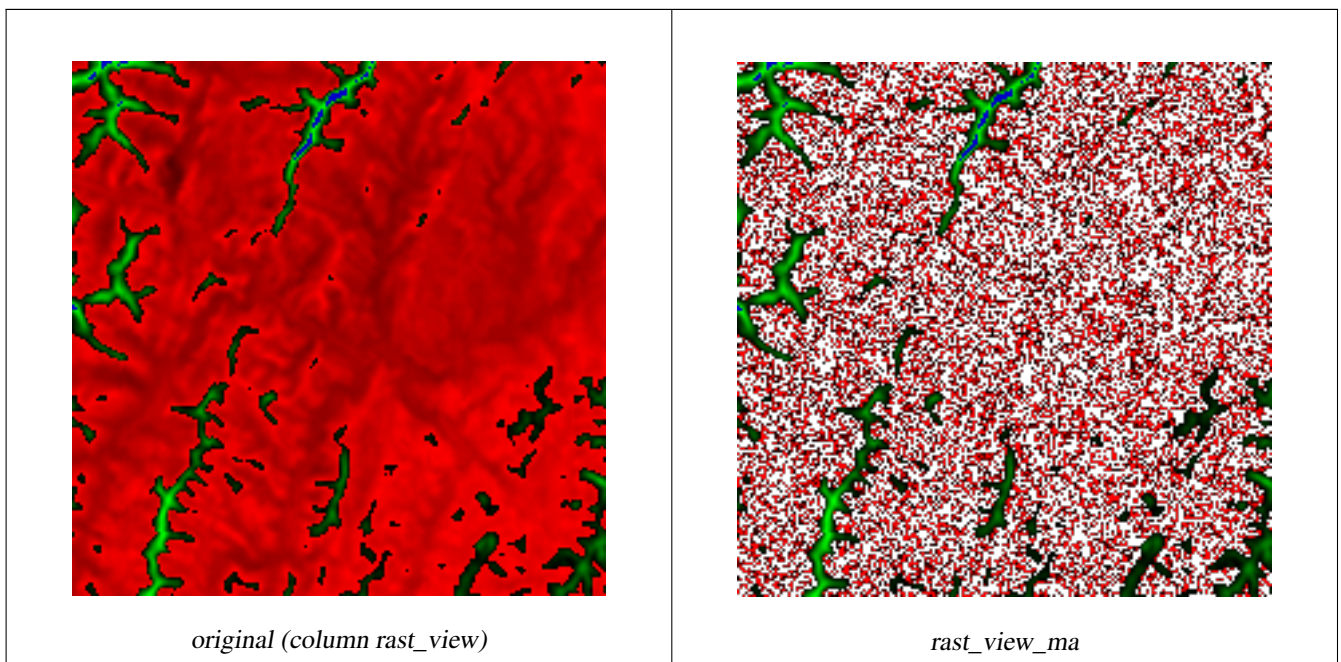
```
ALTER TABLE dummy_rast ADD COLUMN map_rast2 raster;
UPDATE dummy_rast SET
    map_rast2 = ST_MapAlgebraExpr(rast,'2BUI'::text,'CASE WHEN [rast] BETWEEN 100 and 250 ←
        THEN 1 WHEN [rast] = 252 THEN 2 WHEN [rast] BETWEEN 253 and 254 THEN 3 ELSE 0 END':: ←
        text, '0')
WHERE rid = 2;

SELECT DISTINCT
    ST_Value(rast,1,i,j) As origval,
    ST_Value(map_rast2, 1, i, j) As mapval
FROM dummy_rast
CROSS JOIN generate_series(1, 5) AS i
CROSS JOIN generate_series(1,5) AS j
WHERE rid = 2;
```

origval	mapval
249	1
250	1
251	
252	2
253	3
254	3

```
SELECT
    ST_BandPixelType(map_rast2) As b1pixtyp
FROM dummy_rast
WHERE rid = 2;
```

b1pixtyp
2BUI



Create a new 3 band raster same pixel type from our original 3 band raster with first band altered by map algebra and remaining 2 bands unaltered.

```
SELECT
  ST_AddBand(
    ST_AddBand(
      ST_AddBand(
        ST_MakeEmptyRaster(rast_view),
        ST_MapAlgebraExpr(rast_view,1,NULL,'tan([rast])*[rast]')
      ),
      ST_Band(rast_view,2)
    ),
    ST_Band(rast_view, 3)
  ) As rast_view_ma
FROM wind
WHERE rid=167;
```

See Also

[ST_MapAlgebraExpr](#), [ST_MapAlgebraFct](#), [ST_BandPixelType](#), [ST_GeoReference](#), [ST_Value](#)

12.12.8 ST_MapAlgebraExpr

ST_MapAlgebraExpr — 2 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the two input raster bands and of pixeltype provided. band 1 of each raster is assumed if no band numbers are specified. The resulting raster will be aligned (scale, skew and pixel corners) on the grid defined by the first raster and have its extent defined by the "extenttype" parameter. Values for "extenttype" can be: INTERSECTION, UNION, FIRST, SECOND.

Synopsis

raster **ST_MapAlgebraExpr**(raster rast1, raster rast2, text expression, text pixeltype=same_as_rast1_band, text extenttype=INTERSECTION, text nodata1expr=NULL, text nodata2expr=NULL, double precision nodatanodataval=NULL);

raster **ST_MapAlgebraExpr**(raster rast1, integer band1, raster rast2, integer band2, text expression, text pixeltype=same_as_rast1_band, text extenttype=INTERSECTION, text nodata1expr=NULL, text nodata2expr=NULL, double precision nodatanodataval=NULL);

Description



Warning

ST_MapAlgebraExpr is deprecated as of 2.1.0. Use **ST_MapAlgebra (expression version)** instead.

Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation to the two bands defined by the `expression` on the two input raster bands `rast1`, (`rast2`). If no `band1`, `band2` is specified band 1 is assumed. The resulting raster will be aligned (scale, skew and pixel corners) on the grid defined by the first raster. The resulting raster will have the extent defined by the `extenttype` parameter.

expression A PostgreSQL algebraic expression involving the two rasters and PostgreSQL defined functions/operators that will define the pixel value when pixels intersect. e.g. `(([rast1] + [rast2])/2.0)::integer`

pixeltype The resulting pixel type of the output raster. Must be one listed in **ST_BandPixelType**, left out or set to NULL. If not passed in or set to NULL, will default to the pixeltype of the first raster.

extenttype Controls the extent of resulting raster

1. **INTERSECTION** - The extent of the new raster is the intersection of the two rasters. This is the default.
2. **UNION** - The extent of the new raster is the union of the two rasters.
3. **FIRST** - The extent of the new raster is the same as the one of the first raster.
4. **SECOND** - The extent of the new raster is the same as the one of the second raster.

nodata1expr An algebraic expression involving only `rast2` or a constant that defines what to return when pixels of `rast1` are nodata values and spatially corresponding `rast2` pixels have values.

nodata2expr An algebraic expression involving only `rast1` or a constant that defines what to return when pixels of `rast2` are nodata values and spatially corresponding `rast1` pixels have values.

nodatanodataval A numeric constant to return when spatially corresponding `rast1` and `rast2` pixels are both nodata values.

If `pixeltype` is passed in, then the new raster will have a band of that pixeltype. If `pixeltype` is passed NULL or no pixel type specified, then the new raster band will have the same pixeltype as the input `rast1` band.

Use the term `[rast1.val]` `[rast2.val]` to refer to the pixel value of the original raster bands and `[rast1.x]`, `[rast1.y]` etc. to refer to the column / row positions of the pixels.

Availability: 2.0.0

Example: 2 Band Intersection and Union

Create a new 1 band raster from our original that is a function of modulo 2 of the original raster band.

```
--Create a cool set of rasters --
DROP TABLE IF EXISTS fun_shapes;
CREATE TABLE fun_shapes(rid serial PRIMARY KEY, fun_name text, rast raster);

-- Insert some cool shapes around Boston in Massachusetts state plane meters --
INSERT INTO fun_shapes(fun_name, rast)
VALUES ('ref', ST_AsRaster(ST_MakeEnvelope(235229, 899970, 237229, 901930,26986),200,200,'8 ←
    BUI',0,0));

INSERT INTO fun_shapes(fun_name,rast)
WITH ref(rast) AS (SELECT rast FROM fun_shapes WHERE fun_name = 'ref' )
SELECT 'area' AS fun_name, ST_AsRaster(ST_Buffer(ST_SetSRID(ST_Point(236229, 900930),26986) ←
    , 1000),
```

```

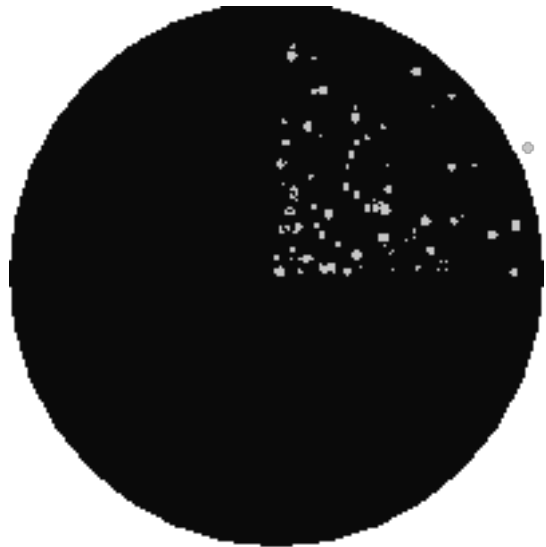
        ref.rast,'8BUI', 10, 0) As rast
FROM ref
UNION ALL
SELECT 'rand bubbles',
       ST_AsRaster(
         (SELECT ST_Collect(geom)
          FROM (SELECT ST_Buffer(ST_SetSRID(ST_Point(236229 + i*random()*100, 900930 + j*random()*100),26986), random()*20) As geom
               FROM generate_series(1,10) As i, generate_series(1,10) As j
               ) As foo ), ref.rast,'8BUI', 200, 0)
FROM ref;

--map them -
SELECT ST_MapAlgebraExpr(
  area.rast, bub.rast, '[rast2.val]', '8BUI', 'INTERSECTION', '[rast2.val]', '[rast1.val]') As interrast,
  ST_MapAlgebraExpr(
  area.rast, bub.rast, '[rast2.val]', '8BUI', 'UNION', '[rast2.val]', '[rast1.val]') As unionrast
FROM
  (SELECT rast FROM fun_shapes WHERE
   fun_name = 'area') As area
CROSS JOIN (SELECT rast
FROM fun_shapes WHERE
fun_name = 'rand bubbles') As bub

```



mapalgebra intersection



map algebra union

Example: Overlaying rasters on a canvas as separate bands

```

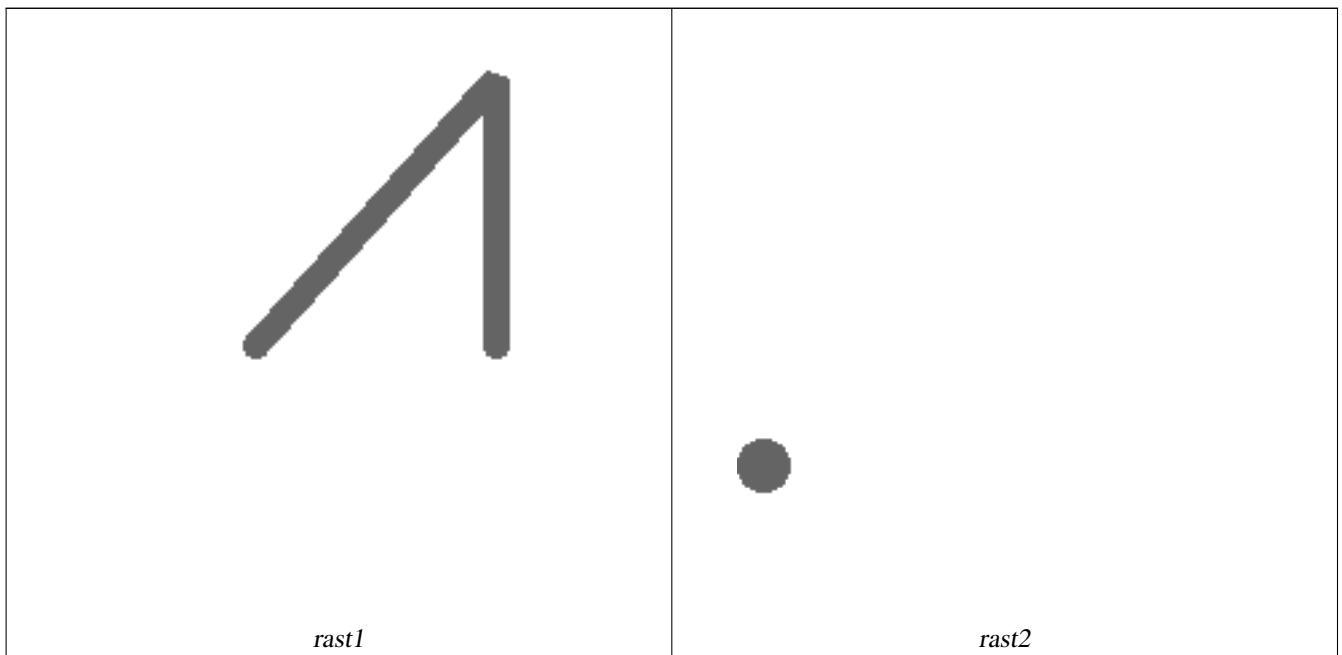
-- we use ST_AsPNG to render the image so all single band ones look grey --
WITH mygeoms
  AS ( SELECT 2 As bnum, ST_Buffer(ST_Point(1,5),10) As geom
      UNION ALL
      SELECT 3 AS bnum,
            ST_Buffer(ST_GeomFromText('LINESTRING(50 50,150 150,150 50)'), 10,'join=bevel') As geom
      UNION ALL

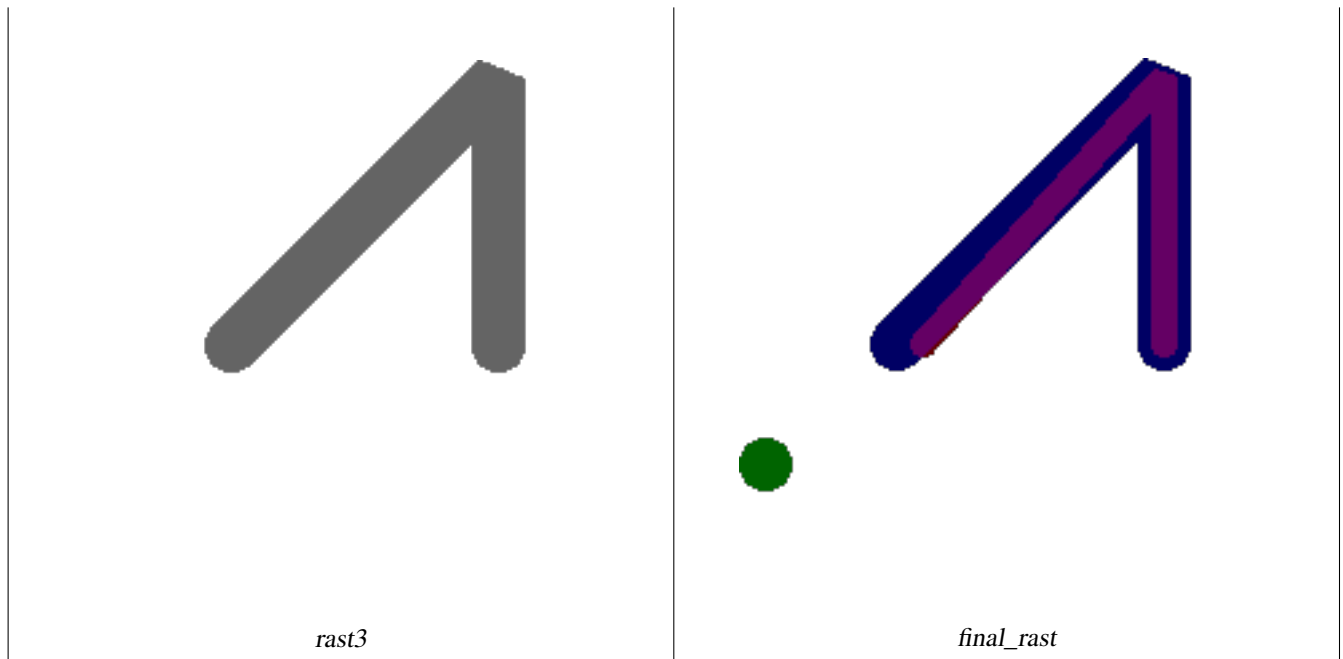
```

```

        SELECT 1 As bnum,
               ST_Buffer(ST_GeomFromText('LINESTRING(60 50,150 150,150 50)'), 5,'join= ↵
               bevel') As geom
        ),
-- define our canvas to be 1 to 1 pixel to geometry
canvas
AS (SELECT ST_AddBand(ST_MakeEmptyRaster(200,
    200,
    ST_XMin(e)::integer, ST_YMax(e)::integer, 1, -1, 0, 0) , '8BUI'::text,0) As rast
    FROM (SELECT ST_Extent(geom) As e,
            Max(ST_SRID(geom)) As srid
            from mygeoms
            ) As foo
    ),
rbands AS (SELECT ARRAY(SELECT ST_MapAlgebraExpr(canvas.rast, ST_AsRaster(m.geom, canvas ↵
    .rast, '8BUI', 100),
            '[rast2.val]', '8BUI', 'FIRST', '[rast2.val]', '[rast1.val]') As rast
            FROM mygeoms AS m CROSS JOIN canvas
            ORDER BY m.bnum) As rasts
    )
SELECT rasts[1] As rast1 , rasts[2] As rast2, rasts[3] As rast3, ST_AddBand(
    ST_AddBand(rasts[1],rasts[2]), rasts[3]) As final_rast
FROM rbands;

```





Example: Overlay 2 meter boundary of select parcels over an aerial imagery

```
-- Create new 3 band raster composed of first 2 clipped bands, and overlay of 3rd band with ←
  our geometry
-- This query took 3.6 seconds on PostGIS windows 64-bit install
WITH pr AS
-- Note the order of operation: we clip all the rasters to dimensions of our region
(SELECT ST_Clip(rast,ST_Expand(geom,50) ) As rast, g.geom
  FROM aerals.o_2_boston AS r INNER JOIN
-- union our parcels of interest so they form a single geometry we can later intersect with
  (SELECT ST_Union(ST_Transform(geom,26986)) AS geom
    FROM landparcels WHERE pid IN('0303890000', '0303900000')) As g
   ON ST_Intersects(rast::geometry, ST_Expand(g.geom,50))
),
-- we then union the raster shards together
-- ST_Union on raster is kinda of slow but much faster the smaller you can get the rasters
-- therefore we want to clip first and then union
prunion AS
(SELECT ST_AddBand(NULL, ARRAY[ST_Union(rast,1),ST_Union(rast,2),ST_Union(rast,3)] ) As ←
  clipped,geom
  FROM pr
  GROUP BY geom)
-- return our final raster which is the unioned shard with
-- with the overlay of our parcel boundaries
-- add first 2 bands, then mapalgebra of 3rd band + geometry
SELECT ST_AddBand(ST_Band(clipped,ARRAY[1,2])
  , ST_MapAlgebraExpr(ST_Band(clipped,3), ST_AsRaster(ST_Buffer(ST_Boundary(geom),2), ←
    clipped, '8BUI',250),
    '[rast2.val]', '8BUI', 'FIRST', '[rast2.val]', '[rast1.val]') ) As rast
  FROM prunion;
```




The blue lines are the boundaries of select parcels

See Also

[ST_MapAlgebraExpr](#), [ST_AddBand](#), [ST_AsPNG](#), [ST_AsRaster](#), [ST_MapAlgebraFct](#), [ST_BandPixelType](#), [ST_GeoReference](#), [ST_Value](#), [ST_Union](#), [ST_Union](#)

12.12.9 ST_MapAlgebraFct

ST_MapAlgebraFct — 1 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified.

Synopsis

```
raster ST_MapAlgebraFct(raster rast, regprocedure onerasteruserfunc);
raster ST_MapAlgebraFct(raster rast, regprocedure onerasteruserfunc, text[] VARIADIC args);
raster ST_MapAlgebraFct(raster rast, text pixeltype, regprocedure onerasteruserfunc);
raster ST_MapAlgebraFct(raster rast, text pixeltype, regprocedure onerasteruserfunc, text[] VARIADIC args);
raster ST_MapAlgebraFct(raster rast, integer band, regprocedure onerasteruserfunc);
raster ST_MapAlgebraFct(raster rast, integer band, regprocedure onerasteruserfunc, text[] VARIADIC args);
raster ST_MapAlgebraFct(raster rast, integer band, text pixeltype, regprocedure onerasteruserfunc);
raster ST_MapAlgebraFct(raster rast, integer band, text pixeltype, regprocedure onerasteruserfunc, text[] VARIADIC args);
```

Description



Warning

ST_MapAlgebraFct is deprecated as of 2.1.0. Use **ST_MapAlgebra** (callback function version) instead.

Creates a new one band raster formed by applying a valid PostgreSQL function specified by the `onerasteruserfunc` on the input raster (`rast`). If no band is specified, band 1 is assumed. The new raster will have the same georeference, width, and height as the original raster but will only have one band.

If `pixeltype` is passed in, then the new raster will have a band of that pixeltype. If `pixeltype` is passed NULL, then the new raster band will have the same pixeltype as the input `rast` band.

The `onerasteruserfunc` parameter must be the name and signature of a SQL or PL/pgSQL function, cast to a regprocedure. A very simple and quite useless PL/pgSQL function example is:

```
CREATE OR REPLACE FUNCTION simple_function(pixel FLOAT, pos INTEGER[], VARIADIC args TEXT ↔
[])
RETURNS FLOAT
AS $$ BEGIN
    RETURN 0.0;
END; $$
LANGUAGE 'plpgsql' IMMUTABLE;
```

The `userfunction` may accept two or three arguments: a float value, an optional integer array, and a variadic text array. The first argument is the value of an individual raster cell (regardless of the raster datatype). The second argument is the position of the current processing cell in the form '`{x,y}`'. The third argument indicates that all remaining parameters to `ST_MapAlgebraFct` shall be passed through to the `userfunction`.

Passing a regprocedure argument to a SQL function requires the full function signature to be passed, then cast to a regprocedure type. To pass the above example PL/pgSQL function as an argument, the SQL for the argument is:

```
'simple_function(float,integer[],text[])'::regprocedure
```

Note that the argument contains the name of the function, the types of the function arguments, quotes around the name and argument types, and a cast to a regprocedure.

The third argument to the `userfunction` is a variadic text array. All trailing text arguments to any `ST_MapAlgebraFct` call are passed through to the specified `userfunction`, and are contained in the `args` argument.



Note

For more information about the VARIADIC keyword, please refer to the PostgreSQL documentation and the "SQL Functions with Variable Numbers of Arguments" section of [Query Language \(SQL\) Functions](#).



Note

The `text[]` argument to the `userfunction` is required, regardless of whether you choose to pass any arguments to your user function for processing or not.

Availability: 2.0.0

Examples

Create a new 1 band raster from our original that is a function of modulo 2 of the original raster band.

```
ALTER TABLE dummy_rast ADD COLUMN map_rast raster;
CREATE FUNCTION mod_fct(pixel float, pos integer[], variadic args text[])
RETURNS float
AS $$
BEGIN
    RETURN pixel::integer % 2;
END;
$$
```

```
LANGUAGE 'plpgsql' IMMUTABLE;
```

```
UPDATE dummy_rast SET map_rast = ST_MapAlgebraFct(rast,NULL,'mod_fct(float,integer[],text ←  
[])'::regprocedure) WHERE rid = 2;
```

```
SELECT ST_Value(rast,1,i,j) As origval, ST_Value(map_rast, 1, i, j) As mapval  
FROM dummy_rast CROSS JOIN generate_series(1, 3) AS i CROSS JOIN generate_series(1,3) AS j  
WHERE rid = 2;
```

origval	mapval
253	1
254	0
253	1
253	1
254	0
254	0
250	0
254	0
254	0

Create a new 1 band raster of pixel-type 2BUI from our original that is reclassified and set the nodata value to a passed parameter to the user function (0).

```
ALTER TABLE dummy_rast ADD COLUMN map_rast2 raster;
```

```
CREATE FUNCTION classify_fct(pixel float, pos integer[], variadic args text[])  
RETURNS float
```

```
AS
```

```
$$
```

```
DECLARE
```

```
    nodata float := 0;
```

```
BEGIN
```

```
    IF NOT args[1] IS NULL THEN
```

```
        nodata := args[1];
```

```
    END IF;
```

```
    IF pixel < 251 THEN
```

```
        RETURN 1;
```

```
    ELSIF pixel = 252 THEN
```

```
        RETURN 2;
```

```
    ELSIF pixel > 252 THEN
```

```
        RETURN 3;
```

```
    ELSE
```

```
        RETURN nodata;
```

```
    END IF;
```

```
END;
```

```
$$
```

```
LANGUAGE 'plpgsql';
```

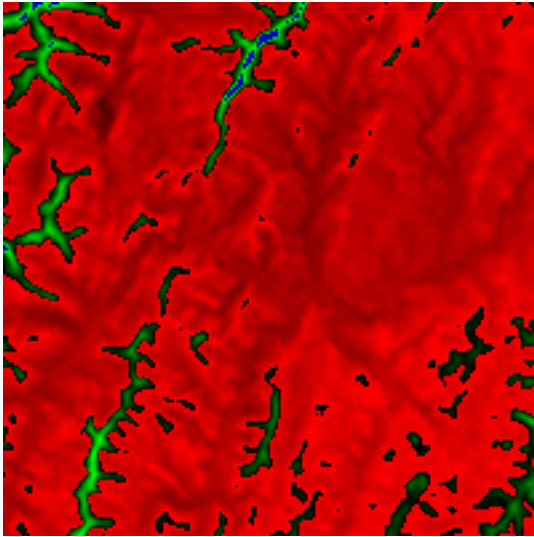
```
UPDATE dummy_rast SET map_rast2 = ST_MapAlgebraFct(rast,'2BUI','classify_fct(float,integer ←  
[],text[])'::regprocedure, '0') WHERE rid = 2;
```

```
SELECT DISTINCT ST_Value(rast,1,i,j) As origval, ST_Value(map_rast2, 1, i, j) As mapval  
FROM dummy_rast CROSS JOIN generate_series(1, 5) AS i CROSS JOIN generate_series(1,5) AS j  
WHERE rid = 2;
```

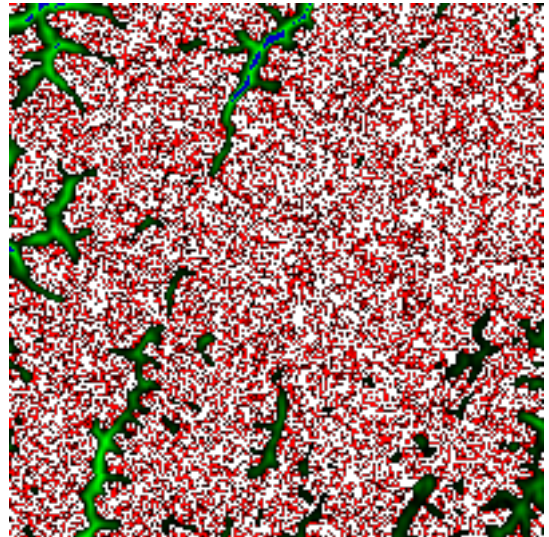
origval	mapval
249	1
250	1
251	
252	2
253	3
254	3

```
SELECT ST_BandPixelType(map_rast2) As b1pixtyp
FROM dummy_rast WHERE rid = 2;
```

```
b1pixtyp
-----
2BUI
```



original (column rast-view)



rast_view_ma

Create a new 3 band raster same pixel type from our original 3 band raster with first band altered by map algebra and remaining 2 bands unaltered.

```
CREATE FUNCTION rast_plus_tan(pixel float, pos integer[], variadic args text[])
RETURNS float
AS
$$
BEGIN
    RETURN tan(pixel) * pixel;
END;
$$
LANGUAGE 'plpgsql';

SELECT ST_AddBand(
    ST_AddBand(
        ST_AddBand(
            ST_MakeEmptyRaster(rast_view),
            ST_MapAlgebraFct(rast_view,1,NULL,'rast_plus_tan(float,integer[],text[])':: ↵
                regprocedure)
        ),
        ST_Band(rast_view,2)
    ),
    ST_Band(rast_view, 3) As rast_view_ma
)
FROM wind
WHERE rid=167;
```

See Also

[ST_MapAlgebraExpr](#), [ST_BandPixelType](#), [ST_GeoReference](#), [ST_SetValue](#)

12.12.10 ST_MapAlgebraFct

ST_MapAlgebraFct — 2 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the 2 input raster bands and of pixeltype provided. Band 1 is assumed if no band is specified. Extent type defaults to INTERSECTION if not specified.

Synopsis

raster **ST_MapAlgebraFct**(raster rast1, raster rast2, regprocedure tworastuserfunc, text pixeltype=same_as_rast1, text extenttype=INTERSECTION, text[] VARIADIC userargs);

raster **ST_MapAlgebraFct**(raster rast1, integer band1, raster rast2, integer band2, regprocedure tworastuserfunc, text pixeltype=same_as_rast1, text extenttype=INTERSECTION, text[] VARIADIC userargs);

Description**Warning**

ST_MapAlgebraFct is deprecated as of 2.1.0. Use [ST_MapAlgebra \(callback function version\)](#) instead.

Creates a new one band raster formed by applying a valid PostgreSQL function specified by the `tworastuserfunc` on the input raster `rast1`, `rast2`. If no `band1` or `band2` is specified, band 1 is assumed. The new raster will have the same georeference, width, and height as the original rasters but will only have one band.

If `pixeltype` is passed in, then the new raster will have a band of that pixeltype. If `pixeltype` is passed NULL or left out, then the new raster band will have the same pixeltype as the input `rast1` band.

The `tworastuserfunc` parameter must be the name and signature of an SQL or PL/pgSQL function, cast to a regprocedure. An example PL/pgSQL function example is:

```
CREATE OR REPLACE FUNCTION simple_function_for_two_rasters(pixel1 FLOAT, pixel2 FLOAT, pos ←
  INTEGER[], VARIADIC args TEXT[])
  RETURNS FLOAT
  AS $$ BEGIN
    RETURN 0.0;
  END; $$
LANGUAGE 'plpgsql' IMMUTABLE;
```

The `tworastuserfunc` may accept three or four arguments: a double precision value, a double precision value, an optional integer array, and a variadic text array. The first argument is the value of an individual raster cell in `rast1` (regardless of the raster datatype). The second argument is an individual raster cell value in `rast2`. The third argument is the position of the current processing cell in the form '`{x,y}`'. The fourth argument indicates that all remaining parameters to **ST_MapAlgebraFct** shall be passed through to the `tworastuserfunc`.

Passing a regprocedure argument to a SQL function requires the full function signature to be passed, then cast to a regprocedure type. To pass the above example PL/pgSQL function as an argument, the SQL for the argument is:

```
'simple_function(double precision, double precision, integer[], text[])':regprocedure
```

Note that the argument contains the name of the function, the types of the function arguments, quotes around the name and argument types, and a cast to a regprocedure.

The fourth argument to the `tworastuserfunc` is a variadic text array. All trailing text arguments to any **ST_MapAlgebraFct** call are passed through to the specified `tworastuserfunc`, and are contained in the `userargs` argument.

**Note**

For more information about the VARIADIC keyword, please refer to the PostgreSQL documentation and the "SQL Functions with Variable Numbers of Arguments" section of [Query Language \(SQL\) Functions](#).

**Note**

The text[] argument to the `tworastuserfunc` is required, regardless of whether you choose to pass any arguments to your user function for processing or not.

Availability: 2.0.0

Example: Overlaying rasters on a canvas as separate bands

```
-- define our user defined function --
CREATE OR REPLACE FUNCTION raster_mapalgebra_union(
    rast1 double precision,
    rast2 double precision,
    pos integer[],
    VARIADIC userargs text[]
)
RETURNS double precision
AS $$
DECLARE
BEGIN
    CASE
        WHEN rast1 IS NOT NULL AND rast2 IS NOT NULL THEN
            RETURN ((rast1 + rast2)/2.);
        WHEN rast1 IS NULL AND rast2 IS NULL THEN
            RETURN NULL;
        WHEN rast1 IS NULL THEN
            RETURN rast2;
        ELSE
            RETURN rast1;
        END CASE;

    RETURN NULL;
END;
$$ LANGUAGE 'plpgsql' IMMUTABLE COST 1000;

-- prep our test table of rasters
DROP TABLE IF EXISTS map_shapes;
CREATE TABLE map_shapes(rid serial PRIMARY KEY, rast raster, bnum integer, descrip text);
INSERT INTO map_shapes(rast,bnum, descrip)
WITH mygeoms
    AS ( SELECT 2 As bnum, ST_Buffer(ST_Point(90,90),30) As geom, 'circle' As descrip
        UNION ALL
        SELECT 3 AS bnum,
            ST_Buffer(ST_GeomFromText('LINESTRING(50 50,150 150,150 50)'), 15) As geom, ←
            'big road' As descrip
        UNION ALL
        SELECT 1 As bnum,
            ST_Translate(ST_Buffer(ST_GeomFromText('LINESTRING(60 50,150 150,150 50)'), ←
            8,'join=bevel'), 10,-6) As geom, 'small road' As descrip
    ),
-- define our canvas to be 1 to 1 pixel to geometry
canvas
    AS ( SELECT ST_AddBand(ST_MakeEmptyRaster(250,
```

```

        250,
        ST_XMin(e)::integer, ST_YMax(e)::integer, 1, -1, 0, 0 ) , '8BUI'::text,0) As rast
    FROM (SELECT ST_Extent(geom) As e,
            Max(ST_SRID(geom)) As srid
        from mygeoms
        ) As foo
    )
-- return our rasters aligned with our canvas
SELECT ST_AsRaster(m.geom, canvas.rast, '8BUI', 240) As rast, bnum, descrip
    FROM mygeoms AS m CROSS JOIN canvas
UNION ALL
SELECT canvas.rast, 4, 'canvas'
FROM canvas;

-- Map algebra on single band rasters and then collect with ST_AddBand
INSERT INTO map_shapes(rast,bnum,descrip)
SELECT ST_AddBand(ST_AddBand(rasts[1], rasts[2]),rasts[3]), 4, 'map bands overlay fct union ←
    (canvas)'
    FROM (SELECT ARRAY(SELECT ST_MapAlgebraFct(m1.rast, m2.rast,
        'raster_mapalgebra_union(double precision, double precision, integer[], text[]) ←
        '::regprocedure, '8BUI', 'FIRST')
        FROM map_shapes As m1 CROSS JOIN map_shapes As m2
        WHERE m1.descrip = 'canvas' AND m2.descrip <> 'canvas' ORDER BY m2.bnum) As rasts) As ←
        foo;

```



map bands overlay (canvas) (R: small road, G: circle, B: big road)

User Defined function that takes extra args

```

CREATE OR REPLACE FUNCTION raster_mapalgebra_userargs(
    rast1 double precision,
    rast2 double precision,
    pos integer[],
    VARIADIC userargs text[]

```

```

)
RETURNS double precision
AS $$
DECLARE
BEGIN
    CASE
        WHEN rast1 IS NOT NULL AND rast2 IS NOT NULL THEN
            RETURN least(userargs[1]::integer, (rast1 + rast2)/2.);
        WHEN rast1 IS NULL AND rast2 IS NULL THEN
            RETURN userargs[2]::integer;
        WHEN rast1 IS NULL THEN
            RETURN greatest(rast2, random()*userargs[3]::integer)::integer;
        ELSE
            RETURN greatest(rast1, random()*userargs[4]::integer)::integer;
    END CASE;

    RETURN NULL;
END;
$$ LANGUAGE 'plpgsql' VOLATILE COST 1000;

SELECT ST_MapAlgebraFct(m1.rast, 1, m1.rast, 3,
    'raster_mapalgebra_userargs(double precision, double precision, integer[], text ←
    [])'::regprocedure,
    '8BUI', 'INTERSECT', '100','200','200','0')
    FROM map_shapes As m1
WHERE m1.descrip = 'map bands overlay fct union (canvas)';

```



user defined with extra args and different bands from same raster

See Also

[ST_MapAlgebraExpr](#), [ST_BandPixelType](#), [ST_GeoReference](#), [ST_SetValue](#)

12.12.11 ST_MapAlgebraFctNgb

ST_MapAlgebraFctNgb — 1-band version: Map Algebra Nearest Neighbor using user-defined PostgreSQL function. Return a raster which values are the result of a PLPGSQL user function involving a neighborhood of values from the input raster band.

Synopsis

raster **ST_MapAlgebraFctNgb**(raster rast, integer band, text pixeltype, integer ngbwidth, integer ngbheight, regprocedure on-
erastngbuserfunc, text nodatamode, text[] VARIADIC args);

Description



Warning

ST_MapAlgebraFctNgb is deprecated as of 2.1.0. Use **ST_MapAlgebra (callback function version)** instead.

(one raster version) Return a raster which values are the result of a PLPGSQL user function involving a neighborhood of values from the input raster band. The user function takes the neighborhood of pixel values as an array of numbers, for each pixel, returns the result from the user function, replacing pixel value of currently inspected pixel with the function result.

rast Raster on which the user function is evaluated.

band Band number of the raster to be evaluated. Default to 1.

pixeltype The resulting pixel type of the output raster. Must be one listed in **ST_BandPixelType** or left out or set to NULL. If not passed in or set to NULL, will default to the pixeltype of the `rast`. Results are truncated if they are larger than what is allowed for the pixeltype.

ngbwidth The width of the neighborhood, in cells.

ngbheight The height of the neighborhood, in cells.

onerastngbuserfunc PLPGSQL/psql user function to apply to neighborhood pixels of a single band of a raster. The first element is a 2-dimensional array of numbers representing the rectangular pixel neighborhood

nodatamode Defines what value to pass to the function for a neighborhood pixel that is nodata or NULL

'ignore': any NODATA values encountered in the neighborhood are ignored by the computation -- this flag must be sent to the user callback function, and the user function decides how to ignore it.

'NULL': any NODATA values encountered in the neighborhood will cause the resulting pixel to be NULL -- the user callback function is skipped in this case.

'value': any NODATA values encountered in the neighborhood are replaced by the reference pixel (the one in the center of the neighborhood). Note that if this value is NODATA, the behavior is the same as 'NULL' (for the affected neighborhood)

args Arguments to pass into the user function.

Availability: 2.0.0

Examples

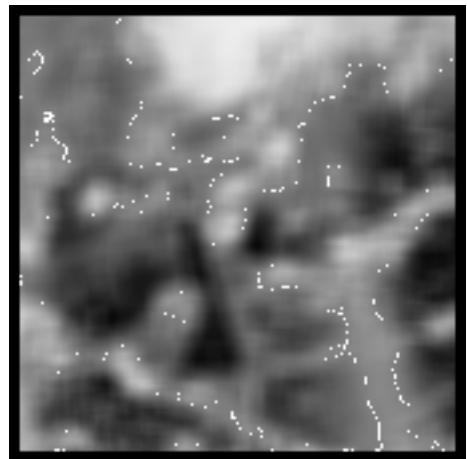
Examples utilize the katrina raster loaded as a single tile described in http://trac.osgeo.org/gdal/wiki/frmts_wtkraster.html and then prepared in the **ST_Rescale** examples

```
--
-- A simple 'callback' user function that averages up all the values in a neighborhood.
--
CREATE OR REPLACE FUNCTION rast_avg(matrix float[][], nodatamode text, variadic args text ←
[])
RETURNS float AS
$$
DECLARE
    _matrix float[][];
    x1 integer;
    x2 integer;
    y1 integer;
    y2 integer;
    sum float;
BEGIN
    _matrix := matrix;
    sum := 0;
    FOR x in array_lower(matrix, 1)..array_upper(matrix, 1) LOOP
        FOR y in array_lower(matrix, 2)..array_upper(matrix, 2) LOOP
            sum := sum + _matrix[x][y];
        END LOOP;
    END LOOP;
    RETURN (sum*1.0/(array_upper(matrix,1)*array_upper(matrix,2) ))::integer ;
END;
$$
LANGUAGE 'plpgsql' IMMUTABLE COST 1000;

-- now we apply to our raster averaging pixels within 2 pixels of each other in X and Y ←
direction --
SELECT ST_MapAlgebraFctNgb(rast, 1, '8BUI', 4,4,
    'rast_avg(float[][], text, text[])':regprocedure, 'NULL', NULL) As nn_with_border
FROM katrinas_rescaled
limit 1;
```



First band of our raster



new raster after averaging pixels withing 4x4 pixels of each other

See Also

[ST_MapAlgebraFct](#), [ST_MapAlgebraExpr](#), [ST_Rescale](#)

12.12.12 ST_Reclass

ST_Reclass — Creates a new raster composed of band types reclassified from original. The nband is the band to be changed. If nband is not specified assumed to be 1. All other bands are returned unchanged. Use case: convert a 16BUI band to a 8BUI and so forth for simpler rendering as viewable formats.

Synopsis

```
raster ST_Reclass(raster rast, integer nband, text reclassexpr, text pixeltype, double precision nodataval=NULL);
raster ST_Reclass(raster rast, reclassarg[] VARIADIC reclassargset);
raster ST_Reclass(raster rast, text reclassexpr, text pixeltype);
```

Description

Creates a new raster formed by applying a valid PostgreSQL algebraic operation defined by the `reclassexpr` on the input raster (`rast`). If no band is specified band 1 is assumed. The new raster will have the same georeference, width, and height as the original raster. Bands not designated will come back unchanged. Refer to [reclassarg](#) for description of valid reclassification expressions.

The bands of the new raster will have pixel type of `pixeltype`. If `reclassargset` is passed in then each `reclassarg` defines behavior of each band generated.

Availability: 2.0.0

Examples Basic

Create a new raster from the original where band 2 is converted from 8BUI to 4BUI and all values from 101-254 are set to nodata value.

```
ALTER TABLE dummy_rast ADD COLUMN reclass_rast raster;
UPDATE dummy_rast SET reclass_rast = ST_Reclass(rast,2,'0-87:1-10, 88-100:11-15, ←
    101-254:0-0', '4BUI',0) WHERE rid = 2;

SELECT i as col, j as row, ST_Value(rast,2,i,j) As origval,
       ST_Value(reclass_rast, 2, i, j) As reclassval,
       ST_Value(reclass_rast, 2, i, j, false) As reclassval_include_nodata
FROM dummy_rast CROSS JOIN generate_series(1, 3) AS i CROSS JOIN generate_series(1,3) AS j
WHERE rid = 2;
```

col	row	origval	reclassval	reclassval_include_nodata
1	1	78	9	9
2	1	98	14	14
3	1	122		0
1	2	96	14	14
2	2	118		0
3	2	180		0
1	3	99	15	15
2	3	112		0
3	3	169		0

Example: Advanced using multiple reclassargs

Create a new raster from the original where band 1,2,3 is converted to 1BB,4BUI, 4BUI respectively and reclassified. Note this uses the variadic `reclassarg` argument which can take as input an indefinite number of reclassargs (theoretically as many bands as you have)

```

UPDATE dummy_rast SET reclass_rast =
    ST_Reclass(rast,
        ROW(2,'0-87]:1-10, (87-100]:11-15, (101-254]:0-0', '4BUI',NULL)::reclassarg,
        ROW(1,'0-253]:1, 254:0', '1BB', NULL)::reclassarg,
        ROW(3,'0-70]:1, (70-86:2, [86-150]:3, [150-255:4', '4BUI', NULL)::reclassarg
    ) WHERE rid = 2;

SELECT i as col, j as row, ST_Value(rast,1,i,j) As ov1, ST_Value(reclass_rast, 1, i, j) As ←
    rv1,
    ST_Value(rast,2,i,j) As ov2, ST_Value(reclass_rast, 2, i, j) As rv2,
    ST_Value(rast,3,i,j) As ov3, ST_Value(reclass_rast, 3, i, j) As rv3
FROM dummy_rast CROSS JOIN generate_series(1, 3) AS i CROSS JOIN generate_series(1,3) AS j
WHERE rid = 2;

```

col	row	ov1	rv1	ov2	rv2	ov3	rv3
1	1	253	1	78	9	70	1
2	1	254	0	98	14	86	3
3	1	253	1	122	0	100	3
1	2	253	1	96	14	80	2
2	2	254	0	118	0	108	3
3	2	254	0	180	0	162	4
1	3	250	1	99	15	90	3
2	3	254	0	112	0	108	3
3	3	254	0	169	0	175	4

Example: Advanced Map a single band 32BF raster to multiple viewable bands

Create a new 3 band (8BUI,8BUI,8BUI viewable raster) from a raster that has only one 32bf band

```

ALTER TABLE wind ADD COLUMN rast_view raster;
UPDATE wind
    set rast_view = ST_AddBand( NULL,
        ARRAY[
            ST_Reclass(rast, 1, '0.1-10]:1-10,9-10]:11, (11-33:0'::text, '8BUI'::text,0),
            ST_Reclass(rast,1, '11-33):0-255, [0-32:0, (34-1000:0'::text, '8BUI'::text,0),
            ST_Reclass(rast,1, '0-32]:0, (32-100:100-255'::text, '8BUI'::text,0)
        ]
    );

```

See Also

[ST_AddBand](#), [ST_Band](#), [ST_BandPixelType](#), [ST_MakeEmptyRaster](#), [reclassarg](#), [ST_Value](#)

12.12.13 ST_Union

ST_Union — Returns the union of a set of raster tiles into a single raster composed of 1 or more bands.

Synopsis

```

raster ST_Union(setof raster rast);
raster ST_Union(setof raster rast, unionarg[] unionargset);
raster ST_Union(setof raster rast, integer nband);
raster ST_Union(setof raster rast, text uniontype);
raster ST_Union(setof raster rast, integer nband, text uniontype);

```

Description

Returns the union of a set of raster tiles into a single raster composed of at least one band. The resulting raster's extent is the extent of the whole set. In the case of intersection, the resulting value is defined by `uniontype` which is one of the following: LAST (default), FIRST, MIN, MAX, COUNT, SUM, MEAN, RANGE.



Note

In order for rasters to be unioned, they must all have the same alignment. Use [ST_SameAlignment](#) and [ST_NotSameAlignmentReason](#) for more details and help. One way to fix alignment issues is to use [ST_Resample](#) and use the same reference raster for alignment.

Availability: 2.0.0

Enhanced: 2.1.0 Improved Speed (fully C-Based).

Availability: 2.1.0 `ST_Union(rast, unionarg)` variant was introduced.

Enhanced: 2.1.0 `ST_Union(rast)` (variant 1) unions all bands of all input rasters. Prior versions of PostGIS assumed the first band.

Enhanced: 2.1.0 `ST_Union(rast, uniontype)` (variant 4) unions all bands of all input rasters.

Examples: Reconstitute a single band chunked raster tile

```
-- this creates a single band from first band of raster tiles
-- that form the original file system tile
SELECT filename, ST_Union(rast,1) As file_rast
FROM sometable WHERE filename IN('dem01', 'dem02') GROUP BY filename;
```

Examples: Return a multi-band raster that is the union of tiles intersecting geometry

```
-- this creates a multi band raster collecting all the tiles that intersect a line
-- Note: In 2.0, this would have just returned a single band raster
-- , new union works on all bands by default
-- this is equivalent to unionarg: ARRAY[ROW(1, 'LAST'), ROW(2, 'LAST'), ROW(3, 'LAST')]:: ↵
unionarg[]
SELECT ST_Union(rast)
FROM aerials.boston
WHERE ST_Intersects(rast, ST_GeomFromText('LINESTRING(230486 887771, 230500 88772)',26986) ↵
);
```

Examples: Return a multi-band raster that is the union of tiles intersecting geometry

Here we use the longer syntax if we only wanted a subset of bands or we want to change order of bands

```
-- this creates a multi band raster collecting all the tiles that intersect a line
SELECT ST_Union(rast,ARRAY[ROW(2, 'LAST'), ROW(1, 'LAST'), ROW(3, 'LAST')]::unionarg[])
FROM aerials.boston
WHERE ST_Intersects(rast, ST_GeomFromText('LINESTRING(230486 887771, 230500 88772)',26986) ↵
);
```

See Also

[unionarg](#), [ST_Envelope](#), [ST_ConvexHull](#), [ST_Clip](#), [ST_Union](#)

12.13 Built-in Map Algebra Callback Functions

12.13.1 ST_Distinct4ma

ST_Distinct4ma — Raster processing function that calculates the number of unique pixel values in a neighborhood.

Synopsis

float8 **ST_Distinct4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);
double precision **ST_Distinct4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the number of unique pixel values in a neighborhood of pixels.



Note
Variant 1 is a specialized callback function for use as a callback parameter to [ST_MapAlgebraFctNgb](#).



Note
Variant 2 is a specialized callback function for use as a callback parameter to [ST_MapAlgebra](#) (callback function version).



Warning
Use of Variant 1 is discouraged since [ST_MapAlgebraFctNgb](#) has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, NULL, 1, 1, 'st_distinct4ma(float[],text,text[])':: ↵
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
 rid | st_value
-----+-----
   2 |      3
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra](#) (callback function version), [ST_Min4ma](#), [ST_Max4ma](#), [ST_Sum4ma](#), [ST_Mean4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.13.2 ST_InvDistWeight4ma

ST_InvDistWeight4ma — Raster processing function that interpolates a pixel's value from the pixel's neighborhood.

Synopsis

double precision **ST_InvDistWeight4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate an interpolated value for a pixel using the Inverse Distance Weighted method.

There are two optional parameters that can be passed through `userargs`. The first parameter is the power factor (variable `k` in the equation below) between 0 and 1 used in the Inverse Distance Weighted equation. If not specified, default value is 1. The second parameter is the weight percentage applied only when the value of the pixel of interest is included with the interpolated value from the neighborhood. If not specified and the pixel of interest has a value, that value is returned.

The basic inverse distance weight equation is:

$$\hat{z}(x_o) = \frac{\sum_{j=1}^m z(x_j) d_{ij}^{-k}}{\sum_{j=1}^m d_{ij}^{-k}}$$

k = power factor, a real number between 0 and 1



Note

This function is a specialized callback function for use as a callback parameter to [ST_MapAlgebra \(callback function version\)](#).

Availability: 2.1.0

Examples

```
-- NEEDS EXAMPLE
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_MinDist4ma](#)

12.13.3 ST_Max4ma

ST_Max4ma — Raster processing function that calculates the maximum pixel value in a neighborhood.

Synopsis

float8 **ST_Max4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);

double precision **ST_Max4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the maximum pixel value in a neighborhood of pixels.
For Variant 2, a substitution value for NODATA pixels can be specified by passing that value to userargs.



Note
Variant 1 is a specialized callback function for use as a callback parameter to [ST_MapAlgebraFctNgb](#).



Note
Variant 2 is a specialized callback function for use as a callback parameter to [ST_MapAlgebra](#) (callback function version).



Warning
Use of Variant 1 is discouraged since [ST_MapAlgebraFctNgb](#) has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, NULL, 1, 1, 'st_max4ma(float[][],text,text[])':: ↵
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
  rid | st_value
-----+-----
    2 |    254
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra](#) (callback function version), [ST_Min4ma](#), [ST_Sum4ma](#), [ST_Mean4ma](#), [ST_Range4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.13.4 ST_Mean4ma

[ST_Mean4ma](#) — Raster processing function that calculates the mean pixel value in a neighborhood.

Synopsis

float8 **ST_Mean4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);
double precision **ST_Mean4ma**(double precision[][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the mean pixel value in a neighborhood of pixels.
For Variant 2, a substitution value for NODATA pixels can be specified by passing that value to userargs.



Note
Variant 1 is a specialized callback function for use as a callback parameter to `ST_MapAlgebraFctNgb`.



Note
Variant 2 is a specialized callback function for use as a callback parameter to `ST_MapAlgebra` (callback function version).



Warning
Use of Variant 1 is discouraged since `ST_MapAlgebraFctNgb` has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples: Variant 1

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, '32BF', 1, 1, 'st_mean4ma(float[][],text,text[])'::↔
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
rid |      st_value
-----+-----
  2 | 253.222229003906
(1 row)
```

Examples: Variant 2

```
SELECT
  rid,
  st_value(
    ST_MapAlgebra(rast, 1, 'st_mean4ma(double precision[][][], integer[][], text ↔
      [])'::regprocedure,'32BF', 'FIRST', NULL, 1, 1)
    , 2, 2)
FROM dummy_rast
WHERE rid = 2;
rid |      st_value
-----+-----
  2 | 253.222229003906
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra](#) (callback function version), [ST_Min4ma](#), [ST_Max4ma](#), [ST_Sum4ma](#), [ST_Range4ma](#), [ST_StdDev4ma](#)

12.13.5 ST_Min4ma

ST_Min4ma — Raster processing function that calculates the minimum pixel value in a neighborhood.

Synopsis

float8 **ST_Min4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);
double precision **ST_Min4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the minimum pixel value in a neighborhood of pixels.
For Variant 2, a substitution value for NODATA pixels can be specified by passing that value to userargs.



Note
Variant 1 is a specialized callback function for use as a callback parameter to [ST_MapAlgebraFctNgb](#).



Note
Variant 2 is a specialized callback function for use as a callback parameter to [ST_MapAlgebra](#) (callback function version).



Warning
Use of Variant 1 is discouraged since [ST_MapAlgebraFctNgb](#) has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, NULL, 1, 1, 'st_min4ma(float[][],text,text[])':: ↵
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
rid | st_value
-----+-----
  2 |      250
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra \(callback function version\)](#), [ST_Max4ma](#), [ST_Sum4ma](#), [ST_Mean4ma](#), [ST_Range4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.13.6 ST_MinDist4ma

ST_MinDist4ma — Raster processing function that returns the minimum distance (in number of pixels) between the pixel of interest and a neighboring pixel with value.

Synopsis

double precision **ST_MinDist4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Return the shortest distance (in number of pixels) between the pixel of interest and the closest pixel with value in the neighborhood.

**Note**

The intent of this function is to provide an informative data point that helps infer the usefulness of the pixel of interest's interpolated value from [ST_InvDistWeight4ma](#). This function is particularly useful when the neighborhood is sparsely populated.

**Note**

This function is a specialized callback function for use as a callback parameter to [ST_MapAlgebra \(callback function version\)](#).

Availability: 2.1.0

Examples

```
-- NEEDS EXAMPLE
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_InvDistWeight4ma](#)

12.13.7 ST_Range4ma

ST_Range4ma — Raster processing function that calculates the range of pixel values in a neighborhood.

Synopsis

float8 **ST_Range4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);
double precision **ST_Range4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the range of pixel values in a neighborhood of pixels.
For Variant 2, a substitution value for NODATA pixels can be specified by passing that value to userargs.



Note
Variant 1 is a specialized callback function for use as a callback parameter to [ST_MapAlgebraFctNgb](#).



Note
Variant 2 is a specialized callback function for use as a callback parameter to [ST_MapAlgebra](#) (callback function version).



Warning
Use of Variant 1 is discouraged since [ST_MapAlgebraFctNgb](#) has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, NULL, 1, 1, 'st_range4ma(float[][],text,text[])':: ↵
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
  rid | st_value
-----+-----
    2 |         4
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra](#) (callback function version), [ST_Min4ma](#), [ST_Max4ma](#), [ST_Sum4ma](#), [ST_Mean4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.13.8 ST_StdDev4ma

ST_StdDev4ma — Raster processing function that calculates the standard deviation of pixel values in a neighborhood.

Synopsis

float8 **ST_StdDev4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);
double precision **ST_StdDev4ma**(double precision[][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the standard deviation of pixel values in a neighborhood of pixels.



Note
Variant 1 is a specialized callback function for use as a callback parameter to [ST_MapAlgebraFctNgb](#).



Note
Variant 2 is a specialized callback function for use as a callback parameter to [ST_MapAlgebra](#) (callback function version).



Warning
Use of Variant 1 is discouraged since [ST_MapAlgebraFctNgb](#) has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, '32BF', 1, 1, 'st_stddev4ma(float[][],text,text[])':: ↵
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
  rid |      st_value
-----+-----
    2 | 1.30170822143555
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra](#) (callback function version), [ST_Min4ma](#), [ST_Max4ma](#), [ST_Sum4ma](#), [ST_Mean4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.13.9 ST_Sum4ma

[ST_Sum4ma](#) — Raster processing function that calculates the sum of all pixel values in a neighborhood.

Synopsis

float8 **ST_Sum4ma**(float8[][] matrix, text nodatamode, text[] VARIADIC args);
double precision **ST_Sum4ma**(double precision[][][] value, integer[][] pos, text[] VARIADIC userargs);

Description

Calculate the sum of all pixel values in a neighborhood of pixels.
For Variant 2, a substitution value for NODATA pixels can be specified by passing that value to userargs.



Note
Variant 1 is a specialized callback function for use as a callback parameter to [ST_MapAlgebraFctNgb](#).



Note
Variant 2 is a specialized callback function for use as a callback parameter to [ST_MapAlgebra](#) (callback function version).



Warning
Use of Variant 1 is discouraged since [ST_MapAlgebraFctNgb](#) has been deprecated as of 2.1.0.

Availability: 2.0.0
Enhanced: 2.1.0 Addition of Variant 2

Examples

```
SELECT
  rid,
  st_value(
    st_mapalgebrafctngb(rast, 1, '32BF', 1, 1, 'st_sum4ma(float[][],text,text[])':: ↵
      regprocedure, 'ignore', NULL), 2, 2
  )
FROM dummy_rast
WHERE rid = 2;
rid | st_value
-----+-----
  2 |      2279
(1 row)
```

See Also

[ST_MapAlgebraFctNgb](#), [ST_MapAlgebra](#) (callback function version), [ST_Min4ma](#), [ST_Max4ma](#), [ST_Mean4ma](#), [ST_Range4ma](#), [ST_Distinct4ma](#), [ST_StdDev4ma](#)

12.14 Raster Processing: DEM (Elevation)

12.14.1 ST_Aspect

ST_Aspect — Returns the aspect (in degrees by default) of an elevation raster band. Useful for analyzing terrain.

Examples: Variant 2

Complete example of tiles of a coverage. This query only works with PostgreSQL 9.1 or higher.

```
WITH foo AS (
  SELECT ST_Tile(
    ST_SetValues(
      ST_AddBand(
        ST_MakeEmptyRaster(6, 6, 0, 0, 1, -1, 0, 0, 0),
        1, '32BF', 0, -9999
      ),
      1, 1, 1, ARRAY[
        [1, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 2, 1],
        [1, 2, 2, 3, 3, 1],
        [1, 1, 3, 2, 1, 1],
        [1, 2, 2, 1, 2, 1],
        [1, 1, 1, 1, 1, 1]
      ]::double precision[]
    ),
    2, 2
  ) AS rast
)
SELECT
  t1.rast,
  ST_Aspect(ST_Union(t2.rast), 1, t1.rast)
FROM foo t1
CROSS JOIN foo t2
WHERE ST_Intersects(t1.rast, t2.rast)
GROUP BY t1.rast;
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_TRI](#), [ST_TPI](#), [ST_Roughness](#), [ST_HillShade](#), [ST_Slope](#)

12.14.2 ST_HillShade

ST_HillShade — Returns the hypothetical illumination of an elevation raster band using provided azimuth, altitude, brightness and scale inputs.

Synopsis

raster **ST_HillShade**(raster rast, integer band=1, text pixeltype=32BF, double precision azimuth=315, double precision altitude=45, double precision max_bright=255, double precision scale=1.0, boolean interpolate_nodata=FALSE);
 raster **ST_HillShade**(raster rast, integer band, raster customextent, text pixeltype=32BF, double precision azimuth=315, double precision altitude=45, double precision max_bright=255, double precision scale=1.0, boolean interpolate_nodata=FALSE);

Description

Returns the hypothetical illumination of an elevation raster band using the azimuth, altitude, brightness, and scale inputs. Utilizes map algebra and applies the hill shade equation to neighboring pixels. Return pixel values are between 0 and 255.

azimuth is a value between 0 and 360 degrees measured clockwise from North.

altitude is a value between 0 and 90 degrees where 0 degrees is at the horizon and 90 degrees is directly overhead.

max_bright is a value between 0 and 255 with 0 as no brightness and 255 as max brightness.

scale is the ratio of vertical units to horizontal. For Feet:LatLon use scale=370400, for Meters:LatLon use scale=111120.

If `interpolate_nodata` is TRUE, values for NODATA pixels from the input raster will be interpolated using [ST_InvDistWeight4ma](#) before computing the hillshade illumination.



Note

For more information about Hillshade, please refer to [How hillshade works](#).

Availability: 2.0.0

Enhanced: 2.1.0 Uses `ST_MapAlgebra()` and added optional `interpolate_nodata` function parameter

Changed: 2.1.0 In prior versions, azimuth and altitude were expressed in radians. Now, azimuth and altitude are expressed in degrees

Examples: Variant 1

```
WITH foo AS (
  SELECT ST_SetValues(
    ST_AddBand(ST_MakeEmptyRaster(5, 5, 0, 0, 1, -1, 0, 0, 0), 1, '32BF', 0, -9999),
    1, 1, 1, ARRAY[
      [1, 1, 1, 1, 1],
      [1, 2, 2, 2, 1],
      [1, 2, 3, 2, 1],
      [1, 2, 2, 2, 1],
      [1, 1, 1, 1, 1]
    ]::double precision[][])
  ) AS rast
)
SELECT
  ST_DumpValues(ST_Hillshade(rast, 1, '32BF'))
FROM foo
```

```
-----
(1, "{ {NULL,NULL,NULL,NULL,NULL}, {NULL,251.32763671875,220.749786376953,147.224319458008, ←
  NULL}, {NULL,220.749786376953,180.312225341797,67.7497863769531,NULL}, {NULL ←
  ,147.224319458008
,67.7497863769531,43.1210060119629,NULL}, {NULL,NULL,NULL,NULL,NULL}} ")
(1 row)
```

Examples: Variant 2

Complete example of tiles of a coverage. This query only works with PostgreSQL 9.1 or higher.

```
WITH foo AS (
  SELECT ST_Tile(
    ST_SetValues(
      ST_AddBand(
        ST_MakeEmptyRaster(6, 6, 0, 0, 1, -1, 0, 0, 0),
        1, '32BF', 0, -9999
      ),
      1, 1, 1, ARRAY[
```

```

        [1, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 2, 1],
        [1, 2, 2, 3, 3, 1],
        [1, 1, 3, 2, 1, 1],
        [1, 2, 2, 1, 2, 1],
        [1, 1, 1, 1, 1, 1]
    ]::double precision[]
),
    2, 2
) AS rast
)
SELECT
    t1.rast,
    ST_Hillshade(ST_Union(t2.rast), 1, t1.rast)
FROM foo t1
CROSS JOIN foo t2
WHERE ST_Intersects(t1.rast, t2.rast)
GROUP BY t1.rast;

```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_TRI](#), [ST_TPI](#), [ST_Roughness](#), [ST_Aspect](#), [ST_Slope](#)

12.14.3 ST_Roughness

ST_Roughness — Returns a raster with the calculated "roughness" of a DEM.

Synopsis

```
raster ST_Roughness(raster rast, integer nband, raster customextent, text pixeltype="32BF" , boolean interpolate_nodata=FALSE);
```

Description

Calculates the "roughness" of a DEM, by subtracting the maximum from the minimum for a given area.

Availability: 2.1.0

Examples

```
-- needs examples
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_TRI](#), [ST_TPI](#), [ST_Slope](#), [ST_HillShade](#), [ST_Aspect](#)

12.14.4 ST_Slope

ST_Slope — Returns the slope (in degrees by default) of an elevation raster band. Useful for analyzing terrain.

Synopsis

raster **ST_Slope**(raster rast, integer nband=1, text pixeltype=32BF, text units=DEGREES, double precision scale=1.0, boolean interpolate_nodata=FALSE);

raster **ST_Slope**(raster rast, integer nband, raster customextent, text pixeltype=32BF, text units=DEGREES, double precision scale=1.0, boolean interpolate_nodata=FALSE);

Description

Returns the slope (in degrees by default) of an elevation raster band. Utilizes map algebra and applies the slope equation to neighboring pixels.

`units` indicates the units of the slope. Possible values are: RADIANS, DEGREES (default), PERCENT.

`scale` is the ratio of vertical units to horizontal. For Feet:LatLon use `scale=370400`, for Meters:LatLon use `scale=111120`.

If `interpolate_nodata` is TRUE, values for NODATA pixels from the input raster will be interpolated using [ST_InvDistWeight4ma](#) before computing the surface slope.



Note

For more information about Slope, Aspect and Hillshade, please refer to [ESRI - How hillshade works](#) and [ERDAS Field Guide - Slope Images](#).

Availability: 2.0.0

Enhanced: 2.1.0 Uses `ST_MapAlgebra()` and added optional `units`, `scale`, `interpolate_nodata` function parameters

Changed: 2.1.0 In prior versions, return values were in radians. Now, return values default to degrees

Examples: Variant 1

```
WITH foo AS (
  SELECT ST_SetValues(
    ST_AddBand(ST_MakeEmptyRaster(5, 5, 0, 0, 1, -1, 0, 0, 0), 1, '32BF', 0, -9999),
    1, 1, 1, ARRAY[
      [1, 1, 1, 1, 1],
      [1, 2, 2, 2, 1],
      [1, 2, 3, 2, 1],
      [1, 2, 2, 2, 1],
      [1, 1, 1, 1, 1]
    ]::double precision[][])
  ) AS rast
)
SELECT
  ST_DumpValues(ST_Slope(rast, 1, '32BF'))
FROM foo

          st_dumpvalues
```

```
(1, "{10.0249881744385,21.5681285858154,26.5650520324707,21.5681285858154,10.0249881744385},{21.5681285858154,26.5650520324707,36.8698959350586,0,36.8698959350586,26.5650520324707},{21.5681285858154,35.26438905681285858154,26.5650520324707,21.5681285858154,10.0249881744385}}")
(1 row)
```

Examples: Variant 2

Complete example of tiles of a coverage. This query only works with PostgreSQL 9.1 or higher.

```
WITH foo AS (
  SELECT ST_Tile(
    ST_SetValues(
      ST_AddBand(
        ST_MakeEmptyRaster(6, 6, 0, 0, 1, -1, 0, 0, 0),
        1, '32BF', 0, -9999
      ),
      1, 1, 1, ARRAY[
        [1, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 2, 1],
        [1, 2, 2, 3, 3, 1],
        [1, 1, 3, 2, 1, 1],
        [1, 2, 2, 1, 2, 1],
        [1, 1, 1, 1, 1, 1]
      ]::double precision[]
    ),
    2, 2
  ) AS rast
)
SELECT
  t1.rast,
  ST_Slope(ST_Union(t2.rast), 1, t1.rast)
FROM foo t1
CROSS JOIN foo t2
WHERE ST_Intersects(t1.rast, t2.rast)
GROUP BY t1.rast;
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_TRI](#), [ST_TPI](#), [ST_Roughness](#), [ST_HillShade](#), [ST_Aspect](#)

12.14.5 ST_TPI

ST_TPI — Returns a raster with the calculated Topographic Position Index.

Synopsis

raster **ST_TPI**(raster rast, integer nband, raster customextent, text pixeltype='32BF' , boolean interpolate_nodata=FALSE);

Description

Calculates the Topographic Position Index, which is defined as the focal mean with radius of one minus the center cell.

**Note**

This function only supports a focalmean radius of one.

Availability: 2.1.0

Examples

```
-- needs examples
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_TRI](#), [ST_Roughness](#), [ST_Slope](#), [ST_HillShade](#), [ST_Aspect](#)

12.14.6 ST_TRI

ST_TRI — Returns a raster with the calculated Terrain Ruggedness Index.

Synopsis

raster **ST_TRI**(raster rast, integer nband, raster customextent, text pixeltype="32BF" , boolean interpolate_nodata=FALSE);

Description

Terrain Ruggedness Index is calculated by comparing a central pixel with its neighbors, taking the absolute values of the differences, and averaging the result.



Note

This function only supports a focalmean radius of one.

Availability: 2.1.0

Examples

```
-- needs examples
```

See Also

[ST_MapAlgebra \(callback function version\)](#), [ST_Roughness](#), [ST_TPI](#), [ST_Slope](#), [ST_HillShade](#), [ST_Aspect](#)

12.15 Raster Processing: Raster to Geometry

12.15.1 Box3D

Box3D — Returns the box 3d representation of the enclosing box of the raster.

Synopsis

box3d **Box3D**(raster rast);

Description

Returns the box representing the extent of the raster.

The polygon is defined by the corner points of the bounding box ((MINX, MINY), (MAXX, MAXY))

Changed: 2.0.0 In pre-2.0 versions, there used to be a box2d instead of box3d. Since box2d is a deprecated type, this was changed to box3d.

Examples

```
SELECT
    rid,
    Box3D(rast) AS rastbox
FROM dummy_rast;
```

rid	rastbox
1	BOX3D(0.5 0.5 0,20.5 60.5 0)
2	BOX3D(3427927.75 5793243.5 0,3427928 5793244 0)

See Also

[ST_Envelope](#)

12.15.2 ST_ConvexHull

ST_ConvexHull — Return the convex hull geometry of the raster including pixel values equal to BandNoDataValue. For regular shaped and non-skewed rasters, this gives the same result as ST_Envelope so only useful for irregularly shaped or skewed rasters.

Synopsis

geometry **ST_ConvexHull**(raster rast);

Description

Return the convex hull geometry of the raster including the NoDataBandValue band pixels. For regular shaped and non-skewed rasters, this gives more or less the same result as ST_Envelope so only useful for irregularly shaped or skewed rasters.



Note
ST_Envelope floors the coordinates and hence add a little buffer around the raster so the answer is subtly different from ST_ConvexHull which does not floor.

Examples

Refer to [PostGIS Raster Specification](#) for a diagram of this.

```
-- Note envelope and convexhull are more or less the same
SELECT ST_AsText(ST_ConvexHull(rast)) As convexhull,
       ST_AsText(ST_Envelope(rast)) As env
FROM dummy_rast WHERE rid=1;
```

convexhull	env
------------	-----

```
-----+----- ↵
POLYGON((0.5 0.5,20.5 0.5,20.5 60.5,0.5 60.5,0.5 0.5)) | POLYGON((0 0,20 0,20 60,0 60,0 0) ↵
)

-- now we skew the raster
-- note how the convex hull and envelope are now different
SELECT ST_AsText(ST_ConvexHull(rast)) As convhull,
       ST_AsText(ST_Envelope(rast)) As env
FROM (SELECT ST_SetRotation(rast, 0.1, 0.1) As rast
      FROM dummy_rast WHERE rid=1) As foo;

               convhull                               |                               env
-----+----- ↵
POLYGON((0.5 0.5,20.5 1.5,22.5 61.5,2.5 60.5,0.5 0.5)) | POLYGON((0 0,22 0,22 61,0 61,0 0) ↵
)
```

See Also

[ST_Envelope](#), [ST_MinConvexHull](#), [ST_ConvexHull](#), [ST_AsText](#)

12.15.3 ST_DumpAsPolygons

ST_DumpAsPolygons — Returns a set of geomval (geom,val) rows, from a given raster band. If no band number is specified, band num defaults to 1.

Synopsis

setof geomval **ST_DumpAsPolygons**(raster rast, integer band_num=1, boolean exclude_nodata_value=TRUE);

Description

This is a set-returning function (SRF). It returns a set of geomval rows, formed by a geometry (geom) and a pixel band value (val). Each polygon is the union of all pixels for that band that have the same pixel value denoted by val.

ST_DumpAsPolygon is useful for polygonizing rasters. It is the reverse of a GROUP BY in that it creates new rows. For example it can be used to expand a single raster into multiple POLYGONS/MULTIPOLYGONS.

Changed 3.3.0, validation and fixing is disabled to improve performance. May result invalid geometries.

Availability: Requires GDAL 1.7 or higher.



Note
If there is a no data value set for a band, pixels with that value will not be returned except in the case of exclude_nodata_value=false.



Note
If you only care about count of pixels with a given value in a raster, it is faster to use [ST_ValueCount](#).



Note
This is different than ST_PixelAsPolygons where one geometry is returned for each pixel regardless of pixel value.

Examples

```
-- this syntax requires PostgreSQL 9.3+
SELECT val, ST_AsText(geom) As geomwkt
FROM (
  SELECT dp.*
  FROM dummy_rast, LATERAL ST_DumpAsPolygons(rast) AS dp
  WHERE rid = 2
) As foo
WHERE val BETWEEN 249 and 251
ORDER BY val;
```

val	geomwkt
249	POLYGON((3427927.95 5793243.95,3427927.95 5793243.85,3427928 5793243.85,3427928 5793243.95,3427927.95 5793243.95))
250	POLYGON((3427927.75 5793243.9,3427927.75 5793243.85,3427927.8 5793243.85,3427927.8 5793243.9,3427927.75 5793243.9))
250	POLYGON((3427927.8 5793243.8,3427927.8 5793243.75,3427927.85 5793243.75,3427927.85 5793243.8,3427927.8 5793243.8))
251	POLYGON((3427927.75 5793243.85,3427927.75 5793243.8,3427927.8 5793243.8,3427927.8 5793243.85,3427927.75 5793243.85))

See Also

[geomval](#), [ST_Value](#), [ST_Polygon](#), [ST_ValueCount](#)

12.15.4 ST_Envelope

ST_Envelope — Returns the polygon representation of the extent of the raster.

Synopsis

geometry **ST_Envelope**(raster rast);

Description

Returns the polygon representation of the extent of the raster in spatial coordinate units defined by srid. It is a float8 minimum bounding box represented as a polygon.

The polygon is defined by the corner points of the bounding box ((MINX, MINY), (MINX, MAXY), (MAXX, MAXY), (MAXX, MINY), (MINX, MINY))

Examples

```
SELECT rid, ST_AsText(ST_Envelope(rast)) As envgeomwkt
FROM dummy_rast;
```

rid	envgeomwkt
1	POLYGON((0 0,20 0,20 60,0 60,0 0))
2	POLYGON((3427927 5793243,3427928 5793243,3427928 5793244,3427927 5793244,3427927 5793243))

See Also

[ST_Envelope](#), [ST_AsText](#), [ST_SRID](#)

12.15.5 ST_MinConvexHull

ST_MinConvexHull — Return the convex hull geometry of the raster excluding NODATA pixels.

Synopsis

geometry **ST_MinConvexHull**(raster rast, integer nband=NULL);

Description

Return the convex hull geometry of the raster excluding NODATA pixels. If nband is NULL, all bands of the raster are considered.

Availability: 2.1.0

Examples

```
WITH foo AS (
  SELECT
    ST_SetValues(
      ST_SetValues(
        ST_AddBand(ST_AddBand(ST_MakeEmptyRaster(9, 9, 0, 0, 1, -1, 0, 0, 0), 1, '8 ←
        BUI', 0, 0), 2, '8BUI', 1, 0),
        1, 1, 1,
        ARRAY[
          [0, 0, 0, 0, 0, 0, 0, 0, 0],
          [0, 0, 0, 0, 0, 0, 0, 0, 0],
          [0, 0, 0, 0, 0, 0, 0, 0, 0],
          [0, 0, 0, 1, 0, 0, 0, 0, 1],
          [0, 0, 0, 1, 1, 0, 0, 0, 0],
          [0, 0, 0, 1, 0, 0, 0, 0, 0],
          [0, 0, 0, 0, 0, 0, 0, 0, 0],
          [0, 0, 0, 0, 0, 0, 0, 0, 0],
          [0, 0, 0, 0, 0, 0, 0, 0, 0]
        ]::double precision[][])
      ),
      2, 1, 1,
      ARRAY[
        [0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0, 0, 0, 0],
        [1, 0, 0, 0, 0, 1, 0, 0, 0],
        [0, 0, 0, 0, 1, 1, 0, 0, 0],
        [0, 0, 0, 0, 0, 1, 0, 0, 0],
        [0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0]
      ]::double precision[][])
    ) AS rast
)
SELECT
  ST_AsText(ST_ConvexHull(rast)) AS hull,
  ST_AsText(ST_MinConvexHull(rast)) AS mhull,
```

```

    ST_AsText(ST_MinConvexHull(rast, 1)) AS mnull_1,
    ST_AsText(ST_MinConvexHull(rast, 2)) AS mnull_2
FROM foo
```

```
hull      |                               mhull      |
  mhull_1 |                               mhull_2 |
```

POLYGON((0 0,9 0,9 -9,0 -9,0 0)) | POLYGON((0 -3,9 -3,9 -9,0 -9,0 -3)) | POLYGON((3 -3,9 -3,9 -6,3 -6,3 -3)) | POLYGON((0 -3,6 -3,6 -9,0 -9,0 -3))

See Also

ST_Envelope, ST_ConvexHull, ST_ConvexHull, ST_AsText

12.15.6 ST_Polygon

ST_Polygon — Returns a multipolygon geometry formed by the union of pixels that have a pixel value that is not no data value. If no band number is specified, band num defaults to 1.

Synopsis

```
geometry ST_Polygon(raster rast, integer band_num=1);
```

Description

Changed 3.3.0, validation and fixing is disabled to improve performance. May result invalid geometries.

Availability: 0.1.6 Requires GDAL 1.7 or higher.

Enhanced: 2.1.0 Improved Speed (fully C-Based) and the returning multipolygon is ensured to be valid.

Changed: 2.1.0 In prior versions would sometimes return a polygon, changed to always return multipolygon.

Examples

```
-- by default no data band value is 0 or not set, so polygon will return a square polygon
SELECT ST_AsText(ST_Polygon(rast)) As geomwkt
FROM dummy_rast
WHERE rid = 2;
```

geomwkt

```
MULTIPOLYGON(((3427927.75 5793244,3427928 5793244,3427928 5793243.75,3427927.75 5793243.75,3427927.75 5793244)))
```

```
-- now we change the no data value of first band
UPDATE dummy_rast SET rast = ST_SetBandNoDataValue(rast,1,254)
WHERE rid = 2;
SELECT rid, ST_BandNoDataValue(rast)
from dummy_rast where rid = 2;
```

```
-- ST_Polygon excludes the pixel value 254 and returns a multipolygon
SELECT ST_AsText(ST_Polygon(rast)) As geomwkt
FROM dummy_rast
WHERE rid = 2;
```

```

geomwkt
-----
MULTIPOLYGON(((3427927.9 5793243.95,3427927.85 5793243.95,3427927.85 5793244,3427927.9 ↵
5793244,3427927.9 5793243.95)),((3427928 5793243.85,3427928 5793243.8,3427927.95 ↵
5793243.8,3427927.95 5793243.85,3427927.9 5793243.85,3427927.9 5793243.9,3427927.9 ↵
5793243.95,3427927.95 5793243.95,3427928 5793243.95,3427928 5793243.85)),((3427927.8 ↵
5793243.75,3427927.75 5793243.75,3427927.75 5793243.8,3427927.75 5793243.85,3427927.75 ↵
5793243.9,3427927.75 5793244,3427927.8 5793244,3427927.8 5793243.9,3427927.8 ↵
5793243.85,3427927.85 5793243.85,3427927.85 5793243.8,3427927.85 5793243.75,3427927.8 ↵
5793243.75)))

-- Or if you want the no data value different for just one time

SELECT ST_AsText (
    ST_Polygon (
        ST_SetBandNoDataValue (rast,1,252)
    )
) As geomwkt
FROM dummy_rast
WHERE rid =2;

geomwkt
-----
MULTIPOLYGON(((3427928 5793243.85,3427928 5793243.8,3427928 5793243.75,3427927.85 ↵
5793243.75,3427927.8 5793243.75,3427927.8 5793243.8,3427927.75 5793243.8,3427927.75 ↵
5793243.85,3427927.75 5793243.9,3427927.75 5793244,3427927.8 5793244,3427927.85 ↵
5793244,3427927.9 5793244,3427928 5793244,3427928 5793243.95,3427928 5793243.85) ↵
,(3427927.9 5793243.9,3427927.9 5793243.85,3427927.95 5793243.85,3427927.95 ↵
5793243.9,3427927.9 5793243.9)))

```

See Also

[ST_Value](#), [ST_DumpAsPolygons](#)

12.16 Raster Operators

12.16.1 &&

&& — Returns TRUE if A's bounding box intersects B's bounding box.

Synopsis

```

boolean &&( raster A , raster B );
boolean &&( raster A , geometry B );
boolean &&( geometry B , raster A );

```

Description

The **&&** operator returns TRUE if the bounding box of raster/geometr A intersects the bounding box of raster/geometr B.



Note

This operand will make use of any indexes that may be available on the rasters.

Availability: 2.0.0

Examples

```
SELECT A.rid As a_rid, B.rid As b_rid, A.rast && B.rast As intersect
FROM dummy_rast AS A CROSS JOIN dummy_rast AS B LIMIT 3;
```

a_rid	b_rid	intersect
2	2	t
2	3	f
2	1	f

12.16.2 &<

&< — Returns TRUE if A’s bounding box is to the left of B’s.

Synopsis

boolean &<(raster A , raster B);

Description

The &< operator returns TRUE if the bounding box of raster A overlaps or is to the left of the bounding box of raster B, or more accurately, overlaps or is NOT to the right of the bounding box of raster B.



Note
This operand will make use of any indexes that may be available on the rasters.

Examples

```
SELECT A.rid As a_rid, B.rid As b_rid, A.rast &< B.rast As overleft
FROM dummy_rast AS A CROSS JOIN dummy_rast AS B;
```

a_rid	b_rid	overleft
2	2	t
2	3	f
2	1	f
3	2	t
3	3	t
3	1	f
1	2	t
1	3	t
1	1	t

12.16.3 &>

&> — Returns TRUE if A’s bounding box is to the right of B’s.

Synopsis

boolean `&>`(raster A , raster B);

Description

The `&>` operator returns `TRUE` if the bounding box of raster A overlaps or is to the right of the bounding box of raster B, or more accurately, overlaps or is `NOT` to the left of the bounding box of raster B.



Note

This operand will make use of any indexes that may be available on the geometries.

Examples

```
SELECT A.rid As a_rid, B.rid As b_rid, A.rast &> B.rast As overright
FROM dummy_rast AS A CROSS JOIN dummy_rast AS B;
```

a_rid	b_rid	overright
2	2	t
2	3	t
2	1	t
3	2	f
3	3	t
3	1	f
1	2	f
1	3	t
1	1	t

12.16.4 =

`=` — Returns `TRUE` if A's bounding box is the same as B's. Uses double precision bounding box.

Synopsis

boolean `=`(raster A , raster B);

Description

The `=` operator returns `TRUE` if the bounding box of raster A is the same as the bounding box of raster B. PostgreSQL uses the `=`, `<`, and `>` operators defined for rasters to perform internal orderings and comparison of rasters (ie. in a `GROUP BY` or `ORDER BY` clause).



Caution

This operand will `NOT` make use of any indexes that may be available on the rasters. Use `~=` instead. This operator exists mostly so one can group by the raster column.

Availability: 2.1.0

See Also

~=

12.16.5 @

@ — Returns TRUE if A's bounding box is contained by B's. Uses double precision bounding box.

Synopsis

```
boolean @( raster A , raster B );
boolean @( geometry A , raster B );
boolean @( raster B , geometry A );
```

Description

The @ operator returns TRUE if the bounding box of raster/geometry A is contained by bounding box of raster/geometr B.

**Note**

This operand will use spatial indexes on the rasters.

Availability: 2.0.0 raster @ raster, raster @ geometry introduced

Availability: 2.0.5 geometry @ raster introduced

See Also

~

12.16.6 ~=

~= — Returns TRUE if A's bounding box is the same as B's.

Synopsis

```
boolean ~= ( raster A , raster B );
```

Description

The ~= operator returns TRUE if the bounding box of raster A is the same as the bounding box of raster B.

**Note**

This operand will make use of any indexes that may be available on the rasters.

Availability: 2.0.0

Examples

Very useful usecase is for taking two sets of single band rasters that are of the same chunk but represent different themes and creating a multi-band raster

```
SELECT ST_AddBand(prec.rast, alt.rast) As new_rast
FROM prec INNER JOIN alt ON (prec.rast ~= alt.rast);
```

See Also

[ST_AddBand](#), [=](#)

12.16.7 ~

~ — Returns TRUE if A's bounding box is contains B's. Uses double precision bounding box.

Synopsis

```
boolean ~( raster A , raster B );
boolean ~( geometry A , raster B );
boolean ~( raster B , geometry A );
```

Description

The ~ operator returns TRUE if the bounding box of raster/geometry A is contains bounding box of raster/geometr B.



Note

This operand will use spatial indexes on the rasters.

Availability: 2.0.0

See Also

[@](#)

12.17 Raster and Raster Band Spatial Relationships

12.17.1 ST_Contains

ST_Contains — Return true if no points of raster rastB lie in the exterior of raster rastA and at least one point of the interior of rastB lies in the interior of rastA.

Synopsis

```
boolean ST_Contains( raster rastA , integer nbandA , raster rastB , integer nbandB );
boolean ST_Contains( raster rastA , raster rastB );
```

Description

Raster `rastA` contains `rastB` if and only if no points of `rastB` lie in the exterior of `rastA` and at least one point of the interior of `rastB` lies in the interior of `rastA`. If the band number is not provided (or set to `NULL`), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not `NODATA`) are considered in the test.



Note
This function will make use of any indexes that may be available on the rasters.



Note
To test the spatial relationship of a raster and a geometry, use `ST_Polygon` on the raster, e.g. `ST_Contains(ST_Polygon(raster), geometry)` or `ST_Contains(geometry, ST_Polygon(raster))`.



Note
`ST_Contains()` is the inverse of `ST_Within()`. So, `ST_Contains(rastA, rastB)` implies `ST_Within(rastB, rastA)`.

Availability: 2.1.0

Examples

```
-- specified band numbers
SELECT r1.rid, r2.rid, ST_Contains(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN ↵
    dummy_rast r2 WHERE r1.rid = 1;

NOTICE: The first raster provided has no bands
rid | rid | st_contains
-----+-----+-----
  1 |  1 | 
  1 |  2 | f

-- no band numbers specified
SELECT r1.rid, r2.rid, ST_Contains(r1.rast, r2.rast) FROM dummy_rast r1 CROSS JOIN ↵
    dummy_rast r2 WHERE r1.rid = 1;
rid | rid | st_contains
-----+-----+-----
  1 |  1 | t
  1 |  2 | f
```

See Also

[ST_Intersects](#), [ST_Within](#)

12.17.2 ST_ContainsProperly

`ST_ContainsProperly` — Return true if `rastB` intersects the interior of `rastA` but not the boundary or exterior of `rastA`.

Synopsis

boolean **ST_ContainsProperly**(raster rastA , integer nbandA , raster rastB , integer nbandB);
 boolean **ST_ContainsProperly**(raster rastA , raster rastB);

Description

Raster rastA contains properly rastB if rastB intersects the interior of rastA but not the boundary or exterior of rastA. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.

Raster rastA does not contain properly itself but does contain itself.



Note

This function will make use of any indexes that may be available on the rasters.



Note

To test the spatial relationship of a raster and a geometry, use ST_Polygon on the raster, e.g. ST_ContainsProperly(ST_Polygon(raster), geometry) or ST_ContainsProperly(geometry, ST_Polygon(raster)).

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_ContainsProperly(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN
  dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_containsproperly
2	1	f
2	2	f

See Also

[ST_Intersects](#), [ST_Contains](#)

12.17.3 ST_Covers

ST_Covers — Return true if no points of raster rastB lie outside raster rastA.

Synopsis

boolean **ST_Covers**(raster rastA , integer nbandA , raster rastB , integer nbandB);
 boolean **ST_Covers**(raster rastA , raster rastB);

Description

Raster `rastA` covers `rastB` if and only if no points of `rastB` lie in the exterior of `rastA`. If the band number is not provided (or set to `NULL`), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not `NODATA`) are considered in the test.



Note
This function will make use of any indexes that may be available on the rasters.



Note
To test the spatial relationship of a raster and a geometry, use `ST_Polygon` on the raster, e.g. `ST_Covers(ST_Polygon(raster), geometry)` or `ST_Covers(geometry, ST_Polygon(raster))`.

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_Covers(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN ↔
dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_covers
2	1	f
2	2	t

See Also

[ST_Intersects](#), [ST_CoveredBy](#)

12.17.4 ST_CoveredBy

`ST_CoveredBy` — Return true if no points of raster `rastA` lie outside raster `rastB`.

Synopsis

boolean **ST_CoveredBy**(raster `rastA` , integer `nbandA` , raster `rastB` , integer `nbandB`);
boolean **ST_CoveredBy**(raster `rastA` , raster `rastB`);

Description

Raster `rastA` is covered by `rastB` if and only if no points of `rastA` lie in the exterior of `rastB`. If the band number is not provided (or set to `NULL`), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not `NODATA`) are considered in the test.



Note
This function will make use of any indexes that may be available on the rasters.



Note
To test the spatial relationship of a raster and a geometry, use ST_Polygon on the raster, e.g. ST_CoveredBy(ST_Polygon(raster), geometry) or ST_CoveredBy(geometry, ST_Polygon(raster)).

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_CoveredBy(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN
dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_coveredby
2	1	f
2	2	t

See Also

[ST_Intersects](#), [ST_Covers](#)

12.17.5 ST_Disjoint

ST_Disjoint — Return true if raster rastA does not spatially intersect rastB.

Synopsis

boolean **ST_Disjoint**(raster rastA , integer nbandA , raster rastB , integer nbandB);
boolean **ST_Disjoint**(raster rastA , raster rastB);

Description

Raster rastA and rastB are disjointed if they do not share any space together. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.



Note
This function does NOT use any indexes.



Note
To test the spatial relationship of a raster and a geometry, use ST_Polygon on the raster, e.g. ST_Disjoint(ST_Polygon(raster), geometry).

Availability: 2.1.0

Examples

```
-- rid = 1 has no bands, hence the NOTICE and the NULL value for st_disjoint
SELECT r1.rid, r2.rid, ST_Disjoint(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN ↵
    dummy_rast r2 WHERE r1.rid = 2;

NOTICE:  The second raster provided has no bands
  rid | rid | st_disjoint
-----+-----+-----
    2 |  1 |
    2 |  2 | f
```

```
-- this time, without specifying band numbers
SELECT r1.rid, r2.rid, ST_Disjoint(r1.rast, r2.rast) FROM dummy_rast r1 CROSS JOIN ↵
    dummy_rast r2 WHERE r1.rid = 2;

  rid | rid | st_disjoint
-----+-----+-----
    2 |  1 | t
    2 |  2 | f
```

See Also

ST_Intersects

12.17.6 ST_Intersects

ST_Intersects — Return true if raster rastA spatially intersects raster rastB.

Synopsis

boolean **ST_Intersects**(raster rastA , integer nbandA , raster rastB , integer nbandB);
boolean **ST_Intersects**(raster rastA , raster rastB);
boolean **ST_Intersects**(raster rast , integer nband , geometry geommin);
boolean **ST_Intersects**(raster rast , geometry geommin , integer nband=NULL);
boolean **ST_Intersects**(geometry geommin , raster rast , integer nband=NULL);

Description

Return true if raster rastA spatially intersects raster rastB. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.



Note
This function will make use of any indexes that may be available on the rasters.

Enhanced: 2.0.0 support raster/raster intersects was introduced.



Warning
Changed: 2.1.0 The behavior of the ST_Intersects(raster, geometry) variants changed to match that of ST_Intersects(geometry, raster).

Examples

```
-- different bands of same raster
SELECT ST_Intersects(rast, 2, rast, 3) FROM dummy_rast WHERE rid = 2;

st_intersects
-----
t
```

See Also

[ST_Intersection](#), [ST_Disjoint](#)

12.17.7 ST_Overlaps

ST_Overlaps — Return true if raster rastA and rastB intersect but one does not completely contain the other.

Synopsis

boolean **ST_Overlaps**(raster rastA , integer nbandA , raster rastB , integer nbandB);
 boolean **ST_Overlaps**(raster rastA , raster rastB);

Description

Return true if raster rastA spatially overlaps raster rastB. This means that rastA and rastB intersect but one does not completely contain the other. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.



Note

This function will make use of any indexes that may be available on the rasters.



Note

To test the spatial relationship of a raster and a geometry, use `ST_Polygon` on the raster, e.g. `ST_Overlaps(ST_Polygon(raster), geometry)`.

Availability: 2.1.0

Examples

```
-- comparing different bands of same raster
SELECT ST_Overlaps(rast, 1, rast, 2) FROM dummy_rast WHERE rid = 2;

st_overlaps
-----
f
```

See Also

[ST_Intersects](#)

12.17.8 ST_Touches

ST_Touches — Return true if raster rastA and rastB have at least one point in common but their interiors do not intersect.

Synopsis

boolean **ST_Touches**(raster rastA , integer nbandA , raster rastB , integer nbandB);
boolean **ST_Touches**(raster rastA , raster rastB);

Description

Return true if raster rastA spatially touches raster rastB. This means that rastA and rastB have at least one point in common but their interiors do not intersect. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.



Note
This function will make use of any indexes that may be available on the rasters.



Note
To test the spatial relationship of a raster and a geometry, use ST_Polygon on the raster, e.g. ST_Touches(ST_Polygon(raster), geometry).

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_Touches(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN ↔
dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_touches
2	1	f
2	2	f

See Also

[ST_Intersects](#)

12.17.9 ST_SameAlignment

ST_SameAlignment — Returns true if rasters have same skew, scale, spatial ref, and offset (pixels can be put on same grid without cutting into pixels) and false if they don't with notice detailing issue.

Synopsis

boolean **ST_SameAlignment**(raster rastA , raster rastB);
 boolean **ST_SameAlignment**(double precision ulx1 , double precision uly1 , double precision scalex1 , double precision scaley1 , double precision skewx1 , double precision skewy1 , double precision ulx2 , double precision uly2 , double precision scalex2 , double precision scaley2 , double precision skewx2 , double precision skewy2);
 boolean **ST_SameAlignment**(raster set rastfield);

Description

Non-Aggregate version (Variants 1 and 2): Returns true if the two rasters (either provided directly or made using the values for upperleft, scale, skew and srid) have the same scale, skew, srid and at least one of any of the four corners of any pixel of one raster falls on any corner of the grid of the other raster. Returns false if they don't and a NOTICE detailing the alignment issue.

Aggregate version (Variant 3): From a set of rasters, returns true if all rasters in the set are aligned. The **ST_SameAlignment**() function is an "aggregate" function in the terminology of PostgreSQL. That means that it operates on rows of data, in the same way the **SUM**() and **AVG**() functions do.

Availability: 2.0.0

Enhanced: 2.1.0 addition of Aggregate variant

Examples: Rasters

```
SELECT ST_SameAlignment (
    ST_MakeEmptyRaster(1, 1, 0, 0, 1, 1, 0, 0),
    ST_MakeEmptyRaster(1, 1, 0, 0, 1, 1, 0, 0)
) as sm;

sm
----
t
```

```
SELECT ST_SameAlignment(A.rast,b.rast)
FROM dummy_rast AS A CROSS JOIN dummy_rast AS B;

NOTICE: The two rasters provided have different SRIDs
NOTICE: The two rasters provided have different SRIDs
 st_samealignment
-----
t
f
f
f
```

See Also

Section [11.1](#), [ST_NotSameAlignmentReason](#), [ST_MakeEmptyRaster](#)

12.17.10 ST_NotSameAlignmentReason

ST_NotSameAlignmentReason — Returns text stating if rasters are aligned and if not aligned, a reason why.

Synopsis

text **ST_NotSameAlignmentReason**(raster rastA, raster rastB);

Description

Returns text stating if rasters are aligned and if not aligned, a reason why.



Note

If there are several reasons why the rasters are not aligned, only one reason (the first test to fail) will be returned.

Availability: 2.1.0

Examples

```
SELECT
  ST_SameAlignment (
    ST_MakeEmptyRaster(1, 1, 0, 0, 1, 1, 0, 0),
    ST_MakeEmptyRaster(1, 1, 0, 0, 1.1, 1.1, 0, 0)
  ),
  ST_NotSameAlignmentReason (
    ST_MakeEmptyRaster(1, 1, 0, 0, 1, 1, 0, 0),
    ST_MakeEmptyRaster(1, 1, 0, 0, 1.1, 1.1, 0, 0)
  )
;

st_samealignment | st_otsamealignmentreason
-----+-----
f                | The rasters have different scales on the X axis
(1 row)
```

See Also

Section 11.1, [ST_SameAlignment](#)

12.17.11 ST_Within

ST_Within — Return true if no points of raster rastA lie in the exterior of raster rastB and at least one point of the interior of rastA lies in the interior of rastB.

Synopsis

boolean **ST_Within**(raster rastA , integer nbandA , raster rastB , integer nbandB);
boolean **ST_Within**(raster rastA , raster rastB);

Description

Raster rastA is within rastB if and only if no points of rastA lie in the exterior of rastB and at least one point of the interior of rastA lies in the interior of rastB. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.



Note

This operand will make use of any indexes that may be available on the rasters.

**Note**

To test the spatial relationship of a raster and a geometry, use `ST_Polygon` on the raster, e.g. `ST_Within(ST_Polygon(raster), geometry)` or `ST_Within(geometry, ST_Polygon(raster))`.

**Note**

`ST_Within()` is the inverse of `ST_Contains()`. So, `ST_Within(rastA, rastB)` implies `ST_Contains(rastB, rastA)`.

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_Within(r1.rast, 1, r2.rast, 1) FROM dummy_rast r1 CROSS JOIN ↔
dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_within
2	1	f
2	2	t

See Also

[ST_Intersects](#), [ST_Contains](#), [ST_DWithin](#), [ST_DFullyWithin](#)

12.17.12 ST_DWithin

`ST_DWithin` — Return true if rasters `rastA` and `rastB` are within the specified distance of each other.

Synopsis

```
boolean ST_DWithin( raster rastA , integer nbandA , raster rastB , integer nbandB , double precision distance_of_srid );
boolean ST_DWithin( raster rastA , raster rastB , double precision distance_of_srid );
```

Description

Return true if rasters `rastA` and `rastB` are within the specified distance of each other. If the band number is not provided (or set to NULL), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not NODATA) are considered in the test.

The distance is specified in units defined by the spatial reference system of the rasters. For this function to make sense, the source rasters must both be of the same coordinate projection, having the same SRID.

**Note**

This operand will make use of any indexes that may be available on the rasters.



Note
To test the spatial relationship of a raster and a geometry, use `ST_Polygon` on the raster, e.g. `ST_DWithin(ST_Polygon(raster), geometry)`.

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_DWithin(r1.rast, 1, r2.rast, 1, 3.14) FROM dummy_rast r1 CROSS JOIN dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_dwithin
2	1	f
2	2	t

See Also

[ST_Within](#), [ST_DFullyWithin](#)

12.17.13 ST_DFullyWithin

`ST_DFullyWithin` — Return true if rasters `rastA` and `rastB` are fully within the specified distance of each other.

Synopsis

boolean `ST_DFullyWithin`(raster `rastA` , integer `nbandA` , raster `rastB` , integer `nbandB` , double precision `distance_of_srid`);
boolean `ST_DFullyWithin`(raster `rastA` , raster `rastB` , double precision `distance_of_srid`);

Description

Return true if rasters `rastA` and `rastB` are fully within the specified distance of each other. If the band number is not provided (or set to `NULL`), only the convex hull of the raster is considered in the test. If the band number is provided, only those pixels with value (not `NODATA`) are considered in the test.

The distance is specified in units defined by the spatial reference system of the rasters. For this function to make sense, the source rasters must both be of the same coordinate projection, having the same `SRID`.



Note
This operand will make use of any indexes that may be available on the rasters.



Note
To test the spatial relationship of a raster and a geometry, use `ST_Polygon` on the raster, e.g. `ST_DFullyWithin(ST_Polygon(raster), geometry)`.

Availability: 2.1.0

Examples

```
SELECT r1.rid, r2.rid, ST_DFullyWithin(r1.rast, 1, r2.rast, 1, 3.14) FROM dummy_rast r1 ↵
CROSS JOIN dummy_rast r2 WHERE r1.rid = 2;
```

rid	rid	st_dfullywithin
2	1	f
2	2	t

See Also

[ST_Within](#), [ST_DWithin](#)

12.18 Raster Tips

12.18.1 Out-DB Rasters

12.18.1.1 Directory containing many files

When GDAL opens a file, GDAL eagerly scans the directory of that file to build a catalog of other files. If this directory contains many files (e.g. thousands, millions), opening that file becomes extremely slow (especially if that file happens to be on a network drive such as NFS).

To control this behavior, GDAL provides the following environment variable: [GDAL_DISABLE_READDIR_ON_OPEN](#). Set `GDAL_DISABLE_READDIR_ON_OPEN` to `TRUE` to disable directory scanning.

In Ubuntu (and assuming you are using PostgreSQL's packages for Ubuntu), `GDAL_DISABLE_READDIR_ON_OPEN` can be set in `/etc/postgresql/POSTGRESQL_VERSION/CLUSTER_NAME/environment` (where `POSTGRESQL_VERSION` is the version of PostgreSQL, e.g. 9.6 and `CLUSTER_NAME` is the name of the cluster, e.g. maindb). You can also set PostGIS environment variables here as well.

```
# environment variables for postmaster process
# This file has the same syntax as postgresql.conf:
# VARIABLE = simple_value
# VARIABLE2 = 'any value!'
# I. e. you need to enclose any value which does not only consist of letters,
# numbers, and '-', '_', '.' in single quotes. Shell commands are not
# evaluated.
POSTGIS_GDAL_ENABLED_DRIVERS = 'ENABLE_ALL'

POSTGIS_ENABLE_OUTDB_RASTERS = 1

GDAL_DISABLE_READDIR_ON_OPEN = 'TRUE'
```

12.18.1.2 Maximum Number of Open Files

The maximum number of open files permitted by Linux and PostgreSQL are typically conservative (typically 1024 open files per process) given the assumption that the system is consumed by human users. For Out-DB Rasters, a single valid query can easily exceed this limit (e.g. a dataset of 10 year's worth of rasters with one raster for each day containing minimum and maximum temperatures and we want to know the absolute min and max value for a pixel in that dataset).

The easiest change to make is the following PostgreSQL setting: [max_files_per_process](#). The default is set to 1000, which is far too low for Out-DB Rasters. A safe starting value could be 65536 but this really depends on your datasets and the queries run against those datasets. This setting can only be made on server start and probably only in the PostgreSQL configuration file (e.g. `/etc/postgresql/POSTGRESQL_VERSION/CLUSTER_NAME/postgresql.conf` in Ubuntu environments).

```
...
# - Kernel Resource Usage -

max_files_per_process = 65536          # min 25
                                         # (change requires restart)
...
```

The major change to make is the Linux kernel's open files limits. There are two parts to this:

- Maximum number of open files for the entire system
- Maximum number of open files per process

12.18.1.2.1 Maximum number of open files for the entire system

You can inspect the current maximum number of open files for the entire system with the following example:

```
$ sysctl -a | grep fs.file-max
fs.file-max = 131072
```

If the value returned is not large enough, add a file to `/etc/sysctl.d/` as per the following example:

```
$ echo "fs.file-max = 6145324" >> /etc/sysctl.d/fs.conf

$ cat /etc/sysctl.d/fs.conf
fs.file-max = 6145324

$ sysctl -p --system
* Applying /etc/sysctl.d/fs.conf ...
fs.file-max = 2097152
* Applying /etc/sysctl.conf ...

$ sysctl -a | grep fs.file-max
fs.file-max = 6145324
```

12.18.1.2.2 Maximum number of open files per process

We need to increase the maximum number of open files per process for the PostgreSQL server processes.

To see what the current PostgreSQL service processes are using for maximum number of open files, do as per the following example (make sure to have PostgreSQL running):

```
$ ps aux | grep postgres
postgres 31713  0.0  0.4 179012 17564 pts/0    S    Dec26   0:03 /home/dustymugs/devel/ ↵
    postgresql/sandbox/10/usr/local/bin/postgres -D /home/dustymugs/devel/postgresql/sandbox ↵
    /10/pgdata
postgres 31716  0.0  0.8 179776 33632 ?        Ss   Dec26   0:01 postgres: checkpointer ↵
    process
postgres 31717  0.0  0.2 179144  9416 ?        Ss   Dec26   0:05 postgres: writer process
postgres 31718  0.0  0.2 179012  8708 ?        Ss   Dec26   0:06 postgres: wal writer ↵
    process
postgres 31719  0.0  0.1 179568  7252 ?        Ss   Dec26   0:03 postgres: autovacuum ↵
    launcher process
postgres 31720  0.0  0.1  34228  4124 ?        Ss   Dec26   0:09 postgres: stats collector ↵
    process
postgres 31721  0.0  0.1 179308  6052 ?        Ss   Dec26   0:00 postgres: bgworker: ↵
    logical replication launcher

$ cat /proc/31718/limits
```

Limit	Soft Limit	Hard Limit	Units
Max cpu time	unlimited	unlimited	seconds
Max file size	unlimited	unlimited	bytes
Max data size	unlimited	unlimited	bytes
Max stack size	8388608	unlimited	bytes
Max core file size	0	unlimited	bytes
Max resident set	unlimited	unlimited	bytes
Max processes	15738	15738	processes
Max open files	1024	4096	files
Max locked memory	65536	65536	bytes
Max address space	unlimited	unlimited	bytes
Max file locks	unlimited	unlimited	locks
Max pending signals	15738	15738	signals
Max msgqueue size	819200	819200	bytes
Max nice priority	0	0	
Max realtime priority	0	0	
Max realtime timeout	unlimited	unlimited	us

In the example above, we inspected the open files limit for Process 31718. It doesn't matter which PostgreSQL process, any of them will do. The response we are interested in is *Max open files*.

We want to increase *Soft Limit* and *Hard Limit* of *Max open files* to be greater than the value we specified for the PostgreSQL setting `max_files_per_process`. In our example, we set `max_files_per_process` to 65536.

In Ubuntu (and assuming you are using PostgreSQL's packages for Ubuntu), the easiest way to change the *Soft Limit* and *Hard Limit* is to edit `/etc/init.d/postgresql` (SysV) or `/lib/systemd/system/postgresql*.service` (systemd).

Let's first address the SysV Ubuntu case where we add `ulimit -H -n 262144` and `ulimit -n 131072` to `/etc/init.d/postgresql`.

```
...
case "$1" in
  start|stop|restart|reload)
    if [ "$1" = "start" ]; then
      create_socket_directory
    fi
    if [ -z "`pg_lsclusters -h`" ]; then
      log_warning_msg 'No PostgreSQL clusters exist; see "man pg_createcluster"'
      exit 0
    fi
  ;;
  *)
    ulimit -H -n 262144
    ulimit -n 131072

    for v in $versions; do
      $1 $v || EXIT=$?
    done
    exit ${EXIT:-0}
  ;;
  status)
  ;;
*)
  ;;
esac
...
```

Now to address the systemd Ubuntu case. We will add `LimitNOFILE=131072` to every `/lib/systemd/system/postgresql*.service` file in the **[Service]** section.

```
...
[Service]

LimitNOFILE=131072

...

[Install]
WantedBy=multi-user.target
```

...

After making the necessary systemd changes, make sure to reload the daemon

```
systemctl daemon-reload
```

Chapter 13

Preguntas frecuentes sobre PostGIS Raster

1. *¿Dónde puedo encontrar más información sobre el Proyecto Raster PostGIS?*

Dirigirse a la [página inicial de PostGIS Raster](#).

2. *¿Existen libros o tutoriales para que pueda empezar con esta estupenda invención?*

Hya un largo y completo tutorial para principiantes [Intersección de búferes vectoriales con cobertura raster grandes usando PostGIS Raster](#). Jorge tiene una serie de artículos de blog sobre PostGIS Raster que demuestran cómo cargar datos raster como también comparación cruzada con las mismas tareas en Oracle GeoRaster. Echa un vistazo a [Jorge's PostGIS Raster / Oracle GeoRaster Series](#). Hay un capítulo entero (más de 35 páginas de contenido) dedicada a PostGIS Raster con código libre y descargas de datos en [PostGIS in Action - Raster chapter](#). Usted puede [comprar PostGIS in Action](#) ahora desde Manning la copia impresa (descuentos significativos para compras a granel) o simplemente el formato de libro electrónico. También puede comprar desde Amazon y varios otros distribuidores de libros. Todos los libros de copia impresa vienen con un cupón gratis para descargar la versión de e-book. Here is a review from a PostGIS Raster user [PostGIS raster applied to land classification urban forestry](#)

3. *¿Cómo instalo la funcionalidad Ráster en mi base de datos PostGIS?*

PostGIS Raster is part of the PostGIS codebase and generally available with most PostGIS binary distributions. Starting with PostGIS 3.0, PostGIS raster is now a separate extension and requires: ``CREATE EXTENSION postgis_raster;`` to enable it in your database. If you are compiling your own PostGIS, you will need to compile with GDAL otherwise postgis_raster extension will not be built. Refer to [Download PostGIS binaries](#) for popular distributions of PostGIS that include raster support.

4. *¿Cómo se cargan datos ráster en PostGIS?*

The latest version of PostGIS comes packaged with a `raster2pgsql` raster loader executable capable of loading many kinds of rasters and also generating lower resolution overviews without any additional software. Please refer to Section [11.1.1](#) for more details.

5. *¿Qué formatos de ficheros ráster puedo cargar en mi base de datos?*

Cualquiera de los que soporta la librería GDAL. Los formatos soportados por GDAL están documentados en [GDAL File Formats](#). Nuestra instalación GDAL concreta puede que no soporte todos los formatos. Para comprobar los que están soportados en nuestra instalación de GDAL podemos usar

```
raster2pgsql -G
```

6. *¿Puedo exportar mis datos ráster en PostGIS a otros formatos ráster?*

Si PostGIS raster has a function [ST_AsGDALRaster](#) that will allow you to use SQL to export to any raster format supported by your GDAL. You can get a list of these using the [ST_GDALDrivers](#) SQL function. You can also use GDAL commandline tools to export PostGIS raster to other formats. GDAL has a PostGIS raster driver, but is only compiled in if you choose to compile with PostgreSQL support. El controlador actualmente no soporta rásters con bloqueos irregulares, aunque éstos se pueden almacenar en PostGIS con el tipo de datos ráster. Si estamos compilando desde los fuentes, necesitamos incluir en nuestra configuración

```
--with-pg=path/to/pg_config
```

para habilitar el controlador. Véase [GDAL Build Hints](#) para conocer recomendaciones sobre cómo generar ejecutables de GDAL en varias plataformas. Si nuestra versión de GDAL está compilada con el controlador ráster para PostGIS, deberíamos ver PostGIS Raster en la lista cuando hagamos

```
gdalinfo --formats
```

Para obtener un resumen vía GDAL acerca de nuestro ráster utilizamos `gdalinfo`:

```
gdalinfo "PG:host=localhost port=5432 dbname='mygisdb' user='postgres' password=' ←
whatever' schema='nuestroesquema' table=nuestratabla"
```

Para exportar a otros formatos ráster, usaremos `gdal_translate`. Lo que viene abajo exportará todos los datos de una tabla a un fichero PNG al 10% de su tamaño. Dependiendo de los tipos de banda de píxel, algunas conversiones puede que no funcionen si el formato exportado no soporta ese tipo de píxel. Por ejemplo, tipos de banda en punto flotante y enteros sin signo de 32 bits no se convertirán fácilmente a JPG o algunos otros. Aquí hay un ejemplo sencillo de conversión

```
gdal_translate -of PNG -outsize 10% 10% "PG:host=localhost port=5432 dbname='mygisdb' ←
user='postgres' password='whatever' schema='someschema' table=sometable" C:\ ←
somefile.png
```

Podemos también usar las cláusulas WHERE de SQL en nuestra exportación utilizando los `where=...` en nuestra cadena de conexión con el controlador. Abajo hay algunas que usan la cláusula WHERE

```
gdal_translate -of PNG -outsize 10% 10% "PG:host=localhost port=5432 dbname='mygisdb' ←
user='postgres' password='whatever' schema='someschema' table=sometable where=' ←
filename='abcd.sid' " C:\somefile.png
```

```
gdal_translate -of PNG -outsize 10% 10% "PG:host=localhost port=5432 dbname='mygisdb' ←
user='postgres' password='whatever' schema='someschema' table=sometable where=' ←
ST_Intersects(rast, ST_SetSRID(ST_Point(-71.032,42.3793),4326) )' " C:\ ←
intersectregion.png
```

Para ver más ejemplos y la sintaxis consulte [Leyendo datos ráster, sección PostGIS Raster](#)

7. ¿Están ya compilados con el soporte ráster de PostGIS sus ejecutables GDAL de los que dispone?

Sí. Compruebe la página [GDAL Binaries](#). Cualquiera que esté compilado con el soporte PostgreSQL debe incluir PostGIS Raster. PostGIS Raster está pasando por muchos cambios. Si desea obtener la última compilación nocturna para Windows -- a continuación, echa un vistazo a los Tamas Szekeres construcciones nocturnas construidas con Visual Studio que contienen troncales GDAL, Python Bindings y MapServer ejecutables y controladores incorporados PostGIS Raster. Simplemente haga clic en el SDK bat y ejecute sus comandos desde allí. <http://www.gisinternals.com>. También están disponibles los archivos de proyecto vs.

8. ¿Qué herramientas puedo usar para ver datos ráster de PostGIS?

You can use [MapServer](#) compiled with GDAL to view Raster data. QGIS supports viewing of PostGIS Raster if you have PostGIS raster driver installed. En teoría, cualquier herramienta que procese los datos mediante GDAL puede soportar datos raster de PostGIS o admitirlo con un esfuerzo bastante mínimo. Una vez más para Windows, los binarios de Tamas <http://www.gisinternals.com> son una buena opción si no quieres tener que configurar tu propia compilación.

9. ¿Cómo puedo añadir una capa ráster de PostGIS a mi mapa de MapServer?

Primero necesitamos tener compilado GDAL 1.7 o superior con soporte ráster de PostGIS. Es preferible GDAL 1.8 o superior ya que muchos problemas han sido solucionados en la 1.8, y más serán corregidos en la versión troncal. Podemos hacer como con cualquier otro ráster. Consulte [MapServer Raster processing options](#) para una lista de las diferentes funciones que podemos usar para procesar capas ráster en MapServer. Lo que hace particularmente interesante a los datos raster PostGIS, es que, ya que cada mosaico puede tener varias columnas estándar de la base de datos, podemos segmentarlos en nuestro origen de datos. Debajo hay un ejemplo de cómo definiríamos una capa ráster de PostGIS en MapServer.

**Note**

Se necesita el "mode=2" para rásters en mosaico que fué añadido en PostGIS 2.0 y los controladores de GDAL 1.8. Ésto no está en los controladores GDAL 1.7.

```
-- visualización raster con opciones raster standard
LAYER
  NAME coolwktraster
  TYPE raster
  STATUS ON
  DATA "PG:host=localhost port=5432 dbname='somedb' user='someuser' password=' ←
    whatever'
    schema='someschema' table='coolttable' mode='2'"
  PROCESSING "NODATA=0"
  PROCESSING "SCALE=AUTO"
  #... other standard raster processing functions here
  #... classes are optional but useful for 1 band data
  CLASS
    NAME "boring"
    EXPRESSION ([pixel] < 20)
    COLOR 250 250 250
  END
  CLASS
    NAME "mildly interesting"
    EXPRESSION ([pixel] > 20 AND [pixel] < 1000)
    COLOR 255 0 0
  END
  CLASS
    NAME "very interesting"
    EXPRESSION ([pixel] >= 1000)
    COLOR 0 255 0
  END
END
```

```
-- visualización raster con opciones raster standard y con clausula WHERE
LAYER
  NAME soil_survey2009
  TYPE raster
  STATUS ON
  DATA "PG:host=localhost port=5432 dbname='somedb' user='someuser' password=' ←
    whatever'
    schema='someschema' table='coolttable' where='survey_year=2009' mode ←
    = '2'"
  PROCESSING "NODATA=0"
  #... other standard raster processing functions here
  #... classes are optional but useful for 1 band data
END
```

10. *¿Qué funciones puedo utilizar actualmente con mis datos ráster?*

Consulte la relación en Chapter 12. Hay más, pero es un trabajo en marcha todavía. Consulte [PostGIS Raster roadmap page](#) para detalles acerca de qué esperar en el futuro.

11. *Obtengo el error "ERROR: function st_intersects(raster, unknown) is not unique or st_union(geometry,text) is not unique". ¿Cómo lo soluciono?*

The function is not unique error happens if one of your arguments is a textual representation of a geometry instead of a geometry. In these cases, PostgreSQL marks the textual representation as an unknown type, which means it can fall into the `st_intersects(raster, geometry)` or `st_intersects(raster,raster)` thus resulting in a non-unique case since both functions can in theory support your request. To prevent this, you need to cast the textual representation of the geometry to a geometry. Por ejemplo, si nuestro código se parece a éste:

```
SELECT rast
FROM my_raster
WHERE ST_Intersects(rast, 'SRID=4326;POINT(-10 10)');
```

Haga un moldeado de tipos "cast" de la representación en texto de la geometría a geometría cambiando el código de esta manera:

```
SELECT rast
FROM my_raster
WHERE ST_Intersects(rast, 'SRID=4326;POINT(-10 10)::geometry');
```

12. *¿En qué se diferencia el PostGIS Raster de los tipos Oracle GeoRaster (SDO_GEORASTER) y SDO_RASTER?*

Para una discusión más extensa sobre este tema, consultar la web de Jorge Arévalo [Oracle GeoRaster and PostGIS Raster: First impressions](#) La mayor ventaja de una-georeferencia-por-raster sobre una-georeferencia-por-capas es la de permitir: las coberturas no necesitan ser obligatoriamente rectangulares (como es el caso, a menudo, de coberturas ráster de gran extensión. Consulte las posibles disposiciones acerca de los ráster en la documentación)* solapar rásters (necesario para implementar la conversión de menor pérdida de vectorial a ráster). Estas disposiciones son posibles también en Oracle, pero implican el almacenamiento de múltiples objetos SDO_GEORASTER enlazados a muchas tablas SDO_RASTER. Una cobertura compleja puede llevar a cientos de tablas en la base de datos. Con PostGIS Raster podemos almacenar una disposición ráster similar en una única tabla. Es un poco como si PostGIS nos forzase a almacenar sólo coberturas vectoriales completas sin vacíos o solapamientos (una capa rectangular topológicamente perfecta). Esto puede ser muy útil en algunas situaciones pero la práctica nos dice que no es realista ni deseable para la mayoría de las coberturas geográficas. Pensamos que es una gran ventaja de la que la estructura raster debería beneficiarse también.

13. *raster2pgsql la carga de archivo de gran tamaño falla con la cadena de bytes N ¿es demasiado grande para la codificación de conversión?*

raster2pgsql no hace ninguna conexión a su base de datos cuando genera el archivo a cargar. Si su base de datos ha establecido una codificación cliente explícita diferente de su codificación de base de datos, entonces al cargar archivos ráster grandes (por encima de 30 MB de tamaño), puede ejecutar un error porque los bytes son demasiado largos para la conversión de codificación. En general, esto sucede si por ejemplo se tiene la base de datos en UTF-8, sino para reconocer aplicaciones de windows, se tiene la codificación del cliente configurado en WIN1252. Para evitar este problema asegúrese de que la codificación de cliente es la misma que su codificación de base de datos durante la carga. Puede hacer esto estableciendo explícitamente la configuración de la codificación en el script de carga. Ejemplo, si se está en las ventanas:

```
set PGCLIENTENCODING=UTF8
```

Si esta en Unix/Linux

```
export PGCLIENTENCODING=UTF8
```

Más información en este tema se detallan en <http://trac.osgeo.org/postgis/ticket/2209>

14. *Estoy recibiendo error ERROR: RASTER_fromGDALRaster: No se pudo abrir bytea con GDAL. Compruebe que el bytea es de un formato compatible con GDAL. Cuando se utiliza ST_FromGDALRaster ERROR: rt_raster_to_gdal: No se pudo cargar el controlador de salida de GDAL Al intentar usar ST_AsPNG u otras funciones de entrada de raster.*

A partir de PostGIS 2.1.3 y 2.0.5, se hizo un cambio de seguridad por defecto se deshabilitaron todos los controladores GDAL y salida de raster db. [PostGIS 2.0.6, 2.1.3 security release](#). Para rehabilitar controladores específicos o todos los controladores y rehabilitar el soporte de base de datos, consulte [Section 2.1](#).

Chapter 14

Extras de PostGIS

Este capítulo documenta las características encontradas en la carpeta Extras de fuente de tarballs y fuente de repositorio de PostGIS. Estos no siempre son empaquetados con las versiones binarias de PostGIS, pero son generalmente plpgsql básicos o scripts de shell estándar que pueden ser ejecutados tal cual.

14.1 Normalizador de Direcciones

Esta es una bifurcación **del estandarizador PAGC** (el código original para esta parte era **el estandarizador de direcciones PAGC PostgreSQL**).

El normalizador de direcciones es un analizador de direcciones de una sola línea que toma una dirección de entrada y la normaliza basándose en un conjunto de reglas almacenadas en una tabla y en las tablas de lex y gaz

El código está construido en una única librería de extensiones postgresql llamada `address_standardizer` que puede ser instalada con `CREATE EXTENSION address_standardizer;`. A demás de la extensión `address_standardizer`, una extensión de datos de ejemplo llamada `address_standardizer_data_us` es construida, la cual contiene tablas de gaz, lex, y rules para datos de Estados Unidos. Estas extensiones se pueden instalar mediante `CREATE EXTENSION address_standardizer_data_us;`

El código para esta extensión se puede encontrar en PostGIS `extensions/address_standardizer` y es actualmente autocontenido.

Para instrucciones de instalación, consulte: Section [2.3](#).

14.1.1 Cómo funciona el analizador

El analizador trabaja de derecha a izquierda localizando primero los macro elementos para el código postal, estado/provincia, ciudad y a continuación los micro elementos para determinar si se está tratando con un número de casa y calle o una intersección de calle o un hito. Actualmente no busca por un código o nombre de país, pero podría ser introducido en el futuro.

Código de país Se supone que es de EE. UU. o CA según: código postal de estado/provincia como EE. UU. o Canadá, como EE. UU. o Canadá más EE. UU. .

Código postal Éstos se reconocen utilizando expresiones regulares compatibles con Perl. Estos regexs están actualmente en el `parseaddress-api.c` y es relativamente simple hacer cambios si es necesario.

Estado/provincia Éstos son reconocidos utilizando expresiones regulares compatibles con Perl. Estos regexs están actualmente en el `parseaddress-api.c` pero podrían ser movidos e incluidos en el futuro para facilitar el mantenimiento.

14.1.2 Tipos de Address Standardizer

14.1.2.1 stdaddr

stdaddr — Un tipo compuesto que consiste en los elementos de una dirección. Este es el tipo de retorno para la función `standardize_address`.

Descripción

Un tipo compuesto que consta de elementos de una dirección. Este es el tipo de retorno de la `standardize_address` función. Algunas descripciones de los elementos se han tomado de [Atributos postales de PAGC](#).

Los números de token indican el número de referencia de salida [rules table](#)



This method needs `address_standardizer` extension.

construyendo Es texto (token número 0): se refiere al número o nombre del edificio. Identificadores y tipos de edificios no analizados. Generalmente en blanco para la mayoría de direcciones.

house_num Es un texto (ficha número 1): este es el número de la calle en una calle. Ejemplo 75 en 75 State Street.

predir Es texto (token número 2): NOMBRE DE LA CALLE PRE-DIRECCIONAL como Norte, Sur, Este, Oeste, etc.

qual Es texto (token número 3): NOMBRE DE CALLE PRE-MODIFICADOR Ejemplo *VIEJO* en 3715 VIEJA CARRETERA 99.

pretipo es texto (token número 4): TIPO DE PREFIJO DE CALLE

nombre es texto (token número 5): NOMBRE DE LA CALLE

suftype es texto (token número 6): TIPO DE POSTE DE CALLE, p. ej. St, Ave, Cir. Un tipo de calle que sigue al nombre de la calle raíz. Ejemplo *STREET* en 75 State Street.

sufdir es texto (token número 7): STREET POST-DIRECCIONAL Un modificador direccional que sigue al nombre de la calle. Ejemplo *WEST* en 3715 TENTH AVENUE WEST.

ruralroute Es texto (ficha número 8): RUTA RURAL. Ejemplo 7 en RR 7.

extra Es texto: Información adicional como el número de piso.

ciudad es texto (token número 10): Ejemplo Boston.

estado es texto (token número 11): Ejemplo MASSACHUSETTS

país es texto (token número 12): Ejemplo EE. UU.

código postal es el texto CÓDIGO POSTAL (CÓDIGO POSTAL) (número de ficha 13): Ejemplo 02109

box es el texto NÚMERO DE CAJA POSTAL (token número 14 y 15): Ejemplo 02109

unidad is text Apartment number or Suite Number (token number 17): Example 3B in APT 3B.

14.1.3 Tipos de Address Standardizer

14.1.3.1 rules table

rules table — The rules table contains a set of rules that maps address input sequence tokens to standardized output sequence. A rule is defined as a set of input tokens followed by -1 (terminator) followed by set of output tokens followed by -1 followed by number denoting kind of rule followed by ranking of rule.

Descripción

Una tabla de reglas debe tener al menos las siguientes columnas, aunque se le permite agregar más para sus propios usos.

id Llave primaria de la tabla

regla text field denoting the rule. Details at [PAGC Address Standardizer Rule records](#).

A rule consists of a set of non-negative integers representing input tokens, terminated by a -1, followed by an equal number of non-negative integers representing postal attributes, terminated by a -1, followed by an integer representing a rule type, followed by an integer representing the rank of the rule. The rules are ranked from 0 (lowest) to 17 (highest).

So for example the rule 2 0 2 22 3 -1 5 5 6 7 3 -1 2 6 maps to sequence of output tokens *TYPE NUMBER TYPE DIRECT QUALIF* to the output sequence *STREET STREET SUFTYP SUFDIR QUALIF*. The rule is an ARC_C rule of rank 6.

Numbers for corresponding output tokens are listed in [stdaddr](#).

Tokens de entrada

Each rule starts with a set of input tokens followed by a terminator -1. Valid input tokens excerpted from [PAGC Input Tokens](#) are as follows:

Form-Based Input Tokens

AMPERS (13). El ampersand (&) se utiliza frecuentemente para abreviar la letra "y".

DASH (9). Un carácter de puntuación.

DOUBLE (21). Secuencia de dos letras. A menudo se utilizan como identificadores.

FRACT (25). Las fracciones a veces se usan en números cívicos o números de unidad.

MIXED (23). Una cadena alfanumérica que contiene letras y dígitos. Se utiliza para identificadores.

NUMBER (0). Una cadena de dígitos.

ORD (15). Representaciones como Primera o 1ra. Se utiliza a menudo en nombres de calles.

ORD (18). Una sola letra.

WORD (1). Una palabra es una cadena de letras de longitud arbitraria. Una sola letra puede ser SINGLE y una WORD.

Function-based Input Tokens

BOXH (14). Palabras utilizadas para denotar casillas postales. Por ejemplo *Box* o *PO Box*.

BUILDH (19). Words used to denote buildings or building complexes, usually as a prefix. For example: *Tower* in *Tower 7A*.

BUILDH (24). Words and abbreviations used to denote buildings or building complexes, usually as a suffix. For example: *Shopping Centre*.

DIRECT (22). Words used to denote directions, for example *North*.

MILE (20). Words used to denote milepost addresses.

ROAD (6). Words and abbreviations used to denote highways and roads. For example: the *Interstate* in *Interstate 5*

RR (8). Words and abbreviations used to denote rural routes. *RR*.

TYPE (2). Words and abbreviation used to denote street types. For example: *ST* or *AVE*.

UNITH (16). Words and abbreviation used to denote internal subaddresses. For example, *APT* or *UNIT*.

Postal Type Input Tokens

QUINT (28). Un número de 5 dígitos. Identifica un código postal

QUAD (29). A 4 digit number. Identifies ZIP4.

PCH (27). A 3 character sequence of letter number letter. Identifies an FSA, the first 3 characters of a Canadian postal code.

PCT (26). A 3 character sequence of number letter number. Identifies an LDU, the last 3 characters of a Canadian postal code.

Stopwords

STOPWORDS combine with WORDS. In rules a string of multiple WORDs and STOPWORDS will be represented by a single WORD token.

STOPWORD (7). A word with low lexical significance, that can be omitted in parsing. For example: *THE*.

Tokens de salida

After the first -1 (terminator), follows the output tokens and their order, followed by a terminator -1. Numbers for corresponding output tokens are listed in [stdaddr](#). What are allowed is dependent on kind of rule. Output tokens valid for each rule type are listed in the section called “[Rule Types and Rank](#)”.

Rule Types and Rank

The final part of the rule is the rule type which is denoted by one of the following, followed by a rule rank. The rules are ranked from 0 (lowest) to 17 (highest).

MACRO_C

(token number = "0"). The class of rules for parsing MACRO clauses such as *PLACE STATE ZIP*

MACRO_C output tokens (excerpted from <http://www.pgcgeo.org/docs/html/pagc-12.html#--r-typ-->).

CITY (token number "10"). Example "Albany"

STATE (token number "11"). Example "NY"

NATION (token number "12"). This attribute is not used in most reference files. Example "USA"

POSTAL (token number "13"). (SADS elements "ZIP CODE" , "PLUS 4"). This attribute is used for both the US Zip and the Canadian Postal Codes.

MICRO_C

(token number = "1"). The class of rules for parsing full MICRO clauses (such as House, street, sufdir, predir, pretyp, suftype, qualif) (ie ARC_C plus CIVIC_C). These rules are not used in the build phase.

MICRO_C output tokens (excerpted from <http://www.pgcgeo.org/docs/html/pagc-12.html#--r-typ-->).

HOUSE Es un texto (ficha número 1): este es el número de la calle en una calle. Ejemplo 75 en 75 State Street.

predir Es texto (token número 2): NOMBRE DE LA CALLE PRE-DIRECCIONAL como Norte, Sur, Este, Oeste, etc.

qual Es texto (token número 3): NOMBRE DE CALLE PRE-MODIFICADOR Ejemplo *VIEJO* en 3715 VIEJA CARRETERA 99.

pretipo es texto (token número 4): TIPO DE PREFIJO DE CALLE

street es texto (token número 5): NOMBRE DE LA CALLE

suftype es texto (token número 6): TIPO DE POSTE DE CALLE, p. ej. St, Ave, Cir. Un tipo de calle que sigue al nombre de la calle raíz. Ejemplo *STREET* en 75 State Street.

sufdir es texto (token número 7): STREET POST-DIRECTIONAL Un modificador direccional que sigue al nombre de la calle. Ejemplo *WEST* en 3715 TENTH AVENUE WEST.

ARC_C

(token number = "2"). The class of rules for parsing MICRO clauses, excluding the HOUSE attribute. As such uses same set of output tokens as MICRO_C minus the HOUSE token.

CIVIC_C

(token number = "3"). The class of rules for parsing the HOUSE attribute.

EXTRA_C

(token number = "4"). The class of rules for parsing EXTRA attributes - attributes excluded from geocoding. These rules are not used in the build phase.

EXTRA_C output tokens (excerpted from <http://www.pagcgeo.org/docs/html/pagc-12.html#--r-typ-->).

BLDNG (token number 0): Unparsed building identifiers and types.

BOXH (token number 14): The **BOX** in BOX 3B

BOXT (token number 15): The **3B** in BOX 3B

RR (token number 8): The **RR** in RR 7

UNITH (token number 16): The **APT** in APT 3B

UNITT (token number 17): The **3B** in APT 3B

UNKNWN (token number 9): An otherwise unclassified output.

14.1.3.2 lex table

lex table — A lex table is used to classify alphanumeric input and associate that input with (a) input tokens (See the section called “**Tokens de entrada**”) and (b) standardized representations.

Descripción

A lex (short for lexicon) table is used to classify alphanumeric input and associate that input with the section called “**Tokens de entrada**” and (b) standardized representations. Things you will find in these tables are ONE mapped to stdword: 1.

A lex has at least the following columns in the table. You may add

id Llave primaria de la tabla

seq integer: definition number?

word text: the input word

stdword text: the standardized replacement word

token integer: the kind of word it is. Only if it is used in this context will it be replaced. Refer to **PAGC Tokens**.

14.1.3.3 gaz table

gaz table — A gaz table is used to standardize place names and associate that input with (a) input tokens (See the section called “**Tokens de entrada**”) and (b) standardized representations.

Descripción

A gaz (short for gazeteer) table is used to standardize place names and associate that input with the section called “**Tokens de entrada**” and (b) standardized representations. For example if you are in US, you may load these with State Names and associated abbreviations.

A gaz table has at least the following columns in the table. You may add more columns if you wish for your own purposes.

- id** Llave primaria de la tabla
- seq** integer: definition number? - identifier used for that instance of the word
- word** text: the input word
- stdword** text: the standardized replacement word
- token** integer: the kind of word it is. Only if it is used in this context will it be replaced. Refer to **PAGC Tokens**.

14.1.4 Funciones de Address Standardizer

14.1.4.1 parse_address

parse_address — Takes a 1 line address and breaks into parts


Synopsis

record **parse_address**(text address);

Descripción

Returns takes an address as input, and returns a record output consisting of fields *num*, *street*, *street2*, *address1*, *city*, *state*, *zip*, *zipplus*, *country*.

Disponibilidad: 2.2.0

 This method needs address_standardizer extension.

Ejemplos

Single Addresss

```
SELECT num, street, city, zip, zipplus
      FROM parse_address('1 Devonshire Place, Boston, MA 02109-1234') AS a;
```

num	street	city	zip	zipplus
1	Devonshire Place	Boston	02109	1234

Table of addresses

```
-- basic table
CREATE TABLE places(addid serial PRIMARY KEY, address text);

INSERT INTO places(address)
VALUES ('529 Main Street, Boston MA, 02129'),
      ('77 Massachusetts Avenue, Cambridge, MA 02139'),
      ('25 Wizard of Oz, Walaford, KS 99912323'),
      ('26 Capen Street, Medford, MA');
```



```
('124 Mount Auburn St, Cambridge, Massachusetts 02138'),
('950 Main Street, Worcester, MA 01610');

-- parse the addresses
-- if you want all fields you can use (a).*
SELECT addid, (a).num, (a).street, (a).city, (a).state, (a).zip, (a).zipplus
FROM (SELECT addid, parse_address(address) As a
FROM places) AS p;
```

addid	num	street	city	state	zip	zipplus
1	529	Main Street	Boston	MA	02129	
2	77	Massachusetts Avenue	Cambridge	MA	02139	
3	25	Wizard of Oz	Walaford	KS	99912	323
4	26	Capen Street	Medford	MA		
5	124	Mount Auburn St	Cambridge	MA	02138	
6	950	Main Street	Worcester	MA	01610	

(6 rows)

Ver también

14.1.4.2 standardize_address

standardize_address — Returns an stdaddr form of an input address utilizing lex, gaz, and rule tables.

Synopsis

```
stdaddr standardize_address(text lextab, text gaztab, text rultab, text address);
stdaddr standardize_address(text lextab, text gaztab, text rultab, text micro, text macro);
```


Descripción

Returns an **stdaddr** form of an input address utilizing **lex table** table name, **gaz table**, and **rules table** table names and an address.

Variant 1: Takes an address as a single line.

Variant 2: Takes an address as 2 parts. A **micro** consisting of standard first line of postal address e.g. house_num street, and a **macro** consisting of standard postal second line of an address e.g city, state postal_code country.

Disponibilidad: 2.2.0

 This method needs address_standardizer extension.

Ejemplos

Using address_standardizer_data_us extension

```
CREATE EXTENSION address_standardizer_data_us; -- only needs to be done once
```

Variant 1: Single line address. This doesn't work well with non-US addresses

```
SELECT house_num, name, suftype, city, country, state, unit FROM standardize_address(' ←
us_lex',
                                           'us_gaz', 'us_rules', 'One Devonshire Place, PH 301, Boston, MA ←
                                           02109');
```

house_num	name	suftype	city	country	state	unit
1	DEVONSHIRE	PLACE	BOSTON	USA	MASSACHUSETTS	# PENTHOUSE 301

Using tables packaged with tiger geocoder. This example only works if you installed `postgis_tiger_geocoder`.

```
SELECT * FROM standardize_address('tiger.pagc_lex',
    'tiger.pagc_gaz', 'tiger.pagc_rules', 'One Devonshire Place, PH 301, Boston, MA 02109-1234');
```

Make easier to read we'll dump output using `hstore` extension `CREATE EXTENSION hstore`; you need to install

```
SELECT (each(hstore(p))).*
FROM standardize_address('tiger.pagc_lex', 'tiger.pagc_gaz',
    'tiger.pagc_rules', 'One Devonshire Place, PH 301, Boston, MA 02109') As p;
```

key	value
box	
city	BOSTON
name	DEVONSHIRE
qual	
unit	# PENTHOUSE 301
extra	
state	MA
predir	
sufdir	
country	USA
pretype	
suftype	PL
building	
postcode	02109
house_num	1
ruralroute	

(16 rows)

Variant 2: As a two part Address

```
SELECT (each(hstore(p))).*
FROM standardize_address('tiger.pagc_lex', 'tiger.pagc_gaz',
    'tiger.pagc_rules', 'One Devonshire Place, PH 301', 'Boston, MA 02109, US') As p;
```

key	value
box	
city	BOSTON
name	DEVONSHIRE
qual	
unit	# PENTHOUSE 301
extra	
state	MA
predir	
sufdir	
country	USA
pretype	
suftype	PL
building	
postcode	02109
house_num	1
ruralroute	

(16 rows)

Ver también

[stdaddr](#), [rules table](#), [lex table](#), [gaz table](#), [Pagc_Normalize_Address](#)

14.2 Geocodificador Tiger

Hay un par de geocodificadores de software libre para PostGIS, que a diferencia del geocodificador tiger tienen la ventaja de soporte para geocodificación multi-país.

- **Nominatim** uses OpenStreetMap gazeteer formatted data. It requires osm2pgsql for loading the data, PostgreSQL 8.4+ and PostGIS 1.5+ to function. It is packaged as a webservice interface and seems designed to be called as a webservice. Just like the tiger geocoder, it has both a geocoder and a reverse geocoder component. From the documentation, it is unclear if it has a pure SQL interface like the tiger geocoder, or if a good deal of the logic is implemented in the web interface.
- **GIS Graphy** también utiliza PostGIS y como Nominatim trabaja con datos de OpenStreetMap (OSM). Viene con un cargador para cargar datos OSM y, al igual que Nominatim es capaz de geocodificar no solo USA. Similar a Nominatim, se ejecuta como servicio web y se apoya en Java 1.5, aplicaciones Servlet, Soir. GisGraphy es multiplataforma y también tiene un geocodificador inverso entre otras buenas características.

14.2.1 Drop_Indexes_Generate_Script

Drop_Indexes_Generate_Script — Generates a script that drops all non-primary key and non-unique indexes on tiger schema and user specified schema. Defaults schema to `tiger_data` if no schema is specified.

Synopsis

```
text Drop_Indexes_Generate_Script(text param_schema=tiger_data);
```

Descripción

Generates a script that drops all non-primary key and non-unique indexes on tiger schema and user specified schema. Defaults schema to `tiger_data` if no schema is specified.

This is useful for minimizing index bloat that may confuse the query planner or take up unnecessary space. Use in combination with [Install_Missing_Indexes](#) to add just the indexes used by the geocoder.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT drop_indexes_generate_script() As actionsql;
actionsql
-----
DROP INDEX tiger.idx_tiger_countysub_lookup_lower_name;
DROP INDEX tiger.idx_tiger_edges_countyfp;
DROP INDEX tiger.idx_tiger_faces_countyfp;
DROP INDEX tiger.tiger_place_the_geom_gist;
DROP INDEX tiger.tiger_edges_the_geom_gist;
DROP INDEX tiger.tiger_state_the_geom_gist;
DROP INDEX tiger.idx_tiger_addr_least_address;
DROP INDEX tiger.idx_tiger_addr_tlid;
DROP INDEX tiger.idx_tiger_addr_zip;
DROP INDEX tiger.idx_tiger_county_countyfp;
DROP INDEX tiger.idx_tiger_county_lookup_lower_name;
DROP INDEX tiger.idx_tiger_county_lookup_snd_name;
```

```

DROP INDEX tiger.idx_tiger_county_lower_name;
DROP INDEX tiger.idx_tiger_county_snd_name;
DROP INDEX tiger.idx_tiger_county_the_geom_gist;
DROP INDEX tiger.idx_tiger_countysub_lookup_snd_name;
DROP INDEX tiger.idx_tiger_cousub_countyfp;
DROP INDEX tiger.idx_tiger_cousub_cousubfp;
DROP INDEX tiger.idx_tiger_cousub_lower_name;
DROP INDEX tiger.idx_tiger_cousub_snd_name;
DROP INDEX tiger.idx_tiger_cousub_the_geom_gist;
DROP INDEX tiger_data.idx_tiger_data_ma_addr_least_address;
DROP INDEX tiger_data.idx_tiger_data_ma_addr_tlid;
DROP INDEX tiger_data.idx_tiger_data_ma_addr_zip;
DROP INDEX tiger_data.idx_tiger_data_ma_county_countyfp;
DROP INDEX tiger_data.idx_tiger_data_ma_county_lookup_lower_name;
DROP INDEX tiger_data.idx_tiger_data_ma_county_lookup_snd_name;
DROP INDEX tiger_data.idx_tiger_data_ma_county_lower_name;
DROP INDEX tiger_data.idx_tiger_data_ma_county_snd_name;
:
:

```

Ver también

[Install_Missing_Indexes](#), [Missing_Indexes_Generate_Script](#)

14.2.2 Drop_Nation_Tables_Generate_Script

Drop_Nation_Tables_Generate_Script — Generates a script that drops all tables in the specified schema that start with `county_all`, `state_all` or state code followed by `county` or `state`.

Synopsis

text **Drop_Nation_Tables_Generate_Script**(text param_schema=tiger_data);

Descripción

Generates a script that drops all tables in the specified schema that start with `county_all`, `state_all` or state code followed by `county` or `state`. This is needed if you are upgrading from `tiger_2010` to `tiger_2011` data.

Disponibilidad: 2.1.0

Ejemplos

```

SELECT drop_nation_tables_generate_script();
DROP TABLE tiger_data.county_all;
DROP TABLE tiger_data.county_all_lookup;
DROP TABLE tiger_data.state_all;
DROP TABLE tiger_data.ma_county;
DROP TABLE tiger_data.ma_state;

```

Ver también

[Loader_Generate_Nation_Script](#)

14.2.3 Drop_State_Tables_Generate_Script

Drop_State_Tables_Generate_Script — Generates a script that drops all tables in the specified schema that are prefixed with the state abbreviation. Defaults schema to `tiger_data` if no schema is specified.

Synopsis

text **Drop_State_Tables_Generate_Script**(text param_state, text param_schema=tiger_data);

Descripción

Generates a script that drops all tables in the specified schema that are prefixed with the state abbreviation. Defaults schema to `tiger_data` if no schema is specified. This function is useful for dropping tables of a state just before you reload a state in case something went wrong during your previous load.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT drop_state_tables_generate_script('PA');
DROP TABLE tiger_data.pa_addr;
DROP TABLE tiger_data.pa_county;
DROP TABLE tiger_data.pa_county_lookup;
DROP TABLE tiger_data.pa_cousub;
DROP TABLE tiger_data.pa_edges;
DROP TABLE tiger_data.pa_faces;
DROP TABLE tiger_data.pa_featnames;
DROP TABLE tiger_data.pa_place;
DROP TABLE tiger_data.pa_state;
DROP TABLE tiger_data.pa_zip_lookup_base;
DROP TABLE tiger_data.pa_zip_state;
DROP TABLE tiger_data.pa_zip_state_loc;
```

Ver también

[Loader_Generate_Script](#)

14.2.4 Geocode

Geocode — Takes in an address as a string (or other normalized address) and outputs a set of possible locations which include a point geometry in NAD 83 long lat, a normalized address for each, and the rating. The lower the rating the more likely the match. Results are sorted by lowest rating first. Can optionally pass in maximum results, defaults to 10, and restrict_region (defaults to NULL)

Synopsis

setof record **geocode**(varchar address, integer max_results=10, geometry restrict_region=NULL, norm_addy OUT addy, geometry OUT geomout, integer OUT rating);
setof record **geocode**(norm_addy in_addy, integer max_results=10, geometry restrict_region=NULL, norm_addy OUT addy, geometry OUT geomout, integer OUT rating);

Descripción

Takes in an address as a string (or already normalized address) and outputs a set of possible locations which include a point geometry in NAD 83 long lat, a `normalized_address` (addy) for each, and the rating. The lower the rating the more likely the match. Results are sorted by lowest rating first. Uses Tiger data (edges,faces,addr), PostgreSQL fuzzy string matching (soundex,levenshtein) and PostGIS line interpolation functions to interpolate address along the Tiger edges. The higher the rating the less likely the geocode is right. The geocoded point is defaulted to offset 10 meters from center-line off to side (L/R) of street address is located on.

Enhanced: 2.0.0 to support Tiger 2010 structured data and revised some logic to improve speed, accuracy of geocoding, and to offset point from centerline to side of street address is located on. The new parameter `max_results` useful for specifying number of best results or just returning the best result.

Examples: Basic

The below examples timings are on a 3.0 GHZ single processor Windows 7 machine with 2GB ram running PostgreSQL 9.1rc1/PostGIS 2.0 loaded with all of MA,MN,CA, RI state Tiger data loaded.

Exact matches are faster to compute (61ms)

```
SELECT g.rating, ST_X(g.geomout) As lon, ST_Y(g.geomout) As lat,
       (addy).address As stno, (addy).streetname As street,
       (addy).streettypeabbrev As styp, (addy).location As city, (addy).stateabbrev As st, ( ←
       addy).zip
FROM geocode('75 State Street, Boston MA 02109', 1) As g;
rating |          lon          |          lat          | stno | street | styp | city | st | zip
-----+-----+-----+-----+-----+-----+-----+-----+-----
      0 | -71.0557505845646 | 42.35897920691 |    75 | State  | St   | Boston | MA | 02109
```

Even if zip is not passed in the geocoder can guess (took about 122-150 ms)

```
SELECT g.rating, ST_AsText(ST_SnapToGrid(g.geomout,0.00001)) As wktmlonlat,
       (addy).address As stno, (addy).streetname As street,
       (addy).streettypeabbrev As styp, (addy).location As city, (addy).stateabbrev As st, ( ←
       addy).zip
FROM geocode('226 Hanover Street, Boston, MA',1) As g;
rating |          wktmlonlat          | stno | street | styp | city | st | zip
-----+-----+-----+-----+-----+-----+-----+-----
      1 | POINT(-71.05528 42.36316) |    226 | Hanover | St   | Boston | MA | 02113
```

Can handle misspellings and provides more than one possible solution with ratings and takes longer (500ms).

```
SELECT g.rating, ST_AsText(ST_SnapToGrid(g.geomout,0.00001)) As wktmlonlat,
       (addy).address As stno, (addy).streetname As street,
       (addy).streettypeabbrev As styp, (addy).location As city, (addy).stateabbrev As st, ( ←
       addy).zip
FROM geocode('31 - 37 Stewart Street, Boston, MA 02116',1) As g;
rating |          wktmlonlat          | stno | street | styp | city | st | zip
-----+-----+-----+-----+-----+-----+-----+-----
     70 | POINT(-71.06466 42.35114) |     31 | Stuart | St   | Boston | MA | 02116
```

Using to do a batch geocode of addresses. Easiest is to set `max_results=1`. Only process those not yet geocoded (have no rating).

```
CREATE TABLE addresses_to_geocode(addid serial PRIMARY KEY, address text,
                                   lon numeric, lat numeric, new_address text, rating integer);

INSERT INTO addresses_to_geocode(address)
VALUES ('529 Main Street, Boston MA, 02129'),
       ('77 Massachusetts Avenue, Cambridge, MA 02139'),
       ('25 Wizard of Oz, Walaford, KS 99912323'),
```

```

('26 Capen Street, Medford, MA'),
('124 Mount Auburn St, Cambridge, Massachusetts 02138'),
('950 Main Street, Worcester, MA 01610');

-- only update the first 3 addresses (323-704 ms - there are caching and shared memory ↵
-- effects so first geocode you do is always slower) --
-- for large numbers of addresses you don't want to update all at once
-- since the whole geocode must commit at once
-- For this example we rejoin with LEFT JOIN
-- and set to rating to -1 rating if no match
-- to ensure we don't regeocode a bad address
UPDATE addresses_to_geocode
  SET (rating, new_address, lon, lat)
    = ( COALESCE(g.rating, -1), pprint_addy(g.addy),
        ST_X(g.geomout)::numeric(8,5), ST_Y(g.geomout)::numeric(8,5) )
FROM (SELECT addid, address
      FROM addresses_to_geocode
      WHERE rating IS NULL ORDER BY addid LIMIT 3) As a
  LEFT JOIN LATERAL geocode(a.address,1) As g ON true
WHERE a.addid = addresses_to_geocode.addid;

result
-----
Query returned successfully: 3 rows affected, 480 ms execution time.

SELECT * FROM addresses_to_geocode WHERE rating is not null;

addid |                address                | lon  | lat  | ↵
-----+-----+-----+-----+-----+-----+-----+-----
1 | 529 Main Street, Boston MA, 02129 | -71.07177 | 42.38357 | 529 Main St, ↵
  | Boston, MA 02129 | 0
2 | 77 Massachusetts Avenue, Cambridge, MA 02139 | -71.09396 | 42.35961 | 77 ↵
  | Massachusetts Ave, Cambridge, MA 02139 | 0
3 | 25 Wizard of Oz, Walaford, KS 99912323 | -97.92913 | 38.12717 | Willowbrook, ↵
  | KS 67502 | 108
(3 rows)

```

Examples: Using Geometry filter

```

SELECT g.rating, ST_AsText(ST_SnapToGrid(g.geomout,0.00001)) As wktlonlat,
  (addy).address As stno, (addy).streetname As street,
  (addy).streettypeabbrev As styp,
  (addy).location As city, (addy).stateabbrev As st, (addy).zip
FROM geocode('100 Federal Street, MA',
  3,
  (SELECT ST_Union(the_geom)
   FROM place WHERE statefp = '25' AND name = 'Lynn')::geometry
 ) As g;

rating | wktlonlat | stno | street | styp | city | st | zip
-----+-----+-----+-----+-----+-----+-----+-----
7 | POINT(-70.96796 42.4659) | 100 | Federal | St | Lynn | MA | 01905
16 | POINT(-70.96786 42.46853) | NULL | Federal | St | Lynn | MA | 01905
(2 rows)

Time: 622.939 ms

```

Ver también

[Normalize_Address](#), [Pprint_Addy](#), [ST_AsText](#), [ST_SnapToGrid](#), [ST_X](#), [ST_Y](#)

14.2.5 Geocode_Intersection

Geocode_Intersection — Takes in 2 streets that intersect and a state, city, zip, and outputs a set of possible locations on the first cross street that is at the intersection, also includes a geomout as the point location in NAD 83 long lat, a `normalized_address` (addy) for each location, and the rating. The lower the rating the more likely the match. Results are sorted by lowest rating first. Can optionally pass in maximum results, defaults to 10. Uses Tiger data (edges, faces, addr), PostgreSQL fuzzy string matching (soundex, levenshtein).

Synopsis

setof record **geocode_intersection**(text roadway1, text roadway2, text in_state, text in_city, text in_zip, integer max_results=10, norm_addy OUT addy, geometry OUT geomout, integer OUT rating);

Descripción

Takes in 2 streets that intersect and a state, city, zip, and outputs a set of possible locations on the first cross street that is at the intersection, also includes a point geometry in NAD 83 long lat, a normalized address for each location, and the rating. The lower the rating the more likely the match. Results are sorted by lowest rating first. Can optionally pass in maximum results, defaults to 10. Returns `normalized_address` (addy) for each, geomout as the point location in nad 83 long lat, and the rating. The lower the rating the more likely the match. Results are sorted by lowest rating first. Uses Tiger data (edges,faces,addr), PostgreSQL fuzzy string matching (soundex,levenshtein)

Disponibilidad: 2.0.0

Examples: Basic

The below examples timings are on a 3.0 GHZ single processor Windows 7 machine with 2GB ram running PostgreSQL 9.0/PostGIS 1.5 loaded with all of MA state Tiger data loaded. Currently a bit slow (3000 ms)

Testing on Windows 2003 64-bit 8GB on PostGIS 2.0 PostgreSQL 64-bit Tiger 2011 data loaded -- (41ms)

```
SELECT pprint_addy(addy), st_astext(geomout),rating
      FROM geocode_intersection( 'Haverford St','Germania St', 'MA', 'Boston', ↵
        '02130',1);
```

pprint_addy	st_astext	rating
98 Haverford St, Boston, MA 02130	POINT(-71.101375 42.31376)	0

Even if zip is not passed in the geocoder can guess (took about 3500 ms on the windows 7 box), on the windows 2003 64-bit 741 ms

```
SELECT pprint_addy(addy), st_astext(geomout),rating
      FROM geocode_intersection('Weld', 'School', 'MA', 'Boston');
```

pprint_addy	st_astext	rating
98 Weld Ave, Boston, MA 02119	POINT(-71.099 42.314234)	3
99 Weld Ave, Boston, MA 02119	POINT(-71.099 42.314234)	3

Ver también

[Geocode](#), [Pprint_Addy](#), [ST_AsText](#)

14.2.6 Get_Geocode_Setting

Get_Geocode_Setting — Returns value of specific setting stored in tiger.geocode_settings table.

Synopsis

text **Get_Geocode_Setting**(text setting_name);

Descripción

Returns value of specific setting stored in tiger.geocode_settings table. Settings allow you to toggle debugging of functions. Later plans will be to control rating with settings. Current list of settings are as follows:

name	setting	unit	category	↔	short_desc
debug_geocode_address	false	boolean	debug	↔	outputs debug information in notice log such as queries when geocode_address is called if true
debug_geocode_intersection	false	boolean	debug	↔	outputs debug information in notice log such as queries when geocode_intersection is called if true
debug_normalize_address	false	boolean	debug	↔	outputs debug information in notice log such as queries and intermediate expressions when normalize_address is called if true
debug_reverse_geocode	false	boolean	debug	↔	if true, outputs debug information in notice log such as queries and intermediate expressions when reverse_geocode
reverse_geocode_numbered_roads	0	integer	rating	↔	For state and county highways, 0 - no preference in name, 1 - prefer the numbered highway name, 2 - prefer local state/county name
use_pagc_address_parser	false	boolean	normalize	↔	If set to true, will try to use the address_standardizer extension (via pagc_normalize_address) instead of tiger normalize_address built one

Changed: 2.2.0 : default settings are now kept in a table called geocode_settings_default. Use customized settingsa are in geocode_settings and only contain those that have been set by user.

Disponibilidad: 2.1.0

Example return debugging setting

```
SELECT get_geocode_setting('debug_geocode_address) As result;
result
-----
false
```

Ver también

[Set_Geocode_Setting](#)

14.2.7 Get_Tract

Get_Tract — Returns census tract or field from tract table of where the geometry is located. Default to returning short name of tract.

Synopsis

```
text get_tract(geometry loc_geom, text output_field=name);
```

Descripción

Given a geometry will return the census tract location of that geometry. NAD 83 long lat is assumed if no spatial ref sys is specified.

Note

This function uses the census `tract` which is not loaded by default. If you have already loaded your state table, you can load `tract` as well as `bg`, and `tabblock` using the [Loader_Generate_Census_Script](#) script.

If you have not loaded your state data yet and want these additional tables loaded, do the following

```
UPDATE tiger.loader_lookuptables SET load = true WHERE load = false AND lookup_name IN('tract', 'bg', 'tabblock');
```

then they will be included by the [Loader_Generate_Script](#).

Disponibilidad: 2.0.0

Examples: Basic

```
SELECT get_tract(ST_Point(-71.101375, 42.31376) ) As tract_name;
tract_name
-----
1203.01
```

```
--this one returns the tiger geoid
SELECT get_tract(ST_Point(-71.101375, 42.31376), 'tract_id' ) As tract_id;
tract_id
-----
25025120301
```

Ver también

[Geocode](#) >

14.2.8 Install_Missing_Indexes

Install_Missing_Indexes — Finds all tables with key columns used in geocoder joins and filter conditions that are missing used indexes on those columns and will add them.

Synopsis

```
boolean Install_Missing_Indexes();
```

Descripción

Finds all tables in `tiger` and `tiger_data` schemas with key columns used in geocoder joins and filters that are missing indexes on those columns and will output the SQL DDL to define the index for those tables and then execute the generated script. This is a helper function that adds new indexes needed to make queries faster that may have been missing during the load process. This function is a companion to [Missing_Indexes_Generate_Script](#) that in addition to generating the create index script, also executes it. It is called as part of the `update_geocode.sql` upgrade script.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT install_missing_indexes();
       install_missing_indexes
-----
t
```

Ver también

[Loader_Generate_Script](#), [Missing_Indexes_Generate_Script](#)

14.2.9 Loader_Generate_Census_Script

`Loader_Generate_Census_Script` — Generates a shell script for the specified platform for the specified states that will download Tiger census state tract, bg, and tabblocks data tables, stage and load into `tiger_data` schema. Each state script is returned as a separate record.

Synopsis

```
setof text loader_generate_census_script(text[] param_states, text os);
```

Descripción

Generates a shell script for the specified platform for the specified states that will download Tiger data census state tract, block groups bg, and tabblocks data tables, stage and load into `tiger_data` schema. Each state script is returned as a separate record.

It uses unzip on Linux (7-zip on Windows by default) and wget to do the downloading. It uses Section [4.7.2](#) to load in the data. Note the smallest unit it does is a whole state. It will only process the files in the staging and temp folders.

It uses the following control tables to control the process and different OS shell syntax variations.

1. `loader_variables` keeps track of various variables such as census site, year, data and staging schemas
2. `loader_platform` profiles of various platforms and where the various executables are located. Comes with windows and linux. More can be added.
3. `loader_lookuptables` each record defines a kind of table (state, county), whether to process records in it and how to load them in. Defines the steps to import data, stage data, add, removes columns, indexes, and constraints for each. Each table is prefixed with the state and inherits from a table in the tiger schema. e.g. creates `tiger_data.ma_faces` which inherits from `tiger.faces`

Disponibilidad: 2.0.0



Note

[Loader_Generate_Script](#) includes this logic, but if you installed tiger geocoder prior to PostGIS 2.0.0 alpha5, you'll need to run this on the states you have already done to get these additional tables.

Ejemplos

Generate script to load up data for select states in Windows shell script format.

```
SELECT loader_generate_census_script (ARRAY['MA'], 'windows');
-- result --
set STATEDIR="\gisdata\www2.census.gov\geo\pvs\tiger2010st\25_Massachusetts"
set TMPDIR=\gisdata\temp\
set UNZIPTOOL="C:\Program Files\7-Zip\7z.exe"
set WGETTOOL="C:\wget\wget.exe"
set PGBIN=C:\projects\pg\pg91win\bin\
set PGPORT=5432
set PGHOST=localhost
set PGUSER=postgres
set PGPASSWORD=yourpasswordhere
set PGDATABASE=tiger_postgis20
set PSQL="%PGBIN%psql"
set SHP2PGSQL="%PGBIN%shp2pgsql"
cd \gisdata

%WGETTOOL% http://www2.census.gov/geo/pvs/tiger2010st/25_Massachusetts/25/ --no-parent -- ←
    relative --accept=*bg10.zip,*tract10.zip,*tabblock10.zip --mirror --reject=html
del %TMPDIR%\*.* /Q
%PSQL% -c "DROP SCHEMA tiger_staging CASCADE;"
%PSQL% -c "CREATE SCHEMA tiger_staging;"
cd %STATEDIR%
for /r %%z in (*.zip) do %UNZIPTOOL% e %%z -o%TMPDIR%
cd %TMPDIR%
%PSQL% -c "CREATE TABLE tiger_data.MA_tract (CONSTRAINT pk_MA_tract PRIMARY KEY (tract_id) ) ←
    INHERITS (tiger.tract); "
%SHP2PGSQL% -c -s 4269 -g the_geom -W "latin1" tl_2010_25_tract10.dbf tiger_staging. ←
    ma_tract10 | %PSQL%
%PSQL% -c "ALTER TABLE tiger_staging.MA_tract10 RENAME geoid10 TO tract_id; SELECT ←
    loader_load_staged_data(lower('MA_tract10'), lower('MA_tract')); "
%PSQL% -c "CREATE INDEX tiger_data_MA_tract_the_geom_gist ON tiger_data.MA_tract USING gist ←
    (the_geom); "
%PSQL% -c "VACUUM ANALYZE tiger_data.MA_tract;"
%PSQL% -c "ALTER TABLE tiger_data.MA_tract ADD CONSTRAINT chk_statefp CHECK (statefp = ←
    '25');"
:
```

Generate sh script

```
STATEDIR="/gisdata/www2.census.gov/geo/pvs/tiger2010st/25_Massachusetts"
TMPDIR="/gisdata/temp/"
UNZIPTOOL=unzip
WGETTOOL="/usr/bin/wget"
export PGBIN=/usr/pgsql-9.0/bin
export PGPORT=5432
export PGHOST=localhost
export PGUSER=postgres
export PGPASSWORD=yourpasswordhere
export PGDATABASE=geocoder
PSQL=${PGBIN}/psql
SHP2PGSQL=${PGBIN}/shp2pgsql
cd /gisdata

wget http://www2.census.gov/geo/pvs/tiger2010st/25_Massachusetts/25/ --no-parent --relative ←
    --accept=*bg10.zip,*tract10.zip,*tabblock10.zip --mirror --reject=html
rm -f ${TMPDIR}/*.*
${PSQL} -c "DROP SCHEMA tiger_staging CASCADE;"
${PSQL} -c "CREATE SCHEMA tiger_staging;"
```

```
cd $STATEDIR
for z in *.zip; do $UNZIPTOOL -o -d $TMPDIR $z; done
:
:
```

Ver también

[Loader_Generate_Script](#)

14.2.10 Loader_Generate_Script

Loader_Generate_Script — Generates a shell script for the specified platform for the specified states that will download Tiger data, stage and load into `tiger_data` schema. Each state script is returned as a separate record. Latest version supports Tiger 2010 structural changes and also loads census tract, block groups, and blocks tables.

Synopsis

setof text **loader_generate_script**(text[] param_states, text os);

Descripción

Generates a shell script for the specified platform for the specified states that will download Tiger data, stage and load into `tiger_data` schema. Each state script is returned as a separate record.

It uses unzip on Linux (7-zip on Windows by default) and wget to do the downloading. It uses Section 4.7.2 to load in the data. Note the smallest unit it does is a whole state, but you can overwrite this by downloading the files yourself. It will only process the files in the staging and temp folders.

It uses the following control tables to control the process and different OS shell syntax variations.

1. `loader_variables` keeps track of various variables such as census site, year, data and staging schemas
2. `loader_platform` profiles of various platforms and where the various executables are located. Comes with windows and linux. More can be added.
3. `loader_lookuptables` each record defines a kind of table (state, county), whether to process records in it and how to load them in. Defines the steps to import data, stage data, add, removes columns, indexes, and constraints for each. Each table is prefixed with the state and inherits from a table in the tiger schema. e.g. creates `tiger_data.ma_faces` which inherits from `tiger.faces`

Availability: 2.0.0 to support Tiger 2010 structured data and load census tract (tract), block groups (bg), and blocks (tabblocks) tables .



Note

If you are using pgAdmin 3, be warned that by default pgAdmin 3 truncates long text. To fix, change *File -> Options -> Query Tool -> Query Editor -> Max. characters per column* to larger than 50000 characters.

Ejemplos

Using psql where gistest is your database and /gisdata/data_load.sh is the file to create with the shell commands to run.

```
psql -U postgres -h localhost -d gistest -A -t \
-c "SELECT Loader_Generate_Script (ARRAY['MA'], 'gistest') " > /gisdata/data_load.sh;
```

Generate script to load up data for 2 states in Windows shell script format.

```
SELECT loader_generate_script (ARRAY['MA','RI'], 'windows') AS result;
-- result --
set TMPDIR=\gisdata\temp\
set UNZIPTOOL="C:\Program Files\7-Zip\7z.exe"
set WGETTOOL="C:\wget\wget.exe"
set PGBIN=C:\Program Files\PostgreSQL\9.4\bin\
set PGPORT=5432
set PGHOST=localhost
set PGUSER=postgres
set PGPASSWORD=yourpasswordhere
set PGDATABASE=geocoder
set PSQL="%PGBIN%psql"
set SHP2PGSQL="%PGBIN%shp2pgsql"
cd \gisdata

cd \gisdata
%WGETTOOL% ftp://ftp2.census.gov/geo/tiger/TIGER2015/PLACE/tl_*_25_* --no-parent --relative --
--recursive --level=2 --accept=zip --mirror --reject=html
cd \gisdata/ftp2.census.gov/geo/tiger/TIGER2015/PLACE
:
:
```

Generate sh script

```
SELECT loader_generate_script (ARRAY['MA','RI'], 'sh') AS result;
-- result --
TMPDIR="/gisdata/temp/"
UNZIPTOOL=unzip
WGETTOOL="/usr/bin/wget"
export PGBIN=/usr/lib/postgresql/9.4/bin
-- variables used by psql: https://www.postgresql.org/docs/current/static/libpq-envvars.html
export PGPORT=5432
export PGHOST=localhost
export PGUSER=postgres
export PGPASSWORD=yourpasswordhere
export PGDATABASE=geocoder
PSQL=${PGBIN}/psql
SHP2PGSQL=${PGBIN}/shp2pgsql
cd /gisdata

cd /gisdata
wget ftp://ftp2.census.gov/geo/tiger/TIGER2015/PLACE/tl_*_25_* --no-parent --relative --
recursive --level=2 --accept=zip --mirror --reject=html
cd /gisdata/ftp2.census.gov/geo/tiger/TIGER2015/PLACE
rm -f ${TMPDIR}/*. *
:
:
```

Ver también

Section 2.4.1, [Missing_Indexes_Generate_Script](#)

14.2.11 Loader_Generate_Nation_Script

Loader_Generate_Nation_Script — Generates a shell script for the specified platform that loads in the county and state lookup tables.

Synopsis

```
text loader_generate_nation_script(text os);
```

Descripción

Generates a shell script for the specified platform that loads in the `county_all`, `county_all_lookup`, `state_all` tables into `tiger_data` schema. These inherit respectively from the `county`, `county_lookup`, `state` tables in `tiger` schema.

It uses `unzip` on Linux (7-zip on Windows by default) and `wget` to do the downloading. It uses Section 4.7.2 to load in the data.

It uses the following control tables `tiger.loader_platform`, `tiger.loader_variables`, and `tiger.loader_lookuptables` to control the process and different OS shell syntax variations.

1. `loader_variables` keeps track of various variables such as census site, year, data and staging schemas
2. `loader_platform` profiles of various platforms and where the various executables are located. Comes with windows and linux/unix. More can be added.
3. `loader_lookuptables` each record defines a kind of table (state, county), whether to process records in it and how to load them in. Defines the steps to import data, stage data, add, removes columns, indexes, and constraints for each. Each table is prefixed with the state and inherits from a table in the `tiger` schema. e.g. creates `tiger_data.ma_faces` which inherits from `tiger.faces`

Enhanced: 2.4.1 zip code 5 tabulation area (zcta5) load step was fixed and when enabled, zcta5 data is loaded as a single table called `zcta5_all` as part of the nation script load.

Disponibilidad: 2.1.0



Note

If you want zip code 5 tabulation area (zcta5) to be included in your nation script load, do the following:

```
UPDATE tiger.loader_lookuptables SET load = true WHERE table_name = 'zcta510';
```



Note

If you were running `tiger_2010` version and you want to reload as state with newer tiger data, you'll need to for the very first load generate and run drop statements [Drop_Nation_Tables_Generate_Script](#) before you run this script.

Ejemplos

Generate script script to load nation data Windows.

```
SELECT loader_generate_nation_script('windows');
```

Generate script to load up data for Linux/Unix systems.

```
SELECT loader_generate_nation_script('sh');
```

Ver también

[Loader_Generate_Script](#), [Missing_Indexes_Generate_Script](#)

14.2.12 Missing_Indexes_Generate_Script

Missing_Indexes_Generate_Script — Finds all tables with key columns used in geocoder joins that are missing indexes on those columns and will output the SQL DDL to define the index for those tables.

Synopsis

```
text Missing_Indexes_Generate_Script();
```

Descripción

Finds all tables in `tiger` and `tiger_data` schemas with key columns used in geocoder joins that are missing indexes on those columns and will output the SQL DDL to define the index for those tables. This is a helper function that adds new indexes needed to make queries faster that may have been missing during the load process. As the geocoder is improved, this function will be updated to accommodate new indexes being used. If this function outputs nothing, it means all your tables have what we think are the key indexes already in place.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT missing_indexes_generate_script();
-- output: This was run on a database that was created before many corrections were made to ←
the loading script ---
CREATE INDEX idx_tiger_county_countyfp ON tiger.county USING btree(countyfp);
CREATE INDEX idx_tiger_cousub_countyfp ON tiger.cousub USING btree(countyfp);
CREATE INDEX idx_tiger_edges_tfidr ON tiger.edges USING btree(tfidr);
CREATE INDEX idx_tiger_edges_tfidl ON tiger.edges USING btree(tfidl);
CREATE INDEX idx_tiger_zip_lookup_all_zip ON tiger.zip_lookup_all USING btree(zip);
CREATE INDEX idx_tiger_data_ma_county_countyfp ON tiger_data.ma_county USING btree(countyfp ←
);
CREATE INDEX idx_tiger_data_ma_cousub_countyfp ON tiger_data.ma_cousub USING btree(countyfp ←
);
CREATE INDEX idx_tiger_data_ma_edges_countyfp ON tiger_data.ma_edges USING btree(countyfp);
CREATE INDEX idx_tiger_data_ma_faces_countyfp ON tiger_data.ma_faces USING btree(countyfp);
```

Ver también

[Loader_Generate_Script](#), [Install_Missing_Indexes](#)

14.2.13 Normalize_Address

Normalize_Address — Given a textual street address, returns a composite `norm_addy` type that has road suffix, prefix and type standardized, street, streetname etc. broken into separate fields. This function will work with just the lookup data packaged with the `tiger_geocoder` (no need for `tiger` census data).

Synopsis

```
norm_addy normalize_address(varchar in_address);
```


Descripción

Given a textual street address, returns a composite `norm_addy` type that has road suffix, prefix and type standardized, street, streetname etc. broken into separate fields. This is the first step in the geocoding process to get all addresses into normalized postal form. No other data is required aside from what is packaged with the geocoder.

This function just uses the various direction/state/suffix lookup tables preloaded with the `tiger_geocoder` and located in the `tiger` schema, so it doesn't need you to download tiger census data or any other additional data to make use of it. You may find the need to add more abbreviations or alternative namings to the various lookup tables in the `tiger` schema.

It uses various control lookup tables located in `tiger` schema to normalize the input address.

Fields in the `norm_addy` type object returned by this function in this order where () indicates a field required by the geocoder, [] indicates an optional field:

(address) [predirAbbrev] (streetName) [streetTypeAbbrev] [postdirAbbrev] [internal] [location] [stateAbbrev] [zip] [parsed] [zip4] [address_alphanumeric]

Enhanced: 2.4.0 `norm_addy` object includes additional fields `zip4` and `address_alphanumeric`.

1. `address` is an integer: The street number
2. `predirAbbrev` is varchar: Directional prefix of road such as N, S, E, W etc. These are controlled using the `direction_lookup` table.
3. `streetName` varchar
4. `streetTypeAbbrev` varchar abbreviated version of street type: e.g. St, Ave, Cir. These are controlled using the `street_type_lookup` table.
5. `postdirAbbrev` varchar abbreviated directional suffix of road N, S, E, W etc. These are controlled using the `direction_lookup` table.
6. `internal` varchar internal address such as an apartment or suite number.
7. `location` varchar usually a city or governing province.
8. `stateAbbrev` varchar two character US State. e.g MA, NY, MI. These are controlled by the `state_lookup` table.
9. `zip` varchar 5-digit zipcode. e.g. 02109.
10. `parsed` boolean - denotes if address was formed from normalize process. The `normalize_address` function sets this to true before returning the address.
11. `zip4` last 4 digits of a 9 digit zip code. Availability: PostGIS 2.4.0.
12. `address_alphanumeric` Full street number even if it has alpha characters like 17R. Parsing of this is better using [PgNormalizeAddress](#) function. Availability: PostGIS 2.4.0.

Ejemplos

Output select fields. Use [PprintAddy](#) if you want a pretty textual output.

```
SELECT address As orig, (g.na).streetname, (g.na).streettypeabbrev
FROM (SELECT address, normalize_address(address) As na
      FROM addresses_to_geocode) As g;
```

orig	streetname	streettypeabbrev
28 Capen Street, Medford, MA	Capen	St
124 Mount Auburn St, Cambridge, Massachusetts 02138	Mount Auburn	St
950 Main Street, Worcester, MA 01610	Main	St
529 Main Street, Boston MA, 02129	Main	St
77 Massachusetts Avenue, Cambridge, MA 02139	Massachusetts	Ave
25 Wizard of Oz, Walford, KS 99912323	Wizard of Oz	

Ver también

[Geocode](#), [Pprint_Addy](#)

14.2.14 Pagc_Normalize_Address

`Pagc_Normalize_Address` — Given a textual street address, returns a composite `norm_addy` type that has road suffix, prefix and type standardized, street, streetname etc. broken into separate fields. This function will work with just the lookup data packaged with the `tiger_geocoder` (no need for tiger census data). Requires `address_standardizer` extension.

Synopsis

```
norm_addy pagc_normalize_address(varchar in_address);
```

Descripción

Given a textual street address, returns a composite `norm_addy` type that has road suffix, prefix and type standardized, street, streetname etc. broken into separate fields. This is the first step in the geocoding process to get all addresses into normalized postal form. No other data is required aside from what is packaged with the geocoder.

This function just uses the various `pagc_*` lookup tables preloaded with the `tiger_geocoder` and located in the `tiger` schema, so it doesn't need you to download tiger census data or any other additional data to make use of it. You may find the need to add more abbreviations or alternative namings to the various lookup tables in the `tiger` schema.

It uses various control lookup tables located in `tiger` schema to normalize the input address.

Fields in the `norm_addy` type object returned by this function in this order where () indicates a field required by the geocoder, [] indicates an optional field:

There are slight variations in casing and formatting over the [Normalize_Address](#).

Disponibilidad: 2.1.0



This method needs `address_standardizer` extension.

(address) [predirAbbrev] (streetName) [streetTypeAbbrev] [postdirAbbrev] [internal] [location] [stateAbbrev] [zip]

The native standardaddr of `address_standardizer` extension is at this time a bit richer than `norm_addy` since its designed to support international addresses (including country). `standardaddr` equivalent fields are:

house_num, predir, name, suftype, sufdir, unit, city, state, postcode

Enhanced: 2.4.0 `norm_addy` object includes additional fields `zip4` and `address_alphanumeric`.

1. `address` is an integer: The street number
2. `predirAbbrev` is varchar: Directional prefix of road such as N, S, E, W etc. These are controlled using the `direction_lookup` table.
3. `streetName` varchar
4. `streetTypeAbbrev` varchar abbreviated version of street type: e.g. St, Ave, Cir. These are controlled using the `street_type_lookup` table.
5. `postdirAbbrev` varchar abbreviated directional suffice of road N, S, E, W etc. These are controlled using the `direction_lookup` table.
6. `internal` varchar internal address such as an apartment or suite number.
7. `location` varchar usually a city or governing province.
8. `stateAbbrev` varchar two character US State. e.g MA, NY, MI. These are controlled by the `state_lookup` table.

- 9. zip varchar 5-digit zipcode. e.g. 02109.
- 10. parsed boolean - denotes if address was formed from normalize process. The normalize_address function sets this to true before returning the address.
- 11. zip4 last 4 digits of a 9 digit zip code. Availability: PostGIS 2.4.0.
- 12. address_alphanumeric Full street number even if it has alpha characters like 17R. Parsing of this is better using [Pagc_Normalize_Address](#) function. Availability: PostGIS 2.4.0.

Ejemplos

Single call example

```
SELECT addy.*
FROM pagc_normalize_address('9000 E ROO ST STE 999, Springfield, CO') AS addy;
```

address	predirabbrev	streetname	streettypeabbrev	postdirabbrev	internal	
location	stateabbrev	zip	parsed			
9000	E	ROO	ST		SUITE 999	
SPRINGFIELD	CO		t			

Batch call. There are currently speed issues with the way postgis_tiger_geocoder wraps the address_standardizer. These will hopefully be resolved in later editions. To work around them, if you need speed for batch geocoding to call generate a normaddy in batch mode, you are encouraged to directly call the address_standardizer standardize_address function as shown below which is similar exercise to what we did in [Normalize_Address](#) that uses data created in [Geocode](#).

```
WITH g AS (SELECT address, ROW((sa).house_num, (sa).predir, (sa).name
, (sa).suftype, (sa).sufdir, (sa).unit , (sa).city, (sa).state, (sa).postcode, true)::
norm_addy As na
FROM (SELECT address, standardize_address('tiger.pagc_lex'
, 'tiger.pagc_gaz'
, 'tiger.pagc_rules', address) As sa
FROM addresses_to_geocode) As g)
SELECT address As orig, (g.na).streetname, (g.na).streettypeabbrev
FROM g;
```

orig	streetname	streettypeabbrev
529 Main Street, Boston MA, 02129	MAIN	ST
77 Massachusetts Avenue, Cambridge, MA 02139	MASSACHUSETTS	AVE
25 Wizard of Oz, Walaford, KS 99912323	WIZARD OF	
26 Capen Street, Medford, MA	CAPEN	ST
124 Mount Auburn St, Cambridge, Massachusetts 02138	MOUNT AUBURN	ST
950 Main Street, Worcester, MA 01610	MAIN	ST

Ver también

[Normalize_Address](#), [Geocode](#)

14.2.15 Pprint_Addy

Pprint_Addy — Given a norm_addy composite type object, returns a pretty print representation of it. Usually used in conjunction with normalize_address.

Synopsis

varchar **pprint_addy**(norm_addy in_addy);

Descripción

Given a `norm_addy` composite type object, returns a pretty print representation of it. No other data is required aside from what is packaged with the geocoder.

Usually used in conjunction with [Normalize_Address](#).

Ejemplos

Pretty print a single address

```
SELECT pprint_addy(normalize_address('202 East Fremont Street, Las Vegas, Nevada 89101'))
  As pretty_address;
      pretty_address
-----
202 E Fremont St, Las Vegas, NV 89101
```

Pretty print address a table of addresses

```
SELECT address As orig, pprint_addy(normalize_address(address)) As pretty_address
  FROM addresses_to_geocode;
```

orig	pretty_address
529 Main Street, Boston MA, 02129	529 Main St, Boston MA, 02129
77 Massachusetts Avenue, Cambridge, MA 02139	77 Massachusetts Ave, Cambridge, MA 02139
28 Capen Street, Medford, MA	28 Capen St, Medford, MA
124 Mount Auburn St, Cambridge, Massachusetts 02138	124 Mount Auburn St, Cambridge, MA 02138
950 Main Street, Worcester, MA 01610	950 Main St, Worcester, MA 01610

Ver también

[Normalize_Address](#)

14.2.16 Reverse_Geocode

Reverse_Geocode — Takes a geometry point in a known spatial ref sys and returns a record containing an array of theoretically possible addresses and an array of cross streets. If `include_strnum_range = true`, includes the street range in the cross streets.

Synopsis

record **Reverse_Geocode**(geometry pt, boolean include_strnum_range=false, geometry[] OUT intpt, norm_addy[] OUT addy, varchar[] OUT street);

Descripción

Takes a geometry point in a known spatial ref and returns a record containing an array of theoretically possible addresses and an array of cross streets. If include_strnum_range = true, includes the street range in the cross streets. include_strnum_range defaults to false if not passed in. Addresses are sorted according to which road a point is closest to so first address is most likely the right one.

Why do we say theoretical instead of actual addresses. The Tiger data doesn't have real addresses, but just street ranges. As such the theoretical address is an interpolated address based on the street ranges. Like for example interpolating one of my addresses returns a 26 Court St. and 26 Court Sq., though there is no such place as 26 Court Sq. This is because a point may be at a corner of 2 streets and thus the logic interpolates along both streets. The logic also assumes addresses are equally spaced along a street, which of course is wrong since you can have a municipal building taking up a good chunk of the street range and the rest of the buildings are clustered at the end.

Note: Hmm this function relies on Tiger data. If you have not loaded data covering the region of this point, then hmm you will get a record filled with NULLS.

Returned elements of the record are as follows:

- 1. `intpt` is an array of points: These are the center line points on the street closest to the input point. There are as many points as there are addresses.
- 2. `addy` is an array of `norm_addy` (normalized addresses): These are an array of possible addresses that fit the input point. The first one in the array is most likely. Generally there should be only one, except in the case when a point is at the corner of 2 or 3 streets, or the point is somewhere on the road and not off to the side.
- 3. `street` an array of `varchar`: These are cross streets (or the street) (streets that intersect or are the street the point is projected to be on).

Enhanced: 2.4.1 if optional `zcta5` dataset is loaded, the `reverse_geocode` function can resolve to state and zip even if the specific state data is not loaded. Refer to [Loader_Generate_Nation_Script](#) for details on loading `zcta5` data.

Disponibilidad: 2.0.0

Ejemplos

Example of a point at the corner of two streets, but closest to one. This is approximate location of MIT: 77 Massachusetts Ave, Cambridge, MA 02139 Note that although we don't have 3 streets, PostgreSQL will just return null for entries above our upper bound so safe to use. This includes street ranges

```
SELECT pprint_addy(r.addy[1]) As st1, pprint_addy(r.addy[2]) As st2, pprint_addy(r.addy[3]) ←
      As st3,
      array_to_string(r.street, ',') As cross_streets
FROM reverse_geocode(ST_GeomFromText('POINT(-71.093902 42.359446)',4269),true) As r ←
;
```

result	st1	st2	st3	cross_streets
	67 Massachusetts Ave, Cambridge, MA 02139			67 - 127 Massachusetts Ave,32 - 88 ← Vassar St

Here we choose not to include the address ranges for the cross streets and picked a location really really close to a corner of 2 streets thus could be known by two different addresses.

```
SELECT pprint_addy(r.addy[1]) As st1, pprint_addy(r.addy[2]) As st2,
pprint_addy(r.addy[3]) As st3, array_to_string(r.street, ',') As cross_str
FROM reverse_geocode(ST_GeomFromText('POINT(-71.06941 42.34225)',4269)) As r;
```

result

st1	st2	st3	cross_str
5 Bradford St, Boston, MA 02118	49 Waltham St, Boston, MA 02118		Waltham St

For this one we reuse our geocoded example from [Geocode](#) and we only want the primary address and at most 2 cross streets.

```
SELECT actual_addr, lon, lat, pprint_addy((rg).addy[1]) As int_addr1,
      (rg).street[1] As cross1, (rg).street[2] As cross2
FROM (SELECT address As actual_addr, lon, lat,
      reverse_geocode( ST_SetSRID(ST_Point(lon,lat),4326) ) As rg
      FROM addresses_to_geocode WHERE rating > -1) As foo;
```

actual_addr	int_addr1	lon	lat	↔	↔
cross2				cross1	
529 Main Street, Boston MA, 02129 Boston, MA 02129	Medford St	-71.07181	42.38359	527 Main St,	↔
77 Massachusetts Avenue, Cambridge, MA 02139 Massachusetts Ave, Cambridge, MA 02139	Vassar St	-71.09428	42.35988	77	↔
26 Capen Street, Medford, MA Medford, MA 02155	Capen St	-71.12377	42.41101	9 Edison Ave,	↔
124 Mount Auburn St, Cambridge, Massachusetts 02138 Rd, Cambridge, MA 02138	Mount Auburn St	-71.12304	42.37328	3 University	↔
950 Main Street, Worcester, MA 01610 Worcester, MA 01603	Main St	-71.82368	42.24956	3 Maywood St,	↔
	Maywood Pl				

Ver también

[Pprint_Addy](#), [Missing_Indexes_Generate_Script](#)

14.2.17 Topology_Load_Tiger

Topology_Load_Tiger — Loads a defined region of tiger data into a PostGIS Topology and transforming the tiger data to spatial reference of the topology and snapping to the precision tolerance of the topology.

Synopsis

text **Topology_Load_Tiger**(varchar topo_name, varchar region_type, varchar region_id);

Descripción

Loads a defined region of tiger data into a PostGIS Topology. The faces, nodes and edges are transformed to the spatial reference system of the target topology and points are snapped to the tolerance of the target topology. The created faces, nodes, edges maintain the same ids as the original Tiger data faces, nodes, edges so that datasets can be in the future be more easily reconciled with tiger data. Returns summary details about the process.

This would be useful for example for redistricting data where you require the newly formed polygons to follow the center lines of streets and for the resulting polygons not to overlap.

**Note**

This function relies on Tiger data as well as the installation of the PostGIS topology module. For more information, refer to Chapter 10 and Section 2.2.3. If you have not loaded data covering the region of interest, then no topology records will be created. This function will also fail if you have not created a topology using the topology functions.

**Note**

Most topology validation errors are a result of tolerance issues where after transformation the edges points don't quite line up or overlap. To remedy the situation you may want to increase or lower the precision if you get topology validation failures.

Required arguments:

1. `topo_name` The name of an existing PostGIS topology to load data into.
2. `region_type` The type of bounding region. Currently only `place` and `county` are supported. Plan is to have several more. This is the table to look into to define the region bounds. e.g `tiger.place`, `tiger.county`
3. `region_id` This is what TIGER calls the geoid. It is the unique identifier of the region in the table. For place it is the `plcidfp` column in `tiger.place`. For county it is the `cntyidfp` column in `tiger.county`

Disponibilidad: 2.0.0

Example: Boston, Massachusetts Topology

Create a topology for Boston, Massachusetts in Mass State Plane Feet (2249) with tolerance 0.25 feet and then load in Boston city tiger faces, edges, nodes.

```
SELECT topology.CreateTopology('topo_boston', 2249, 0.25);
createtopology
-----
15
-- 60,902 ms ~ 1 minute on windows 7 desktop running 9.1 (with 5 states tiger data loaded)
SELECT tiger.topology_load_tiger('topo_boston', 'place', '2507000');
-- topology_loader_tiger --
29722 edges holding in temporary. 11108 faces added. 1875 edges of faces added. 20576 ↔
nodes added.
19962 nodes contained in a face. 0 edge start end corrected. 31597 edges added.

-- 41 ms --
SELECT topology.TopologySummary('topo_boston');
-- topologysummary--
Topology topo_boston (15), SRID 2249, precision 0.25
20576 nodes, 31597 edges, 11109 faces, 0 topogeoms in 0 layers

-- 28,797 ms to validate yeh returned no errors --
SELECT * FROM
    topology.ValidateTopology('topo_boston');

      error      |   id1   |   id2
-----+-----+-----
```

Example: Suffolk, Massachusetts Topology

Create a topology for Suffolk, Massachusetts in Mass State Plane Meters (26986) with tolerance 0.25 meters and then load in Suffolk county tiger faces, edges, nodes.

```
SELECT topology.CreateTopology('topo_suffolk', 26986, 0.25);
-- this took 56,275 ms ~ 1 minute on Windows 7 32-bit with 5 states of tiger loaded
-- must have been warmed up after loading boston
SELECT tiger.topology_load_tiger('topo_suffolk', 'county', '25025');
-- topology_loader_tiger --
36003 edges holding in temporary. 13518 faces added. 2172 edges of faces added.
24761 nodes added. 24075 nodes contained in a face. 0 edge start end corrected. 38175 ←
edges added.
-- 31 ms --
SELECT topology.TopologySummary('topo_suffolk');
-- topologysummary--
Topology topo_suffolk (14), SRID 26986, precision 0.25
24761 nodes, 38175 edges, 13519 faces, 0 topogeoms in 0 layers

-- 33,606 ms to validate --
SELECT * FROM
    topology.ValidateTopology('topo_suffolk');

      error      |      id1      |      id2
-----+-----+-----
coincident nodes | 81045651 | 81064553
edge crosses node | 81045651 | 85737793
edge crosses node | 81045651 | 85742215
edge crosses node | 81045651 | 620628939
edge crosses node | 81064553 | 85697815
edge crosses node | 81064553 | 85728168
edge crosses node | 81064553 | 85733413
```

Ver también

[CreateTopology](#), [CreateTopoGeom](#), [TopologySummary](#), [ValidateTopology](#)

14.2.18 Set_Geocode_Setting

Set_Geocode_Setting — Sets a setting that affects behavior of geocoder functions.

Synopsis

text **Set_Geocode_Setting**(text setting_name, text setting_value);

Descripción

Sets value of specific setting stored in `tiger.geocode_settings` table. Settings allow you to toggle debugging of functions. Later plans will be to control rating with settings. Current list of settings are listed in [Get_Geocode_Setting](#).

Disponibilidad: 2.1.0

Example return debugging setting

If you run [Geocode](#) when this function is true, the NOTICE log will output timing and queries.

```
SELECT set_geocode_setting('debug_geocode_address', 'true') As result;
result
-----
true
```


Ver también[Get_Geocode_Setting](#)

Chapter 15

PostGIS Special Functions Index

15.1 PostGIS Aggregate Functions

The functions given below are spatial aggregate functions provided with PostGIS that can be used just like any other sql aggregate function such as sum, average.

- **ST_3DExtent** - Aggregate function that returns the 3D bounding box of geometries.
- **ST_3DUnion** - Perform 3D union.
- **ST_AsFlatGeobuf** - Return a FlatGeobuf representation of a set of rows.
- **ST_AsGeobuf** - Return a Geobuf representation of a set of rows.
- **ST_AsMVT** - Aggregate function returning a MVT representation of a set of rows.
- **ST_ClusterIntersecting** - Aggregate function that clusters the input geometries into connected sets.
- **ST_ClusterWithin** - Aggregate function that clusters the input geometries by separation distance.
- **ST_Extent** - Aggregate function that returns the bounding box of geometries.
- **ST_GeomCollFromText** - Creates a GeometryCollection or Multi* geometry from a set of geometries.
- **ST_MakeLine** - Crea una cadena de línea desde geometrías de punto, multipunto o de línea.
- **ST_MemUnion** - Aggregate function which unions geometries in a memory-efficient but slower way
- **ST_Polygonize** - Computes a collection of polygons formed from the linework of a set of geometries.
- **ST_SameAlignment** - Returns true if rasters have same skew, scale, spatial ref, and offset (pixels can be put on same grid without cutting into pixels) and false if they don't with notice detailing issue.
- **ST_Union** - Computes a geometry representing the point-set union of the input geometries.
- **TopoElementArray_Agg** - Devuelve un topoelementarray para un conjunto de element_id, matriz de tipo (topoelements).

15.2 PostGIS Window Functions

The functions given below are spatial window functions provided with PostGIS that can be used just like any other sql window function such as row_number(), lead(), lag(). All these require an SQL OVER() clause.

- **ST_ClusterDBSCAN** - Window function that returns a cluster id for each input geometry using the DBSCAN algorithm.
 - **ST_ClusterKMeans** - Window function that returns a cluster id for each input geometry using the K-means algorithm.
-

15.3 PostGIS SQL-MM Compliant Functions

The functions given below are PostGIS functions that conform to the SQL/MM 3 standard

- **ST_3DArea** - Computes area of 3D surface geometries. Will return 0 for solids. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 8.1, 10.5
- **ST_3DDWithin** - Tests if two 3D geometries are within a given 3D distance This method implements the SQL/MM specification. SQL-MM ?
- **ST_3DDifference** - Perform 3D difference This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
- **ST_3DDistance** - Returns the 3D cartesian minimum distance (based on spatial ref) between two geometries in projected units. This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3
- **ST_3DIntersection** - Perform 3D intersection This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
- **ST_3DIntersects** - Tests if two geometries spatially intersect in 3D - only for points, linestrings, polygons, polyhedral surface (area). This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
- **ST_3DLength** - Returns the 3D length of a linear geometry. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 7.1, 10.3
- **ST_3DPerimeter** - Returns the 3D perimeter of a polygonal geometry. This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3: 8.1, 10.5
- **ST_3DUnion** - Perform 3D union. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
- **ST_AddEdgeModFace** - Añada un nuevo borde y, si al hacerlo, divide una cara, modifica la cara original y añade una nueva cara. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalle de Rutina: X.3.13
- **ST_AddEdgeNewFaces** - Agrega un nuevo borde y, si al hacerlo divide una cara, se elimina la cara original y es reemplazada con dos nuevas caras. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.12
- **ST_AddIsoEdge** - Agrega un borde aislado definido por la geometría alinestring a una topología que conecta dos nodos aislados existentes anode y anothernode y devuelve el identificador de borde del nuevo borde. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de rutina: X.3.4
- **ST_AddIsoNode** - Agrega un nodo aislado a una cara de una topología y devuelve el identificador de nodo del nuevo nodo. Si la cara es nula, el nodo es creado de todas maneras. This method implements the SQL/MM specification. SQL-MM: Topo-Net Rutinas: X+1.3.1
- **ST_Area** - Returns the area of a polygonal geometry. This method implements the SQL/MM specification. SQL-MM 3: 8.1.2, 9.5.3
- **ST_AsBinary** - Return the OGC/ISO Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data. This method implements the SQL/MM specification. SQL-MM 3: 5.1.37
- **ST_AsGML** - Return the geometry as a GML version 2 or 3 element. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 17.2
- **ST_AsText** - Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata. This method implements the SQL/MM specification. SQL-MM 3: 5.1.25
- **ST_Boundary** - Devuelve el cierre del limite combinatorio de esta geometría. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.17
- **ST_Buffer** - Computes a geometry covering all points within a given distance from a geometry. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.30

- **ST_Centroid** - Returns the geometric center of a geometry. This method implements the SQL/MM specification. SQL-MM 3: 8.1.4, 9.5.5
 - **ST_ChangeEdgeGeom** - Cambia la forma de un borde sin afectar la estructura de la topología. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalle de Rutina X.3.6
 - **ST_Contains** - Tests if no points of B lie in the exterior of A, and A and B have at least one interior point in common. This method implements the SQL/MM specification. SQL-MM 3: 5.1.31
 - **ST_ConvexHull** - Computes the convex hull of a geometry. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.16
 - **ST_CoordDim** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry. This method implements the SQL/MM specification. SQL-MM 3: 5.1.3
 - **ST_CreateTopoGeo** - Agrega una colección de geometrías a una topología vacía dada y devuelve un mensaje que detalla el éxito. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de la rutina -- X.3.18
 - **ST_Crosses** - Tests if two geometries have some, but not all, interior points in common. This method implements the SQL/MM specification. SQL-MM 3: 5.1.29
 - **ST_CurveToLine** - Converts a geometry containing curves to a linear geometry. This method implements the SQL/MM specification. SQL-MM 3: 7.1.7
 - **ST_Difference** - Computes a geometry representing the part of geometry A that does not intersect geometry B. This method implements the SQL/MM specification. SQL-MM 3: 5.1.20
 - **ST_Dimension** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry. This method implements the SQL/MM specification. SQL-MM 3: 5.1.2
 - **ST_Disjoint** - Tests if two geometries are disjoint (they have no point in common). This method implements the SQL/MM specification. SQL-MM 3: 5.1.26
 - **ST_Distance** - Returns the distance between two geometry or geography values. This method implements the SQL/MM specification. SQL-MM 3: 5.1.23
 - **ST_EndPoint** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString. This method implements the SQL/MM specification. SQL-MM 3: 7.1.4
 - **ST_Envelope** - Devuelve una geometría que representa la caja en doble precisión (float8) de la geometría dada. This method implements the SQL/MM specification. SQL-MM 3: 5.1.19
 - **ST_Equals** - Tests if two geometries include the same set of points. This method implements the SQL/MM specification. SQL-MM 3: 5.1.24
 - **ST_ExteriorRing** - Devuelva el número de anillos interiores de una geometría poligonal. This method implements the SQL/MM specification. SQL-MM 3: 8.2.3, 8.3.3
 - **ST_GMLToSQL** - Devuelve un valor específico ST_Geometry desde una representación GML. Esto es un alias de ST_GeomFromGML. This method implements the SQL/MM specification. SQL-MM 3: 5.1.50 (excepto para soporte de curvas).
 - **ST_GeomCollFromText** - Hace una colección Geometry de la colección WKT con el SRID dado. Si no se da SRID, el valor predeterminado es 0. This method implements the SQL/MM specification.
 - **ST_GeomFromText** - Devuelve un valor específico de ST_Geometry desde una representación "Extended Well-Known Binary" (EWKB). This method implements the SQL/MM specification. SQL-MM 3: 5.1.40
 - **ST_GeomFromWKB** - Crea una instancia de geometría desde la representación de una geometría en "Well-Known Binary" (WKB) y un SRID opcional. This method implements the SQL/MM specification. SQL-MM 3: 5.1.41
 - **ST_GeometryFromText** - Devuelve un valor específico de ST_Geometry desde una representación "Well-Known Text" (WKT). Es un alias para ST_GeomFromText. This method implements the SQL/MM specification. SQL-MM 3: 5.1.40
 - **ST_GeometryN** - Devuelve el tipo de geometría del valor de ST_Geometry. This method implements the SQL/MM specification. SQL-MM 3: 9.1.5
-

- **ST_GeometryType** - Devuelve el tipo de geometría del valor de ST_Geometry. This method implements the SQL/MM specification. SQL-MM 3: 5.1.4
 - **ST_GetFaceEdges** - Devuelve un conjunto de bordes ordenados que ligan afase. This method implements the SQL/MM specification. SQL-MM 3 Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.5
 - **ST_GetFaceGeometry** - Devuelve el polígono en la topología dada con el identificador de la cara especificada. This method implements the SQL/MM specification. SQL-MM 3 Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.16
 - **ST_InitTopoGeo** - Crea un nuevo esquema de topología y registra este nuevo esquema en la tabla topology.topology y el resumen de los detalles del proceso. This method implements the SQL/MM specification. SQL-MM 3 Topo-Geo y Topo-Net 3: Detalles de la rutina: X.3.17
 - **ST_InteriorRingN** - Devuelva el número de anillos interiores de una geometría poligonal. This method implements the SQL/MM specification. SQL-MM 3: 8.2.6, 8.3.5
 - **ST_Intersection** - Computes a geometry representing the shared portion of geometries A and B. This method implements the SQL/MM specification. SQL-MM 3: 5.1.18
 - **ST_Intersects** - Tests if two geometries intersect (they have at least one point in common). This method implements the SQL/MM specification. SQL-MM 3: 5.1.27
 - **ST_IsClosed** - Devuelve TRUE si los puntos de inicio y final de una LINESTRING son coincidentes. Para superficies poliedricas si son cerradas (volumetricas). This method implements the SQL/MM specification. SQL-MM 3: 7.1.5, 9.3.3
 - **ST_IsEmpty** - Tests if a geometry is empty. This method implements the SQL/MM specification. SQL-MM 3: 5.1.7
 - **ST_IsRing** - Tests if a LineString is closed and simple. This method implements the SQL/MM specification. SQL-MM 3: 7.1.6
 - **ST_IsSimple** - Devuelve (TRUE) si la geometría no tiene puntos geométricos anómalos, como auto intersecciones o tangencias. This method implements the SQL/MM specification. SQL-MM 3: 5.1.8
 - **ST_IsValid** - Tests if a geometry is well-formed in 2D. This method implements the SQL/MM specification. SQL-MM 3: 5.1.9
 - **ST_Length** - Returns the 2D length of a linear geometry. This method implements the SQL/MM specification. SQL-MM 3: 7.1.2, 9.3.4
 - **ST_LineFromText** - Hace una geometría de la representación WKT con el SRID dado. Si SRID no se da, el valor predeterminado es 0. This method implements the SQL/MM specification. SQL-MM 3: 7.2.8
 - **ST_LineFromWKB** - Crea un LINESTRING desde un WKB con el SRID dado This method implements the SQL/MM specification. SQL-MM 3: 7.2.9
 - **ST_LinestringFromWKB** - Crea una geometría desde un WKB con el SRID dado. This method implements the SQL/MM specification. SQL-MM 3: 7.2.9
 - **ST_LocateAlong** - Returns the point(s) on a geometry that match a measure value. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1.13
 - **ST_LocateBetween** - Returns the portions of a geometry that match a measure range. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 5.1
 - **ST_M** - Returns the M coordinate of a Point. This method implements the SQL/MM specification.
 - **ST_MLineFromText** - Devuelve un valor especificado ST_MultiLineString desde una representación WKT. This method implements the SQL/MM specification. SQL-MM 3: 9.4.4
 - **ST_MPointFromText** - Hace una geometría desde un WKT con el SRID dado. Si no se da un SRID, el valor predeterminado es 0. This method implements the SQL/MM specification. SQL-MM 3: 9.2.4
 - **ST_MPolyFromText** - Hace una Geometría MultiPolygon desde un WKT con el SRID dado. Si no se da SRID, el valor predeterminado es 0. This method implements the SQL/MM specification. SQL-MM 3: 9.6.4
-

- **ST_ModEdgeHeal** - Cura dos aristas eliminando el nodo que las conecta, modificando la primera arista y eliminando la segunda arista. Devuelve el identificador del nodo eliminado. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.9
 - **ST_ModEdgeSplit** - Dividir un borde creando un nuevo nodo a lo largo de un borde existente, modificando el borde original y agregando un nuevo borde. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.9
 - **ST_MoveIsoNode** - Mueve un nodo aislado en una topología de un punto a otro. Si la nueva geometría apoint existe como nodo se lanza un error. Devuelve la descripción del movimiento. This method implements the SQL/MM specification. SQL-MM: Topo-Net Rutina: X.3.2
 - **ST_NewEdgeHeal** - Cura dos aristas eliminando el nodo que las conecta, eliminando ambas aristas y sustituyéndolas por una arista cuya dirección sea la misma que la primera arista proporcionada. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.9
 - **ST_NewEdgesSplit** - Divide un borde creando un nuevo nodo a lo largo de un borde existente, eliminando el borde original y reemplazandolo con dos bordes nuevos. Devuelve el identificador del nuevo nodo creado que une los nuevos bordes. This method implements the SQL/MM specification. SQL-MM: Topo-Net Rutina: X.3.8
 - **ST_NumGeometries** - Devuelve el numero de puntos en la geometría. Funciona con todas las geometrías. This method implements the SQL/MM specification. SQL-MM 3: 9.1.4
 - **ST_NumInteriorRings** - Devuelva el número de anillos interiores de una geometría poligonal. This method implements the SQL/MM specification. SQL-MM 3: 8.2.5
 - **ST_NumPatches** - Devuelve el número de caras en una superficie poliédrica. Devolverá nulo para geometrías no poliédricas. This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3: 8.5
 - **ST_NumPoints** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString. This method implements the SQL/MM specification. SQL-MM 3: 7.2.4
 - **ST_OrderingEquals** - Tests if two geometries represent the same geometry and have points in the same directional order. This method implements the SQL/MM specification. SQL-MM 3: 5.1.43
 - **ST_Overlaps** - Tests if two geometries intersect and have the same dimension, but are not completely contained by each other. This method implements the SQL/MM specification. SQL-MM 3: 5.1.32
 - **ST_PatchN** - Devuelve el tipo de geometría del valor de ST_Geometry. This method implements the SQL/MM specification. SQL-MM ISO/IEC 13249-3: 8.5
 - **ST_Perimeter** - Returns the length of the boundary of a polygonal geometry or geography. This method implements the SQL/MM specification. SQL-MM 3: 8.1.3, 9.5.4
 - **ST_Point** - Creates a Point with X, Y and SRID values. This method implements the SQL/MM specification. SQL-MM 3: 6.1.2
 - **ST_PointFromText** - Crea una geometría puntual desde un WKT con el SRID dado. Si no se especifica el SRID por defecto será unknown. This method implements the SQL/MM specification. SQL-MM 3: 6.1.8
 - **ST_PointFromWKB** - Crea una geometría desde un WKB con el SRID dado. This method implements the SQL/MM specification. SQL-MM 3: 6.1.9
 - **ST_PointN** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString. This method implements the SQL/MM specification. SQL-MM 3: 7.2.5, 7.3.5
 - **ST_PointOnSurface** - Computes a point guaranteed to lie in a polygon, or on a geometry. This method implements the SQL/MM specification. SQL-MM 3: 8.1.5, 9.5.6. The specifications define ST_PointOnSurface for surface geometries only. PostGIS extends the function to support all common geometry types. Other databases (Oracle, DB2, ArcSDE) seem to support this function only for surfaces. SQL Server 2008 supports all common geometry types.
 - **ST_Polygon** - Creates a Polygon from a LineString with a specified SRID. This method implements the SQL/MM specification. SQL-MM 3: 8.3.2
-

- **ST_PolygonFromText** - Hace una geometría desde un WKT con el SRID dado. Si no se da un SRID, el valor predeterminado es 0. This method implements the SQL/MM specification. SQL-MM 3: 8.3.6
 - **ST_Relate** - Tests if two geometries have a topological relationship matching an Intersection Matrix pattern, or computes their Intersection Matrix This method implements the SQL/MM specification. SQL-MM 3: 5.1.25
 - **ST_RemEdgeModFace** - Elimina un borde y, si el borde eliminado separa dos caras, elimina una de ellas y modifica la otra para tomar el espacio de ambas. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.15
 - **ST_RemEdgeNewFace** - Elimina un borde y, si el borde eliminado separa dos caras, borra las caras originales y las reemplaza con una nueva cara. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X.3.14
 - **ST_RemoveIsoEdge** - Elimina un borde aislado y devuelve la descripción de la acción. Si el borde no está aislado, se lanza una excepción. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X+1.3.3
 - **ST_RemoveIsoNode** - Elimina un nodo aislado y devuelve la descripción de la acción. Si el nodo no está aislado (es el inicio o el final de un borde), entonces se lanza una excepción. This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detalles de Rutina: X+1.3.3
 - **ST_SRID** - Returns the spatial reference identifier for a geometry. This method implements the SQL/MM specification. SQL-MM 3: 5.1.5
 - **ST_StartPoint** - Returns the first point of a LineString. This method implements the SQL/MM specification. SQL-MM 3: 7.1.3
 - **ST_SymDifference** - Computes a geometry representing the portions of geometries A and B that do not intersect. This method implements the SQL/MM specification. SQL-MM 3: 5.1.21
 - **ST_Touches** - Tests if two geometries have at least one point in common, but their interiors do not intersect. This method implements the SQL/MM specification. SQL-MM 3: 5.1.28
 - **ST_Transform** - Return a new geometry with coordinates transformed to a different spatial reference system. This method implements the SQL/MM specification. SQL-MM 3: 5.1.6
 - **ST_Union** - Computes a geometry representing the point-set union of the input geometries. This method implements the SQL/MM specification. SQL-MM 3: 5.1.19 the z-index (elevation) when polygons are involved.
 - **ST_Volume** - Computes the volume of a 3D solid. If applied to surface (even closed) geometries will return 0. This method implements the SQL/MM specification. SQL-MM IEC 13249-3: 9.1 (same as ST_3DVolume)
 - **ST_WKBToSQL** - Devuelve un valor específico de ST_Geometry desde una representación "Well-Known Binary" (WKB). Es un alias para ST_GeomFromWKB que no toma srid This method implements the SQL/MM specification. SQL-MM 3: 5.1.36
 - **ST_WKTToSQL** - Devuelve un valor específico de ST_Geometry desde una representación "Well-Known Text" (WKT). Es un alias para ST_GeomFromText This method implements the SQL/MM specification. SQL-MM 3: 5.1.34
 - **ST_Within** - Tests if no points of A lie in the exterior of B, and A and B have at least one interior point in common. This method implements the SQL/MM specification. SQL-MM 3: 5.1.30
 - **ST_X** - Returns the X coordinate of a Point. This method implements the SQL/MM specification. SQL-MM 3: 6.1.3
 - **ST_Y** - Returns the Y coordinate of a Point. This method implements the SQL/MM specification. SQL-MM 3: 6.1.4
 - **ST_Z** - Returns the Z coordinate of a Point. This method implements the SQL/MM specification.
 - **TG_ST_SRID** - Returns the spatial reference identifier for a topogeometry. This method implements the SQL/MM specification. SQL-MM 3: 14.1.5
-

15.4 PostGIS Geography Support Functions

The functions and operators given below are PostGIS functions/operators that take as input or return as output a **geography** data type object.



Note

Functions with a (T) are not native geodetic functions, and use a ST_Transform call to and from geometry to do the operation. As a result, they may not behave as expected when going over dateline, poles, and for large geometries or geometry pairs that cover more than one UTM zone. Basic transform - (favoring UTM, Lambert Azimuthal (North/South), and falling back on mercator in worst case scenario)

- **ST_Area** - Returns the area of a polygonal geometry.
- **ST_AsBinary** - Return the OGC/ISO Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- **ST_AsEWKT** - Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.
- **ST_AsGML** - Return the geometry as a GML version 2 or 3 element.
- **ST_AsGeoJSON** - Return a geometry as a GeoJSON element.
- **ST_AsKML** - Return the geometry as a KML element.
- **ST_AsSVG** - Returns SVG path data for a geometry.
- **ST_AsText** - Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.
- **ST_Azimuth** - Returns the north-based azimuth of a line between two points.
- **ST_Buffer** - Computes a geometry covering all points within a given distance from a geometry.
- **ST_Centroid** - Returns the geometric center of a geometry.
- **ST_CoveredBy** - Tests if no point in A is outside B
- **ST_Covers** - Tests if no point in B is outside A
- **ST_DWithin** - Tests if two geometries are within a given distance
- **ST_Distance** - Returns the distance between two geometry or geography values.
- **ST_GeogFromText** - Devuelve un valor específico "geography" desde una representación "Well-Known Text" (WKT) o extendida.
- **ST_GeogFromWKB** - Crea una instancia "geography" desde la representación de una geometría en "Well-Known Binary" (WKB) o "Extended Well-Known Binary" (EWKB).
- **ST_GeographyFromText** - Devuelve un valor específico "geography" desde una representación "Well-Known Text" (WKT) o extendida.
- **=** - Returns TRUE if the coordinates and coordinate order geometry/geography A are the same as the coordinates and coordinate order of geometry/geography B.
- **ST_Intersection** - Computes a geometry representing the shared portion of geometries A and B.
- **ST_Intersects** - Tests if two geometries intersect (they have at least one point in common).
- **ST_Length** - Returns the 2D length of a linear geometry.
- **ST_Perimeter** - Returns the length of the boundary of a polygonal geometry or geography.
- **ST_Project** - Returns a point projected from a start point by a distance and bearing (azimuth).

- **ST_Segmentize** - Devuelve una geometry/geography modificada que no tenga un segmento mayor que la distancia dada.
- **ST_Summary** - Devuelve un resumen de texto del contenido de la geometría.
- **<->** - Returns the 2D distance between A and B.
- **&&** - Returns TRUE if A's 2D bounding box intersects B's 2D bounding box.

15.5 PostGIS Raster Support Functions

The functions and operators given below are PostGIS functions/operators that take as input or return as output a **raster** data type object. Listed in alphabetical order.

- **Box3D** - Returns the box 3d representation of the enclosing box of the raster.
- **@** - Returns TRUE if A's bounding box is contained by B's. Uses double precision bounding box.
- **~** - Returns TRUE if A's bounding box is contains B's. Uses double precision bounding box.
- **=** - Returns TRUE if A's bounding box is the same as B's. Uses double precision bounding box.
- **&&** - Returns TRUE if A's bounding box intersects B's bounding box.
- **&<** - Returns TRUE if A's bounding box is to the left of B's.
- **&>** - Returns TRUE if A's bounding box is to the right of B's.
- **~=** - Returns TRUE if A's bounding box is the same as B's.
- **ST_Retile** - Return a set of configured tiles from an arbitrarily tiled raster coverage.
- **ST_AddBand** - Returns a raster with the new band(s) of given type added with given initial value in the given index location. If no index is specified, the band is added to the end.
- **ST_AsBinary/ST_AsWKB** - Return the Well-Known Binary (WKB) representation of the raster.
- **ST_AsGDALRaster** - Return the raster tile in the designated GDAL Raster format. Raster formats are one of those supported by your compiled library. Use ST_GDALDrivers() to get a list of formats supported by your library.
- **ST_AsHexWKB** - Return the Well-Known Binary (WKB) in Hex representation of the raster.
- **ST_AsJPEG** - Return the raster tile selected bands as a single Joint Photographic Exports Group (JPEG) image (byte array). If no band is specified and 1 or more than 3 bands, then only the first band is used. If only 3 bands then all 3 bands are used and mapped to RGB.
- **ST_AsPNG** - Return the raster tile selected bands as a single portable network graphics (PNG) image (byte array). If 1, 3, or 4 bands in raster and no bands are specified, then all bands are used. If more 2 or more than 4 bands and no bands specified, then only band 1 is used. Bands are mapped to RGB or RGBA space.
- **ST_AsRaster** - Converts a PostGIS geometry to a PostGIS raster.
- **ST_AsTIFF** - Return the raster selected bands as a single TIFF image (byte array). If no band is specified or any of specified bands does not exist in the raster, then will try to use all bands.
- **ST_Aspect** - Returns the aspect (in degrees by default) of an elevation raster band. Useful for analyzing terrain.
- **ST_Band** - Returns one or more bands of an existing raster as a new raster. Useful for building new rasters from existing rasters.
- **ST_BandFileSize** - Returns the file size of a band stored in file system. If no bandnum specified, 1 is assumed.
- **ST_BandFileTimestamp** - Returns the file timestamp of a band stored in file system. If no bandnum specified, 1 is assumed.
- **ST_BandIsNoData** - Returns true if the band is filled with only nodata values.

- **ST_BandMetaData** - Returns basic meta data for a specific raster band. band num 1 is assumed if none-specified.
 - **ST_BandNoDataValue** - Returns the value in a given band that represents no data. If no band num 1 is assumed.
 - **ST_BandPath** - Returns system file path to a band stored in file system. If no bandnum specified, 1 is assumed.
 - **ST_BandPixelType** - Returns the type of pixel for given band. If no bandnum specified, 1 is assumed.
 - **ST_Clip** - Returns the raster clipped by the input geometry. If band number not is specified, all bands are processed. If crop is not specified or TRUE, the output raster is cropped.
 - **ST_ColorMap** - Creates a new raster of up to four 8BUI bands (grayscale, RGB, RGBA) from the source raster and a specified band. Band 1 is assumed if not specified.
 - **ST_Contains** - Return true if no points of raster rastB lie in the exterior of raster rastA and at least one point of the interior of rastB lies in the interior of rastA.
 - **ST_ContainsProperly** - Return true if rastB intersects the interior of rastA but not the boundary or exterior of rastA.
 - **ST_Contour** - Generates a set of vector contours from the provided raster band, using the GDAL contouring algorithm.
 - **ST_ConvexHull** - Return the convex hull geometry of the raster including pixel values equal to BandNoDataValue. For regular shaped and non-skewed rasters, this gives the same result as ST_Envelope so only useful for irregularly shaped or skewed rasters.
 - **ST_Count** - Returns the number of pixels in a given band of a raster or raster coverage. If no band is specified defaults to band 1. If exclude_nodata_value is set to true, will only count pixels that are not equal to the nodata value.
 - **ST_CountAgg** - Aggregate. Returns the number of pixels in a given band of a set of rasters. If no band is specified defaults to band 1. If exclude_nodata_value is set to true, will only count pixels that are not equal to the NODATA value.
 - **ST_CoveredBy** - Return true if no points of raster rastA lie outside raster rastB.
 - **ST_Covers** - Return true if no points of raster rastB lie outside raster rastA.
 - **ST_DFullyWithin** - Return true if rasters rastA and rastB are fully within the specified distance of each other.
 - **ST_DWithin** - Return true if rasters rastA and rastB are within the specified distance of each other.
 - **ST_Disjoint** - Return true if raster rastA does not spatially intersect rastB.
 - **ST_DumpAsPolygons** - Returns a set of geomval (geom,val) rows, from a given raster band. If no band number is specified, band num defaults to 1.
 - **ST_DumpValues** - Get the values of the specified band as a 2-dimension array.
 - **ST_Envelope** - Returns the polygon representation of the extent of the raster.
 - **ST_FromGDALRaster** - Returns a raster from a supported GDAL raster file.
 - **ST_GeoReference** - Returns the georeference meta data in GDAL or ESRI format as commonly seen in a world file. Default is GDAL.
 - **ST_Grayscale** - Creates a new one-8BUI band raster from the source raster and specified bands representing Red, Green and Blue
 - **ST_HasNoBand** - Returns true if there is no band with given band number. If no band number is specified, then band number 1 is assumed.
 - **ST_Height** - Returns the height of the raster in pixels.
 - **ST_HillShade** - Returns the hypothetical illumination of an elevation raster band using provided azimuth, altitude, brightness and scale inputs.
 - **ST_Histogram** - Returns a set of record summarizing a raster or raster coverage data distribution separate bin ranges. Number of bins are autocomputed if not specified.
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- **ST_InterpolateRaster** - Interpolates a gridded surface based on an input set of 3-d points, using the X- and Y-values to position the points on the grid and the Z-value of the points as the surface elevation.
- **ST_Intersection** - Returns a raster or a set of geometry-pixelvalue pairs representing the shared portion of two rasters or the geometrical intersection of a vectorization of the raster and a geometry.
- **ST_Intersects** - Return true if raster rastA spatially intersects raster rastB.
- **ST_IsEmpty** - Returns true if the raster is empty (width = 0 and height = 0). Otherwise, returns false.
- **ST_MakeEmptyCoverage** - Cover georeferenced area with a grid of empty raster tiles.
- **ST_MakeEmptyRaster** - Returns an empty raster (having no bands) of given dimensions (width & height), upperleft X and Y, pixel size and rotation (scalex, scaley, skewx & skewy) and reference system (srid). If a raster is passed in, returns a new raster with the same size, alignment and SRID. If srid is left out, the spatial ref is set to unknown (0).
- **ST_MapAlgebra (callback function version)** - Callback function version - Returns a one-band raster given one or more input rasters, band indexes and one user-specified callback function.
- **ST_MapAlgebraExpr** - 1 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified.
- **ST_MapAlgebraExpr** - 2 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the two input raster bands and of pixeltype provided. band 1 of each raster is assumed if no band numbers are specified. The resulting raster will be aligned (scale, skew and pixel corners) on the grid defined by the first raster and have its extent defined by the "extenttype" parameter. Values for "extenttype" can be: INTERSECTION, UNION, FIRST, SECOND.
- **ST_MapAlgebraFct** - 1 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified.
- **ST_MapAlgebraFct** - 2 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the 2 input raster bands and of pixeltype provided. Band 1 is assumed if no band is specified. Extent type defaults to INTERSECTION if not specified.
- **ST_MapAlgebraFctNgb** - 1-band version: Map Algebra Nearest Neighbor using user-defined PostgreSQL function. Return a raster which values are the result of a PLPGSQL user function involving a neighborhood of values from the input raster band.
- **ST_MapAlgebra (expression version)** - Expression version - Returns a one-band raster given one or two input rasters, band indexes and one or more user-specified SQL expressions.
- **ST_MemSize** - Returns the amount of space (in bytes) the raster takes.
- **ST_MetaData** - Returns basic meta data about a raster object such as pixel size, rotation (skew), upper, lower left, etc.
- **ST_MinConvexHull** - Return the convex hull geometry of the raster excluding NODATA pixels.
- **ST_NearestValue** - Returns the nearest non-NODATA value of a given band's pixel specified by a columnx and rowy or a geometric point expressed in the same spatial reference coordinate system as the raster.
- **ST_Neighborhood** - Returns a 2-D double precision array of the non-NODATA values around a given band's pixel specified by either a columnX and rowY or a geometric point expressed in the same spatial reference coordinate system as the raster.
- **ST_NotSameAlignmentReason** - Returns text stating if rasters are aligned and if not aligned, a reason why.
- **ST_NumBands** - Returns the number of bands in the raster object.
- **ST_Overlaps** - Return true if raster rastA and rastB intersect but one does not completely contain the other.
- **ST_PixelAsCentroid** - Returns the centroid (point geometry) of the area represented by a pixel.
- **ST_PixelAsCentroids** - Returns the centroid (point geometry) for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The point geometry is the centroid of the area represented by a pixel.
- **ST_PixelAsPoint** - Returns a point geometry of the pixel's upper-left corner.

- **ST_PixelAsPoints** - Returns a point geometry for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The coordinates of the point geometry are of the pixel's upper-left corner.
 - **ST_PixelAsPolygon** - Returns the polygon geometry that bounds the pixel for a particular row and column.
 - **ST_PixelAsPolygons** - Returns the polygon geometry that bounds every pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel.
 - **ST_PixelHeight** - Returns the pixel height in geometric units of the spatial reference system.
 - **ST_PixelOfValue** - Get the columnx, rowy coordinates of the pixel whose value equals the search value.
 - **ST_PixelWidth** - Returns the pixel width in geometric units of the spatial reference system.
 - **ST_Polygon** - Returns a multipolygon geometry formed by the union of pixels that have a pixel value that is not no data value. If no band number is specified, band num defaults to 1.
 - **ST_Quantile** - Compute quantiles for a raster or raster table coverage in the context of the sample or population. Thus, a value could be examined to be at the raster's 25%, 50%, 75% percentile.
 - **ST_RastFromHexWKB** - Return a raster value from a Hex representation of Well-Known Binary (WKB) raster.
 - **ST_RastFromWKB** - Return a raster value from a Well-Known Binary (WKB) raster.
 - **ST_RasterToWorldCoord** - Returns the raster's upper left corner as geometric X and Y (longitude and latitude) given a column and row. Column and row starts at 1.
 - **ST_RasterToWorldCoordX** - Returns the geometric X coordinate upper left of a raster, column and row. Numbering of columns and rows starts at 1.
 - **ST_RasterToWorldCoordY** - Returns the geometric Y coordinate upper left corner of a raster, column and row. Numbering of columns and rows starts at 1.
 - **ST_Reclass** - Creates a new raster composed of band types reclassified from original. The nband is the band to be changed. If nband is not specified assumed to be 1. All other bands are returned unchanged. Use case: convert a 16BUI band to a 8BUI and so forth for simpler rendering as viewable formats.
 - **ST_Resample** - Resample a raster using a specified resampling algorithm, new dimensions, an arbitrary grid corner and a set of raster georeferencing attributes defined or borrowed from another raster.
 - **ST_Rescale** - Resample a raster by adjusting only its scale (or pixel size). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.
 - **ST_Resize** - Resize a raster to a new width/height
 - **ST_Reskew** - Resample a raster by adjusting only its skew (or rotation parameters). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.
 - **ST_Rotation** - Returns the rotation of the raster in radian.
 - **ST_Roughness** - Returns a raster with the calculated "roughness" of a DEM.
 - **ST_SRID** - Returns the spatial reference identifier of the raster as defined in spatial_ref_sys table.
 - **ST_SameAlignment** - Returns true if rasters have same skew, scale, spatial ref, and offset (pixels can be put on same grid without cutting into pixels) and false if they don't with notice detailing issue.
 - **ST_ScaleX** - Returns the X component of the pixel width in units of coordinate reference system.
 - **ST_ScaleY** - Returns the Y component of the pixel height in units of coordinate reference system.
 - **ST_SetBandIndex** - Update the external band number of an out-db band
 - **ST_SetBandIsNoData** - Sets the isnodata flag of the band to TRUE.
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- **ST_SetBandNoDataValue** - Sets the value for the given band that represents no data. Band 1 is assumed if no band is specified. To mark a band as having no nodata value, set the nodata value = NULL.
 - **ST_SetBandPath** - Update the external path and band number of an out-db band
 - **ST_SetGeoReference** - Set Georeference 6 georeference parameters in a single call. Numbers should be separated by white space. Accepts inputs in GDAL or ESRI format. Default is GDAL.
 - **ST_SetM** - Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimension using the requested resample algorithm.
 - **ST_SetRotation** - Set the rotation of the raster in radian.
 - **ST_SetSRID** - Sets the SRID of a raster to a particular integer srid defined in the spatial_ref_sys table.
 - **ST_SetScale** - Sets the X and Y size of pixels in units of coordinate reference system. Number units/pixel width/height.
 - **ST_SetSkew** - Sets the georeference X and Y skew (or rotation parameter). If only one is passed in, sets X and Y to the same value.
 - **ST_SetUpperLeft** - Sets the value of the upper left corner of the pixel of the raster to projected X and Y coordinates.
 - **ST_SetValue** - Returns modified raster resulting from setting the value of a given band in a given columnx, rowy pixel or the pixels that intersect a particular geometry. Band numbers start at 1 and assumed to be 1 if not specified.
 - **ST_SetValues** - Returns modified raster resulting from setting the values of a given band.
 - **ST_SetZ** - Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimension using the requested resample algorithm.
 - **ST_SkewX** - Returns the georeference X skew (or rotation parameter).
 - **ST_SkewY** - Returns the georeference Y skew (or rotation parameter).
 - **ST_Slope** - Returns the slope (in degrees by default) of an elevation raster band. Useful for analyzing terrain.
 - **ST_SnapToGrid** - Resample a raster by snapping it to a grid. New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.
 - **ST_Summary** - Returns a text summary of the contents of the raster.
 - **ST_SummaryStats** - Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. Band 1 is assumed is no band is specified.
 - **ST_SummaryStatsAgg** - Aggregate. Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a set of raster. Band 1 is assumed is no band is specified.
 - **ST_TPI** - Returns a raster with the calculated Topographic Position Index.
 - **ST_TRI** - Returns a raster with the calculated Terrain Ruggedness Index.
 - **ST_Tile** - Returns a set of rasters resulting from the split of the input raster based upon the desired dimensions of the output rasters.
 - **ST_Touches** - Return true if raster rastA and rastB have at least one point in common but their interiors do not intersect.
 - **ST_Transform** - Reprojects a raster in a known spatial reference system to another known spatial reference system using specified resampling algorithm. Options are NearestNeighbor, Bilinear, Cubic, CubicSpline, Lanczos defaulting to NearestNeighbor.
 - **ST_Union** - Returns the union of a set of raster tiles into a single raster composed of 1 or more bands.
 - **ST_UpperLeftX** - Returns the upper left X coordinate of raster in projected spatial ref.
 - **ST_UpperLeftY** - Returns the upper left Y coordinate of raster in projected spatial ref.
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- **ST_Value** - Returns the value of a given band in a given columnx, rowy pixel or at a particular geometric point. Band numbers start at 1 and assumed to be 1 if not specified. If `exclude_nodata_value` is set to false, then all pixels include nodata pixels are considered to intersect and return value. If `exclude_nodata_value` is not passed in then reads it from metadata of raster.
- **ST_ValueCount** - Returns a set of records containing a pixel band value and count of the number of pixels in a given band of a raster (or a raster coverage) that have a given set of values. If no band is specified defaults to band 1. By default nodata value pixels are not counted, and all other values in the pixel are output and pixel band values are rounded to the nearest integer.
- **ST_Width** - Returns the width of the raster in pixels.
- **ST_Within** - Return true if no points of raster `rastA` lie in the exterior of raster `rastB` and at least one point of the interior of `rastA` lies in the interior of `rastB`.
- **ST_WorldToRasterCoord** - Returns the upper left corner as column and row given geometric X and Y (longitude and latitude) or a point geometry expressed in the spatial reference coordinate system of the raster.
- **ST_WorldToRasterCoordX** - Returns the column in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw) represented in world spatial reference system of raster.
- **ST_WorldToRasterCoordY** - Returns the row in the raster of the point geometry (pt) or a X and Y world coordinate (xw, yw) represented in world spatial reference system of raster.
- **UpdateRasterSRID** - Change the SRID of all rasters in the user-specified column and table.

15.6 PostGIS Geometry / Geography / Raster Dump Functions

The functions given below are PostGIS functions that take as input or return as output a set of or single **geometry_dump** or **geomval** data type object.

- **ST_DumpAsPolygons** - Returns a set of **geomval** (geom,val) rows, from a given raster band. If no band number is specified, band num defaults to 1.
- **ST_Intersection** - Returns a raster or a set of geometry-pixelvalue pairs representing the shared portion of two rasters or the geometrical intersection of a vectorization of the raster and a geometry.

15.7 PostGIS Box Functions

The functions given below are PostGIS functions that take as input or return as output the `box*` family of PostGIS spatial types. The box family of types consists of **box2d**, and **box3d**

- **Box2D** - Returns a BOX2D representing the 2D extent of a geometry.
- **Box3D** - Returns a BOX3D representing the 3D extent of a geometry.
- **Box3D** - Returns the box 3d representation of the enclosing box of the raster.
- **ST_3DExtent** - Aggregate function that returns the 3D bounding box of geometries.
- **ST_3DMakeBox** - Creates a BOX3D defined by two 3D point geometries.
- **ST_AsMVTGeom** - Transforms a geometry into the coordinate space of a MVT tile.
- **ST_AsTWKB** - Returns the geometry as TWKB, aka "Tiny Well-Known Binary"
- **ST_Box2dFromGeoHash** - Devuelve un BOX2D de una cadena de GeoHash.
- **ST_ClipByBox2D** - Computes the portion of a geometry falling within a rectangle.
- **ST_EstimatedExtent** - Returns the estimated extent of a spatial table.

- **ST_Expand** - Returns a bounding box expanded from another bounding box or a geometry.
- **ST_Extent** - Aggregate function that returns the bounding box of geometries.
- **ST_MakeBox2D** - Creates a BOX2D defined by two 2D point geometries.
- **ST_XMax** - Returns the X maxima of a 2D or 3D bounding box or a geometry.
- **ST_XMin** - Returns the X minima of a 2D or 3D bounding box or a geometry.
- **ST_YMax** - Returns the Y maxima of a 2D or 3D bounding box or a geometry.
- **ST_YMin** - Returns the Y minima of a 2D or 3D bounding box or a geometry.
- **ST_ZMax** - Returns the Z maxima of a 2D or 3D bounding box or a geometry.
- **ST_ZMin** - Returns the Z minima of a 2D or 3D bounding box or a geometry.
- **RemoveUnusedPrimitives** - Removes topology primitives which not needed to define existing TopoGeometry objects.
- **ValidateTopology** - Devuelve un conjunto de objetos validate_topology_return_type que detallan problemas con la topología.
- **~(box2df,box2df)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) contains another 2D float precision bounding box (BOX2DF).
- **~(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) contains a geometry's 2D bonding box.
- **~(geometry,box2df)** - Returns TRUE if a geometry's 2D bonding box contains a 2D float precision bounding box (BOX2DF).
- **@(box2df,box2df)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into another 2D float precision bounding box.
- **@(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into a geometry's 2D bounding box.
- **@(geometry,box2df)** - Returns TRUE if a geometry's 2D bounding box is contained into a 2D float precision bounding box (BOX2DF).
- **&&(box2df,box2df)** - Returns TRUE if two 2D float precision bounding boxes (BOX2DF) intersect each other.
- **&&(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) intersects a geometry's (cached) 2D bounding box.
- **&&(geometry,box2df)** - Returns TRUE if a geometry's (cached) 2D bounding box intersects a 2D float precision bounding box (BOX2DF).

15.8 PostGIS Functions that support 3D

The functions given below are PostGIS functions that do not throw away the Z-Index.

- **AddGeometryColumn** - Suprime una columna de geometrías de una tabla espacial.
- **Box3D** - Returns a BOX3D representing the 3D extent of a geometry.
- **DropGeometryColumn** - Suprime una columna de geometrías de una tabla espacial.
- **GeometryType** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **ST_3DArea** - Computes area of 3D surface geometries. Will return 0 for solids.
- **ST_3DClosestPoint** - Returns the 3D point on g1 that is closest to g2. This is the first point of the 3D shortest line.
- **ST_3DConvexHull** - Computes the 3D convex hull of a geometry.

- **ST_3DDFullyWithin** - Tests if two 3D geometries are entirely within a given 3D distance
 - **ST_3DDWithin** - Tests if two 3D geometries are within a given 3D distance
 - **ST_3DDifference** - Perform 3D difference
 - **ST_3DDistance** - Returns the 3D cartesian minimum distance (based on spatial ref) between two geometries in projected units.
 - **ST_3DExtent** - Aggregate function that returns the 3D bounding box of geometries.
 - **ST_3DIntersection** - Perform 3D intersection
 - **ST_3DIntersects** - Tests if two geometries spatially intersect in 3D - only for points, linestrings, polygons, polyhedral surface (area).
 - **ST_3DLength** - Returns the 3D length of a linear geometry.
 - **ST_3DLineInterpolatePoint** - Returns a point interpolated along a 3D line at a fractional location.
 - **ST_3DLongestLine** - Returns the 3D longest line between two geometries
 - **ST_3DMaxDistance** - Returns the 3D cartesian maximum distance (based on spatial ref) between two geometries in projected units.
 - **ST_3DPerimeter** - Returns the 3D perimeter of a polygonal geometry.
 - **ST_3DShortestLine** - Returns the 3D shortest line between two geometries
 - **ST_3DUnion** - Perform 3D union.
 - **ST_AddMeasure** - Interpolates measures along a linear geometry.
 - **ST_AddPoint** - Añade un punto a una cadena de línea.
 - **ST_Affine** - Apply a 3D affine transformation to a geometry.
 - **ST_ApproximateMedialAxis** - Compute the approximate medial axis of an areal geometry.
 - **ST_AsBinary** - Return the OGC/ISO Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
 - **ST_AsEWKB** - Return the Extended Well-Known Binary (EWKB) representation of the geometry with SRID meta data.
 - **ST_AsEWKT** - Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.
 - **ST_AsGML** - Return the geometry as a GML version 2 or 3 element.
 - **ST_AsGeoJSON** - Return a geometry as a GeoJSON element.
 - **ST_AsHEXEWKB** - Returns a Geometry in HEXEWKB format (as text) using either little-endian (NDR) or big-endian (XDR) encoding.
 - **ST_AsKML** - Return the geometry as a KML element.
 - **ST_AsX3D** - Returns a Geometry in X3D xml node element format: ISO-IEC-19776-1.2-X3DEncodings-XML
 - **ST_Boundary** - Devuelve el cierre del limite combinatorio de esta geometría.
 - **ST_BoundingDiagonal** - Devuelve la diagonal del cuadro delimitador de la geometría suministrada.
 - **ST_CPAWithin** - Tests if the closest point of approach of two trajectories is within the specified distance.
 - **ST_ClosestPointOfApproach** - Returns a measure at the closest point of approach of two trajectories.
 - **ST_Collect** - Creates a GeometryCollection or Multi* geometry from a set of geometries.
 - **ST_ConstrainedDelaunayTriangles** - Return a constrained Delaunay triangulation around the given input geometry.
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- **ST_ConvexHull** - Computes the convex hull of a geometry.
 - **ST_CoordDim** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
 - **ST_CurveToLine** - Converts a geometry containing curves to a linear geometry.
 - **ST_DelaunayTriangles** - Returns the Delaunay triangulation of the vertices of a geometry.
 - **ST_Difference** - Computes a geometry representing the part of geometry A that does not intersect geometry B.
 - **ST_DistanceCPA** - Returns the distance between the closest point of approach of two trajectories.
 - **ST_Dump** - Returns a set of geometry_dump rows for the components of a geometry.
 - **ST_DumpPoints** - Devuelve un resumen de texto del contenido de la geometría.
 - **ST_DumpRings** - Returns a set of geometry_dump rows for the exterior and interior rings of a Polygon.
 - **ST_DumpSegments** - Devuelve un resumen de texto del contenido de la geometría.
 - **ST_EndPoint** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.
 - **ST_ExteriorRing** - Devuelva el número de anillos interiores de una geometría poligonal.
 - **ST_Extrude** - Extrude a surface to a related volume
 - **ST_FlipCoordinates** - Returns a version of a geometry with X and Y axis flipped.
 - **ST_Force2D** - Forzar las geometrías en un "modo de 2 dimensiones".
 - **ST_ForceCurve** - Relanzar una geometría en su tipo curvo, si corresponde.
 - **ST_ForceLHR** - Force LHR orientation
 - **ST_ForcePolygonCCW** - Orienta todos los aros exteriores en sentido contrario a las agujas del reloj y todos los aros interiores en sentido horario.
 - **ST_ForcePolygonCW** - Orienta todos los anillos exteriores en el sentido de las agujas del reloj y todos los anillos interiores en sentido contrario a las agujas del reloj.
 - **ST_ForceRHR** - Fuerza la orientación de los vértices en un polígono para seguir la regla de la mano derecha.
 - **ST_ForceSFS** - Fuerza las geometrías para usar sólo los tipos de geometría SFS 1.1.
 - **ST_Force_3D** - Forzar las geometrías en modo XYZ. Este es un alias para ST_Force3DZ.
 - **ST_Force_3DZ** - Fuerza las geometrías en modo XYZ.
 - **ST_Force_4D** - Fuerza las geometrías en modo XYZM.
 - **ST_Force_Collection** - Convertir la geometría en una GEOMETRYCOLLECTION.
 - **ST_GeomFromEWKB** - Devuelve un valor específico de ST_Geometry desde una representación "Extended Well-Known Binary" (EWKB).
 - **ST_GeomFromEWKT** - Devuelve un valor especificado ST_Geometry desde una representación "Extended Well-Known Text" (EWKT).
 - **ST_GeomFromGML** - Toma una representación GML como entrada de una geometría y extrae un objeto geométrico PostGIS
 - **ST_GeomFromGeoJSON** - Toma como entrada una representación geojson de una geometría y devuelve un objeto geométrico PostGIS
 - **ST_GeomFromKML** - Toma una representación de una geometría KML de entrada y devuelve un objeto geométrico PostGIS
 - **ST_GeometricMedian** - Returns the geometric median of a MultiPoint.
 - **ST_GeometryN** - Devuelve el tipo de geometría del valor de ST_Geometry.
-

- **ST_GeometryType** - Devuelve el tipo de geometría del valor de ST_Geometry.
 - **ST_HasArc** - Tests if a geometry contains a circular arc
 - **ST_InteriorRingN** - Devuelva el número de anillos interiores de una geometría poligonal.
 - **ST_InterpolatePoint** - Devuelve el valor de la dimensión medida de una geometría en el punto cerrado al punto proporcionado.
 - **ST_Intersection** - Computes a geometry representing the shared portion of geometries A and B.
 - **ST_IsClosed** - Devuelve TRUE si los puntos de inicio y final de una LINESTRING son coincidentes. Para superficies poliedricas si son cerradas (volumetricas).
 - **ST_IsCollection** - Devuelve True si la Geometría es una colección vacía, polígono vacío, punto vacío etc.
 - **ST_IsPlanar** - Check if a surface is or not planar
 - **ST_IsPolygonCCW** - Devuelve true si todos los aros exteriores están orientados hacia la izquierda y todos los aros interiores están orientados hacia la derecha.
 - **ST_IsPolygonCW** - Devuelve true si todos los aros exteriores están orientados hacia la derecha y todos los aros interiores están orientados en sentido contrario a las agujas del reloj.
 - **ST_IsSimple** - Devuelve (TRUE) si la geometría no tiene puntos geométricos anómalos, como auto intersecciones o tangencias.
 - **ST_IsSolid** - Test if the geometry is a solid. No validity check is performed.
 - **ST_IsValidTrajectory** - Tests if the geometry is a valid trajectory.
 - **ST_Length_Spheroid** - Returns the 2D or 3D length/perimeter of a lon/lat geometry on a spheroid.
 - **ST_LineFromMultiPoint** - Crea una LineString desde una geometría MultiPoint.
 - **ST_LineInterpolatePoint** - Returns a point interpolated along a line at a fractional location.
 - **ST_LineInterpolatePoints** - Returns points interpolated along a line at a fractional interval.
 - **ST_LineSubstring** - Returns the part of a line between two fractional locations.
 - **ST_LineToCurve** - Converts a linear geometry to a curved geometry.
 - **ST_LocateBetweenElevations** - Returns the portions of a geometry that lie in an elevation (Z) range.
 - **ST_M** - Returns the M coordinate of a Point.
 - **ST_MakeLine** - Crea una cadena de línea desde geometrías de punto, multipunto o de línea.
 - **ST_MakePoint** - Creates a 2D, 3DZ or 4D Point.
 - **ST_MakePolygon** - Creates a Polygon from a shell and optional list of holes.
 - **ST_MakeSolid** - Cast the geometry into a solid. No check is performed. To obtain a valid solid, the input geometry must be a closed Polyhedral Surface or a closed TIN.
 - **ST_MakeValid** - Attempts to make an invalid geometry valid without losing vertices.
 - **ST_MemSize** - Devuelve el tipo de geometría del valor de ST_Geometry.
 - **ST_MemUnion** - Aggregate function which unions geometries in a memory-efficient but slower way
 - **ST_NDims** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
 - **ST_NPoints** - Devuelve el numero de puntos (vértices) en la geometría.
 - **ST_NRings** - Devuelva el número de anillos interiores de una geometría poligonal.
 - **ST_Node** - Nodes a collection of lines.
-

- **ST_NumGeometries** - Devuelve el numero de puntos en la geometría. Funciona con todas las geometrías.
 - **ST_NumPatches** - Devuelve el número de caras en una superficie poliédrica. Devolverá nulo para geometrías no poliédricas.
 - **ST_Orientation** - Determine surface orientation
 - **ST_PatchN** - Devuelve el tipo de geometría del valor de ST_Geometry.
 - **ST_PointFromWKB** - Crea una geometría desde un WKB con el SRID dado.
 - **ST_PointN** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.
 - **ST_PointOnSurface** - Computes a point guaranteed to lie in a polygon, or on a geometry.
 - **ST_Points** - Devuelve un MultiPoint que contiene todas las coordenadas de una geometría.
 - **ST_Polygon** - Creates a Polygon from a LineString with a specified SRID.
 - **ST_RemovePoint** - Remove a point from a linestring.
 - **ST_RemoveRepeatedPoints** - Returns a version of a geometry with duplicate points removed.
 - **ST_Reverse** - Devuelve la geometría con el orden de vértice invertido.
 - **ST_Rotate** - Rotates a geometry about an origin point.
 - **ST_RotateX** - Rotates a geometry about the X axis.
 - **ST_RotateY** - Rotates a geometry about the Y axis.
 - **ST_RotateZ** - Rotates a geometry about the Z axis.
 - **ST_Scale** - Scales a geometry by given factors.
 - **ST_Scroll** - Change start point of a closed LineString.
 - **ST_SetPoint** - Reemplace el punto de una cadena de línea con un punto dado.
 - **ST_Shift_Longitude** - Shifts the longitude coordinates of a geometry between -180..180 and 0..360.
 - **ST_SnapToGrid** - Ajusta todos los puntos de la geometría de entrada a una cuadrícula regular.
 - **ST_StartPoint** - Returns the first point of a LineString.
 - **ST_StraightSkeleton** - Compute a straight skeleton from a geometry
 - **ST_SwapOrdinates** - Returns a version of the given geometry with given ordinate values swapped.
 - **ST_SymDifference** - Computes a geometry representing the portions of geometries A and B that do not intersect.
 - **ST_Tessellate** - Perform surface Tessellation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS
 - **ST_TransScale** - Translates and scales a geometry by given offsets and factors.
 - **ST_Translate** - Translates a geometry by given offsets.
 - **ST_UnaryUnion** - Computes the union of the components of a single geometry.
 - **ST_Union** - Computes a geometry representing the point-set union of the input geometries.
 - **ST_Volume** - Computes the volume of a 3D solid. If applied to surface (even closed) geometries will return 0.
 - **ST_WrapX** - Wrap a geometry around an X value.
 - **ST_X** - Returns the X coordinate of a Point.
 - **ST_XMax** - Returns the X maxima of a 2D or 3D bounding box or a geometry.
 - **ST_XMin** - Returns the X minima of a 2D or 3D bounding box or a geometry.
-

- **ST_Y** - Returns the Y coordinate of a Point.
- **ST_YMax** - Returns the Y maxima of a 2D or 3D bounding box or a geometry.
- **ST_YMin** - Returns the Y minima of a 2D or 3D bounding box or a geometry.
- **ST_Z** - Returns the Z coordinate of a Point.
- **ST_ZMax** - Returns the Z maxima of a 2D or 3D bounding box or a geometry.
- **ST_ZMin** - Returns the Z minima of a 2D or 3D bounding box or a geometry.
- **ST_Zmflag** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
- **TG_Equals** - Devuelve true si dos topogeometries están compuestas de las mismas primitivas topologicas.
- **TG_Intersects** - Devuelve verdadero si cualquier par de primitivas de las dos topogeometries se intersectan.
- **UpdateGeometrySRID** - Updates the SRID of all features in a geometry column, and the table metadata.
- **geometry_overlaps_nd** - Returns TRUE if A's n-D bounding box intersects B's n-D bounding box.
- **overlaps_nd_geometry_gidx** - Returns TRUE if a geometry's (cached) n-D bounding box intersects a n-D float precision bounding box (GIDX).
- **overlaps_nd_gidx_geometry** - Returns TRUE if a n-D float precision bounding box (GIDX) intersects a geometry's (cached) n-D bounding box.
- **overlaps_nd_gidx_gidx** - Returns TRUE if two n-D float precision bounding boxes (GIDX) intersect each other.
- **postgis_sfcgal_full_version** - Returns the full version of SFCGAL in use including CGAL and Boost versions
- **postgis_sfcgal_version** - Returns the version of SFCGAL in use

15.9 PostGIS Curved Geometry Support Functions

The functions given below are PostGIS functions that can use CIRCULARSTRING, CURVEPOLYGON, and other curved geometry types

- **AddGeometryColumn** - Suprime una columna de geometrías de una tabla espacial.
- **Box2D** - Returns a BOX2D representing the 2D extent of a geometry.
- **Box3D** - Returns a BOX3D representing the 3D extent of a geometry.
- **DropGeometryColumn** - Suprime una columna de geometrías de una tabla espacial.
- **GeometryType** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **PostGIS_AddBBox** - Add bounding box to the geometry.
- **PostGIS_DropBBox** - Drop the bounding box cache from the geometry.
- **PostGIS_HasBBox** - Returns TRUE if the bbox of this geometry is cached, FALSE otherwise.
- **ST_3DExtent** - Aggregate function that returns the 3D bounding box of geometries.
- **ST_Affine** - Apply a 3D affine transformation to a geometry.
- **ST_AsBinary** - Return the OGC/ISO Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- **ST_AsEWKB** - Return the Extended Well-Known Binary (EWKB) representation of the geometry with SRID meta data.
- **ST_AsEWKT** - Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.

- **ST_AsHEXEWKB** - Returns a Geometry in HEXEWKB format (as text) using either little-endian (NDR) or big-endian (XDR) encoding.
 - **ST_AsText** - Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.
 - **ST_GeomCollFromText** - Creates a GeometryCollection or Multi* geometry from a set of geometries.
 - **ST_CoordDim** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
 - **ST_CurveToLine** - Converts a geometry containing curves to a linear geometry.
 - **ST_Distance** - Returns the distance between two geometry or geography values.
 - **ST_Dump** - Returns a set of geometry_dump rows for the components of a geometry.
 - **ST_NumPoints** - Devuelve un resumen de texto del contenido de la geometría.
 - **ST_EndPoint** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.
 - **ST_EstimatedExtent** - Returns the estimated extent of a spatial table.
 - **ST_FlipCoordinates** - Returns a version of a geometry with X and Y axis flipped.
 - **ST_Force2D** - Forzar las geometrías en un "modo de 2 dimensiones".
 - **ST_ForceCurve** - Relanzar una geometría en su tipo curvo, si corresponde.
 - **ST_ForceSFS** - Fuerza las geometrías para usar sólo los tipos de geometría SFS 1.1.
 - **ST_Force3D** - Forzar las geometrías en modo XYZ. Este es un alias para ST_Force3DZ.
 - **ST_Force3DM** - Fuerza las geometrías en modo XYM.
 - **ST_Force3DZ** - Fuerza las geometrías en modo XYZ.
 - **ST_Force4D** - Fuerza las geometrías en modo XYZM.
 - **ST_ForceCollection** - Convertir la geometría en una GEOMETRYCOLLECTION.
 - **ST_GeoHash** - Return a GeoHash representation of the geometry.
 - **ST_GeogFromWKB** - Crea una instancia "geography" desde la representación de una geometría en "Well-Known Binary" (WKB) o "Extended Well-Known Binary" (EWKB).
 - **ST_GeomFromEWKB** - Devuelve un valor específico de ST_Geometry desde una representación "Extended Well-Known Binary" (EWKB).
 - **ST_GeomFromEWKT** - Devuelve un valor especificado ST_Geometry desde una representación "Extended Well-Known Text" (EWKT).
 - **ST_GeomFromText** - Devuelve un valor específico de ST_Geometry desde una representación "Extended Well-Known Binary" (EWKB).
 - **ST_GeomFromWKB** - Crea una instancia de geometría desde la representación de una geometría en "Well-Known Binary" (WKB) y un SRID opcional.
 - **ST_GeometryN** - Devuelve el tipo de geometría del valor de ST_Geometry.
 - **=** - Returns TRUE if the coordinates and coordinate order geometry/geography A are the same as the coordinates and coordinate order of geometry/geography B.
 - **&<|** - Returns TRUE if A's bounding box overlaps or is below B's.
 - **ST_HasArc** - Tests if a geometry contains a circular arc
 - **ST_Intersects** - Tests if two geometries intersect (they have at least one point in common).
-

- **ST_IsClosed** - Devuelve TRUE si los puntos de inicio y final de una LINESTRING son coincidentes. Para superficies poliedricas si son cerradas (volumetricas).
 - **ST_IsCollection** - Devuelve True si la Geometría es una colección vacía, polígono vacío, punto vacío etc.
 - **ST_IsEmpty** - Tests if a geometry is empty.
 - **ST_LineToCurve** - Converts a linear geometry to a curved geometry.
 - **ST_MemSize** - Devuelve el tipo de geometría del valor de ST_Geometry.
 - **ST_NPoints** - Devuelve el numero de puntos (vértices) en la geometría.
 - **ST_NRings** - Devuelva el número de anillos interiores de una geometría poligonal.
 - **ST_PointFromWKB** - Crea una geometría desde un WKB con el SRID dado.
 - **ST_PointN** - Devuelve el número de puntos en un valor ST_LineString o ST_CircularString.
 - **ST_Points** - Devuelve un MultiPoint que contiene todas las coordenadas de una geometría.
 - **ST_Rotate** - Rotates a geometry about an origin point.
 - **ST_RotateZ** - Rotates a geometry about the Z axis.
 - **ST_SRID** - Returns the spatial reference identifier for a geometry.
 - **ST_Scale** - Scales a geometry by given factors.
 - **ST_SetSRID** - Set the SRID on a geometry.
 - **ST_StartPoint** - Returns the first point of a LineString.
 - **ST_Summary** - Devuelve un resumen de texto del contenido de la geometría.
 - **ST_SwapOrdinates** - Returns a version of the given geometry with given ordinate values swapped.
 - **ST_TransScale** - Translates and scales a geometry by given offsets and factors.
 - **ST_Transform** - Return a new geometry with coordinates transformed to a different spatial reference system.
 - **ST_Translate** - Translates a geometry by given offsets.
 - **ST_XMax** - Returns the X maxima of a 2D or 3D bounding box or a geometry.
 - **ST_XMin** - Returns the X minima of a 2D or 3D bounding box or a geometry.
 - **ST_YMax** - Returns the Y maxima of a 2D or 3D bounding box or a geometry.
 - **ST_YMin** - Returns the Y minima of a 2D or 3D bounding box or a geometry.
 - **ST_ZMax** - Returns the Z maxima of a 2D or 3D bounding box or a geometry.
 - **ST_ZMin** - Returns the Z minima of a 2D or 3D bounding box or a geometry.
 - **ST_Zmflag** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
 - **UpdateGeometrySRID** - Updates the SRID of all features in a geometry column, and the table metadata.
 - **~(box2df,box2df)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) contains another 2D float precision bounding box (BOX2DF).
 - **~(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) contains a geometry's 2D bonding box.
 - **~(geometry,box2df)** - Returns TRUE if a geometry's 2D bonding box contains a 2D float precision bounding box (GIDX).
 - **&&** - Returns TRUE if A's 2D bounding box intersects B's 2D bounding box.
 - **&&&** - Returns TRUE if A's n-D bounding box intersects B's n-D bounding box.
-

- **@(box2df,box2df)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into another 2D float precision bounding box.
- **@(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into a geometry's 2D bounding box.
- **@(geometry,box2df)** - Returns TRUE if a geometry's 2D bounding box is contained into a 2D float precision bounding box (BOX2DF).
- **&&(box2df,box2df)** - Returns TRUE if two 2D float precision bounding boxes (BOX2DF) intersect each other.
- **&&(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) intersects a geometry's (cached) 2D bounding box.
- **&&(geometry,box2df)** - Returns TRUE if a geometry's (cached) 2D bounding box intersects a 2D float precision bounding box (BOX2DF).
- **&&&(geometry,gidx)** - Returns TRUE if a geometry's (cached) n-D bounding box intersects a n-D float precision bounding box (GIDX).
- **&&&(gidx,geometry)** - Returns TRUE if a n-D float precision bounding box (GIDX) intersects a geometry's (cached) n-D bounding box.
- **&&&(gidx,gidx)** - Returns TRUE if two n-D float precision bounding boxes (GIDX) intersect each other.

15.10 PostGIS Polyhedral Surface Support Functions

The functions given below are PostGIS functions that can use POLYHEDRALSURFACE, POLYHEDRALSURFACEM geometries

- **Box2D** - Returns a BOX2D representing the 2D extent of a geometry.
- **Box3D** - Returns a BOX3D representing the 3D extent of a geometry.
- **GeometryType** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **ST_3DArea** - Computes area of 3D surface geometries. Will return 0 for solids.
- **ST_3DClosestPoint** - Returns the 3D point on g1 that is closest to g2. This is the first point of the 3D shortest line.
- **ST_3DConvexHull** - Computes the 3D convex hull of a geometry.
- **ST_3DDFullyWithin** - Tests if two 3D geometries are entirely within a given 3D distance
- **ST_3DDWithin** - Tests if two 3D geometries are within a given 3D distance
- **ST_3DDifference** - Perform 3D difference
- **ST_3DDistance** - Returns the 3D cartesian minimum distance (based on spatial ref) between two geometries in projected units.
- **ST_3DExtent** - Aggregate function that returns the 3D bounding box of geometries.
- **ST_3DIntersection** - Perform 3D intersection
- **ST_3DIntersects** - Tests if two geometries spatially intersect in 3D - only for points, linestrings, polygons, polyhedral surface (area).
- **ST_3DLongestLine** - Returns the 3D longest line between two geometries
- **ST_3DMaxDistance** - Returns the 3D cartesian maximum distance (based on spatial ref) between two geometries in projected units.
- **ST_3DShortestLine** - Returns the 3D shortest line between two geometries






- **ST_3DUnion** - Perform 3D union.
- **ST_Affine** - Apply a 3D affine transformation to a geometry.
- **ST_ApproximateMedialAxis** - Compute the approximate medial axis of an areal geometry.
- **ST_Area** - Returns the area of a polygonal geometry.
- **ST_AsBinary** - Return the OGC/ISO Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- **ST_AsEWKB** - Return the Extended Well-Known Binary (EWKB) representation of the geometry with SRID meta data.
- **ST_AsEWKT** - Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.
- **ST_AsGML** - Return the geometry as a GML version 2 or 3 element.
- **ST_AsX3D** - Returns a Geometry in X3D xml node element format: ISO-IEC-19776-1.2-X3DEncodings-XML
- **ST_CoordDim** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
- **ST_Dimension** - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
- **ST_Dump** - Returns a set of geometry_dump rows for the components of a geometry.
- **ST_NumPoints** - Devuelve un resumen de texto del contenido de la geometría.
- **ST_Expand** - Returns a bounding box expanded from another bounding box or a geometry.
- **ST_Extent** - Aggregate function that returns the bounding box of geometries.
- **ST_Extrude** - Extrude a surface to a related volume
- **ST_FlipCoordinates** - Returns a version of a geometry with X and Y axis flipped.
- **ST_Force2D** - Forzar las geometrías en un "modo de 2 dimensiones".
- **ST_ForceLHR** - Force LHR orientation
- **ST_ForceRHR** - Fuerza la orientación de los vértices en un polígono para seguir la regla de la mano derecha.
- **ST_ForceSFS** - Fuerza las geometrías para usar sólo los tipos de geometría SFS 1.1.
- **ST_Force3D** - Forzar las geometrías en modo XYZ. Este es un alias para ST_Force3DZ.
- **ST_Force3DZ** - Fuerza las geometrías en modo XYZ.
- **ST_ForceCollection** - Convertir la geometría en una GEOMETRYCOLLECTION.
- **ST_GeomFromEWKB** - Devuelve un valor específico de ST_Geometry desde una representación " Extended Well-Known Binary" (EWKB).
- **ST_GeomFromEWKT** - Devuelve un valor especificado ST_Geometry desde una representación "Extended Well-Known Text" (EWKT).
- **ST_GeomFromGML** - Toma una representación GML como entrada de una geometría y extrae un objeto geométrico PostGIS
- **ST_GeometryN** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **ST_GeometryType** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **=** - Returns TRUE if the coordinates and coordinate order geometry/geography A are the same as the coordinates and coordinate order of geometry/geography B.
- **&<|** - Returns TRUE if A's bounding box overlaps or is below B's.
- **~=** - Returns TRUE if A's bounding box is the same as B's.

- **ST_IsClosed** - Devuelve TRUE si los puntos de inicio y final de una LINESTRING son coincidentes. Para superficies poliedricas si son cerradas (volumetricas).
- **ST_IsPlanar** - Check if a surface is or not planar
- **ST_IsSolid** - Test if the geometry is a solid. No validity check is performed.
- **ST_MakeSolid** - Cast the geometry into a solid. No check is performed. To obtain a valid solid, the input geometry must be a closed Polyhedral Surface or a closed TIN.
- **ST_MemSize** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **ST_NPoints** - Devuelve el numero de puntos (vértices) en la geometría.
- **ST_NumGeometries** - Devuelve el numero de puntos en la geometría. Funciona con todas las geometrías.
- **ST_NumPatches** - Devuelve el número de caras en una superficie poliédrica. Devolverá nulo para geometrías no poliédricas.
- **ST_PatchN** - Devuelve el tipo de geometría del valor de ST_Geometry.
- **ST_RemoveRepeatedPoints** - Returns a version of a geometry with duplicate points removed.
- **ST_Reverse** - Devuelve la geometría con el orden de vértice invertido.
- **ST_Rotate** - Rotates a geometry about an origin point.
- **ST_RotateX** - Rotates a geometry about the X axis.
- **ST_RotateY** - Rotates a geometry about the Y axis.
- **ST_RotateZ** - Rotates a geometry about the Z axis.
- **ST_Scale** - Scales a geometry by given factors.
- **ST_ShiftLongitude** - Shifts the longitude coordinates of a geometry between -180..180 and 0..360.
- **ST_StraightSkeleton** - Compute a straight skeleton from a geometry
- **ST_Summary** - Devuelve un resumen de texto del contenido de la geometría.
- **ST_SwapOrdinates** - Returns a version of the given geometry with given ordinate values swapped.
- **ST_Tessellate** - Perform surface Tessellation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS
- **ST_Transform** - Return a new geometry with coordinates transformed to a different spatial reference system.
- **ST_Volume** - Computes the volume of a 3D solid. If applied to surface (even closed) geometries will return 0.
- **~(box2df,box2df)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) contains another 2D float precision bounding box (BOX2DF).
- **~(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) contains a geometry's 2D bonding box.
- **~(geometry,box2df)** - Returns TRUE if a geometry's 2D bonding box contains a 2D float precision bounding box (BOX2DF).
- **&&** - Returns TRUE if A's 2D bounding box intersects B's 2D bounding box.
- **&&&** - Returns TRUE if A's n-D bounding box intersects B's n-D bounding box.
- **@(box2df,box2df)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into another 2D float precision bounding box.
- **@(box2df,geometry)** - Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into a geometry's 2D bounding box.
- **@(geometry,box2df)** - Returns TRUE if a geometry's 2D bounding box is contained into a 2D float precision bounding box (BOX2DF).






























- `&&(box2df,box2df)` - Returns TRUE if two 2D float precision bounding boxes (BOX2DF) intersect each other.
- `&&(box2df,geometry)` - Returns TRUE if a 2D float precision bounding box (BOX2DF) intersects a geometry's (cached) 2D bounding box.
- `&&(geometry,box2df)` - Returns TRUE if a geometry's (cached) 2D bounding box intersects a 2D float precision bounding box (BOX2DF).
- `&&&(geometry,gidx)` - Returns TRUE if a geometry's (cached) n-D bounding box intersects a n-D float precision bounding box (GIDX).
- `&&&(gidx,geometry)` - Returns TRUE if a n-D float precision bounding box (GIDX) intersects a geometry's (cached) n-D bounding box.
- `&&&(gidx,gidx)` - Returns TRUE if two n-D float precision bounding boxes (GIDX) intersect each other.
- `postgis_sfcgal_full_version` - Returns the full version of SFCGAL in use including CGAL and Boost versions
- `postgis_sfcgal_version` - Returns the version of SFCGAL in use




15.11 PostGIS Function Support Matrix









Below is an alphabetical listing of spatial specific functions in PostGIS and the kinds of spatial types they work with or OGC/SQL compliance they try to conform to.










- A  means the function works with the type or subtype natively.
- A  means it works but with a transform cast built-in using cast to geometry, transform to a "best srid" spatial ref and then cast back. Results may not be as expected for large areas or areas at poles and may accumulate floating point junk.
- A  means the function works with the type because of a auto-cast to another such as to box3d rather than direct type support.
- A  means the function only available if PostGIS compiled with SFCGAL support.
- A  means the function support is provided by SFCGAL if PostGIS compiled with SFCGAL support, otherwise GEOS/built-in support.
- geom - Basic 2D geometry support (x,y).
- geog - Basic 2D geography support (x,y).
- 2.5D - basic 2D geometries in 3 D/4D space (has Z or M coord).
- PS - Polyhedral surfaces
- T - Triangles and Triangulated Irregular Network surfaces (TIN)









Function	geom	geog	2.5D	Curves	SQL MM	PS	T
Box2D	✓			✓		✓	✓
Box3D	✓		✓	✓		✓	✓
GeometryType	✓		✓	✓		✓	✓
PostGIS_AddBBox	✓			✓			

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
PostGIS_DropBBox	✓			✓			
PostGIS_Extensions_Upgrade							
PostGIS_Full_Version							
PostGIS_GEOS_Version							
PostGIS_HasBBox	✓			✓			
PostGIS_LibXML_Version							
PostGIS_Lib_Build_Date							
PostGIS_Lib_Version							
PostGIS_Liblwgeom_Version							
PostGIS_PROJ_Version							
PostGIS_Scripts_Build_Date							
PostGIS_Scripts_Installed							
PostGIS_Scripts_Released							
PostGIS_Version							
PostGIS_Wagyu_Version							
ST_3DArea							
ST_3DClosestPoint	✓		✓			✓	
ST_3DConvexHull							
ST_3DDifference							
ST_3DDistance	✓		✓		✓	✓	
ST_3DExtent	✓		✓	✓		✓	✓
ST_3DIntersection							
ST_3DLength	✓		✓		✓		
ST_LineInterpolate	✓		✓				
ST_3DLongestLine	✓		✓			✓	
ST_3DMakeBox	✓						
ST_3DMaxDistance	✓		✓			✓	
ST_3DPerimeter	✓		✓		✓		
ST_3DShortestLine	✓		✓			✓	
ST_3DUnion							
ST_AddMeasure	✓		✓				
ST_AddPoint	✓		✓				
ST_Affine	✓		✓	✓		✓	✓
ST_AlphaShape							
ST_Angle	✓						
ST_ApproximateM	 Axis						




















Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_Area	✓	✓			✓	✓	
ST_Azimuth	✓	✓					
ST_Boundary	✓		✓		✓		✓
ST_BoundingDiagon	✓		✓				
ST_Buffer	✓	✓			✓		
ST_BuildArea	✓						
ST_CPAWithin	✓		✓				
ST_Centroid	✓	✓			✓		
ST_ChaikinSmooth	✓						
ST_ClipByBox2D	✓						
ST_ClosestPoint	✓						
ST_ClosestPointOfApproach	✓		✓				
ST_ClusterDBSCAN	✓						
ST_ClusterIntersect	✓						
ST_ClusterKMeans	✓						
ST_ClusterWithin	✓						
ST_GeomCollFromText	✓		✓	✓			
ST_CollectionExtract	✓						
ST_CollectionHomogenize	✓						
ST_ConcaveHull	✓						✓
ST_ConstrainedDelaunayTriangles							
ST_ConvexHull	✓		✓		✓		
ST_CoordDim	✓		✓	✓	✓	✓	✓
ST_CurveToLine	✓		✓	✓	✓		
ST_DelaunayTriangles	✓		✓				✓
ST_Difference	✓		✓		✓		
ST_Dimension	✓				✓	✓	✓
ST_Distance	✓	✓		✓	✓		
ST_DistanceCPA	✓		✓				
ST_DistanceSphere	✓						
ST_DistanceSpheroid	✓						
ST_Dump	✓		✓	✓		✓	✓
ST_NumPoints	✓		✓	✓		✓	✓







Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_NRRings	✓		✓				
ST_NumPoints	✓		✓				✓
ST_EndPoint	✓		✓	✓	✓		
ST_Envelope	✓				✓		
ST_EstimatedExtent	✗			✓			
ST_Expand	✓					✓	✓
ST_Extent	✓					✓	✓
ST_ExteriorRing	✓		✓		✓		
ST_Extrude							
ST_FilterByM	✓						
ST_FlipCoordinates	✓		✓	✓		✓	✓
ST_Force2D	✓		✓	✓		✓	
ST_ForceCurve	✓		✓	✓			
ST_ForceLHR							
ST_ForcePolygonCCW	✓		✓				
ST_ForcePolygonCW	✓		✓				
ST_ForceRHR	✓		✓			✓	
ST_ForceSFS	✓		✓	✓		✓	✓
ST_Force3D	✓		✓	✓		✓	
ST_Force3DMM	✓			✓			
ST_Force3DZ	✓		✓	✓		✓	
ST_Force4D	✓		✓	✓			
ST_ForceCollection	✓		✓	✓		✓	
ST_FrechetDistance	✓						
ST_GeneratePoints	✓						
ST_GeometricMedian	✓		✓				
ST_GeometryN	✓		✓	✓	✓	✓	✓
ST_GeometryType	✓		✓		✓	✓	
ST_HasArc	✓		✓	✓			
ST_HausdorffDistance	✓						
ST_Hexagon	✓						
ST_HexagonGrid	✓						
ST_InteriorRingN	✓		✓		✓		

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_InterpolatePoint	✓		✓				
ST_Intersection	✓	✓	✓		✓		
ST_IsClosed	✓		✓	✓	✓	✓	
ST_IsCollection	✓		✓	✓			
ST_IsEmpty	✓			✓	✓		
ST_IsPlanar							
ST_IsPolygonCCW	✓		✓				
ST_IsPolygonCW	✓		✓				
ST_IsRing	✓				✓		
ST_IsSimple	✓		✓		✓		
ST_IsSolid							
ST_IsValid	✓				✓		
ST_IsValidDetail	✓						
ST_IsValidReason	✓						
ST_IsValidTrajectory	✓		✓				
ST_Length	✓	✓					
ST_Length2D	✓						
ST_LengthSpheroid	✓		✓				
ST_Letters	✓						
ST_LineFromMultiPoint	✓		✓				
ST_LineInterpolatePoint	✓		✓				
ST_LineInterpolatePoints	✓		✓				
ST_LineLocatePoint	✓						
ST_LineMerge	✓						
ST_LineSubstring	✓		✓				
ST_LineToCurve	✓		✓	✓			
ST_LocateAlong	✓				✓		
ST_LocateBetween	✓				✓		
ST_LocateBetweenPoints	✓		✓				
ST_LongestLine	✓						
ST_M	✓		✓		✓		
ST_MakeBox2D	✓						
ST_MakeEnvelope	✓						

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_MakeLine	✓		✓				
ST_MakePoint	✓		✓				
ST_MakePointM	✓						
ST_MakePolygon	✓		✓				
ST_MakeSolid							
ST_MakeValid	✓		✓				
ST_MaxDistance	✓						
ST_MaximumInscribedCircle	✓						
ST_MemSize	✓		✓	✓		✓	✓
ST_MemUnion	✓		✓				
ST_MinimumBoundingCircle	✓						
ST_MinimumBoundingRadius	✓						
ST_MinimumClearance	✓						
ST_MinimumClearanceLine	✓						
ST_MinkowskiSum							
ST_Multi	✓						
ST_NDims	✓		✓				
ST_NPoints	✓		✓	✓		✓	
ST_NRings	✓		✓	✓			
ST_Node	✓		✓				
ST_Normalize	✓						
ST_NumGeometries	✓		✓		✓	✓	✓
ST_NumInteriorRings	✓						
ST_NumInteriorRing	✓				✓		
ST_NumPatches	✓		✓		✓	✓	
ST_NumPoints	✓				✓		
ST_OffsetCurve	✓						
ST_OptimalAlphaS							
ST_Orientation							
ST_OrientedEnvelope	✓						
ST_PatchN	✓		✓		✓	✓	
ST_Perimeter	✓	✓			✓		

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_Perimeter2D	✓						
ST_Point	✓				✓		
ST_Point	✓						
ST_PointN	✓		✓	✓	✓		
ST_PointOnSurface	✓		✓		✓		
ST_Point	✓						
ST_Point	✓						
ST_Points	✓		✓	✓			
ST_Polygon	✓		✓		✓		
ST_Polygonize	✓						
ST_Project		✓					
ST_QuantizeCoordinates	✓						
ST_ReducePrecision	✓						
ST_RemovePoint	✓		✓				
ST_RemoveRepeatedPoints	✓		✓			✓	
ST_Reverse	✓		✓			✓	
ST_Rotate	✓		✓	✓		✓	✓
ST_RotateX	✓		✓			✓	✓
ST_RotateY	✓		✓			✓	✓
ST_RotateZ	✓		✓	✓		✓	✓
ST_SRID	✓			✓	✓		
ST_Scale	✓		✓	✓		✓	✓
ST_Scroll	✓		✓				
ST_Segmentize	✓	✓					
ST_SetEffectiveArea	✓						
ST_SetPoint	✓		✓				
ST_SetSRID	✓			✓			
ST_SharedPaths	✓						
ST_ShiftLongitude	✓		✓			✓	✓
ST_ShortestLine	✓						
ST_Simplify	✓						
ST_SimplifyPolygon	✓	ll					
ST_SimplifyPreserveTopology	✓	pology					
ST_SimplifyVW	✓						

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_Snap	✓						
ST_SnapToGrid	✓		✓				
ST_Split	✓						
ST_Square	✓						
ST_SquareGrid	✓						
ST_StartPoint	✓		✓	✓	✓		
ST_StraightSkeleton							
ST_Subdivide	✓						
ST_Summary	✓	✓		✓		✓	✓
ST_SwapOrdinates	✓		✓	✓		✓	✓
ST_SymDifference	✓		✓		✓		
ST_Tessellate							
ST_MakeEnvelope	✓						
ST_TransScale	✓		✓	✓			
ST_Transform	✓			✓	✓	✓	
ST_Translate	✓		✓	✓			
ST_TriangulatePoly	✓						✓
ST_UnaryUnion	✓		✓				
ST_Union	✓		✓		✓		
ST_Volume							
ST_VoronoiLines	✓						
ST_VoronoiPolygon	✓						
ST_WrapX	✓		✓				
ST_X	✓		✓		✓		
ST_XMax			✓	✓			
ST_XMin			✓	✓			
ST_Y	✓		✓		✓		
ST_YMax			✓	✓			
ST_YMin			✓	✓			
ST_Z	✓		✓		✓		
ST_ZMax			✓	✓			
ST_ZMin			✓	✓			
ST_Zmflag	✓		✓	✓			

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
postgis.backend							
postgis.enable_outdb_rasters							
postgis.gdal_datapath							
postgis.gdal_enabled_drivers							
postgis.gdal_config_options							
postgis_sfcgal_full_version							
postgis_sfcgal_version							

15.12 New, Enhanced or changed PostGIS Functions

15.12.1 PostGIS Functions new or enhanced in 3.3

The functions given below are PostGIS functions that were added or enhanced.

Functions new in PostGIS 3.3

- **RemoveUnusedPrimitives** - Availability: 3.3.0 Removes topology primitives which not needed to define existing TopoGeometry objects.
- **ST_3DUnion** - Availability: 3.3.0 aggregate variant was added Perform 3D union.
- **ST_AlphaShape** - Availability: 3.3.0 - requires SFCGAL >= 1.4.1. Computes a possible concave geometry using the CGAL Alpha Shapes algorithm.
- **ST_AsMARC21** - Availability: 3.3.0 Returns geometry as a MARC21/XML record with a geographic datafield (034).
- **ST_GeomFromMARC21** - Availability: 3.3.0, requires libxml2 2.6+ Takes MARC21/XML geographic data as input and returns a PostGIS geometry object.
- **ST_OptimalAlphaShape** - Availability: 3.3.0 - requires SFCGAL >= 1.4.1. Computes a possible concave geometry using the CGAL Alpha Shapes algorithm after have computed the "optimal" alpha value.
- **ST_SimplifyPolygonHull** - Availability: 3.3.0 - requires GEOS >= 3.11.0 Computes a simplified topology-preserving outer or inner hull of a polygonal geometry.
- **ST_TriangulatePolygon** - Availability: 3.3.0 - requires GEOS >= 3.11.0 Computes the constrained Delaunay triangulation of polygons

Functions enhanced in PostGIS 3.3

- **ST_ConcaveHull** - Enhanced: 3.3.0, GEOS native implementation enabled for GEOS 3.11+ Computes a possibly concave geometry that encloses all input geometry vertices
- **ST_LineMerge** - Enhanced: 3.3.0 accept a directed parameter - requires GEOS >= 3.11.0 Return the lines formed by sewing together a MultiLineString.

Functions changed in PostGIS 3.3

- **PostGIS_Extensions_Upgrade** - Changed: 3.3.0 support for upgrades from any PostGIS version. Does not work on all systems. Packages and upgrades PostGIS extensions (e.g. postgis_raster, postgis_topology, postgis_sfcgal) to latest available version.

15.12.2 PostGIS Functions new or enhanced in 3.2

The functions given below are PostGIS functions that were added or enhanced.

Functions new in PostGIS 3.2

- **FindLayer** - Availability: 3.2.0 Returns a topology.layer record by different means.
- **FindTopology** - Availability: 3.2.0 Returns a topology record by different means.
- **GetFaceContainingPoint** - Availability: 3.2.0 Finds the face containing a point.
- **ST_AsFlatGeobuf** - Availability: 3.2.0 Return a FlatGeobuf representation of a set of rows.
- **ST_Contour** - Availability: 3.2.0 Generates a set of vector contours from the provided raster band, using the GDAL contouring algorithm.
- **ST_FromFlatGeobuf** - Availability: 3.2.0 Reads FlatGeobuf data.
- **ST_FromFlatGeobufToTable** - Availability: 3.2.0 Creates a table based on the structure of FlatGeobuf data.
- **ST_InterpolateRaster** - Availability: 3.2.0 Interpolates a gridded surface based on an input set of 3-d points, using the X- and Y-values to position the points on the grid and the Z-value of the points as the surface elevation.
- **ST_SRID** - Availability: 3.2.0 Returns the spatial reference identifier for a topogeometry.
- **ST_Scroll** - Availability: 3.2.0 Change start point of a closed LineString.
- **ST_SetM** - Availability: 3.2.0 Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimension using the requested resample algorithm.
- **ST_SetZ** - Availability: 3.2.0 Returns a geometry with the same X/Y coordinates as the input geometry, and values from the raster copied into the Z dimension using the requested resample algorithm.
- **TopoGeom_addTopoGeom** - Availability: 3.2 Adds element of a TopoGeometry to the definition of another TopoGeometry.
- **ValidateTopologyRelation** - Availability: 3.2.0 Returns info about invalid topology relation records

Functions enhanced in PostGIS 3.2

- **GetFaceByPoint** - Enhanced: 3.2.0 more efficient implementation and clearer contract, stops working with invalid topologies. Finds face intersecting a given point.
- **ST_ClusterKMeans** - Enhanced: 3.2.0 Support for max_radius Window function that returns a cluster id for each input geometry using the K-means algorithm.
- **ST_MakeValid** - Enhanced: 3.2.0, added algorithm options, 'linework' and 'structure' which requires GEOS >= 3.10.0. Attempts to make an invalid geometry valid without losing vertices.
- **ST_MoveIsoNode** - Enhanced: 3.2.0 ensures the nod cannot be moved in a different face Mueve un nodo aislado en una topología de un punto a otro. Si la nueva geometría apoint existe como nodo se lanza un error. Devuelve la descripción del movimiento.
- **ST_PixelAsCentroid** - Enhanced: 3.2.0 Faster now implemented in C. Returns the centroid (point geometry) of the area represented by a pixel.
- **ST_PixelAsCentroids** - Enhanced: 3.2.0 Faster now implemented in C. Returns the centroid (point geometry) for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The point geometry is the centroid of the area represented by a pixel.
- **ST_Point** - Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with ST_SetSRID to mark the srid on the geometry. Creates a Point with X, Y and SRID values.

- **ST_Point** - Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with ST_SetSRID to mark the srid on the geometry. Creates a Point with X, Y, Z and SRID values.
- **ST_Point** - Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with ST_SetSRID to mark the srid on the geometry. Creates a Point with X, Y, M and SRID values.
- **ST_Point** - Enhanced: 3.2.0 srid as an extra optional argument was added. Older installs require combining with ST_SetSRID to mark the srid on the geometry. Creates a Point with X, Y, Z, M and SRID values.
- **ST_RemovePoint** - Enhanced: 3.2.0 Remove a point from a linestring.
- **ST_RemoveRepeatedPoints** - Enhanced: 3.2.0 Returns a version of a geometry with duplicate points removed.
- **ST_StartPoint** - Enhanced: 3.2.0 returns a point for all geometries. Prior behavior returns NULLs if input was not a LineString. Returns the first point of a LineString.
- **ST_Value** - Enhanced: 3.2.0 resample optional argument was added. Returns the value of a given band in a given columnx, rowy pixel or at a particular geometric point. Band numbers start at 1 and assumed to be 1 if not specified. If exclude_nodata_value is set to false, then all pixels include nodata pixels are considered to intersect and return value. If exclude_nodata_value is not passed in then reads it from metadata of raster.

Functions changed in PostGIS 3.2

- **ST_Boundary** - Changed: 3.2.0 support for TIN, does not use geos, does not linearize curves Devuelve el cierre del limite combinatorio de esta geometría.
- **ValidateTopology** - Changed: 3.2.0 added optional bbox parameter, perform face labeling and edge linking checks. Devuelve un conjunto de objetos validatetopology_returntype que detallan problemas con la topología.

15.12.3 PostGIS Functions new or enhanced in 3.1

The functions given below are PostGIS functions that were added or enhanced.

Functions new in PostGIS 3.1

- **ST_MaximumInscribedCircle** - Availability: 3.1.0 - requires GEOS >= 3.9.0. Computes the largest circle contained within a geometry.
- **ST_ReducePrecision** - Availability: 3.1.0 - requires GEOS >= 3.9.0. Returns a valid geometry with points rounded to a grid tolerance.

Functions enhanced in PostGIS 3.1

- **ST_AsEWKT** - Enhanced: 3.1.0 support for optional precision parameter. Return the Well-Known Text (WKT) representation of the geometry with SRID meta data.
- **ST_ClusterKMeans** - Enhanced: 3.1.0 Support for 3D geometries and weights Window function that returns a cluster id for each input geometry using the K-means algorithm.
- **ST_Difference** - Enhanced: 3.1.0 accept a gridSize parameter - requires GEOS >= 3.9.0 Computes a geometry representing the part of geometry A that does not intersect geometry B.
- **ST_Intersection** - Enhanced: 3.1.0 accept a gridSize parameter - requires GEOS >= 3.9.0 Computes a geometry representing the shared portion of geometries A and B.
- **ST_MakeValid** - Enhanced: 3.1.0, added removal of Coordinates with NaN values. Attempts to make an invalid geometry valid without losing vertices.
- **ST_Subdivide** - Enhanced: 3.1.0 accept a gridSize parameter, requires GEOS >= 3.9.0 to use this new feature. Computes a rectilinear subdivision of a geometry.

- **ST_SymDifference** - Enhanced: 3.1.0 accept a gridSize parameter - requires GEOS >= 3.9.0 Computes a geometry representing the portions of geometries A and B that do not intersect.
- **ST_UnaryUnion** - Enhanced: 3.1.0 accept a gridSize parameter - requires GEOS >= 3.9.0 Computes the union of the components of a single geometry.
- **ST_Union** - Enhanced: 3.1.0 accept a gridSize parameter - requires GEOS >= 3.9.0 Computes a geometry representing the point-set union of the input geometries.

Functions changed in PostGIS 3.1

- **ST_Count** - Changed: 3.1.0 - The ST_Count(rastertable, rastercolumn, ...) variants removed. Use instead. Returns the number of pixels in a given band of a raster or raster coverage. If no band is specified defaults to band 1. If exclude_nodata_value is set to true, will only count pixels that are not equal to the nodata value.
- **ST_Force3D** - Changed: 3.1.0. Added support for supplying a non-zero Z value. Forzar las geometrías en modo XYZ. Este es un alias para ST_Force3DZ.
- **ST_Force3DM** - Changed: 3.1.0. Added support for supplying a non-zero M value. Fuerza las geometrías en modo XYM.
- **ST_Force3DZ** - Changed: 3.1.0. Added support for supplying a non-zero Z value. Fuerza las geometrías en modo XYZ.
- **ST_Force4D** - Changed: 3.1.0. Added support for supplying non-zero Z and M values. Fuerza las geometrías en modo XYZM.
- **ST_Histogram** - Changed: 3.1.0 Removed ST_Histogram(table_name, column_name) variant. Returns a set of record summarizing a raster or raster coverage data distribution separate bin ranges. Number of bins are autocomputed if not specified.
- **ST_Quantile** - Changed: 3.1.0 Removed ST_Quantile(table_name, column_name) variant. Compute quantiles for a raster or raster table coverage in the context of the sample or population. Thus, a value could be examined to be at the raster's 25%, 50%, 75% percentile.
- **ST_SummaryStats** - Changed: 3.1.0 ST_SummaryStats(rastertable, rastercolumn, ...) variants are removed. Use instead. Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. Band 1 is assumed is no band is specified.

15.12.4 PostGIS Functions new or enhanced in 3.0

The functions given below are PostGIS functions that were added or enhanced.

Functions enhanced in PostGIS 3.0

- **ST_AsMVT** - Enhanced: 3.0 - added support for Feature ID. Aggregate function returning a MVT representation of a set of rows.
- **ST_Contains** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if no points of B lie in the exterior of A, and A and B have at least one interior point in common.
- **ST_ContainsProperly** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if B intersects the interior of A but not the boundary or exterior.
- **ST_CoveredBy** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if no point in A is outside B
- **ST_Covers** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if no point in B is outside A
- **ST_Crosses** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if two geometries have some, but not all, interior points in common.
- **ST_CurveToLine** - Enhanced: 3.0.0 implemented a minimum number of segments per linearized arc to prevent topological collapse. Converts a geometry containing curves to a linear geometry.
- **ST_Disjoint** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if two geometries are disjoint (they have no point in common).

- **ST_Equals** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if two geometries include the same set of points.
- **ST_GeneratePoints** - Enhanced: 3.0.0, added seed parameter Generates random points contained in a Polygon or MultiPolygon.
- **ST_GeomFromGeoJSON** - Enhanced: 3.0.0 parsed geometry defaults to SRID=4326 if not specified otherwise. Toma como entrada una representación geojson de una geometría y devuelve un objeto geométrico PostGIS
- **ST_LocateBetween** - Enhanced: 3.0.0 - added support for POLYGON, TIN, TRIANGLE. Returns the portions of a geometry that match a measure range.
- **ST_LocateBetweenElevations** - Enhanced: 3.0.0 - added support for POLYGON, TIN, TRIANGLE. Returns the portions of a geometry that lie in an elevation (Z) range.
- **ST_Overlaps** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if two geometries intersect and have the same dimension, but are not completely contained by each other.
- **ST_Relate** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if two geometries have a topological relationship matching an Intersection Matrix pattern, or computes their Intersection Matrix
- **ST_Segmentize** - Enhanced: 3.0.0 Segmentize geometry now uses equal length segments Devuelve una geometry/geography modificada que no tenga un segmento mayor que la distancia dada.
- **ST_Touches** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if two geometries have at least one point in common, but their interiors do not intersect.
- **ST_Within** - Enhanced: 3.0.0 enabled support for GEOMETRYCOLLECTION Tests if no points of A lie in the exterior of B, and A and B have at least one interior point in common.

Functions changed in PostGIS 3.0

- **PostGIS_Extensions_Upgrade** - Changed: 3.0.0 to repackage loose extensions and support postgis_raster. Packages and upgrades PostGIS extensions (e.g. postgis_raster, postgis_topology, postgis_sfcgal) to latest available version.
- **ST_3DDistance** - Changed: 3.0.0 - SFCGAL version removed Returns the 3D cartesian minimum distance (based on spatial ref) between two geometries in projected units.
- **ST_3DIntersects** - Changed: 3.0.0 SFCGAL backend removed, GEOS backend supports TINs. Tests if two geometries spatially intersect in 3D - only for points, linestrings, polygons, polyhedral surface (area).
- **ST_Area** - Changed: 3.0.0 - does not depend on SFCGAL anymore. Returns the area of a polygonal geometry.
- **ST_AsGeoJSON** - Changed: 3.0.0 support records as input Return a geometry as a GeoJSON element.
- **ST_AsGeoJSON** - Changed: 3.0.0 output SRID if not EPSG:4326. Return a geometry as a GeoJSON element.
- **ST_AsKML** - Changed: 3.0.0 - Removed the "versioned" variant signature Return the geometry as a KML element.
- **ST_Distance** - Changed: 3.0.0 - does not depend on SFCGAL anymore. Returns the distance between two geometry or geography values.
- **ST_Intersection** - Changed: 3.0.0 does not depend on SFCGAL. Computes a geometry representing the shared portion of geometries A and B.
- **ST_Intersects** - Changed: 3.0.0 SFCGAL version removed and native support for 2D TINS added. Tests if two geometries intersect (they have at least one point in common).
- **ST_Union** - Changed: 3.0.0 does not depend on SFCGAL. Computes a geometry representing the point-set union of the input geometries.

15.12.5 PostGIS Functions new or enhanced in 2.5

The functions given below are PostGIS functions that were added or enhanced.

Functions new in PostGIS 2.5

- **PostGIS_Extensions_Upgrade** - Availability: 2.5.0 Packages and upgrades PostGIS extensions (e.g. postgis_raster, postgis_topology, postgis_sfcgal) to latest available version.
- **ST_Angle** - Availability: 2.5.0 Returns the angle between two vectors defined by 3 or 4 points, or 2 lines.
- **ST_AsHexWKB** - Availability: 2.5.0 Return the Well-Known Binary (WKB) in Hex representation of the raster.
- **ST_BandFileSize** - Availability: 2.5.0 Returns the file size of a band stored in file system. If no bandnum specified, 1 is assumed.
- **ST_BandFileTimestamp** - Availability: 2.5.0 Returns the file timestamp of a band stored in file system. If no bandnum specified, 1 is assumed.
- **ST_ChaikinSmoothing** - Availability: 2.5.0 Returns a smoothed version of a geometry, using the Chaikin algorithm
- **ST_FilterByM** - Availability: 2.5.0 Removes vertices based on their M value
- **ST_Grayscale** - Availability: 2.5.0 Creates a new one-8BUI band raster from the source raster and specified bands representing Red, Green and Blue
- **ST_LineInterpolatePoints** - Availability: 2.5.0 Returns points interpolated along a line at a fractional interval.
- **ST_OrientedEnvelope** - Availability: 2.5.0 Returns a minimum-area rectangle containing a geometry.
- **ST_QuantizeCoordinates** - Availability: 2.5.0 Sets least significant bits of coordinates to zero
- **ST_RastFromHexWKB** - Availability: 2.5.0 Return a raster value from a Hex representation of Well-Known Binary (WKB) raster.
- **ST_RastFromWKB** - Availability: 2.5.0 Return a raster value from a Well-Known Binary (WKB) raster.
- **ST_SetBandIndex** - Availability: 2.5.0 Update the external band number of an out-db band
- **ST_SetBandPath** - Availability: 2.5.0 Update the external path and band number of an out-db band

Functions enhanced in PostGIS 2.5

- **ST_AsBinary/ST_AsWKB** - Enhanced: 2.5.0 Addition of ST_AsWKB Return the Well-Known Binary (WKB) representation of the raster.
- **ST_AsMVT** - Enhanced: 2.5.0 - added support parallel query. Aggregate function returning a MVT representation of a set of rows.
- **ST_AsText** - Enhanced: 2.5 - optional parameter precision introduced. Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.
- **ST_BandMetaData** - Enhanced: 2.5.0 to include outdbbandnum, filesize and filetimestamp for outdb rasters. Returns basic meta data for a specific raster band. band num 1 is assumed if none-specified.
- **ST_Buffer** - Enhanced: 2.5.0 - ST_Buffer geometry support was enhanced to allow for side buffering specification side=both|left|right. Computes a geometry covering all points within a given distance from a geometry.
- **ST_GeomFromGeoJSON** - Enhanced: 2.5.0 can now accept json and jsonb as inputs. Toma como entrada una representación geojson de una geometría y devuelve un objeto geométrico PostGIS
- **ST_GeometricMedian** - Enhanced: 2.5.0 Added support for M as weight of points. Returns the geometric median of a Multi-Point.

- **ST_Intersects** - Enhanced: 2.5.0 Supports GEOMETRYCOLLECTION. Tests if two geometries intersect (they have at least one point in common).
- **ST_OffsetCurve** - Enhanced: 2.5 - added support for GEOMETRYCOLLECTION and MULTILINESTRING Returns an offset line at a given distance and side from an input line.
- **ST_Scale** - Enhanced: 2.5.0 support for scaling relative to a local origin (origin parameter) was introduced. Scales a geometry by given factors.
- **ST_Split** - Enhanced: 2.5.0 support for splitting a polygon by a multiline was introduced. Returns a collection of geometries created by splitting a geometry by another geometry.
- **ST_Subdivide** - Enhanced: 2.5.0 reuses existing points on polygon split, vertex count is lowered from 8 to 5. Computes a rectilinear subdivision of a geometry.

Functions changed in PostGIS 2.5

- **ST_GDALDrivers** - Changed: 2.5.0 - add can_read and can_write columns. Returns a list of raster formats supported by PostGIS through GDAL. Only those formats with can_write=True can be used by ST_AsGDALRaster

15.12.6 PostGIS Functions new or enhanced in 2.4

The functions given below are PostGIS functions that were added or enhanced.

Functions new in PostGIS 2.4

- **ST_AsGeobuf** - Availability: 2.4.0 Return a Geobuf representation of a set of rows.
- **ST_AsMVT** - Availability: 2.4.0 Aggregate function returning a MVT representation of a set of rows.
- **ST_AsMVTGeom** - Availability: 2.4.0 Transforms a geometry into the coordinate space of a MVT tile.
- **ST_Centroid** - Availability: 2.4.0 support for geography was introduced. Returns the geometric center of a geometry.
- **ST_ForcePolygonCCW** - Availability: 2.4.0 Orienta todos los aros exteriores en sentido contrario a las agujas del reloj y todos los aros interiores en sentido horario.
- **ST_ForcePolygonCW** - Availability: 2.4.0 Orienta todos los anillos exteriores en el sentido de las agujas del reloj y todos los anillos interiores en sentido contrario a las agujas del reloj.
- **ST_FrechetDistance** - Availability: 2.4.0 - requires GEOS >= 3.7.0 Returns the Fréchet distance between two geometries.
- **ST_MakeEmptyCoverage** - Availability: 2.4.0 Cover georeferenced area with a grid of empty raster tiles.

Functions enhanced in PostGIS 2.4

All aggregates now marked as parallel safe which should allow them to be used in plans that can employ parallelism.

PostGIS 2.4.1 postgis_tiger_geocoder set to load Tiger 2017 data. Can optionally load zip code 5-digit tabulation (zcta) as part of the **Loader_Generate_Nation_Script**.

- **Loader_Generate_Nation_Script** - Enhanced: 2.4.1 zip code 5 tabulation area (zcta5) load step was fixed and when enabled, zcta5 data is loaded as a single table called zcta5_all as part of the nation script load. Generates a shell script for the specified platform that loads in the county and state lookup tables.
- **Normalize_Address** - Enhanced: 2.4.0 norm_addy object includes additional fields zip4 and address_alphanumeric. Given a textual street address, returns a composite norm_addy type that has road suffix, prefix and type standardized, street, streetname etc. broken into separate fields. This function will work with just the lookup data packaged with the tiger_geocoder (no need for tiger census data).

- **Page_Normalize_Address** - Enhanced: 2.4.0 norm_addy object includes additional fields zip4 and address_alphanumeric. Given a textual street address, returns a composite norm_addy type that has road suffix, prefix and type standardized, street, streetname etc. broken into separate fields. This function will work with just the lookup data packaged with the tiger_geocoder (no need for tiger census data). Requires address_standardizer extension.
- **Reverse_Geocode** - Enhanced: 2.4.1 if optional zcta5 dataset is loaded, the reverse_geocode function can resolve to state and zip even if the specific state data is not loaded. Refer to for details on loading zcta5 data. Takes a geometry point in a known spatial ref sys and returns a record containing an array of theoretically possible addresses and an array of cross streets. If include_stnum_range = true, includes the street range in the cross streets.
- **ST_AsTWKB** - Enhanced: 2.4.0 memory and speed improvements. Returns the geometry as TWKB, aka "Tiny Well-Known Binary"
- **ST_Covers** - Enhanced: 2.4.0 Support for polygon in polygon and line in polygon added for geography type Tests if no point in B is outside A
- **ST_CurveToLine** - Enhanced: 2.4.0 added support for max-deviation and max-angle tolerance, and for symmetric output. Converts a geometry containing curves to a linear geometry.
- **ST_Project** - Enhanced: 2.4.0 Allow negative distance and non-normalized azimuth. Returns a point projected from a start point by a distance and bearing (azimuth).

Functions changed in PostGIS 2.4

All PostGIS aggregates now marked as parallel safe. This will force a drop and recreate of aggregates during upgrade which may fail if any user views or sql functions rely on PostGIS aggregates.

- **=** - Changed: 2.4.0, in prior versions this was bounding box equality not a geometric equality. If you need bounding box equality, use `ST_Equals` instead. Returns TRUE if the coordinates and coordinate order geometry/geography A are the same as the coordinates and coordinate order of geometry/geography B.
- **ST_Node** - Changed: 2.4.0 this function uses GEOSNode internally instead of GEOSUnaryUnion. This may cause the resulting linestrings to have a different order and direction compared to PostGIS < 2.4. Nodes a collection of lines.

15.12.7 PostGIS Functions new or enhanced in 2.3

The functions given below are PostGIS functions that were added or enhanced.



Note

PostGIS 2.3.0: PostgreSQL 9.6+ support for parallel queries.



Note

PostGIS 2.3.0: PostGIS extension, all functions schema qualified to reduce issues in database restore.



Note

PostGIS 2.3.0: PostgreSQL 9.4+ support for BRIN indexes. Refer to Section [4.9.2](#).



Note

PostGIS 2.3.0: Tiger Geocoder upgraded to work with TIGER 2016 data.

Functions new in PostGIS 2.3

- **&&&(geometry,gidx)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a geometry's (cached) n-D bounding box intersects a n-D float precision bounding box (GIDX).
- **&&&(gidx,geometry)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a n-D float precision bounding box (GIDX) intersects a geometry's (cached) n-D bounding box.
- **&&&(gidx,gidx)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if two n-D float precision bounding boxes (GIDX) intersect each other.
- **&&(box2df,box2df)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if two 2D float precision bounding boxes (BOX2DF) intersect each other.
- **&&(box2df,geometry)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a 2D float precision bounding box (BOX2DF) intersects a geometry's (cached) 2D bounding box.
- **&&(geometry,box2df)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a geometry's (cached) 2D bounding box intersects a 2D float precision bounding box (BOX2DF).
- **@(box2df,box2df)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into another 2D float precision bounding box.
- **@(box2df,geometry)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a 2D float precision bounding box (BOX2DF) is contained into a geometry's 2D bounding box.
- **@(geometry,box2df)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a geometry's 2D bounding box is contained into a 2D float precision bounding box (BOX2DF).
- **ST_ClusterDBSCAN** - Availability: 2.3.0 Window function that returns a cluster id for each input geometry using the DBSCAN algorithm.
- **ST_ClusterKMeans** - Availability: 2.3.0 Window function that returns a cluster id for each input geometry using the K-means algorithm.
- **ST_MinimumClearanceLine** - Availability: 2.3.0 - requires GEOS >= 3.6.0 Returns the two-point LineString spanning a geometry's minimum clearance.
- **ST_WrapX** - Availability: 2.3.0 requires GEOS Wrap a geometry around an X value.
- **~(box2df,box2df)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a 2D float precision bounding box (BOX2DF) contains another 2D float precision bounding box (BOX2DF).
- **~(box2df,geometry)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a 2D float precision bounding box (BOX2DF) contains a geometry's 2D bounding box.
- **~(geometry,box2df)** - Availability: 2.3.0 support for Block Range INDEXes (BRIN) was introduced. Requires PostgreSQL 9.5+. Returns TRUE if a geometry's 2D bounding box contains a 2D float precision bounding box (GIDX).

The functions given below are PostGIS functions that are enhanced in PostGIS 2.3.

- **ST_Contains** - Enhanced: 2.3.0 Enhancement to PIP short-circuit extended to support MultiPoints with few points. Prior versions only supported point in polygon.
- **ST_Covers** - Enhanced: 2.3.0 Enhancement to PIP short-circuit for geometry extended to support MultiPoints with few points. Prior versions only supported point in polygon.
- **ST_Expand** - Enhanced: 2.3.0 support was added to expand a box by different amounts in different dimensions.
- **ST_Intersects** - Enhanced: 2.3.0 Enhancement to PIP short-circuit extended to support MultiPoints with few points. Prior versions only supported point in polygon.
- **ST_Transform** - Enhanced: 2.3.0 support for direct PROJ.4 text was introduced.
- **ST_Within** - Enhanced: 2.3.0 Enhancement to PIP short-circuit for geometry extended to support MultiPoints with few points. Prior versions only supported point in polygon.

15.12.8 PostGIS Functions new or enhanced in 2.2

The functions given below are PostGIS functions that were added or enhanced.



Note

postgis_sfcgal now can be installed as an extension using `CREATE EXTENSION postgis_sfcgal;`



Note

PostGIS 2.2.0: Tiger Geocoder upgraded to work with TIGER 2015 data.



Note

address_standardizer, address_standardizer_data_us extensions for standardizing address data refer to [Section 14.1](#) for details.



Note

Many functions in topology rewritten as C functions for increased performance.

Functions new in PostGIS 2.2

- `<<#>>` - Availability: 2.2.0 -- KNN only available for PostgreSQL 9.1+ Returns the n-D distance between A and B bounding boxes.
- `<<->>` - Availability: 2.2.0 -- KNN only available for PostgreSQL 9.1+ Returns the n-D distance between the centroids of A and B bounding boxes.
- `ST_CPAWithin` - Availability: 2.2.0 Tests if the closest point of approach of two trajectories is within the specified distance.
- `ST_ClipByBox2D` - Availability: 2.2.0 Computes the portion of a geometry falling within a rectangle.
- `ST_ClosestPointOfApproach` - Availability: 2.2.0 Returns a measure at the closest point of approach of two trajectories.
- `ST_ClusterIntersecting` - Availability: 2.2.0 Aggregate function that clusters the input geometries into connected sets.
- `ST_ClusterWithin` - Availability: 2.2.0 Aggregate function that clusters the input geometries by separation distance.
- `ST_CountAgg` - Availability: 2.2.0 Aggregate. Returns the number of pixels in a given band of a set of rasters. If no band is specified defaults to band 1. If `exclude_nodata_value` is set to true, will only count pixels that are not equal to the NODATA value.
- `ST_CreateOverview` - Availability: 2.2.0 Create an reduced resolution version of a given raster coverage.
- `ST_DistanceCPA` - Availability: 2.2.0 Returns the distance between the closest point of approach of two trajectories.
- `ST_IsPlanar` - Availability: 2.2.0: This was documented in 2.1.0 but got accidentally left out in 2.1 release. Check if a surface is or not planar
- `ST_IsValidTrajectory` - Availability: 2.2.0 Tests if the geometry is a valid trajectory.
- `ST_MapAlgebra (callback function version)` - Availability: 2.2.0: Ability to add a mask Callback function version - Returns a one-band raster given one or more input rasters, band indexes and one user-specified callback function.

- **ST_MemSize** - Availability: 2.2.0 Returns the amount of space (in bytes) the raster takes.
- **ST_Retile** - Availability: 2.2.0 Return a set of configured tiles from an arbitrarily tiled raster coverage.
- **ST_Subdivide** - Availability: 2.2.0 Computes a rectilinear subdivision of a geometry.
- **ST_SummaryStatsAgg** - Availability: 2.2.0 Aggregate. Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a set of raster. Band 1 is assumed is no band is specified.
- **l=** - Availability: 2.2.0. Index-supported only available for PostgreSQL 9.5+ Returns the distance between A and B trajectories at their closest point of approach.

The functions given below are PostGIS functions that are enhanced in PostGIS 2.2.

- **ST_Area** - Enhanced: 2.2.0 - measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires PROJ >= 4.9.0 to take advantage of the new feature.
- **ST_AsX3D** - Enhanced: 2.2.0: Support for GeoCoordinates and axis (x/y, long/lat) flipping. Look at options for details.
- **ST_Azimuth** - Enhanced: 2.2.0 measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires PROJ >= 4.9.0 to take advantage of the new feature.
- **ST_Distance** - Enhanced: 2.2.0 - measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires PROJ >= 4.9.0 to take advantage of the new feature.
- **ST_Scale** - Enhanced: 2.2.0 support for scaling all dimension (factor parameter) was introduced.
- **ST_Split** - Enhanced: 2.2.0 support for splitting a line by a multiline, a multipoint or (multi)polygon boundary was introduced.
- **<->** - Enhanced: 2.2.0 -- True KNN ("K nearest neighbor") behavior for geometry and geography for PostgreSQL 9.5+. Note for geography KNN is based on sphere rather than spheroid. For PostgreSQL 9.4 and below, geography support is new but only supports centroid box.

15.12.9 PostGIS functions breaking changes in 2.2

The functions given below are PostGIS functions that have possibly breaking changes in PostGIS 2.2. If you use any of these, you may need to check your existing code.

- **Get_Geocode_Setting** - Changed: 2.2.0 : default settings are now kept in a table called geocode_settings_default. Use customized settingsa are in geocode_settings and only contain those that have been set by user.
- **ST_3DClosestPoint** - Changed: 2.2.0 - if 2 2D geometries are input, a 2D point is returned (instead of old behavior assuming 0 for missing Z). In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.
- **ST_3DDistance** - Changed: 2.2.0 - In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.
- **ST_3DLongestLine** - Changed: 2.2.0 - if 2 2D geometries are input, a 2D point is returned (instead of old behavior assuming 0 for missing Z). In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.
- **ST_3DMaxDistance** - Changed: 2.2.0 - In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.
- **ST_3DShortestLine** - Changed: 2.2.0 - if 2 2D geometries are input, a 2D point is returned (instead of old behavior assuming 0 for missing Z). In case of 2D and 3D, Z is no longer assumed to be 0 for missing Z.
- **ST_DistanceSphere** - Changed: 2.2.0 In prior versions this used to be called ST_Distance_Sphere
- **ST_DistanceSpheroid** - Changed: 2.2.0 In prior versions this was called ST_Distance_Spheroid
- **ST_Equals** - Changed: 2.2.0 Returns true even for invalid geometries if they are binary equal
- **ST_LengthSpheroid** - Changed: 2.2.0 In prior versions this was called ST_Length_Spheroid and had the alias ST_3DLength_Spheroid
- **ST_MemSize** - Changed: 2.2.0 name changed to ST_MemSize to follow naming convention.
- **ST_PointInsideCircle** - Changed: 2.2.0 In prior versions this was called ST_Point_Inside_Circle
- **<->** - Changed: 2.2.0 -- For PostgreSQL 9.5 users, old Hybrid syntax may be slower, so you'll want to get rid of that hack if you are running your code only on PostGIS 2.2+ 9.5+. See examples below.

15.12.10 PostGIS Functions new or enhanced in 2.1

The functions given below are PostGIS functions that were added or enhanced.



Note

More Topology performance Improvements. Please refer to Chapter 10 for more details.



Note

Bug fixes (particularly with handling of out-of-band rasters), many new functions (often shortening code you have to write to accomplish a common task) and massive speed improvements to raster functionality. Refer to Chapter 12 for more details.



Note

PostGIS 2.1.0: Tiger Geocoder upgraded to work with TIGER 2012 census data. `geocode_settings` added for debugging and tweaking rating preferences, loader made less greedy, now only downloads tables to be loaded. PostGIS 2.1.1: Tiger Geocoder upgraded to work with TIGER 2013 data. Please refer to Section 14.2 for more details.

Functions new in PostGIS 2.1

- `=` - Availability: 2.1.0 Returns TRUE if A's bounding box is the same as B's. Uses double precision bounding box.
- `ST_ColorMap` - Availability: 2.1.0 Creates a new raster of up to four 8BUI bands (grayscale, RGB, RGBA) from the source raster and a specified band. Band 1 is assumed if not specified.
- `ST_Contains` - Availability: 2.1.0 Return true if no points of raster `rastB` lie in the exterior of raster `rastA` and at least one point of the interior of `rastB` lies in the interior of `rastA`.
- `ST_ContainsProperly` - Availability: 2.1.0 Return true if `rastB` intersects the interior of `rastA` but not the boundary or exterior of `rastA`.
- `ST_CoveredBy` - Availability: 2.1.0 Return true if no points of raster `rastA` lie outside raster `rastB`.
- `ST_Covers` - Availability: 2.1.0 Return true if no points of raster `rastB` lie outside raster `rastA`.
- `ST_DFullyWithin` - Availability: 2.1.0 Return true if rasters `rastA` and `rastB` are fully within the specified distance of each other.
- `ST_DWithin` - Availability: 2.1.0 Return true if rasters `rastA` and `rastB` are within the specified distance of each other.
- `ST_Disjoint` - Availability: 2.1.0 Return true if raster `rastA` does not spatially intersect `rastB`.
- `ST_DumpValues` - Availability: 2.1.0 Get the values of the specified band as a 2-dimension array.
- `ST_FromGDALRaster` - Availability: 2.1.0 Returns a raster from a supported GDAL raster file.
- `ST_InvDistWeight4ma` - Availability: 2.1.0 Raster processing function that interpolates a pixel's value from the pixel's neighborhood.
- `ST_MapAlgebra (callback function version)` - Availability: 2.1.0 Callback function version - Returns a one-band raster given one or more input rasters, band indexes and one user-specified callback function.
- `ST_MapAlgebra (expression version)` - Availability: 2.1.0 Expression version - Returns a one-band raster given one or two input rasters, band indexes and one or more user-specified SQL expressions.
- `ST_MinConvexHull` - Availability: 2.1.0 Return the convex hull geometry of the raster excluding NODATA pixels.

- **ST_MinDist4ma** - Availability: 2.1.0 Raster processing function that returns the minimum distance (in number of pixels) between the pixel of interest and a neighboring pixel with value.
- **ST_NearestValue** - Availability: 2.1.0 Returns the nearest non-NODATA value of a given band's pixel specified by a columnx and rowy or a geometric point expressed in the same spatial reference coordinate system as the raster.
- **ST_Neighborhood** - Availability: 2.1.0 Returns a 2-D double precision array of the non-NODATA values around a given band's pixel specified by either a columnX and rowY or a geometric point expressed in the same spatial reference coordinate system as the raster.
- **ST_NotSameAlignmentReason** - Availability: 2.1.0 Returns text stating if rasters are aligned and if not aligned, a reason why.
- **ST_Overlaps** - Availability: 2.1.0 Return true if raster rastA and rastB intersect but one does not completely contain the other.
- **ST_PixelAsCentroid** - Availability: 2.1.0 Returns the centroid (point geometry) of the area represented by a pixel.
- **ST_PixelAsCentroids** - Availability: 2.1.0 Returns the centroid (point geometry) for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The point geometry is the centroid of the area represented by a pixel.
- **ST_PixelAsPoint** - Availability: 2.1.0 Returns a point geometry of the pixel's upper-left corner.
- **ST_PixelAsPoints** - Availability: 2.1.0 Returns a point geometry for each pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel. The coordinates of the point geometry are of the pixel's upper-left corner.
- **ST_PixelOfValue** - Availability: 2.1.0 Get the columnx, rowy coordinates of the pixel whose value equals the search value.
- **ST_RasterToWorldCoord** - Availability: 2.1.0 Returns the raster's upper left corner as geometric X and Y (longitude and latitude) given a column and row. Column and row starts at 1.
- **ST_Resize** - Availability: 2.1.0 Requires GDAL 1.6.1+ Resize a raster to a new width/height
- **ST_Roughness** - Availability: 2.1.0 Returns a raster with the calculated "roughness" of a DEM.
- **ST_SetValues** - Availability: 2.1.0 Returns modified raster resulting from setting the values of a given band.
- **ST_Summary** - Availability: 2.1.0 Returns a text summary of the contents of the raster.
- **ST_TPI** - Availability: 2.1.0 Returns a raster with the calculated Topographic Position Index.
- **ST_TRI** - Availability: 2.1.0 Returns a raster with the calculated Terrain Ruggedness Index.
- **ST_Tile** - Availability: 2.1.0 Returns a set of rasters resulting from the split of the input raster based upon the desired dimensions of the output rasters.
- **ST_Touches** - Availability: 2.1.0 Return true if raster rastA and rastB have at least one point in common but their interiors do not intersect.
- **ST_Union** - Availability: 2.1.0 ST_Union(rast, unionarg) variant was introduced. Returns the union of a set of raster tiles into a single raster composed of 1 or more bands.
- **ST_Within** - Availability: 2.1.0 Return true if no points of raster rastA lie in the exterior of raster rastB and at least one point of the interior of rastA lies in the interior of rastB.
- **ST_WorldToRasterCoord** - Availability: 2.1.0 Returns the upper left corner as column and row given geometric X and Y (longitude and latitude) or a point geometry expressed in the spatial reference coordinate system of the raster.
- **UpdateRasterSRID** - Availability: 2.1.0 Change the SRID of all rasters in the user-specified column and table.

The functions given below are PostGIS functions that are enhanced in PostGIS 2.1.

- **ST_AddBand** - Enhanced: 2.1.0 support for addbandarg added.
- **ST_AddBand** - Enhanced: 2.1.0 support for new out-db bands added.
- **ST_AsBinary/ST_AsWKB** - Enhanced: 2.1.0 Addition of outasin

- **ST_Aspect** - Enhanced: 2.1.0 Uses ST_MapAlgebra() and added optional interpolate_nodata function parameter
 - **ST_Clip** - Enhanced: 2.1.0 Rewritten in C
 - **ST_Distinct4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_HillShade** - Enhanced: 2.1.0 Uses ST_MapAlgebra() and added optional interpolate_nodata function parameter
 - **ST_Max4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_Mean4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_Min4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_PixelAsPolygons** - Enhanced: 2.1.0 exclude_nodata_value optional argument was added.
 - **ST_Polygon** - Enhanced: 2.1.0 Improved Speed (fully C-Based) and the returning multipolygon is ensured to be valid.
 - **ST_Range4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_SameAlignment** - Enhanced: 2.1.0 addition of Aggregate variant
 - **ST_SetGeoReference** - Enhanced: 2.1.0 Addition of ST_SetGeoReference(raster, double precision, ...) variant
 - **ST_SetValue** - Enhanced: 2.1.0 Geometry variant of ST_SetValue() now supports any geometry type, not just point. The geometry variant is a wrapper around the geomval[] variant of ST_SetValues()
 - **ST_Slope** - Enhanced: 2.1.0 Uses ST_MapAlgebra() and added optional units, scale, interpolate_nodata function parameters
 - **ST_StdDev4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_Sum4ma** - Enhanced: 2.1.0 Addition of Variant 2
 - **ST_Transform** - Enhanced: 2.1.0 Addition of ST_Transform(rast, alignto) variant
 - **ST_Union** - Enhanced: 2.1.0 Improved Speed (fully C-Based).
 - **ST_Union** - Enhanced: 2.1.0 ST_Union(rast) (variant 1) unions all bands of all input rasters. Prior versions of PostGIS assumed the first band.
 - **ST_Union** - Enhanced: 2.1.0 ST_Union(rast, uniontype) (variant 4) unions all bands of all input rasters.
 - **ST_AsGML** - Enhanced: 2.1.0 id support was introduced, for GML 3.
 - **ST_DWithin** - Enhanced: 2.1.0 improved speed for geography. See Making Geography faster for details.
 - **ST_DWithin** - Enhanced: 2.1.0 support for curved geometries was introduced.
 - **ST_Distance** - Enhanced: 2.1.0 improved speed for geography. See Making Geography faster for details.
 - **ST_Distance** - Enhanced: 2.1.0 - support for curved geometries was introduced.
 - **ST_NumPoints** - Enhanced: 2.1.0 Faster speed. Reimplemented as native-C.
 - **ST_MakeValid** - Enhanced: 2.1.0, added support for GEOMETRYCOLLECTION and MULTIPOINT.
-

15.12.11 PostGIS functions breaking changes in 2.1

The functions given below are PostGIS functions that have possibly breaking changes in PostGIS 2.1. If you use any of these, you may need to check your existing code.

- **ST_Aspect** - Changed: 2.1.0 In prior versions, return values were in radians. Now, return values default to degrees
- **ST_HillShade** - Changed: 2.1.0 In prior versions, azimuth and altitude were expressed in radians. Now, azimuth and altitude are expressed in degrees
- **ST_Intersects** - Changed: 2.1.0 The behavior of the ST_Intersects(raster, geometry) variants changed to match that of ST_Intersects(geometry, raster).
- **ST_PixelAsCentroids** - Changed: 2.1.1 Changed behavior of exclude_nodata_value.
- **ST_PixelAsPoints** - Changed: 2.1.1 Changed behavior of exclude_nodata_value.
- **ST_PixelAsPolygons** - Changed: 2.1.1 Changed behavior of exclude_nodata_value.
- **ST_Polygon** - Changed: 2.1.0 In prior versions would sometimes return a polygon, changed to always return multipolygon.
- **ST_RasterToWorldCoordX** - Changed: 2.1.0 In prior versions, this was called ST_Raster2WorldCoordX
- **ST_RasterToWorldCoordY** - Changed: 2.1.0 In prior versions, this was called ST_Raster2WorldCoordY
- **ST_Resample** - Changed: 2.1.0 Parameter srid removed. Variants with a reference raster no longer applies the reference raster's SRID. Use ST_Transform() to reproject raster. Works on rasters with no SRID.
- **ST_Rescale** - Changed: 2.1.0 Works on rasters with no SRID
- **ST_Reskew** - Changed: 2.1.0 Works on rasters with no SRID
- **ST_Slope** - Changed: 2.1.0 In prior versions, return values were in radians. Now, return values default to degrees
- **ST_SnapToGrid** - Changed: 2.1.0 Works on rasters with no SRID
- **ST_WorldToRasterCoordX** - Changed: 2.1.0 In prior versions, this was called ST_World2RasterCoordX
- **ST_WorldToRasterCoordY** - Changed: 2.1.0 In prior versions, this was called ST_World2RasterCoordY
- **ST_EstimatedExtent** - Changed: 2.1.0. Up to 2.0.x this was called ST_Estimated_Extent.

15.12.12 PostGIS Functions new, behavior changed, or enhanced in 2.0

The functions given below are PostGIS functions that were added, enhanced, or have Section 15.12.13 breaking changes in 2.0 releases.

New geometry types: TIN and Polyhedral surfaces was introduced in 2.0



Note

Greatly improved support for Topology. Please refer to Chapter 10 for more details.



Note

In PostGIS 2.0, raster type and raster functionality has been integrated. There are way too many new raster functions to list here and all are new so please refer to Chapter 12 for more details of the raster functions available. Earlier pre-2.0 versions had raster_columns/raster_overviews as real tables. These were changed to views before release. Functions such as ST_AddRasterColumn were removed and replaced with AddRasterConstraints, DropRasterConstraints as a result some apps that created raster tables may need changing.

**Note**

Tiger Geocoder upgraded to work with TIGER 2010 census data and now included in the core PostGIS documentation. A reverse geocoder function was also added. Please refer to Section [14.2](#) for more details.

- **&&** - Availability: 2.0.0 Returns TRUE if A's bounding box intersects B's bounding box.
- **<#>** - Availability: 2.0.0 -- KNN only available for PostgreSQL 9.1+ Returns the 2D distance between A and B bounding boxes.
- **<->** - Availability: 2.0.0 -- Weak KNN provides nearest neighbors based on geometry centroid distances instead of true distances. Exact results for points, inexact for all other types. Available for PostgreSQL 9.1+ Returns the 2D distance between A and B.
- **@** - Availability: 2.0.0 raster @ raster, raster @ geometry introduced Returns TRUE if A's bounding box is contained by B's. Uses double precision bounding box.
- **@** - Availability: 2.0.5 geometry @ raster introduced Returns TRUE if A's bounding box is contained by B's. Uses double precision bounding box.
- **AddOverviewConstraints** - Availability: 2.0.0 Tag a raster column as being an overview of another.
- **AddRasterConstraints** - Availability: 2.0.0 Adds raster constraints to a loaded raster table for a specific column that constrains spatial ref, scaling, blocksize, alignment, bands, band type and a flag to denote if raster column is regularly blocked. The table must be loaded with data for the constraints to be inferred. Returns true if the constraint setting was accomplished and issues a notice otherwise.
- **DropOverviewConstraints** - Availability: 2.0.0 Untag a raster column from being an overview of another.
- **DropRasterConstraints** - Availability: 2.0.0 Drops PostGIS raster constraints that refer to a raster table column. Useful if you need to reload data or update your raster column data.
- **Loader_Generate_Script** - Availability: 2.0.0 to support Tiger 2010 structured data and load census tract (tract), block groups (bg), and blocks (tabblocks) tables. Generates a shell script for the specified platform for the specified states that will download Tiger data, stage and load into tiger_data schema. Each state script is returned as a separate record. Latest version supports Tiger 2010 structural changes and also loads census tract, block groups, and blocks tables.
- **ST_3DDFullyWithin** - Availability: 2.0.0 Tests if two 3D geometries are entirely within a given 3D distance
- **ST_3DDWithin** - Availability: 2.0.0 Tests if two 3D geometries are within a given 3D distance
- **ST_3DIntersects** - Availability: 2.0.0 Tests if two geometries spatially intersect in 3D - only for points, linestrings, polygons, polyhedral surface (area).
- **ST_AsGDALRaster** - Availability: 2.0.0 - requires GDAL >= 1.6.0. Return the raster tile in the designated GDAL Raster format. Raster formats are one of those supported by your compiled library. Use ST_GDALDrivers() to get a list of formats supported by your library.
- **ST_AsJPEG** - Availability: 2.0.0 - requires GDAL >= 1.6.0. Return the raster tile selected bands as a single Joint Photographic Exports Group (JPEG) image (byte array). If no band is specified and 1 or more than 3 bands, then only the first band is used. If only 3 bands then all 3 bands are used and mapped to RGB.
- **ST_AsPNG** - Availability: 2.0.0 - requires GDAL >= 1.6.0. Return the raster tile selected bands as a single portable network graphics (PNG) image (byte array). If 1, 3, or 4 bands in raster and no bands are specified, then all bands are used. If more 2 or more than 4 bands and no bands specified, then only band 1 is used. Bands are mapped to RGB or RGBA space.
- **ST_AsRaster** - Availability: 2.0.0 - requires GDAL >= 1.6.0. Converts a PostGIS geometry to a PostGIS raster.
- **ST_AsTIFF** - Availability: 2.0.0 - requires GDAL >= 1.6.0. Return the raster selected bands as a single TIFF image (byte array). If no band is specified or any of specified bands does not exist in the raster, then will try to use all bands.

- **ST_AsX3D** - Availability: 2.0.0: ISO-IEC-19776-1.2-X3DEncodings-XML Returns a Geometry in X3D xml node element format: ISO-IEC-19776-1.2-X3DEncodings-XML
- **ST_Aspect** - Availability: 2.0.0 Returns the aspect (in degrees by default) of an elevation raster band. Useful for analyzing terrain.
- **ST_Band** - Availability: 2.0.0 Returns one or more bands of an existing raster as a new raster. Useful for building new rasters from existing rasters.
- **ST_BandIsNoData** - Availability: 2.0.0 Returns true if the band is filled with only nodata values.
- **ST_Clip** - Availability: 2.0.0 Returns the raster clipped by the input geometry. If band number not is specified, all bands are processed. If crop is not specified or TRUE, the output raster is cropped.
- **ST_Count** - Availability: 2.0.0 Returns the number of pixels in a given band of a raster or raster coverage. If no band is specified defaults to band 1. If exclude_nodata_value is set to true, will only count pixels that are not equal to the nodata value.
- **ST_Distinct4ma** - Availability: 2.0.0 Raster processing function that calculates the number of unique pixel values in a neighborhood.
- **ST_GDALDrivers** - Availability: 2.0.0 - requires GDAL >= 1.6.0. Returns a list of raster formats supported by PostGIS through GDAL. Only those formats with can_write=True can be used by ST_AsGDALRaster
- **ST_HasNoBand** - Availability: 2.0.0 Returns true if there is no band with given band number. If no band number is specified, then band number 1 is assumed.
- **ST_HillShade** - Availability: 2.0.0 Returns the hypothetical illumination of an elevation raster band using provided azimuth, altitude, brightness and scale inputs.
- **ST_Histogram** - Availability: 2.0.0 Returns a set of record summarizing a raster or raster coverage data distribution separate bin ranges. Number of bins are autocomputed if not specified.
- **ST_IsEmpty** - Availability: 2.0.0 Returns true if the raster is empty (width = 0 and height = 0). Otherwise, returns false.
- **ST_IsValidDetail** - Availability: 2.0.0 Returns a valid_detail row stating if a geometry is valid or if not a reason and a location.
- **ST_IsValidReason** - Availability: 2.0 version taking flags. Returns text stating if a geometry is valid, or a reason for invalidity.
- **ST_MakeValid** - Availability: 2.0.0 Attempts to make an invalid geometry valid without losing vertices.
- **ST_MapAlgebraExpr** - Availability: 2.0.0 1 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified.
- **ST_MapAlgebraExpr** - Availability: 2.0.0 2 raster band version: Creates a new one band raster formed by applying a valid PostgreSQL algebraic operation on the two input raster bands and of pixeltype provided. band 1 of each raster is assumed if no band numbers are specified. The resulting raster will be aligned (scale, skew and pixel corners) on the grid defined by the first raster and have its extent defined by the "extenttype" parameter. Values for "extenttype" can be: INTERSECTION, UNION, FIRST, SECOND.
- **ST_MapAlgebraFct** - Availability: 2.0.0 1 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the input raster band and of pixeltype provided. Band 1 is assumed if no band is specified.
- **ST_MapAlgebraFct** - Availability: 2.0.0 2 band version - Creates a new one band raster formed by applying a valid PostgreSQL function on the 2 input raster bands and of pixeltype provided. Band 1 is assumed if no band is specified. Extent type defaults to INTERSECTION if not specified.
- **ST_MapAlgebraFctNgb** - Availability: 2.0.0 1-band version: Map Algebra Nearest Neighbor using user-defined PostgreSQL function. Return a raster which values are the result of a PLPGSQL user function involving a neighborhood of values from the input raster band.
- **ST_Max4ma** - Availability: 2.0.0 Raster processing function that calculates the maximum pixel value in a neighborhood.
- **ST_Mean4ma** - Availability: 2.0.0 Raster processing function that calculates the mean pixel value in a neighborhood.
- **ST_Min4ma** - Availability: 2.0.0 Raster processing function that calculates the minimum pixel value in a neighborhood.

- **ST_Node** - Availability: 2.0.0 Nodes a collection of lines.
 - **ST_PixelAsPolygon** - Availability: 2.0.0 Returns the polygon geometry that bounds the pixel for a particular row and column.
 - **ST_PixelAsPolygons** - Availability: 2.0.0 Returns the polygon geometry that bounds every pixel of a raster band along with the value, the X and the Y raster coordinates of each pixel.
 - **ST_Quantile** - Availability: 2.0.0 Compute quantiles for a raster or raster table coverage in the context of the sample or population. Thus, a value could be examined to be at the raster's 25%, 50%, 75% percentile.
 - **ST_Range4ma** - Availability: 2.0.0 Raster processing function that calculates the range of pixel values in a neighborhood.
 - **ST_Reclass** - Availability: 2.0.0 Creates a new raster composed of band types reclassified from original. The nband is the band to be changed. If nband is not specified assumed to be 1. All other bands are returned unchanged. Use case: convert a 16BUI band to a 8BUI and so forth for simpler rendering as viewable formats.
 - **ST_RelateMatch** - Availability: 2.0.0 Tests if a DE-9IM Intersection Matrix matches an Intersection Matrix pattern
 - **ST_Resample** - Availability: 2.0.0 Requires GDAL 1.6.1+ Resample a raster using a specified resampling algorithm, new dimensions, an arbitrary grid corner and a set of raster georeferencing attributes defined or borrowed from another raster.
 - **ST_Rescale** - Availability: 2.0.0 Requires GDAL 1.6.1+ Resample a raster by adjusting only its scale (or pixel size). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.
 - **ST_Reskew** - Availability: 2.0.0 Requires GDAL 1.6.1+ Resample a raster by adjusting only its skew (or rotation parameters). New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.
 - **ST_SameAlignment** - Availability: 2.0.0 Returns true if rasters have same skew, scale, spatial ref, and offset (pixels can be put on same grid without cutting into pixels) and false if they don't with notice detailing issue.
 - **ST_SetBandIsNoData** - Availability: 2.0.0 Sets the isnodata flag of the band to TRUE.
 - **ST_Slope** - Availability: 2.0.0 Returns the slope (in degrees by default) of an elevation raster band. Useful for analyzing terrain.
 - **ST_SnapToGrid** - Availability: 2.0.0 Requires GDAL 1.6.1+ Resample a raster by snapping it to a grid. New pixel values are computed using the NearestNeighbor (english or american spelling), Bilinear, Cubic, CubicSpline or Lanczos resampling algorithm. Default is NearestNeighbor.
 - **ST_Split** - Availability: 2.0.0 requires GEOS Returns a collection of geometries created by splitting a geometry by another geometry.
 - **ST_StdDev4ma** - Availability: 2.0.0 Raster processing function that calculates the standard deviation of pixel values in a neighborhood.
 - **ST_Sum4ma** - Availability: 2.0.0 Raster processing function that calculates the sum of all pixel values in a neighborhood.
 - **ST_SummaryStats** - Availability: 2.0.0 Returns summarystats consisting of count, sum, mean, stddev, min, max for a given raster band of a raster or raster coverage. Band 1 is assumed is no band is specified.
 - **ST_Transform** - Availability: 2.0.0 Requires GDAL 1.6.1+ Reprojects a raster in a known spatial reference system to another known spatial reference system using specified resampling algorithm. Options are NearestNeighbor, Bilinear, Cubic, CubicSpline, Lanczos defaulting to NearestNeighbor.
 - **ST_UnaryUnion** - Availability: 2.0.0 Computes the union of the components of a single geometry.
 - **ST_Union** - Availability: 2.0.0 Returns the union of a set of raster tiles into a single raster composed of 1 or more bands.
 - **ST_ValueCount** - Availability: 2.0.0 Returns a set of records containing a pixel band value and count of the number of pixels in a given band of a raster (or a raster coverage) that have a given set of values. If no band is specified defaults to band 1. By default nodata value pixels are not counted. and all other values in the pixel are output and pixel band values are rounded to the nearest integer.
-

- `~` - Availability: 2.0.0 Returns TRUE if A's bounding box is contains B's. Uses double precision bounding box.
- `~=` - Availability: 2.0.0 Returns TRUE if A's bounding box is the same as B's.

The functions given below are PostGIS functions that are enhanced in PostGIS 2.0.

- **Box2D** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **Box3D** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **Geocode** - Enhanced: 2.0.0 to support Tiger 2010 structured data and revised some logic to improve speed, accuracy of geocoding, and to offset point from centerline to side of street address is located on. The new parameter `max_results` useful for specifying number of best results or just returning the best result.
- **ST_Intersection** - Enhanced: 2.0.0 - Intersection in the raster space was introduced. In earlier pre-2.0.0 versions, only intersection performed in vector space were supported.
- **ST_Intersects** - Enhanced: 2.0.0 support raster/raster intersects was introduced.
- **ST_Value** - Enhanced: 2.0.0 `exclude_nodata_value` optional argument was added.
- **ST_3DExtent** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_Affine** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_Area** - Enhanced: 2.0.0 - support for 2D polyhedral surfaces was introduced.
- **ST_AsBinary** - Enhanced: 2.0.0 support for higher coordinate dimensions was introduced.
- **ST_AsBinary** - Enhanced: 2.0.0 support for specifying endian with geography was introduced.
- **ST_AsEWKT** - Enhanced: 2.0.0 support for Geography, Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_AsGML** - Enhanced: 2.0.0 prefix support was introduced. Option 4 for GML3 was introduced to allow using `LineString` instead of `Curve` tag for lines. GML3 Support for Polyhedral surfaces and TINS was introduced. Option 32 was introduced to output the box.
- **ST_AsKML** - Enhanced: 2.0.0 - Add prefix namespace, use default and named args
- **ST_Azimuth** - Enhanced: 2.0.0 support for geography was introduced.
- **ST_Expand** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_Extent** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_MakeValid** - Enhanced: 2.0.1, speed improvements
- **ST_Relate** - Enhanced: 2.0.0 - added support for specifying boundary node rule.
- **ST_Rotate** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_Rotate** - Enhanced: 2.0.0 additional parameters for specifying the origin of rotation were added.
- **ST_RotateX** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_RotateY** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_RotateZ** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_Scale** - Enhanced: 2.0.0 support for Polyhedral surfaces, Triangles and TIN was introduced.
- **ST_Transform** - Enhanced: 2.0.0 support for Polyhedral surfaces was introduced.

15.12.13 PostGIS Functions changed behavior in 2.0

The functions given below are PostGIS functions that have changed behavior in PostGIS 2.0 and may require application changes.



Note

Most deprecated functions have been removed. These are functions that haven't been documented since 1.2 or some internal functions that were never documented. If you are using a function that you don't see documented, it's probably deprecated, about to be deprecated, or internal and should be avoided. If you have applications or tools that rely on deprecated functions, please refer to [?qandaentry] for more details.



Note

Bounding boxes of geometries have been changed from float4 to double precision (float8). This has an impact on answers you get using bounding box operators and casting of bounding boxes to geometries. E.g ST_SetSRID(abbox) will often return a different more accurate answer in PostGIS 2.0+ than it did in prior versions which may very well slightly change answers to view port queries.



Note

The arguments hasnodata was replaced with exclude_nodata_value which has the same meaning as the older hasnodata but clearer in purpose.

- **Box3D** - Changed: 2.0.0 In pre-2.0 versions, there used to be a box2d instead of box3d. Since box2d is a deprecated type, this was changed to box3d.
- **ST_GDALDrivers** - Changed: 2.0.6, 2.1.3 - by default no drivers are enabled, unless GUC or Environment variable gdal_enabled_drivers is set.
- **ST_ScaleX** - Changed: 2.0.0. In WKTRaster versions this was called ST_PixelSizeX.
- **ST_ScaleY** - Changed: 2.0.0. In WKTRaster versions this was called ST_PixelSizeY.
- **ST_SetScale** - Changed: 2.0.0 In WKTRaster versions this was called ST_SetPixelSize. This was changed in 2.0.0.
- **ST_3DExtent** - Changed: 2.0.0 In prior versions this used to be called ST_Extent3D
- **ST_3DLength** - Changed: 2.0.0 In prior versions this used to be called ST_Length3D
- **ST_3DMakeBox** - Changed: 2.0.0 In prior versions this used to be called ST_MakeBox3D
- **ST_3DPerimeter** - Changed: 2.0.0 In prior versions this used to be called ST_Perimeter3D
- **ST_AsBinary** - Changed: 2.0.0 Inputs to this function can not be unknown -- must be geometry. Constructs such as ST_AsBinary('POINT(1 2)') are no longer valid and you will get an error: st_asbinary(unknown) is not unique error. Code like that needs to be changed to ST_AsBinary('POINT(1 2)::geometry');. If that is not possible, then install legacy.sql.
- **ST_AsGML** - Changed: 2.0.0 use default named args
- **ST_AsGeoJSON** - Changed: 2.0.0 support default args and named args.
- **ST_AsSVG** - Changed: 2.0.0 to use default args and support named args
- **ST_Length** - Changed: 2.0.0 Breaking change -- in prior versions applying this to a MULTI/POLYGON of type geography would give you the perimeter of the POLYGON/MULTIPOLYGON. In 2.0.0 this was changed to return 0 to be in line with geometry behavior. Please use ST_Perimeter if you want the perimeter of a polygon

15.12.14 PostGIS Functions new, behavior changed, or enhanced in 1.5

The functions given below are PostGIS functions that were introduced or enhanced in this minor release.

- **PostGIS_LibXML_Version** - Availability: 1.5 Returns the version number of the libxml2 library.
- **ST_AsBinary** - Availability: 1.5.0 geography support was introduced. Return the OGC/ISO Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- **ST_AsGML** - Availability: 1.5.0 geography support was introduced. Return the geometry as a GML version 2 or 3 element.
- **ST_AsGeoJSON** - Availability: 1.5.0 geography support was introduced. Return a geometry as a GeoJSON element.
- **ST_AsText** - Availability: 1.5 - support for geography was introduced. Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.
- **ST_Buffer** - Availability: 1.5 - ST_Buffer was enhanced to support different endcaps and join types. These are useful for example to convert road linestrings into polygon roads with flat or square edges instead of rounded edges. Thin wrapper for geography was added. Computes a geometry covering all points within a given distance from a geometry.
- **ST_Covers** - Availability: 1.5 - support for geography was introduced. Tests if no point in B is outside A
- **ST_DFullyWithin** - Availability: 1.5.0 Tests if two geometries are entirely within a given distance
- **ST_DWithin** - Availability: 1.5.0 support for geography was introduced Tests if two geometries are within a given distance
- **ST_Distance** - Availability: 1.5.0 geography support was introduced in 1.5. Speed improvements for planar to better handle large or many vertex geometries Returns the distance between two geometry or geography values.
- **ST_DistanceSphere** - Availability: 1.5 - support for other geometry types besides points was introduced. Prior versions only work with points. Returns minimum distance in meters between two lon/lat geometries using a spherical earth model.
- **ST_DistanceSpheroid** - Availability: 1.5 - support for other geometry types besides points was introduced. Prior versions only work with points. Returns the minimum distance between two lon/lat geometries using a spheroidal earth model.
- **ST_Expand** - Availability: 1.5.0 behavior changed to output double precision instead of float4 coordinates. Returns a bounding box expanded from another bounding box or a geometry.
- **ST_GeomFromKML** - Availability: 1.5, requires libxml2 2.6+ Toma una representación de una geometría KML de entrada y devuelve un objeto geométrico PostGIS
- **~=** - Availability: 1.5.0 changed behavior Returns TRUE if A's bounding box is the same as B's.
- **ST_Intersection** - Availability: 1.5 support for geography data type was introduced. Computes a geometry representing the shared portion of geometries A and B.
- **ST_Intersects** - Availability: 1.5 support for geography was introduced. Tests if two geometries intersect (they have at least one point in common).
- **ST_Length** - Availability: 1.5.0 geography support was introduced in 1.5. Returns the 2D length of a linear geometry.
- **&&** - Availability: 1.5.0 support for geography was introduced. Returns TRUE if A's 2D bounding box intersects B's 2D bounding box.

15.12.15 PostGIS Functions new, behavior changed, or enhanced in 1.4

The functions given below are PostGIS functions that were introduced or enhanced in the 1.4 release.

- **ST_AsSVG** - Returns SVG path data for a geometry. Availability: 1.2.2. Availability: 1.4.0 Changed in PostGIS 1.4.0 to include L command in absolute path to conform to <http://www.w3.org/TR/SVG/paths.html#PathDataBNF>
- **ST_ContainsProperly** - Tests if B intersects the interior of A but not the boundary or exterior. Availability: 1.4.0

- **ST_IsValidReason** - Returns text stating if a geometry is valid, or a reason for invalidity. Availability: 1.4
- **ST_LineCrossingDirection** - Returns a number indicating the crossing behavior of two LineStrings. Availability: 1.4
- **ST_Union** - Computes a geometry representing the point-set union of the input geometries. Availability: 1.4.0 - ST_Union was enhanced. ST_Union(geomarray) was introduced and also faster aggregate collection in PostgreSQL.

15.12.16 PostGIS Functions new in 1.3

The functions given below are PostGIS functions that were introduced in the 1.3 release.

- **ST_CurveToLine** - Converts a geometry containing curves to a linear geometry. Availability: 1.3.0
- **ST_LineToCurve** - Converts a linear geometry to a curved geometry. Availability: 1.3.0

Chapter 16

Informar de problemas

16.1 Informar sobre errores de software

Informar sobre errores efectivamente es una manera fundamental de ayudar en el desarrollo de PostGIS. El informe de errores más efectivo es el que permite a los desarrolladores de PostGIS reproducirlo, así que lo ideal sería que contenga un trozo de código que lo genere y toda la información posible del entorno en el que fue detectado. Una información bastante buena se puede obtener ejecutando `SELECT postgis_full_version()` [para postgis] y `SELECT version()` [para postgresql].

Si no está usando la última versión, vale la pena echar un vistazo a su [lista de cambios en la versión](#) primero, para ver si el error ya se ha solucionado.

Usar el [seguimiento de errores de PostGIS](#) servirá para asegurarnos de que nuestros informes no son descartados, y nos mantendrá informados de como progresa su gestión. Antes de informar acerca de un nuevo error por favor consulte la base de datos para ver si es uno ya conocido, y si lo es, por favor, agregue la nueva información que tenga sobre él.

Puede leer la documentación de Simon Tatham acerca de [Cómo informar de errores de manera eficiente](#) antes de rellenar un nuevo informe.

16.2 Informando sobre problemas de documentación

La documentación debería reflejar con precisión las características y comportamiento del software. Si no es así, podría deberse a un error del software, o porque la documentación es deficiente o errónea.

Los problemas con la documentación se pueden enviar también al [Seguimiento de errores de PostGIS](#).

Si su revisión es de poca importancia, tan sólo descríbala en un nuevo asunto de la lista de seguimiento, y sea específico acerca de en que parte de la documentación se encuentra.

Si sus cambios son más extensos, es preferible un envío por Subversion. Este es un proceso en cuatro pasos en Unix (suponiendo que tiene instalado ya [Subversion](#)):

1. Consiga una copia de la rama de PostGIS en Subversion. En Unix, teclee:

```
git clone https://git.osgeo.org/gitea/postgis/postgis.git
```

Ésta se almacenará en la carpeta `./trunk`

2. Haga los cambios a la documentación con su editor favorito. En Unix, teclee (por ejemplo):

```
vim trunk/doc/postgis.xml
```

Tenga en cuenta que la documentación está escrita en DocBook XML y no en HTML, así que si no está familiarizado con este formato por favor siga el ejemplo del resto de la documentación.

3. Haga un fichero para solucionarlo que contenga las diferencias desde la copia maestra de la documentación. En Unix, teclee:

svn diff trunk/doc/postgis.xml > doc.patch

4. Adjunte la solución a un nuevo tema en el seguimiento de errores.
-

Appendix A

Apéndice

A.1 PostGIS 3.3.3

This version requires PostgreSQL 11-16beta1, GEOS 3.6 or higher, and Proj 4.9+ Additional features are enabled if you are running GEOS 3.9+ (and ST_MakeValid enhancements with 3.10+), Proj 6.1+, and PostgreSQL 15+.

A.1.1 Bug Fixes and Enhancements

- 5384, Fix crash in ST_AsGML when given id is longer than given prefix (Sandro Santilli)
 - 5380, Fix 2.5 upgrades with views using geography based ST_Distance (Sandro Santilli)
 - 5303, Don't try removing closed edges endpoint from RemoveUnusedPrimitives (Sandro Santilli)
 - 5289, Fix misleading message in RemoveUnusedPrimitives about doubly connected edges healing (Sandro Santilli)
 - 5298, Fix CopyTopology exception with hierarchical layers (Sandro Santilli)
 - 5299, Corrections to address_standardizer_data_us lex (Regina Obe)
 - 5106, Fix segfault in ST_RemEdgeNewFace/ST_RemEdgeModFace when no edge side-faces are found (Sandro Santilli)
 - 5329, Fix downgrade protection introduced in 3.3.0 (Sandro Santilli)
 - 5332, Keep proj errors from percolating into PgSQL log (Paul Ramsey)
 - 5313, Fix memory access issue in ST_InterpolateRaster (Paul Ramsey)
 - 5338, Dump/Restore of raster table fails on enforce_coverage_tile_rast constraint (Regina Obe)
 - 5315, #5318, #5319, #5320, #5342 crashes on infinite coordinates (Regina Obe, Paul Ramsey)
 - 5344, Include topology id sequence state in dumps (Sandro Santilli)
 - 5288, ST_LineCrossingDirection multi-cross error (Paul Ramsey)
 - 5347, _ST_BestSRID crashes on ARM with infinite geometries (Regina Obe)
 - 5331, [postgis_tiger_geocoder] reverse_geocode, prefer addressable ranges (Regina Obe, Locance)
 - 5363, Make ST_ClusterDBScan interruptable (Paul Ramsey)
 - 5257, #5261, #5277, #5304, #5308, #5374, Support for PG16 (Paul Ramsey, Regina Obe, Sandro , Laurenz Albe)
 - 5371, ST_Union segfaults (PG 11-12) (Regina Obe)
 - 5378, ST_Buffer(geography) drops SRID (Paul Ramsey)
 - 5388, [postgis_tiger_geocoder] Fix faces table tiger_gload, caused census rerelease of faces data (Regina Obe)
-

A.2 PostGIS 3.3.2

This version requires PostgreSQL 11-15, GEOS 3.6 or higher, and Proj 4.9+ Additional features are enabled if you are running GEOS 3.9+ (and ST_MakeValid enhancements with 3.10+), Proj 6.1+, and PostgreSQL 15+.

A.2.1 Bug and Security Fixes

[5248](#), Marc21 documentation missing (Regina Obe)

[5240](#), ST_DumpPoints and ST_DumpSegments crash with empty polygon (Regina Obe)

[security] Add schema qual to upgrade util (Regina Obe)

[5255](#), GH598, Remove forced static linking on shp2pgsql, pgsq2shp (Maxim Kochetkov)

[5255](#), GH702, Remove forced static linking on raster2pgsql (Thomas Petazzoni)

[4648](#), [security] Check function ownership at extension packaging time (Sandro Santilli) Thanks to Sven Klemm (Timescale) for the report

[5241](#), Crash on ST_SnapToGrid with empty multis (Regina Obe)

[5081](#), Fix error in topology import of self-intersecting rings (Sandro Santilli)

[5234](#), Fix 2.5d topology building regression (Sandro Santilli)

[5280](#), Handle load of dbase character fields with no width specified (Regina Obe)

[5264](#), Fix topology install on Alpine (Louis Descoteaux)

[5244](#), postgis_tiger_geocoder update for TIGER 2022 (Regina Obe)

[5285](#), Fix import/export of topologies with names needing quotes (Sandro Santilli)

[4988](#), SFCGAL specify name of unknown type when SFCGAL can't process (Regina Obe)

[5084](#), Bad rasterization of linestring (Gilles Vuidel)

A.3 PostGIS 3.3.1

2022/09/09

This version requires PostgreSQL 11 - 15, GEOS 3.6 or higher, and Proj 5.2+. Additional features are enabled if you are running GEOS 3.9+ ST_MakeValid enhancements with 3.10+, numerous additional enhancements with GEOS 3.11+. Requires SFCGAL 1.4.1+ for ST_AlphaShape and ST_OptimalAlphaShape.

A.3.1 Corrección de errores

[5227](#), typo in ST_LineLocatePoint error message (Sandro Santilli)

[5231](#), PG15 no longer compiles because SQL/JSON removed PG upstream (Regina Obe)

A.4 PostGIS 3.3.0

2022/08/26

This version requires PostgreSQL 11 or higher, GEOS 3.6 or higher, and Proj 5.2+. Additional features are enabled if you are running GEOS 3.9+ ST_MakeValid enhancements with 3.10+, numerous additional enhancements with GEOS 3.11+. Requires SFCGAL 1.4.1+ for ST_AlphaShape and ST_OptimalAlphaShape.

NOTE: GEOS 3.11.0 details at [GEOS 3.11.0 release notes](#)

The new configure --enable-lto flag improves speed of math computations. This new feature is disabled by default because on some platforms, causes compilation errors (BSD and MingW64 issues have been raised)

A.4.1 New features

[5116](#), Topology export/import scripts (Sandro Santilli)

ST_Letters creates geometries that look like letters (Paul Ramsey)

[5037](#), postgis_sfcgal: ST_3DConvexHull (Loïc Bartoletti)

postgis_sfcgal: sfcgal_full_version - reports BOOST and CGAL version (Loïc Bartoletti)

[GH 659](#), MARC21/XML, ST_GeomFromMARC21, ST_AsMARC21 (Jim Jones)

[5132](#), [GH 683](#), sfcgal: ST_3DUnion aggregate function (Sergei Shoulbakov)

[5143](#), SFCGAL ST_AlphaShape and ST_OptimalAlphaShape Requires SFCGAL 1.4.1+ (Loïc Bartoletti)

[5162](#), ST_TriangulatePolygon with GEOS 3.11+ (Paul Ramsey, Martin Davis)

[5162](#), ST_SimplifyPolygonHull with GEOS 3.11+ (Paul Ramsey, Martin Davis)

[5183](#), topology.RemoveUnusedPrimitives (Sandro Santilli)

A.4.2 Breaking Changes

Drop support for PostgreSQL 9.6 and 10 (Regina Obe)

Change output for WKT MULTIPOINT. All points now wrapped in parens. (Even Rouault)

[GH 674](#), geometry validation and fixing is disabled for ST_DumpAsPolygons and ST_Polygon so it works faster but might produce invalid polygons. (Aliaksandr Kalenik)

A.4.3 Mejoras

[2861](#), Add index on topology.node(containing_face) speeding up splitting and merging of faces (Sandro Santilli)

[2083](#), Speed up ST_RemEdge topology functions adding index on relation(element_id) and edge_data(abs_next*) (Sandro Santilli)

[5118](#), Allow dropping topologies with missing topogeometry sequences (Sandro Santilli)

[5111](#), faster topology face MBR computation (Sandro Santilli)

postgis_extensions_upgrade() support for upgrades from any PostGIS version, including yet to be released ones (Sandro Santilli)

[5040](#), add postgis_sfcgal_full_version (Loïc Bartoletti)

[GH 655](#), GiST: balance the tree splits better in recursive calls (Darafei Praliaskouski)

[GH 657](#), GiST: do not call no-op decompress function (Aliaksandr Kalenik)

[4939](#), [5161](#), ST_LineMerge now has option to keep the directions of input linestrings, useful when processing road graphs. Requires GEOS 3.11. (Sergei Shoulbakov)

ST_ConcaveHull GEOS 3.11+ native implementation (Paul Ramsey, Martin Davis)

ST_ConcaveHull GEOS 3.11+ polygon-respecting native implementation (Paul Ramsey, Martin Davis)

[4574](#), [GH 678](#), [5121](#) Enable Link-Time Optimizations using --enable-lto (Sergei Shoulbakov)

[GH 676](#), faster ST_Clip (Aliaksandr Kalenik)

[5135](#), Fast GiST index build is enabled by default for PostgreSQL 15+ (Sergei Shoulbakov)

[4939](#), [5161](#), ST_LineMerge now has option to keep the directions of input linestrings, useful when processing road graphs. Requires GEOS 3.11. (Sergei Shoulbakov)

[5158](#), pgtopo_import / pgtopo_export manpages (Sandro Santilli)

[5170](#), add a optional max_rows_per_copy to -Y option to raster2pgsql to control number of rows per copy statement. Default to 50 when not specified (Regina Obe)

[GH 698](#), support parallel aggregate for ST_Union (Sergei Shoulbakov)

[5024](#), Update spatial_ref_sys as part of ALTER EXTENSION update postgis (Paul Ramsey)

A.4.4 Corrección de errores

These are fixes issues in prior minors not backported

[4912](#), GiST: fix crash on STORAGE EXTERNAL for geography (Aliaksandr Kalenik)

[5088](#), Memory corruption in mvt_agg_transfn (Victor Collod)

[5137](#), resetting interrupt flags before query execution (Sergei Shoulbakov)

[5148](#), ST_Clip is more robust to alignment of raster and clip geometry (Sergei Shoulbakov)

[4932](#), Bug with geography ST_Intersects / ST_Distance (Paul Ramsey)

[5089](#), ST_Reverse also reverses components of CompoundCurve (Paul Ramsey)

A.5 PostGIS 3.3.0rc2

2022/08/22

This version requires PostgreSQL 11 or higher, GEOS 3.6 or higher, and Proj 5.2+. Additional features are enabled if you are running GEOS 3.9+ ST_MakeValid enhancements with 3.10+, numerous additional enhancements with GEOS 3.11+. Requires SFCGAL 1.4.1+ for ST_AlphaShape and ST_OptimalAlphaShape.

NOTE: GEOS 3.11.0 was recently released, details at [GEOS 3.11.0 release notes](#)

The new `--enable-lto` flag improves speed of math computations. This new feature is disabled by default because on some platforms, causes compilation errors (BSD and MingW64 issues have been raised)

A.5.1 Corrección de errores

[5089](#), ST_Reverse also reverses components of CompoundCurve (Paul Ramsey)

[5181](#), Reset proj error state after failed parse (Paul Ramsey)

[5171](#), Short circuit geodesic distance when inputs equal (Paul Ramsey)

A.6 PostGIS 3.3.0rc1

2022/08/08

This version requires PostgreSQL 11 or higher, GEOS 3.6 or higher, and Proj 5.2+. Additional features are enabled if you are running GEOS 3.9+ ST_MakeValid enhancements with 3.10+, numerous additional enhancements with GEOS 3.11+. Requires SFCGAL 1.4.1+ for ST_AlphaShape and ST_OptimalAlphaShape.

NOTE: GEOS 3.11.0 was recently released, details at [GEOS 3.11.0 release notes](#)

The new `--enable-lto` flag improves speed of math computations. This new feature is disabled by default because on some platforms, causes compilation errors (BSD and MingW64 issues have been raised)

Use below to enable it.

```
./configure --enable-lto
```

Changes since PostGIS 3.3.0beta2:

A.6.1 Corrección de errores

[5154](#), raster ST_Value is undercosted (Regina Obe)

[5157](#), Revise minimum_bounding_circle Cunit test to be tolerant of small 32-bit floating point differences (Regina Obe)

[5191](#), Functions should use integer instead of int4 (Regina Obe)

[5139](#), PostGIS causes to_jsonb to no longer be parallel safe, ST_AsGeoJSON and ST_AsGML are also parallel unsafe (Regina Obe, Paul Ramsey)

[5025](#), Ensure that additional operators are not appended when the function and opfamily disagree about dimensionality (Paul Ramsey)

[5195](#), #5196 Change address_standardizer and postgis_tiger_geocoder CREATE EXTENSION to use CREATE instead of CREATE OR REPLACE. (Regina Obe)

[5202](#), Guard against downgrade (Sandro Santilli)

[5104](#), postgis_extensions_upgrade() fails with pgextwlist (Regina Obe)

A.7 PostGIS 3.3.0beta2

2022/07/13

This version requires PostgreSQL 11 or higher, GEOS 3.6 or higher, and Proj 5.2+. Additional features are enabled if you are running GEOS 3.9+ ST_MakeValid enhancements with 3.10+, numerous additional enhancements with GEOS 3.11+. Requires SFCGAL 1.4.1+ for ST_AlphaShape and ST_OptimalAlphaShape.

NOTE: GEOS 3.11.0 was recently released, details at [GEOS 3.11.0 release notes](#)

The new --enable-lto flag improves speed of math computations. This new feature is disabled by default because on some platforms, causes compilation errors (BSD and MingW64 issues have been raised)

Use below to enable it.

```
./configure --enable-lto
```

Changes since PostGIS 3.3.0beta1:

A.7.1 Nuevas características

[5183](#), topology.RemoveUnusedPrimitives (Sandro Santilli)

A.7.2 Mejoras

[GH698](#), support parallel aggregate for ST_Union (Sergei Shoulbakov)

A.7.3 Corrección de errores

[5179](#), pgsql2shp syntax error on big-endian (Bas Couwenberg)

A.8 PostGIS 3.3.0beta1

2022/07/03

This version requires PostgreSQL 11 or higher, GEOS 3.6 or higher, and Proj 5.2+. Additional features are enabled if you are running GEOS 3.9+ ST_MakeValid enhancements with 3.10+, numerous additional enhancements with GEOS 3.11+.

Requires SFCGAL 1.4.1+ for ST_AlphaShape and ST_OptimalAlphaShape.

NOTE: GEOS 3.11.0 was recently released, details at [GEOS 3.11.0 release notes](#)

The new `--enable-lto` flag improves math computations. This new feature is disabled by default because on some platforms, causes compilation errors (BSD and MingW64 issues have been raised)

Use below to enable it.

```
./configure --enable-lto
```

A.8.1 Mejoras

[5158](#), `pgtopo_import` / `pgtopo_export` manpages (Sandro Santilli)

[5170](#), add a optional `max_rows_per_copy` to `-Y` option to `raster2pgsql` to control number of rows per copy statement. Default to 50 when not specified (Regina Obe)

[4939](#), [5161](#), `ST_LineMerge` now has option to keep the directions of input linestrings, useful when processing road graphs. Requires GEOS 3.11. (Sergei Shoulbakov)

`ST_ConcaveHull` GEOS 3.11+ polygon-respecting native implementation (Paul Ramsey, Martin Davis)

[5039](#), `postgis_tiger_geocoder` TIGER 2021 (Regina Obe)

A.8.2 New features

>[5169](#), `ST_SimplifyPolygonHull` (requires GEOS 3.11) (Paul Ramsey, Martin Davis)

[5162](#), `ST_TriangulatePolygon` with GEOS 3.11+ (Paul Ramsey, Martin Davis)

A.8.3 Bug Fix

[5173](#) `st_asflatgeobuf` detoast crash (Paul Ramsey)

[4932](#), Bug with geography `ST_Intersects` / `ST_Distance` (Paul Ramsey)

[5114](#), `pgsql2shp` segfault with long or many truncated columns

A.9 PostGIS 3.3.0alpha1

2022/05/21

This version requires PostgreSQL 11 or higher, GEOS 3.6 or higher, and Proj 4.9+. Additional features are enabled if you are running GEOS 3.9+ (precision feature of many processing functions) `ST_MakeValid` enhancements with 3.10+, `ST_ConcaveHull` native GEOS implementation with GEOS 3.11+

Requires SFCGAL 1.4.1+ for `ST_AlphaShape` and `ST_OptimalAlphaShape`.

The new `--enable-lto` flag improves math computations. This new feature is disabled by default because on some platforms, causes compilation errors (BSD and MingW64 issues have been raised)

Use below to enable it.

```
./configure --enable-lto
```

A.9.1 Breaking changes

Drop support for PostgreSQL 9.6 and 10 (Regina Obe)

Change output for WKT MULTIPOINT. All points now wrapped in parens. (Even Roualt)

GH674, geometry validation and fixing is disabled for ST_DumpAsPolygons and ST_Polygon so it works faster but might produce invalid polygons. (Aliaksandr Kalenik)

A.9.2 Mejoras

2861, Add index on topology.node(containing_face) speeding up splitting and merging of faces (Sandro Santilli)

2083, Speed up ST_RemEdge topology functions adding index on relation(element_id) and edge_data(abs_next*) (Sandro Santilli)

5118, Allow dropping topologies with missing topogeometry sequences (Sandro Santilli)

5111, faster topology face MBR computation (Sandro Santilli)

postgis_extensions_upgrade() support for upgrades from any PostGIS version, including yet to be released ones (Sandro Santilli)

5040, add postgis_sfcgal_full_version (Loïc Bartoletti)

GH655, GiST: balance the tree splits better in recursive calls (Darafei Praliaskouski)

GH657, GiST: do not call no-op decompress function (Aliaksandr Kalenik)

4912, GiST: fix crash on STORAGE EXTERNAL for geography (Aliaksandr Kalenik)

ST_ConcaveHull GEOS 3.11+ native implementation (Paul Ramsey, Martin Davis)

4574, GH678, #5121 Enable Link-Time Optimizations using --enable-lto (Sergei Shoulbakov)

GH676, faster ST_Clip (Aliaksandr Kalenik)

5135, Fast GiST index build is enabled by default for PostgreSQL 15+ (Sergei Shoulbakov)

A.9.3 New features

5116, Topology export/import scripts (Sandro Santilli)

ST_Letters creates geometries that look like letters (Paul Ramsey)

5037, postgis_sfcgal: ST_3DConvexHull (Loïc Bartoletti)

postgis_sfcgal: sfcgal_full_version - reports BOOST and CGAL version (Loïc Bartoletti)

GH659, MARC21/XML, ST_GeomFromMARC21, ST_AsMARC21 (Jim Jones)

5132, GH683, sfcgal: ST_3DUnion aggregate function (Sergei Shoulbakov)

5143, SFCGAL ST_AlphaShape and ST_OptimalAlphaShape (Loïc Bartoletti)

A.9.4 Bug Fix

5100, Support for PostgreSQL 15 (atoi removal) (Laurenz Albe)

5123, Support for PostgreSQL 15 - PG15 now exposes json types and functions, do not include for PG15+ (Regina Obe)

5088, Memory corruption in mvt_agg_transfn (Victor Collod)

5137, resetting interrupt flags before query execution (Sergei Shoulbakov)

5148, ST_Clip is more robust to alignment of raster and clip geometry (Sergei Shoulbakov)

A.10 PostGIS 3.2.0 (Olivier Courtin Edition)

2021/12/18

This version requires PostgreSQL 9.6 or higher, GEOS 3.6 or higher, and Proj 4.9+ Additional features are enabled if you are running GEOS 3.9+ (and ST_MakeValid enhancements with 3.10+), Proj 6.1+, and PostgreSQL 14+.

Due to some query performance degradation with the new PG14 fast index build , we have decided to disable the feature by default until we get more user testing as to the true impact of real-world queries. If you are running PG14+, you can reenale it by doing:

```
ALTER OPERATOR FAMILY gist_geometry_ops_2d USING gist
    ADD FUNCTION 11 (geometry)
    geometry_gist_sortsupport_2d (internal);
```

To revert the change:

```
ALTER OPERATOR FAMILY gist_geometry_ops_2d using gist
    DROP FUNCTION 11 (geometry);
```

and then reindex your gist indexes

A.10.1 Breaking changes

5008, Empty geometries are not reported as being within Infinite distance by ST_DWithin (Sandro Santilli)

4824, Removed `--without-wagyu` build option. Using Wagyu is now mandatory to build with MVT support.

4933, topology.GetFaceByPoint will not work with topologies having invalid edge linking.

4981, ST_StartPoint support any geometry. No longer returns null for non-linestrings.

4149, ST_AsMVTGeom now preserves more of original geometry's details at scale close to target extent. If you need previous simplifying behaviour, you can ST_Simplify the geometry in advance. (Darafei Praliaskouski)

- Proj 4.9 or higher is required

5000, Turn off Window support in ST_AsMVT aggregate as no real use-case for it and it crashes with random input (Paul Ramsey)

A.10.2 Mejoras

4997, FlatGeobuf format input/output (Björn Harrtell)

4575, GRANT SELECT on topology metadata tables to PUBLIC (Sandro Santilli)

2592, Do not allow CreateTopology to define topologies with SRID < 0 (Sandro Santilli)

3232, Prevent moving an isolated node to different face (Sandro Santilli)

- Consider collection TopoGeometries while editing topology primitives. (Sandro Santilli)

3248, Prevent removing isolated edges if used in a TopoGeometry (Sandro Santilli)

3231, Prevent removing isolated nodes if used in a TopoGeometry (Sandro Santilli)

3239, Prevent headling topology edges if the connecting node is used in the definition of a TopoGeometry (Sandro Santilli)

4950, Speed up checking containing_face for nodes in ValidateTopology (Sandro Santilli)

4945, Multi-shell face check in ValidateTopology (Sandro Santilli)

4944, Side-location conflict check in ValidateTopology (Sandro Santilli)

3042, ValidateTopology check for edge linking (Sandro Santilli)

- 3276, ValidateTopology check for face's mbr (Sandro Santilli)
- 4936, Bounding box limited ValidateTopology (Sandro Santilli)
- 4933, Speed up topology building in presence of big faces (Sandro Santilli)
- 3233, ValidateTopology check for node's containing_face (Sandro Santilli)
- 4830, ValidateTopology check for edges side face containment (Sandro Santilli)
- 4827, Allow NaN coordinates in WKT input (Paul Ramsey)
- ST_Value() accepts resample parameter to add bilinear option (Paul Ramsey)
- 3778, #4401, ST_Boundary now works for TIN and does not linearize curves (Aliaksandr Kalenik)
- 4881, #4884, Store sign of edge_id for lineal TopoGeometry in relation table to retain direction (Sandro Santilli)
- 4628, Add an option to disable ANALYZE when loading shapefiles (Stefan Corneliu Petrea)
- 4924, Faster ST_RemoveRepeatedPoints on large multipoints, $O(N \log N)$ instead of $O(N^2)$ (Aliaksandr Kalenik, Darafei Praliaskouski)
- 4925, fix ST_DumpPoints to not overlook points (Aliaksandr Kalenik)
- ST_SRID(topogeometry) override, to speedup lookups (Sandro Santilli)
- 2175, Avoid creating additional nodes when adding same closed line to topology (Sandro Santilli)
- 4974, Upgrade path for address_standardizer_data_us (Jan Katins of Aiven, Regina Obe)
- 4975, PostGIS upgrade change to not use temp tables (Jan Katins of Aiven)
- 4981, ST_StartPoint support any geometry (Aliaksandr Kalenik)
- 4799, Include srs in GeoJSON where it exists in spatial_ref_sys.
- 4986, GIST indexes on Postgres 14 are now created faster using Hilbert-sorting method. (Han Wang, Aliaksandr Kalenik, Darafei Praliaskouski, Giuseppe Broccolo)
- 4949, Use proj_normalize_for_visualization to hand "axis swap" decisions (Paul Ramsey)
- GH647, ST_PixelAsCentroids, ST_PixelAsCentroid reimplemented on top of a C function (Sergei Shoulbakov)
- GH648, ST_AsMVTGeom now uses faster clipping (Aliaksandr Kalenik)
- 5018, pgsq2shp basic support for WITH CTE clause (Regina Obe)
- 5019, address_standardizer: Add support for pcre2 (Paul Ramsey)

A.10.3 New features

- 4923, topology.ValidateTopologyRelation (Sandro Santilli)
- 4933, topology.GetFaceContainingPoint (Sandro Santilli)
- 2175, ST_Scroll (Sandro Santilli)
- 4841, FindTopology to quickly get a topology record (Sandro Santilli)
- 4869, FindLayer to quickly get a layer record (Sandro Santilli)
- 4851, TopoGeom_addTopoGeom function (Sandro Santilli)
- ST_MakeValid(geometry, options) allows alternative validity building algorithms with GEOS 3.10 (Paul Ramsey)
- ST_InterpolateRaster() fills in raster cells between sample points using one of a number of algorithms (inverse weighted distance, average, etc) using algorithms from GDAL (Paul Ramsey)
- ST_Contour() generates contour lines from raster values using algorithms from GDAL (Paul Ramsey)
- ST_SetZ()/ST_SetM() fills in z/m coordinates of a geometry using data read from a raster (Paul Ramsey)

New `postgis.gdal_vsi_options` GUC allows out-db rasters on VSI network services to be accessed with authentication keys, etc. (Paul Ramsey)

`ST_DumpSegments` returns a set of segments of input geometry (Aliaksandr Kalenik)

4859, `ST_Point`, `ST_PointZ`, `ST_PointM`, `ST_PointZM`, constructors with SRID parameter (Paul Ramsey)

4808, `ST_ClusterKMeans` now supports `max_radius` argument. Use it when you're not sure what is the number of clusters but you know what the size of clusters should be. (Darafei Praliaskouski)

A.11 PostGIS 3.2.0beta3

2021/12/04

This version requires PostgreSQL 9.6 or higher, GEOS 3.6 or higher, and Proj 4.9+ Additional features are enabled if you are running GEOS 3.9+ (and `ST_MakeValid` enhancements with 3.10+), Proj 6.1+, and PostgreSQL 14+.

Due to some query performance degradation with the new PG14 fast index build , we have decided to disable the feature by default until we get more user testing as to the true impact of real-world queries. If you are running PG14+, you can reenale it by doing:

```
ALTER OPERATOR FAMILY gist_geometry_ops_2d USING gist
    ADD FUNCTION 11 (geometry)
    geometry_gist_sortsupport_2d (internal);
```

To revert the change:

```
ALTER OPERATOR FAMILY gist_geometry_ops_2d using gist
    DROP FUNCTION 11 (geometry);
```

and then reindex your gist indexes

Changes since PostGIS 3.2.0beta2 release:

A.11.1 Breaking changes / fixes

5028, `ST_AsFlatGeobuf` crashes on mixed geometry input (Björn Harrtell)

5029, `ST_AsFlatGeobuf` indexed output corruption (Björn Harrtell)

5014, Crash on `ST_TableFromFlatGeobuf` (Björn Harrtell)

Rename `ST_TableFromFlatGeobuf` to `ST_FromFlatGeobufToTable` (Björn Harrtell)

PG14 fast index building disabled by default. (Paul Ramsey)

A.12 Release 3.2.0beta2

Release date: 2021/11/26

This version requires PostgreSQL 9.6 or higher, GEOS 3.6 or higher, and Proj 4.9+ Additional features are enabled if you are running GEOS 3.9+ (and `ST_MakeValid` enhancements with 3.10+), Proj 6.1+, and PostgreSQL 14+. Changes since PostGIS 3.2.0beta1 release:

A.12.1 Breaking changes / fixes

5016, loader (shp2pgsq): Respect `LD_FLAGS` (Greg Troxel)

5005, `ST_AsFlatGeoBuf` crashes on tables when geometry column is not the first column (Björn Harrtell)

5017, topology.ValidateTopology error relation "shell_check" already exists (Sandro Santilli)

A.12.2 Mejoras

5018, pgsq12shp basic support for WITH CTE clause (Regina Obe)

5019, address_standardizer: Add support for pcre2 (Paul Ramsey)

GH647, ST_AsMVTGeom now uses faster clipping (Aliaksandr Kalenik)

GH648, ST_PixelAsCentroids, ST_PixelAsCentroid reimplemented on top of a C function (Sergei Shoulbakov)

A.13 Release 3.2.0beta1

Release date: 2021/10/23

This version requires PostgreSQL 9.6 or higher, GEOS 3.6 or higher, and Proj 4.9+ Additional features are enabled if you are running GEOS 3.9+ (and ST_MakeValid enhancements with 3.10+), Proj 6.1+, and PostgreSQL 14+.

A.13.1 Bug Fixes and Breaking Changes

5012, Clean regress against released GEOS 3.10.0 (Regina Obe, Paul Ramsey)

5000, Turn off Window support in ST_AsMVT aggregate as no real use-case for it and it crashes with random input (Paul Ramsey)

4994, shp2pgsql is sometimes missing the INSERT statements (Sandro Santilli)

4990, getfacecontainingpoint fails on i386 (Sandro Santilli)

5008, Have ST_DWithin with EMPTY operand always return false (Sandro Santilli)

5002, liblwgeom should build with warning flags by default (Sandro Santilli)

A.13.2 Mejoras

4997, FlatGeobuf format input/output (Björn Harrtell)

A.14 Release 3.2.0alpha1

Release date: 2021/09/10

This version requires PostgreSQL 9.6 or higher, GEOS 3.6 or higher, and Proj 4.9 or higher Additional features are enabled if you are running GEOS 3.9+ (more with GEOS 3.10+), Proj 6.1+, or PostgreSQL 14+.

A.14.1 Breaking changes

#4824, Removed `--without-wagyu` build option. Using Wagyu is now mandatory to build with MVT support.

#4933, topology.GetFaceByPoint will not work with topologies having invalid edge linking.

#4981, ST_StartPoint support any geometry. No longer returns null for non-linestrings.

#4149, ST_AsMVTGeom now preserves more of original geometry's details at scale close to target extent. If you need previous simplifying behaviour, you can ST_Simplify the geometry in advance. (Darafei Praliaskouski)

Proj 4.9 or higher is required.

A.14.2 Mejoras

- #2592, Do not allow CreateTopology to define topologies with SRID > 0 (Sandro Santilli)
- #3232, Prevent moving an isolated node to different face (Sandro Santilli)
- Consider collection TopoGeometries while editing topology primitives. (Sandro Santilli)
- #3248, Prevent removing isolated edges if used in a TopoGeometry (Sandro Santilli)
- #3231, Prevent removing isolated nodes if used in a TopoGeometry (Sandro Santilli)
- #3239, Prevent headling topology edges if the connecting node is used in the definition of a TopoGeometry (Sandro Santilli)
- #4950, Speed up checking containing_face for nodes in ValidateTopology (Sandro Santilli)
- #4945, Multi-shell face check in ValidateTopology (Sandro Santilli)
- #4944, Side-location conflict check in ValidateTopology (Sandro Santilli)
- #3042, ValidateTopology check for edge linking (Sandro Santilli)
- #3276, ValidateTopology check for face's mbr (Sandro Santilli)
- #4936, Bounding box limited ValidateTopology (Sandro Santilli)
- #4933, Speed up topology building in presence of big faces (Sandro Santilli)
- #3233, ValidateTopology check for node's containing_face (Sandro Santilli)
- #4830, ValidateTopology check for edges side face containment (Sandro Santilli)
- #4827, Allow NaN coordinates in WKT input (Paul Ramsey)
- ST_Value() accepts resample parameter to add bilinear option (Paul Ramsey)
- #3778, #4401, ST_Boundary now works for TIN and does not linearize curves (Aliaksandr Kalenik)
- #4881, #4884, Store sign of edge_id for lineal TopoGeometry in relation table to retain direction (Sandro Santilli)
- #4628, Add an option to disable ANALYZE when loading shapefiles (Stefan Corneliu Petrea)
- #4924, Faster ST_RemoveRepeatedPoints on large multipoints, $O(N \log N)$ instead of $O(N^2)$ (Aliaksandr Kalenik, Darafei Praliaskouski)
- #4925, fix ST_DumpPoints to not overlook points (Aliaksandr Kalenik)
- ST_SRID(topogeometry) override, to speedup lookups (Sandro Santilli)
- #2175, Avoid creating additional nodes when adding same closed line to topology (Sandro Santilli)
- #4974, Upgrade path for address_standardizer_data_us (Jan Katins of Aiven, Regina Obe)
- #4975, PostGIS upgrade change to not use temp tables (Jan Katins of Aiven)
- #4981, ST_StartPoint support any geometry (Aliaksandr Kalenik)
- #4799, Include srs in GeoJSON where it exists in spatial_ref_sys.
- #4986, GIST indexes on Postgres 14 are now created faster using Hilbert-sorting method. (Han Wang, Aliaksandr Kalenik, Darafei Praliaskouski, Giuseppe Broccolo)
- #4949, Use proj_normalize_for_visualization to hand "axis swap" decisions (Paul Ramsey)

A.14.3 New features

- #4923, topology.ValidateTopologyRelation (Sandro Santilli)
 - #4933, topology.GetFaceContainingPoint (Sandro Santilli)
 - #2175, ST_Scroll (Sandro Santilli)
 - #4841, FindTopology to quickly get a topology record (Sandro Santilli)
-

#4869, FindLayer to quickly get a layer record (Sandro Santilli)

#4851, TopoGeom_addTopoGeom function (Sandro Santilli)

ST_MakeValid(geometry, options) allows alternative validity building algorithms with GEOS 3.10 (Paul Ramsey)

ST_InterpolateRaster() fills in raster cells between sample points using one of a number of algorithms (inverse weighted distance, average, etc) using algorithms from GDAL (Paul Ramsey)

ST_Contour() generates contour lines from raster values using algorithms from GDAL (Paul Ramsey)

ST_SetZ()/ST_SetM() fills in z/m coordinates of a geometry using data read from a raster (Paul Ramsey)

New postgis.gdal_vsi_options GUC allows out-db rasters on VSI network services to be accessed with authentication keys, etc. (Paul Ramsey)

ST_DumpSegments returns a set of segments of input geometry (Aliaksandr Kalenik)

#4859, ST_Point, ST_PointZ, ST_PointM, ST_PointZM, constructors with SRID parameter (Paul Ramsey)

#4808, ST_ClusterKMeans now supports max_radius argument. Use it when you're not sure what is the number of clusters but you know what the size of clusters should be. (Darafei Praliaskouski)

A.15 Release 3.1.0beta1

Release date: 2020/12/09

Only changes since 3.1.0alpha2 are listed. This version requires PostgreSQL 9.6-13 and GEOS >= 3.6+ Additional features and enhancements enabled if you are running Proj6+, PostgreSQL 12+, and GEOS 3.9.0dev

A.15.1 Breaking changes

4214, Deprecated ST_Count(tablename,...), ST_ApproxCount(tablename, ...), ST_SummaryStats(tablename, ..), ST_Histogram(tablename, ...), ST_ApproxHistogram(tablename, ...), ST_Quantile(tablename, ...), ST_ApproxQuantile(tablename, ...) removed. (Darafei Praliaskouski)

A.15.2 Mejoras

4801, ST_ClusterKMeans supports weights in POINT[Z]M geometries (Darafei Praliaskouski)

4804, ST_ReducePrecision (GEOS 3.9+) allows valid precision reduction (Paul Ramsey)

4805, _ST_SortableHash exposed to work around parallel sorting performance issue in Postgres. If your table is huge, use ORDER BY _ST_SortableHash(geom) instead of ORDER BY geom to make parallel sort faster (Darafei Praliaskouski)

4625, Correlation statistics now calculated. Run ANALYZE for BRIN indexes to start kicking in. (Darafei Praliaskouski)

Fix axis order issue with urn:ogc:def:crs:EPSG in ST_GeomFromGML() (Even Roualt)

A.16 Release 3.1.0alpha3

Release date: 2020/11/19

Only changes since 3.1.0alpha2 are listed. This version requires PostgreSQL 9.6-13 and GEOS >= 3.6+ Additional features and enhancements enabled if you are running Proj6+, PostgreSQL 12+, and GEOS 3.9.0dev

A.16.1 Breaking changes

4737, Bump minimum protobuf-c requirement to 1.1.0 (Raúl Marín) The configure step will now fail if the requirement isn't met or explicitly disabled (--without-protobuf)

4258, Untangle postgis_sfcgal from postgis into its own lib file (Regina Obe)

A.16.2 New features

4698, Add a precision parameter to ST_AsEWKT (Raúl Marín)

Add a gridSize optional parameter to ST_Union, ST_UnaryUnion, ST_Difference, ST_Intersection, ST_SymDifference, ST_Subdivide
Requires GEOS 3.9 (Sandro Santilli)

A.16.3 Mejoras

4789, Speed up TopoJSON output for areal TopoGeometry with many holes (Sandro Santilli)

4758, Improve topology noding robustness (Sandro Santilli)

Make ST_Subdivide interruptable (Sandro Santilli)

4660, Changes in double / coordinate printing (Raúl Marín) - Use the shortest representation (enough to guarantee roundtrip).
- Uses scientific notation for absolute numbers smaller than 1e-8. The previous behaviour was to output 0 for absolute values smaller than 1e-12 and fixed notation for anything bigger than that. - Uses scientific notation for absolute numbers greater than 1e+15 (same behaviour). - The precision parameter now also affects the scientific notation (before it was fixed [5-8]). - All output functions now respect the requested precision (without any limits). - The default precision is the same (9 for GeoJSON, 15 for everything else).

4729, WKT/KML: Print doubles directly into stringbuffers (Raúl Marín)

4533, Use the standard coordinate printing system for box types (Raúl Marín)

4686, Avoid decompressing geographies when possible (Raúl Marín) Affects ANALYZE, _ST_PointOutside, postgis_geobbox, ST_CombineBbox(box2d, geometry), ST_ClipByBox2D when the geometry is fully inside or outside the bbox and ST_BoundingDiagon

4741, Don't use ST_PointInsideCircle if you need indexes, use ST_DWithin instead. Documentation adjusted (Darafei Praliaskouski)

4737, Improve performance and reduce memory usage in ST_AsMVT, especially in queries involving parallelism (Raúl Marín)

4746, Micro optimizations to the serialization process (Raúl Marín)

4719, Fail fast when srids don't match ST_Intersection(geometry,raster) Also schema qualify calls in function. (Regina Obe)

4784, Add ST_CollectionExtract(geometry) with default behaviour of extracting the components of highest coordinate dimension. (Paul Ramsey)

A.16.4 Corrección de errores

4691, Fix segfault during gist index creation with empty geometries (Raúl Marín)

Fix handling of bad WKB inputs (Oracle types) and unit tests for malformed WKB. Remove memory leaks in malformed WKB cases. (Paul Ramsey)

4740, Round values in geography_distance_tree as we do on geography_distance (Raúl Marín, Paul Ramsey, Regina Obe)

4739, Ensure all functions using postgis_oid initialize the internal cache (Raúl Marín)

4767, #4768, #4771, #4772, Fix segfault when parsing invalid WKB (Raúl Marín)

4769, Fix segfault in st_addband (Raúl Marín)

4790, Fix ST_3dintersects calculations with identical vertices (Nicklas Avén)

4742, tiger geocoder reverted to 2018 version on tiger upgrade (Regina Obe)

3372, TopoElementArray cannot be null - change domain constraint (Regina Obe)

A.17 Release 3.1.0alpha2

Release date: 2020/07/18

Only changes since 3.1.0alpha1 are listed. This version requires PostgreSQL 9.6-13 and GEOS >= 3.6+ Additional features and enhancements enabled if you are running Proj6+, PostgreSQL 12+, and GEOS 3.9.0dev

A.17.1 Nuevas características

4656, Cast a `geojson_text::geometry` for implicit GeoJSON ingestion (Raúl Marín)

4687, Expose GEOS `MaximumInscribedCircle` (Paul Ramsey)

4710, `ST_ClusterKMeans` now works with 3D geometries (Darafei Praliaskouski)

A.17.2 Mejoras

4675, `topology.GetRingEdges` now implemented in C (Sandro Santilli)

4681, `ST_GetFaceGeometry`: print corruption information (Sandro Santilli)

4651, `ST_Simplify`: Don't copy if nothing is removed (Raúl Marín)

4657, Avoid De-TOASTing where possible (Paul Ramsey)

4490, Tweak function costs (Raúl Marín)

4672, Cache `getSRSbySRID` and `getSRIDbySRS` (Raúl Marín)

4676, Avoid decompressing toasted geometries to read only the header (Raúl Marín) Optimize cast to Postgresql point type (Raúl Marín)

4620, Update internal `wagyu` to 0.5.0 (Raúl Marín)

4623, Optimize `varlena` returning functions (Raúl Marín)

4677, Share `gserialized` objects between different cache types (Raúl Marín)

Fix compilation with MSVC compiler / Standardize shebangs (Loïc Bartoletti)

A.17.3 Bug fixes

4652, Fix several memory related bugs in `ST_GeomFromGML` (Raúl Marín)

4661, Fix access to `spatial_ref_sys` with a non default schema (Raúl Marín)

4670, `ST_AddPoint`: Fix bug when a positive position is requested (Raúl Marín)

4699, crash on null input to `ST_Union(raster, otherarg)` (Jaime Casanova, 2ndQuadrant)

4716, Fix several issues with `pkg-config` in the configure script (Raúl Marín)

A.18 Release 3.1.0alpha1

Release date: 2020/02/01

This version requires PostgreSQL 9.6+-13 and GEOS >= 3.6+ Additional features and enhancements enabled if you are running Proj6+, PostgreSQL 12+, and GEOS 3.8.0

A.18.1 Breaking Changes

svn number replaced by git hash in version output (Sandro Santilli, Raúl Marín)

4577, Drop support for PostgreSQL 9.5 (Raúl Marín)

4579, Drop `postgis_proc_set_search_path.pl` (Raúl Marín)

4601, `ST_TileEnvelope` signature changed.

3057, `ST_Force3D`, `ST_Force3DZ`, `ST_Force3DM` and `ST_Force4D` signatures changed.

A.18.2 New features

- 4601, Add ST_TileEnvelope margin argument (Yuri Astrakhan)
- 2972, Add quiet mode (-q) to pgsql2shp (Kristian Thy)
- 4617, Add configure switch `--without-phony-revision` (Raúl Marín)
- 3057, Optional value params for Force3D*, Force4D functions (Kristian Thy)
- 4624, ST_HexagonGrid and ST_SquareGrid, set returning functions to generate tilings of the plane (Paul Ramsey)

A.18.3 Mejoras

- 4539, Unify libm includes (Raúl Marín)
- 4569, Allow unknown SRID geometry insertion into typmod SRID column (Paul Ramsey)
- 4149, ST_Simplify(geom, 0) is now O(N). ST_Affine (ST_Translate, ST_TransScale, ST_Rotate) optimized. ST_SnapToGrid optimized. (Darafei Praliaskouski)
- 4574, Link Time Optimizations enabled (Darafei Praliaskouski)
- 4578, Add parallellism and cost properties to brin functions (Raúl Marín)
- 4473, Silence yacc warnings (Raúl Marín)
- 4589, Disable C asserts when building without "--enable-debug" (Raúl Marín)
- 4543, Introduce ryu to print doubles (Raúl Marín)
- 4626, Support pkg-config for libxml2 (Bas Couwenberg)
- 4615, Speed up geojson output (Raúl Marín)

A.19 Release 3.0.0

Release date: 2019/10/20

This version requires PostgreSQL 9.5+-12 and GEOS >= 3.6+ Additional features and enhancements enabled if you are running Proj6+, PostgreSQL 12, and GEOS 3.8.0

A.19.1 Nuevas características

- 2902, postgis_geos_noop (Sandro Santilli)
 - 4128, ST_AsMVT support for Feature ID (Stepan Kuzmin)
 - 4230, SP-GiST and GiST support for ND box operators overlaps, contains, within, equals (Esteban Zimányi and Arthur Lesuisse from Université Libre de Bruxelles (ULB), Darafei Praliaskouski)
 - 4171, ST_3DLineInterpolatePoint (Julien Cabieces, Vincent Mora)
 - 4311, Introduce WAGYU to validate MVT polygons. This option requires a C++11 compiler and will use CXXFLAGS (not CFLAGS). Add `--without-wagyu` to disable this option and keep the behaviour from 2.5 (Raúl Marín)
 - 1833, ST_AsGeoJSON(row) generates full GeoJSON Features (Joe Conway)
 - 3687, Casts json(geometry) and jsonb(geometry) for implicit GeoJSON generation (Paul Ramsey)
 - 4198, Add ST_ConstrainedDelaunayTriangles SFCGAL function (Darafei Praliaskouski)
-

A.19.2 Breaking Changes

4267, Bump minimum GEOS version to 3.6 (Regina Obe, Darafei Praliaskouski)

3888, Raster support now available as a separate extension (Sandro Santilli)

3807, Extension library files no longer include the minor version. Use New configure switch `--with-library-minor-version` if you need the old behavior (Regina Obe)

4230, ND box operators (overlaps, contains, within, equals) now don't look on dimensions that aren't present in both operands. Please REINDEX your ND indexes after upgrade. (Darafei Praliaskouski)

4229, Dropped support for PostgreSQL < 9.5. (Darafei Praliaskouski)

4260, liblwgeom headers are not installed anymore. If your project depends on them available, please use `librttopo` instead. (Darafei Praliaskouski)

4258, Remove SFCGAL support for `ST_Area`, `ST_Distance`, `ST_Intersection`, `ST_Difference`, `ST_Union`, `ST_Intersects`, `ST_3DIntersect`, `ST_3DDistance` and `postgis.backend` switch (Darafei Praliaskouski)

4267, Enable Proj 6 deprecated APIs (Darafei Praliaskouski, Raúl Marín)

4268, Bump minimum SFCGAL version to 1.3.1 (Darafei Praliaskouski)

4331, `ST_3DMakeBox` now returns error instead of a miniscule box (Regina Obe)

4342, Removed "versioned" variants of `ST_AsGeoJSON` and `ST_AsKML` (Paul Ramsey)

4356, `ST_Accum` removed. Use `array_agg` instead. (Darafei Praliaskouski)

4414, Include version number in `address_standardizer` lib (Raúl Marín)

4334, Fix upgrade issues related to renamed function parameters (Raúl Marín)

4442, `raster2pgsql` now skips NODATA tiles. Use `-k` option if you still want them in database for some reason. (Darafei Praliaskouski)

4433, 32-bit hash fix (requires reindexing `hash(geometry)` indexes) (Raúl Marín)

3383, Sorting now uses Hilbert curve and Postgres Abbreviated Compare. You need to REINDEX your btree indexes if you had them. (Darafei Praliaskouski)

A.19.3 Mejoras

4341, Using "support function" API in PostgreSQL 12+ to replace SQL inlining as the mechanism for providing index support under `ST_Intersects`, et al

4330, `postgis_restore` OOM when output piped to an intermediate process (Hugh Ranalli)

4322, Support for Proj 6+ API, bringing more accurate datum transforms and support for WKT projections

4153, `ST_Segmentize` now splits segments proportionally (Darafei Praliaskouski).

4162, `ST_DWithin` documentation examples for storing geometry and radius in table (Darafei Praliaskouski, github user Boscop).

4161 and #4294, `ST_AsMVTGeom`: Shortcut geometries smaller than the resolution (Raúl Marín)

4176, `ST_Intersects` supports `GEOMETRYCOLLECTION` (Darafei Praliaskouski)

4181, `ST_AsMVTGeom`: Avoid type changes due to validation (Raúl Marín)

4183, `ST_AsMVTGeom`: Drop invalid geometries after simplification (Raúl Marín)

4196, Have `postgis_extensions_upgrade()` package unpackaged extensions (Sandro Santilli)

4215, Use floating point compare in `ST_DumpAsPolygons` (Darafei Praliaskouski)

4155, Support for `GEOMETRYCOLLECTION`, `POLYGON`, `TIN`, `TRIANGLE` in `ST_LocateBetween` and `ST_LocateBetweenElevation` (Darafei Praliaskouski)

2767, Documentation for `AddRasterConstraint` optional parameters (Sunveer Singh)

- 4244, Avoid unaligned memory access in BOX2D_out (Raúl Marín)
- 4139, Make mixed-dimension ND index build tree correctly (Darafei Praliaskouski, Arthur Lesuisse, Andrew Gierth, Raúl Marín)
- 4262, Document MULTISURFACE compatibility of ST_LineToCurve (Steven Ottens)
- 4276, ST_AsGeoJSON documentation refresh (Darafei Praliaskouski)
- 4292, ST_AsMVT: parse JSON numeric values with decimals as doubles (Raúl Marín)
- 4300, ST_AsMVTGeom: Always return the simplest geometry (Raúl Marín)
- 4301, ST_Subdivide: fix endless loop on coordinates near coincident to bounds (Darafei Praliaskouski)
- 4289, ST_AsMVTGeom: Transform coordinates space before clipping (Raúl Marín)
- 4272, Improve notice message when unable to compute stats (Raúl Marín)
- 4313, #4307, PostgreSQL 12 compatibility (Laurenz Albe, Raúl Marín)
- 4299, #4304, ST_GeneratePoints is now VOLATILE. IMMUTABLE version with seed parameter added. (Mike Taves)
- 4278, ST_3DDistance and ST_3DIntersects now support Solid TIN and Solid POLYHEDRALSURFACE (Darafei Praliaskouski)
- 4348, ST_AsMVTGeom (GEOS): Enforce validation at all times (Raúl Marín)
- 4295, Allow GEOMETRYCOLLECTION in ST_Overlaps, ST_Contains, ST_ContainsProperly, ST_Covers, ST_CoveredBy, ST_Crosses, ST_Touches, ST_Disjoint, ST_Relate, ST_Equals (Esteban Zimányi)
- 4340, ST_Union aggregate now can handle more than 1 GB of geometries (Darafei Praliaskouski)
- 4378, Allow passing TINs as input to GEOS-backed functions (Darafei Praliaskouski)
- 4368, Reorder LWGEOM struct members to minimize extra padding (Raúl Marín)
- 4141, Use uint64 to handle row counts in the topology extension (Raúl Marín)
- 4412, Support ingesting rasters with NODATA=NaN (Darafei Praliaskouski)
- 4413, Raster tile size follows GeoTIFF block size on raster2pgsql -t auto (Darafei Praliaskouski)
- 4422, Modernize Python 2 code to get ready for Python 3 (Christian Clauss)
- 4352, Use CREATE OR REPLACE AGGREGATE for PG12+ (Raúl Marín)
- 4394, Allow FULL OUTER JOIN on geometry equality operator (Darafei Praliaskouski)
- 4441, Make GiST penalty friendly to multi-column indexes and build single-column ones faster. (Darafei Praliaskouski)
- 4403, Support for shp2pgsql ability to reproject with copy mode (-D) (Regina Obe)
- 4410, More descriptive error messages about SRID mismatch (Darafei Praliaskouski)
- 4399, TIN and Triangle output support in all output functions (Darafei Praliaskouski)
- 3719, Impose minimum number of segments per arc during linearization (Dan Baston / City of Helsinki, Raúl Marín)
- 4277, ST_GeomFromGeoJSON now marks SRID=4326 by default as per RFC7946, ST_AsGeoJSON sets SRID in JSON output if it differs from 4326. (Darafei Praliaskouski)
- 3979, postgis_sfcgal_noop() round trip function (Lucas C. Villa Real)
- 4328, ST_3DIntersects for 2D TINs. (Darafei Praliaskouski)
- 4509, Update geocoder for tiger 2019 (Regina Obe)

A.20 Release 3.0.0rc2

Release date: 2019/10/13

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6. Additional features enabled if you running Proj6+ and/or PostgreSQL 12. Performance enhancements if running GEOS 3.8+

A.20.1 Major highlights

4534, Fix leak in lwcurvepoly_from_wkb_state (Raúl Marín)

4536, Fix leak in lwcollection_from_wkb_state (Raúl Marín)

4537, Fix leak in WKT collection parser (Raúl Marín)

4535, WKB: Avoid buffer overflow (Raúl Marín)

A.21 Release 3.0.0rc1

Release date: 2019/10/08

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6. Additional features enabled if you running Proj6+ and/or PostgreSQL 12. Performance enhancements if running GEOS 3.8+

A.21.1 Major highlights

4519, Fix getSRIDbySRS crash (Raúl Marín)

4520, Use a clean environment when detecting C++ libraries (Raúl Marín)

Restore ST_Union() aggregate signature so drop agg not required and re-work performance/size enhancement to continue to avoid using Array type during ST_Union(), hopefully avoiding Array size limitations. (Paul Ramsey)

A.22 Release 3.0.0beta1

Release date: 2019/09/28

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6. Additional features enabled if you running Proj6+ and/or PostgreSQL 12. Performance enhancements if running GEOS 3.8+

A.22.1 Major highlights

4492, Fix ST_Simplify ignoring the value of the 3rd parameter (Raúl Marín)

4494, Fix ST_Simplify output having an outdated bbox (Raúl Marín)

4493, Fix ST_RemoveRepeatedPoints output having an outdated bbox (Raúl Marín)

4495, Fix ST_SnapToGrid output having an outdated bbox (Raúl Marín)

4496, Make ST_Simplify(TRIANGLE) collapse if requested (Raúl Marín)

4501, Allow postgis_tiger_geocoder to be installable by non-super users (Regina Obe)

4503, Speed up the calculation of cartesian bbox (Raúl Marín)

4504, shp2pgsql -D not working with schema qualified tables (Regina Obe)

4505, Speed up conversion of geometries to/from GEOS (Dan Baston)

4507, Use GEOSMakeValid and GEOSBuildArea for GEOS 3.8+ (Dan Baston)

4491, Speed up ST_RemoveRepeatedPoints (Raúl Marín)

4509, Update geocoder for tiger 2019 (Regina Obe)

4338, Census block level data (tabblock table) not loading (Regina Obe)

A.23 Release 3.0.0alpha4

Release date: 2019/08/11

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6. Additional features enabled if you running Proj6+ and/or PostgreSQL 12

A.23.1 Major highlights

- 4433, 32-bit hash fix (requires reindexing hash(geometry) indexes) (Raúl Marín)
- 4445, Fix a bug in geometry_le (Raúl Marín)
- 4451, Fix the calculation of gserialized_max_header_size (Raúl Marín)
- 4450, Speed up ST_GeometryType (Raúl Marín)
- 4452, Add ST_TileEnvelope() (Paul Ramsey)
- 4403, Support for shp2pgsql ability to reproject with copy mode (-D) (Regina Obe)
- 4417, Update spatial_ref_sys with new entries (Paul Ramsey)
- 4449, Speed up ST_X, ST_Y, ST_Z and ST_M (Raúl Marín)
- 4454, Speed up _ST_OrderingEquals (Raúl Marín)
- 4453, Speed up ST_IsEmpty (Raúl Marín)
- 4271, postgis_extensions_upgrade() also updates after pg_upgrade (Raúl Marín)
- 4466, Fix undefined behaviour in _postgis_gserialized_stats (Raúl Marín)
- 4209, Handle NULL geometry values in pgsq2shp (Paul Ramsey)
- 4419, Use protobuf version to enable/disable mvt/geobuf (Paul Ramsey)
- 4437, Handle POINT EMPTY in shape loader/dumper (Paul Ramsey)
- 4456, add Rasbery Pi 32-bit jenkins bot for testing (Bruce Rindahl, Regina Obe)
- 4420, update path does not exists for address_standardizer extension (Regina Obe)

A.24 Release 3.0.0alpha3

Release date: 2019/07/01

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6

A.24.1 Major highlights

- 4414, Include version number in address_standardizer lib (Raúl Marín)
 - 4352, Use CREATE OR REPLACE AGGREGATE for PG12+ (Raúl Marín)
 - 4334, Fix upgrade issues related to renamed parameters (Raúl Marín)
 - 4388, AddRasterConstraints: Ignore NULLs when generating constraints (Raúl Marín)
 - 4327, Avoid pfree'ing the result of getenv (Raúl Marín)
 - 4406, Throw on invalid characters when decoding geohash (Raúl Marín)
-

- 4429, Avoid resource leaks with PROJ6 (Raúl Marín)
- 4372, PROJ6: Speed improvements (Raúl Marín)
- 3437, Speed up ST_Intersects with Points (Raúl Marín)
- 4438, Update serialization to support extended flags area (Paul Ramsey)
- 4443, Fix wagu configure dropping CPPFLAGS (Raúl Marín)
- 4440, Type lookups in FDW fail (Paul Ramsey)
- 4442, raster2pgsql now skips NODATA tiles. Use -k option if you still want them in database for some reason. (Darafei Praliaskouski)
- 4441, Make GiST penalty friendly to multi-column indexes and build single-column ones faster. (Darafei Praliaskouski)

A.25 Release 3.0.0alpha2

Release date: 2019/06/02

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6

A.25.1 Major highlights

#4404, Fix selectivity issue with support functions (Paul Ramsey)

#4311, Make wagu the default option to validate polygons. This option requires a C++11 compiler and will use CXXFLAGS (not CFLAGS). It is only enabled if built with MVT support (protobuf) Add `--without-wagu` to disable this option and keep the behaviour from 2.5 (Raúl Marín)

#4198, Add ST_ConstrainedDelaunayTriangles SFCGAL function (Darafei Praliaskouski)

A.26 Release 3.0.0alpha1

Release date: 2019/05/26

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.5 - PostgreSQL 12 GEOS >= 3.6

A.26.1 Nuevas características

additional features enabled if you are running Proj6+

Read the NEWS file in the included tarball for more details

A.27 Release 2.5.0

Release date: 2018/09/23

If compiling with PostgreSQL+JIT, LLVM >= 6 is required

Supported PostgreSQL versions for this release are: PostgreSQL 9.4 - PostgreSQL 12 (in development) GEOS >= 3.5

A.27.1 Nuevas características

#1847, spgist 2d and 3d support for PG 11+ (Esteban Zimányi and Arthur Lesuisse from Université Libre de Bruxelles (ULB), Darafei Praliaskouski)

#4056, ST_FilterByM (Nicklas Avén)

#4050, ST_ChaikinSmoothing (Nicklas Avén)

#3989, ST_Buffer single sided option (Stephen Knox)

#3876, ST_Angle function (Rémi Cura)

#3564, ST_LineInterpolatePoints (Dan Baston)

#3896, PostGIS_Extensions_Upgrade() (Regina Obe)

#3913, Upgrade when creating extension from unpackaged (Sandro Santilli)

#2256, _postgis_index_extent() for extent from index (Paul Ramsey)

#3176, Add ST_OrientedEnvelope (Dan Baston)

#4029, Add ST_QuantizeCoordinates (Dan Baston)

#4063, Optional false origin point for ST_Scale (Paul Ramsey)

#4082, Add ST_BandFileSize and ST_BandFileTimestamp, extend ST_BandMetadata (Even Rouault)

#2597, Add ST_Grayscale (Bborie Park)

#4007, Add ST_SetBandPath (Bborie Park)

#4008, Add ST_SetBandIndex (Bborie Park)

A.27.2 Breaking Changes

Upgrade scripts from multiple old versions are now all symlinks to a single upgrade script (Sandro Santilli)

#3944, Update to EPSG register v9.2 (Even Rouault)

#3927, Parallel implementation of ST_AsMVT

#3925, Simplify geometry using map grid cell size before generating MVT

#3899, BTree sort order is now defined on collections of EMPTY and same-prefix geometries (Darafei Praliaskouski)

#3864, Performance improvement for sorting POINT geometries (Darafei Praliaskouski)

#3900, GCC warnings fixed, make -j is now working (Darafei Praliaskouski) - TopoGeo_addLinestring robustness improvements (Sandro Santilli) #1855, #1946, #3718, #3838

#3234, Do not accept EMPTY points as topology nodes (Sandro Santilli)

#1014, Hashable geometry, allowing direct use in CTE signatures (Paul Ramsey)

#3097, Really allow MULTILINESTRING blades in ST_Split() (Paul Ramsey)

#3942, geojson: Do not include private header for json-c >= 0.13 (Björn Esser)

#3954, ST_GeometricMedian now supports point weights (Darafei Praliaskouski)

#3965, #3971, #3977, #4071 ST_ClusterKMeans rewritten: better initialization, faster convergence, K=2 even faster (Darafei Praliaskouski)

#3982, ST_AsEncodedPolyline supports LINESTRING EMPTY and MULTIPOINT EMPTY (Darafei Praliaskouski)

#3986, ST_AsText now has second argument to limit decimal digits (Marc Ducobu, Darafei Praliaskouski)

#4020, Casting from box3d to geometry now returns correctly connected PolyhedralSurface (Matthias Bay)

#2508, ST_OffsetCurve now works with collections (Darafei Praliaskouski)

- #4006, ST_GeomFromGeoJSON support for json and jsonb as input (Paul Ramsey, Regina Obe)
- #4038, ST_Subdivide now selects pivot for geometry split that reuses input vertices. (Darafei Praliaskouski)
- #4025, #4032 Fixed precision issue in ST_ClosestPointOfApproach, ST_DistanceCPA, and ST_CPAWithin (Paul Ramsey, Darafei Praliaskouski)
- #4076, Reduce use of GEOS in topology implementation (Björn Harrtell)
- #4080, Add external raster band index to ST_BandMetaData - Add Raster Tips section to Documentation for information about Raster behavior (e.g. Out-DB performance, maximum open files)
- #4084: Fixed wrong code-comment regarding front/back of BOX3D (Matthias Bay)
- #4060, #4094, PostgreSQL JIT support (Raúl Marín, Laurenz Albe)
- #3960, ST_Centroid now uses lwgeom_centroid (Darafei Praliaskouski)
- #4027, Remove duplicated code in lwgeom_geos (Darafei Praliaskouski, Daniel Baston)
- #4115, Fix a bug that created MVTs with incorrect property values under parallel plans (Raúl Marín).
- #4120, ST_AsMVTGeom: Clip using tile coordinates (Raúl Marín).
- #4132, ST_Intersection on Raster now works without throwing TopologyException (Vinícius A.B. Schmidt, Darafei Praliaskouski)
- #4177, #4180 Support for PostgreSQL 12 dev branch (Laurenz Albe, Raúl Marín)
- #4156, ST_ChaikinSmoothing: also smooth start/end point of polygon by default (Darafei Praliaskouski)

A.28 Release 2.4.5

Release date: 2018/09/12

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.28.1 Corrección de errores

- #4031, Survive to big MaxError tolerances passed to ST_CurveToLine (Sandro Santilli)
 - #4058, Fix infinite loop in linearization of a big radius small arc (Sandro Santilli)
 - #4071, ST_ClusterKMeans crash on NULL/EMPTY fixed (Darafei Praliaskouski)
 - #4079, ensure St_AsMVTGeom outputs CW oriented polygons (Paul Ramsey)
 - #4070, use standard interruption error code on GEOS interruptions (Paul Ramsey)
 - #3980, delay freeing input until processing complete (lucasvr)
 - #4090, PG 11 support (Paul Ramsey, Raúl Marín)
 - #4077, Serialization failure for particular empty geometry cases (Paul Ramsey)
 - #3997, fix bug in lwgeom_median and avoid division by zero (Raúl Marín)
 - #4093, Inconsistent results from qsort callback (yugr)
 - #4081, Geography DWithin() issues for certain cases (Paul Ramsey)
 - #4105, Parallel build of tarball (Bas Couwenberg)
 - #4163, MVT: Fix resource leak when the first geometry is NULL (Raúl Marín)
-

A.29 Release 2.4.4

Release date: 2018/04/08

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.29.1 Corrección de errores

- #3055, [raster] ST_Clip() on a raster without band crashes the server (Regina Obe)
- #3942, geojson: Do not include private header for json-c >= 0.13 (Björn Esser)
- #3952, ST_Transform fails in parallel mode (Paul Ramsey)
- #3978, Fix KNN when upgrading from 2.1 or older (Sandro Santilli)
- #4003, lwpoly_construct_circle: Avoid division by zero (Raúl Marín Rodríguez)
- #4004, Avoid memory exhaustion when building a btree index (Edmund Horner)
- #4016, proj 5.0.0 support (Raúl Marín Rodríguez)
- #4017, lwgeom lexer memory corruption (Peter E)
- #4020, Casting from box3d to geometry now returns correctly connected PolyhedralSurface (Matthias Bay)
- #4025, #4032 Incorrect answers for temporally "almost overlapping" ranges (Paul Ramsey, Darafei Praliaskouski)
- #4052, schema qualify several functions in geography (Regina Obe)
- #4055, ST_ClusterIntersecting drops SRID (Daniel Baston)

A.29.2 Mejoras

- #3946, Compile support for PostgreSQL 11 (Paul Ramsey)
- #3992, Use PKG_PROG_PKG_CONFIG macro from pkg.m4 to detect pkg-config (Bas Couwenberg)
- #4044, Upgrade support for PostgreSQL 11 (Regina Obe)

A.30 Release 2.4.3

Release date: 2018/01/17

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.30.1 Bug Fixes and Enhancements

- #3713, Support encodings that happen to output a ` character
 - #3827, Set configure default to not do interrupt testing, was causing false negatives for many people. (Regina Obe) revised to be standards compliant in #3988 (Greg Troxel)
 - #3930, Minimum bounding circle issues on 32-bit platforms
 - #3965, ST_ClusterKMeans used to lose some clusters on initialization (Darafei Praliaskouski)
 - #3956, Brin opclass object does not upgrade properly (Sandro Santilli)
 - #3982, ST_AsEncodedPolyline supports LINESTRING EMPTY and MULTIPOINT EMPTY (Darafei Praliaskouski)
 - #3975, ST_Transform runs query on spatial_ref_sys without schema qualification. Was causing restore issues. (Paul Ramsey)
-

A.31 Release 2.4.2

Release date: 2017/11/15

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.31.1 Bug Fixes and Enhancements

#3917, Fix zcta5 load

#3667, Fix for bug in geography ST_Segmentize

#3926, Add missing 2.2.6 and 2.3.4 upgrade paths (Muhammad Usama)

A.32 Release 2.4.1

Release date: 2017/10/18

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.32.1 Bug Fixes and Enhancements

#3864, Fix memory leaks in BTREE operators

#3869, Fix build with "gold" linker

#3845, Gracefully handle short-measure issue

#3871, Performance tweak for geometry cmp function

#3879, Division by zero in some arc cases

#3878, Single defn of signum in header

#3880, Undefined behaviour in TYPMOD_GET_SRID

#3875, Fix undefined behaviour in shift operation

#3864, Performance improvements for b-tree geometry sorts

#3874, lw_dist2d_pt_arc division by zero

#3882, undefined behaviour in zigzag with negative inputs

#3891, undefined behaviour in pointarray_to_encoded_polyline

#3895, throw error on malformed WKB input

#3886, fix rare missing boxes in geometry subdivision

#3907, Allocate enough space for all possible GBOX string outputs (Raúl Marín Rodríguez)

A.33 Release 2.4.0

Release date: 2017/09/30

A.33.1 Nuevas características

#3822, Have `postgis_full_version()` also show and check version of PostgreSQL the scripts were built against (Sandro Santilli)

#2411, curves support in `ST_Reverse` (Sandro Santilli)

#2951, `ST_Centroid` for geography (Danny Götte)

#3788, Allow `postgis_restore.pl` to work on directory-style (-Fd) dumps (Roger Crew)

#3772, Direction agnostic `ST_CurveToLine` output (Sandro Santilli / KKGeo)

#2464, `ST_CurveToLine` with `MaxError` tolerance (Sandro Santilli / KKGeo)

#3599, Geobuf output support via `ST_AsGeobuf` (Björn Harrtell)

#3661, Mapbox vector tile output support via `ST_AsMVT` (Björn Harrtell / CartoDB)

#3689, Add orientation checking and forcing functions (Dan Baston)

#3753, Gist penalty speed improvements for 2D and ND points (Darafei Praliaskouski, Andrey Borodin)

#3677, `ST_FrechetDistance` (Shinichi Sugiyama)

Most aggregates (raster and geometry), and all stable / immutable (raster and geometry) marked as parallel safe

#2249, `ST_MakeEmptyCoverage` for raster (David Zwarg, ainomiel)

#3709, Allow signed distance for `ST_Project` (Darafei Praliaskouski)

#524, Covers support for polygon on polygon, line on line, point on line for geography (Danny Götte)

A.33.2 Enhancements and Fixes

Many corrections to docs and several translations almost complete. Andreas Schild who provided many corrections to core docs. PostGIS Japanese translation team first to reach completion of translation.

Support for PostgreSQL 10

Preliminary support for PostgreSQL 11

#3645, Avoid loading logically deleted records from shapefiles

#3747, Add `zip4` and `address_alphanumeric` as attributes to `norm_addy_tiger_geocoder` type.

#3748, `address_standardizer` lookup tables update so `page_normalize_address` better standardizes abbreviations

#3647, better handling of noding in `ST_Node` using `GEOSNode` (Wouter Geraedts)

#3684, Update to EPSG register v9 (Even Rouault)

#3830, Fix initialization of incompatible type (>=9.6) `address_standardizer`

#3662, Make `shp2pgsql` work in debug mode by sending debug to `stderr`

#3405, Fixed memory leak in `lwgeom_to_points`

#3832, Support wide integer fields as `int8` in `shp2pgsql`

#3841, Deterministic sorting support for empty geometries in `btree` geography

#3844, Make `=` operator a strict equality test, and `<` `>` to rough "spatial sorting"

#3855, `ST_AsTWKB` memory and speed improvements

A.33.3 Breaking Changes

Dropped support for PostgreSQL 9.2.

#3810, GEOS 3.4.0 or above minimum required to compile

Most aggregates now marked as parallel safe, which means most aggs have to be dropped / recreated. If you have views that utilize PostGIS aggs, you'll need to drop before upgrade and recreate after upgrade

#3578, ST_NumInteriorRings(POLYGON EMPTY) now returns 0 instead of NULL

_ST_DumpPoints removed, was no longer needed after PostGIS 2.1.0 when ST_DumpPoints got reimplemented in C

B-Tree index operators < = > changed to provide better spatial locality on sorting and have expected behavior on GROUP BY. If you have btree index for geometry or geography, you need to REINDEX it, or review if it was created by accident and needs to be replaced with GiST index. If your code relies on old left-to-right box compare ordering, update it to use << >> operators.

A.34 Release 2.3.3

Release date: 2017/07/01

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.34.1 Bug Fixes and Enhancements

#3777, GROUP BY anomaly with empty geometries

#3711, Azimuth error upon adding 2.5D edges to topology

#3726, PDF manual from dblatex renders fancy quotes for programlisting (Mike Toews)

#3738, raster: Using -s without -Y in raster2pgsql transforms raster data instead of setting srid

#3744, ST_Subdivide loses subparts of inverted geometries (Darafei Praliaskouski Komzpa)

#3750, @ and ~ operator not always schema qualified in geometry and raster functions. Causes restore issues. (Shane StClair of Axiom Data Science)

#3682, Strange fieldlength for boolean in result of pgsq2shp

#3701, Escape double quotes issue in pgsq2shp

#3704, ST_AsX3D crashes on empty geometry

#3730, Change ST_Clip from Error to Notice when ST_Clip can't compute a band

A.35 Release 2.3.2

Release date: 2017/01/31

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.35.1 Bug Fixes and Enhancements

#3418, KNN recheck in 9.5+ fails with index returned tuples in wrong order

#3675, Relationship functions not using an index in some cases

#3680, PostGIS upgrade scripts missing GRANT for views

#3683, Unable to update postgis after postgres pg_upgrade going from < 9.5 to pg > 9.4

#3688, ST_AsLatLonText: round minutes

A.36 Release 2.3.1

Release date: 2016/11/28

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.36.1 Bug Fixes and Enhancements

#1973, `st_concavehull()` returns sometimes empty geometry collection Fix from gde

#3501, add raster constraint max extent exceeds array size limit for large tables

#3643, PostGIS not building on latest OSX XCode

#3644, Deadlock on interrupt

#3650, Mark `ST_Extent`, `ST_3DExtent` and `ST_Mem*` agg functions as parallel safe so they can be parallelized

#3652, Crash on `Collection(MultiCurve())`

#3656, Fix upgrade of aggregates from 2.2 or lower version

#3659, Crash caused by raster GUC define after `CREATE EXTENSION` using wrong memory context. (manaeem)

#3665, Index corruption and memory leak in BRIN indexes patch from Julien Rouhaud (Dalibo)

#3667, geography `ST_Segmentize` bug patch from Hugo Mercier (Oslandia)

A.37 Release 2.3.0

Release date: 2016/09/26

This is a new feature release, with new functions, improved performance, all relevant bug fixes from PostGIS 2.2.3, and other goodies.

A.37.1 Important / Breaking Changes

#3466, Casting from `box3d` to geometry now returns a 3D geometry (Julien Rouhaud of Dalibo)

#3396, `ST_EstimatedExtent`, throw `WARNING` instead of `ERROR` (Regina Obe)

A.37.2 Nuevas características

Add support for custom TOC in `postgis_restore.pl` (Christoph Moench-Tegeder)

Add support for negative indexing in `ST_PointN` and `ST_SetPoint` (Rémi Cura)

Add parameters for geography `ST_Buffer` (Thomas Bonfort)

`TopoGeom_addElement`, `TopoGeom_remElement` (Sandro Santilli)

`populate_topology_layer` (Sandro Santilli)

#454, `ST_WrapX` and `lwgeom_wrapx` (Sandro Santilli)

#1758, `ST_Normalize` (Sandro Santilli)

#2236, `shp2pgsql -d` now emits "DROP TABLE IF EXISTS"

#2259, `ST_VoronoiPolygons` and `ST_VoronoiLines` (Dan Baston)

#2841 and #2996, `ST_MinimumBoundingRadius` and new `ST_MinimumBoundingCircle` implementation using Welzl's algorithm (Dan Baston)

#2991, Enable ST_Transform to use PROJ.4 text (Mike Toews)

#3059, Allow passing per-dimension parameters in ST_Expand (Dan Baston)

#3339, ST_GeneratePoints (Paul Ramsey)

#3362, ST_ClusterDBSCAN (Dan Baston)

#3364, ST_GeometricMedian (Dan Baston)

#3391, Add table inheritance support in ST_EstimatedExtent (Alessandro Pasotti)

#3424, ST_MinimumClearance (Dan Baston)

#3428, ST_Points (Dan Baston)

#3465, ST_ClusterKMeans (Paul Ramsey)

#3469, ST_MakeLine with MULTIPOINTs (Paul Norman)

#3549, Support PostgreSQL 9.6 parallel query mode, as far as possible (Paul Ramsey, Regina Obe)

#3557, Geometry function costs based on query stats (Paul Norman)

#3591, Add support for BRIN indexes. PostgreSQL 9.4+ required. (Giuseppe Broccolo of 2nd Quadrant, Julien Rouhaud and Ronan Dunklau of Dalibo)

#3496, Make postgis non-relocateable for extension install, schema qualify calls in functions (Regina Obe) Should resolve once and for all for extensions #3494, #3486, #3076

#3547, Update tiger geocoder to support TIGER 2016 and to support both http and ftp.

#3613, Segmentize geography using equal length segments (Hugo Mercier of Oslandia)

A.37.3 Corrección de errores

All relevant bug fixes from PostGIS 2.2.3

#2841, ST_MinimumBoundingCircle not covering original

#3604, pgcommon/Makefile.in orders CFLAGS incorrectly leading to wrong liblwgeom.h (Greg Troxel)

A.37.4 Performance Enhancements

#75, Enhancement to PIP short circuit (Dan Baston)

#3383, Avoid deserializing small geometries during index operations (Dan Baston)

#3400, Minor optimization of PIP routines (Dan Baston)

Make adding a line to topology interruptible (Sandro Santilli)

Documentation updates from Mike Toews

A.38 Release 2.2.2

Release date: 2016/03/22

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.38.1 Nuevas características

#3463, Fix crash on face-collapsing edge change

#3422, Improve ST_Split robustness on standard precision double systems (arm64, ppc64el, s390c, powerpc, ...)

#3427, Update spatial_ref_sys to EPSG version 8.8

#3433, ST_ClusterIntersecting incorrect for MultiPoints

#3435, ST_AsX3D fix rendering of concave geometries

#3436, memory handling mistake in parray_clone_deep

#3437, ST_Intersects incorrect for MultiPoints

#3461, ST_GeomFromKML crashes Postgres when there are innerBoundaryIs and no outerBoundaryIs

#3429, upgrading to 2.3 or from 2.1 can cause loop/hang on some platforms

#3460, ST_ClusterWithin 'Tolerance not defined' error after upgrade

#3490, Raster data restore issues, materialized views. Scripts postgis_proc_set_search_path.sql, rtpostgis_proc_set_search_path.sql refer to http://postgis.net/docs/manual-2.2/RT_FAQ.html#faq_raster_data_not_restore

#3426, failing POINT EMPTY tests on fun architectures

A.39 Versión 2.2.1

Fecha de versión: 2016/01/06

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.39.1 Nuevas características

2232, evitar el error acumulado en el redondeo de SVG

#3321, Corregir la regresión del rendimiento en la carga de topología

#3329, Corrección de regresión de robustez en TopoGeo_addPoint

#3349, Corregir la ruta de instalación de los scripts postgis_topology

#3351, Establecer el aislamiento de nodos finales en ST_RemoveIsoEdge (y lwt_RemIsoEdge)

#3355, Geografía ST_Segmentize tiene cuadro delimitador de geometría

#3359, corregir la pérdida de baja de identificación de primitivas desde toTopoGeom a la definición TopoGeometry

#3360, _raster_constraint_info_scale Sintaxis de entrada no válida

#3375, bloqueo en la eliminación de puntos repetidos para la collection(point)

#3378, Fix handling of hierarchical TopoGeometries in presence of multiple topologies

#3380, #3402, Decimate lines on topology load

#3388, #3410, Fix missing end-points in ST_Removepoints

#3389, Buffer overflow in lwgeom_to_geojson

#3390, Compilation under Alpine Linux 3.2 gives an error when compiling the postgis and postgis_topology extension

#3393, ST_Area NaN for some polygons

#3401, Improve ST_Split robustness on 32bit systems

#3404, ST_ClusterWithin crashes backend

#3407, Fix crash on splitting a face or an edge defining multiple TopoGeometry objects

#3411, Clustering functions not using spatial index

#3412, Improve robustness of snapping step in TopoGeo_addLinestring

#3415, Fix OSX 10.9 build under pkgsrc

Fix memory leak in lwt_ChangeEdgeGeom [liblwgeom]

A.40 Versión 2.2.0

Fecha de versión: 2015/10/07

This is a new feature release, with new functions, improved performance, and other goodies.

A.40.1 Nuevas características

Topology API in liblwgeom (Sandro Santilli / Regione Toscana - SITA)

New lwgeom_unaryunion method in liblwgeom

New lwgeom_linemerge method in liblwgeom

New lwgeom_is_simple method in liblwgeom

#3169, Add SFCGAL 1.1 support: add ST_3DDifference, ST_3DUnion, ST_Volume, ST_MakeSolid, ST_IsSolid (Vincent Mora / Oslandia)

#3169, ST_ApproximateMedialAxis (Sandro Santilli)

ST_CPAWithin (Sandro Santilli / Boundless)

Add |= operator with CPA semantic and KNN support with PostgreSQL 9.5+ (Sandro Santilli / Boundless)

#3131, KNN support for the geography type (Paul Ramsey / CartoDB)

#3023, ST_ClusterIntersecting / ST_ClusterWithin (Dan Baston)

#2703, Exact KNN results for all geometry types, aka "KNN re-check" (Paul Ramsey / CartoDB)

#1137, Allow a tolerance value in ST_RemoveRepeatedPoints (Paul Ramsey / CartoDB)

#3062, Allow passing M factor to ST_Scale (Sandro Santilli / Boundless)

#3139, ST_BoundingDiagonal (Sandro Santilli / Boundless)

#3129, ST_IsValidTrajectory (Sandro Santilli / Boundless)

#3128, ST_ClosestPointOfApproach (Sandro Santilli / Boundless)

#3152, ST_DistanceCPA (Sandro Santilli / Boundless)

Canonical output for index key types

ST_SwapOrdinates (Sandro Santilli / Boundless)

#2918, Use GeographicLib functions for geodetics (Mike Toews)

#3074, ST_Subdivide to break up large geometry (Paul Ramsey / CartoDB)

#3040, KNN GiST index based centroid (<<<->>) n-D distance operators (Sandro Santilli / Boundless)

Interruptibility API for liblwgeom (Sandro Santilli / CartoDB)

#2939, ST_ClipByBox2D (Sandro Santilli / CartoDB)

#2247, ST_Retile and ST_CreateOverview: in-db raster overviews creation (Sandro Santilli / Vizzuality)

#899, -m shp2pgsql attribute names mapping -m switch (Regina Obe / Sandro Santilli)

#1678, Added GUC `postgis.gdal_datapath` to specify GDAL config variable `GDAL_DATA`

#2843, Support reprojection on raster import (Sandro Santilli / Vizzuality)

#2349, Support for `encoded_polyline` input/output (Kashif Rasul)

#2159, report `libjson` version from `postgis_full_version()`

#2770, `ST_MemSize(raster)`

Add `postgis_noop(raster)`

Added missing variants of `ST_TPI()`, `ST_TRI()` and `ST_Roughness()`

Added GUC `postgis.gdal_enabled_drivers` to specify GDAL config variable `GDAL_SKIP`

Added GUC `postgis.enable_outdb_rasters` to enable access to rasters with out-db bands

#2387, `address_standardizer` extension as part of PostGIS (Stephen Woodbridge / imaptools.com, Walter Sinclair, Regina Obe)

#2816, `address_standardizer_data_us` extension provides reference `lex,gaz,rules` for `address_standardizer` (Stephen Woodbridge / imaptools.com, Walter Sinclair, Regina Obe)

#2341, New mask parameter for `ST_MapAlgebra`

#2397, read encoding info automatically in shapefile loader

#2430, `ST_ForceCurve`

#2565, `ST_SummaryStatsAgg()`

#2567, `ST_CountAgg()`

#2632, `ST_AsGML()` support for curved features

#2652, Add `--upgrade-path` switch to `run_test.pl`

#2754, `sfcgal` wrapped as an extension

#2227, Simplification with Visvalingam-Whyatt algorithm `ST_SimplifyVW`, `ST_SetEffectiveArea` (Nicklas Avén)

Functions to encode and decode TWKB `ST_AsTWKB`, `ST_GeomFromTWKB` (Paul Ramsey / Nicklas Avén / CartoDB)

A.40.2 Mejoras

#3223, Add `memcmp` short-circuit to `ST_Equals` (Daniel Baston)

#3227, Tiger geocoder upgraded to support Tiger 2015 census

#2278, Make `liblwgeom` compatible between minor releases

#897, `ST_AsX3D` support for `GeoCoordinates` and systems "GD" "WE" ability to flip x/y axis (use option = 2, 3)

`ST_Split`: allow splitting lines by multilines, multipoints and (multi)polygon boundaries

#3070, Simplify geometry type constraint

#2839, Implement selectivity estimator for functional indexes, speeding up spatial queries on raster tables. (Sandro Santilli / Vizzuality)

#2361, Added `spatial_index` column to `raster_columns` view

#2390, Testsuite for `pgsql2shp`

#2527, Added `-k` flag to `raster2pgsql` to skip checking that band is NODATA

#2616, Reduce text casts during topology building and export

#2717, support `startpoint`, `endpoint`, `pointn`, `numpoints` for `compoundcurve`

#2747, Add support for GDAL 2.0

#2754, `SFCGAL` can now be installed with `CREATE EXTENSION` (Vincent Mora @ Oslandia)

- #2828, Convert ST_Envelope(raster) from SQL to C
- #2829, Shortcut ST_Clip(raster) if geometry fully contains the raster and no NODATA specified
- #2906, Update tiger geocoder to handle tiger 2014 data
- #3048, Speed up geometry simplification (J.Santana @ CartoDB)
- #3092, Slow performance of geometry_columns with many tables

A.41 Versión 2.1.8

Fecha de versión: 2015-07-07

This is a critical bug fix release.

A.41.1 Corrección de errores

- #3159, do not force a bbox cache on ST_Affine
- #3018, GROUP BY geography sometimes returns duplicate rows
- #3084, shp2pgsql - illegal number format when specific system locale set
- #3094, Malformed GeoJSON inputs crash backend
- #3104, st_asgml introduces random characters in ID field
- #3155, Remove liblwgeom.h on make uninstall
- #3177, gserialized_is_empty cannot handle nested empty cases
- Fix crash in ST_LineLocatePoint

A.42 Versión 2.1.7

Fecha de versión: 2015-03-30

This is a critical bug fix release.

A.42.1 Corrección de errores

- #3086, ST_DumpValues() crashes backend on cleanup with invalid band indexes
- #3088, Do not (re)define strcasestr in a liblwgeom.h
- #3094, Malformed GeoJSON inputs crash backend

A.43 Versión 2.1.6

Fecha de versión: 2015-03-20

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.43.1 Mejoras

- #3000, Ensure edge splitting and healing algorithms use indexes
 - #3048, Speed up geometry simplification (J.Santana @ CartoDB)
 - #3050, Speed up geometry type reading (J.Santana @ CartoDB)
-

A.43.2 Corrección de errores

- #2941, allow geography columns with SRID other than 4326
- #3069, small objects getting inappropriately fluffed up w/ boxes
- #3068, Have postgis_typmod_dims return NULL for unconstrained dims
- #3061, Allow duplicate points in JSON, GML, GML ST_GeomFrom* functions
- #3058, Fix ND-GiST picksplit method to split on the best plane
- #3052, Make operators <-> and <#> available for PostgreSQL < 9.1
- #3045, Fix dimensionality confusion in &&& operator
- #3016, Allow unregistering layers of corrupted topologies
- #3015, Avoid exceptions from TopologySummary
- #3020, ST_AddBand out-db bug where height using width value
- #3031, Allow restore of Geometry(Point) tables dumped with empties in them

A.44 Versión 2.1.5

Fecha de versión: 2014-12-18

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.44.1 Mejoras

- #2933, Speedup construction of large multi-geometry objects

A.44.2 Corrección de errores

- #2947, Fix memory leak in lwgeom_make_valid for single-component collection input
- #2949, Fix memory leak in lwgeom_mindistance2d for curve input
- #2931, BOX representation is case sensitive
- #2942, PostgreSQL 9.5 support
- #2953, 2D stats not generated when Z/M values are extreme
- #3009, Geography cast may effect underlying tuple

A.45 Versión 2.1.4

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.45.1 Mejoras

- #2745, Speedup ST_Simplify calls against points
 - #2747, Support for GDAL 2.0
 - #2749, Make rtpostgis_upgrade_20_21.sql ACID
 - #2811, Do not specify index names when loading shapefiles/rasters
 - #2829, Shortcut ST_Clip(raster) if geometry fully contains the raster and no NODATA specified
 - #2895, Raise cost of ST_ConvexHull(raster) to 300 for better query plans
-

A.45.2 Corrección de errores

#2605, armel: `_ST_Covers()` returns true for point in hole

#2911, Fix output scale on `ST_Rescale/ST_Resample/ST_Resize` of rasters with scale 1/-1 and offset 0/0.

Corregir caída en `ST_Union(raster)`

#2704, `ST_GeomFromGML()` does not work properly with array of `gml:pos` (Even Roualt)

#2708, `updategeometrysrid` doesn't update srid check when schema not specified. Patch from Marc Jansen

#2720, `lwpoly_add_ring` should update maxrings after realloc

#2759, Fix `postgis_restore.pl` handling of multiline object comments embedding sql comments

#2774, fix undefined behavior in `ptarray_calculate_gbox_geodetic`

Fix potential memory fault in `ST_MakeValid`

#2784, Fix handling of bogus argument to `--with-sfcgal`

#2772, Premature memory free in `RASTER_getBandPath (ST_BandPath)`

#2755, Fix regressions tests against all versions of SFCGAL

#2775, `lwline_from_lwmpoint` leaks memory

#2802, `ST_MapAlgebra` checks for valid callback function return value

#2803, `ST_MapAlgebra` handles no userarg and STRICT callback function

#2834, `ST_Estimated_Extent` and `mixedCase` table names (regression bug)

#2845, Bad geometry created from `ST_AddPoint`

#2870, Binary insert into geography column results geometry being inserted

#2872, make install builds documentation (Greg Troxell)

#2819, find isfinite or replacement on Centos5 / Solaris

#2899, geocode limit 1 not returning best answer (tiger geocoder)

#2903, Unable to compile on FreeBSD

#2927 `reverse_geocode` not filling in direction prefix (tiger geocoder) get rid of deprecated `ST_Line_Locate_Point` called

A.46 Versión 2.1.3

Fecha de versión: 2014/05/13

This is a bug fix and security release.

A.46.1 Cambios importantes

Starting with this version offline raster access and use of GDAL drivers are disabled by default.

An environment variable is introduced to allow for enabling specific GDAL drivers: `POSTGIS_GDAL_ENABLED_DRIVERS`. By default, all GDAL drivers are disabled

An environment variable is introduced to allow for enabling out-db raster bands: `POSTGIS_ENABLE_OUTDB_RASTERS`. By default, out-db raster bands are disabled

The environment variables must be set for the PostgreSQL process, and determines the behavior of the whole cluster.

A.46.2 Corrección de errores

#2697, invalid GeoJSON Polygon input crashes server process

#2700, Fix dumping of higher-dimension datasets with null rows

#2706, ST_DumpPoints of EMPTY geometries crashes server

A.47 Versión 2.1.2

Fecha de versión: 2014/03/31

This is a bug fix release, addressing issues that have been filed since the 2.1.1 release.

A.47.1 Corrección de errores

#2666, Error out at configure time if no SQL preprocessor can be found

#2534, st_distance returning incorrect results for large geographies

#2539, Check for json-c/json.h presence/usability before json/json.h

#2543, invalid join selectivity error from simple query

#2546, GeoJSON with string coordinates parses incorrectly

#2547, Fix ST_Simplify(TopoGeometry) for hierarchical topogeoms

#2552, Fix NULL raster handling in ST_AsPNG, ST_AsTIFF and ST_AsJPEG

#2555, Fix parsing issue of range arguments of ST_Reclass

#2556, geography ST_Intersects results depending on insert order

#2580, Do not allow installing postgis twice in the same database

#2589, Remove use of unnecessary void pointers

#2607, Cannot open more than 1024 out-db files in one process

#2610, Ensure face splitting algorithm uses the edge index

#2615, EstimatedExtent (and hence, underlying stats) gathering wrong bbox

#2619, Empty rings array in GeoJSON polygon causes crash

#2634, regression in sphere distance code

#2638, Geography distance on M geometries sometimes wrong

#2648, #2653, Fix topology functions when "topology" is not in search_path

#2654, Drop deprecated calls from topology

#2655, Let users without topology privileges call postgis_full_version()

#2674, Fix missing operator = and hash_raster_ops opclass on raster

#2675, #2534, #2636, #2634, #2638, Geography distance issues with tree optimization

A.47.2 Mejoras

#2494, avoid memcopy in GiST index (hayamiz)

#2560, soft upgrade: avoid drop/recreate of aggregates that hadn't changed

A.48 Versión 2.1.1

Fecha de versión: 2013/11/06

This is a bug fix release, addressing issues that have been filed since the 2.1.0 release.

A.48.1 Cambios importantes

#2514, Change raster license from GPL v3+ to v2+, allowing distribution of PostGIS Extension as GPLv2.

A.48.2 Corrección de errores

#2396, Make regression tests more endian-agnostic

#2434, Fix ST_Intersection(geog,geog) regression in rare cases

#2454, Fix behavior of ST_PixelAsXXX functions regarding exclude_nodata_value parameter

#2489, Fix upgrades from 2.0 leaving stale function signatures

#2525, Fix handling of SRID in nested collections

#2449, Fix potential infinite loop in index building

#2493, Fix behavior of ST_DumpValues when passed an empty raster

#2502, Fix postgis_topology_scripts_installed() install schema

#2504, Fix segfault on bogus pgsql2shp call

#2512, Support for foreign tables and materialized views in raster_columns and raster_overviews

A.48.3 Mejoras

#2478, support for tiger 2013

#2463, support for exact length calculations on arc geometries

A.49 Versión 2.1.0

Fecha de versión: 2013/08/17

This is a minor release addressing both bug fixes and performance and functionality enhancements addressing issues since 2.0.3 release. If you are upgrading from 2.0+, only a soft upgrade is required. If you are upgrading from 1.5 or earlier, a hard upgrade is required.

A.49.1 Important / Breaking Changes

#1653, Removed srid parameter from ST_Resample(raster) and variants with reference raster no longer apply reference raster's SRID.

#1962 ST_Segmentize - As a result of the introduction of geography support, The construct: `SELECT ST_Segmentize('LINESTRING(2 3 4)', 0.5);` will result in ambiguous function error

#2026, ST_Union(raster) now unions all bands of all rasters

#2089, liblwgeom: lwgeom_set_handlers replaces lwgeom_init_allocators.

#2150, regular_blocking is no longer a constraint. column of same name in raster_columns now checks for existence of spatially_unique and coverage_tile constraints

`ST_Intersects(raster, geometry)` behaves in the same manner as `ST_Intersects(geometry, raster)`.

point variant of `ST_SetValue(raster)` previously did not check SRID of input geometry and raster.

`ST_Hillshade` parameters azimuth and altitude are now in degrees instead of radians.

`ST_Slope` and `ST_Aspect` return pixel values in degrees instead of radians.

#2104, `ST_World2RasterCoord`, `ST_World2RasterCoordX` and `ST_World2RasterCoordY` renamed to `ST_WorldToRasterCoord`, `ST_WorldToRasterCoordX` and `ST_WorldToRasterCoordY`. `ST_Raster2WorldCoord`, `ST_Raster2WorldCoordX` and `ST_Raster2WorldCoordY` renamed to `ST_RasterToWorldCoord`, `ST_RasterToWorldCoordX` and `ST_RasterToWorldCoordY`

`ST_Estimated_Extent` renamed to `ST_EstimatedExtent`

`ST_Line_Interpolate_Point` renamed to `ST_LineInterpolatePoint`

`ST_Line_Substring` renamed to `ST_LineSubstring`

`ST_Line_Locate_Point` renamed to `ST_LineLocatePoint`

`ST_Force_XXX` renamed to `ST_ForceXXX`

`ST_MapAlgebraFctNgb` and 1 and 2 raster variants of `ST_MapAlgebraFct`. Use `ST_MapAlgebra` instead

1 and 2 raster variants of `ST_MapAlgebraExpr`. Use expression variants of `ST_MapAlgebra` instead

A.49.2 Nuevas características

- Refer to http://postgis.net/docs/manual-2.1/PostGIS_Special_Functions_Index.html#NewFunctions_2_1 for complete list of new functions

#310, `ST_DumpPoints` converted to a C function (Nathan Wagner) and much faster

#739, `UpdateRasterSRID()`

#945, improved join selectivity, N-D selectivity calculations, user accessible selectivity and stats reader functions for testing (Paul Ramsey / OpenGeo)

`toTopoGeom` with `TopoGeometry` sink (Sandro Santilli / Vizzuality)

`clearTopoGeom` (Sandro Santilli / Vizzuality)

`ST_Segmentize(geography)` (Paul Ramsey / OpenGeo)

`ST_DelaunayTriangles` (Sandro Santilli / Vizzuality)

`ST_NearestValue`, `ST_Neighborhood` (Bborie Park / UC Davis)

`ST_PixelAsPoint`, `ST_PixelAsPoints` (Bborie Park / UC Davis)

`ST_PixelAsCentroid`, `ST_PixelAsCentroids` (Bborie Park / UC Davis)

`ST_Raster2WorldCoord`, `ST_World2RasterCoord` (Bborie Park / UC Davis)

Additional raster/raster spatial relationship functions (`ST_Contains`, `ST_ContainsProperly`, `ST_Covers`, `ST_CoveredBy`, `ST_Disjoint`, `ST_Overlaps`, `ST_Touches`, `ST_Within`, `ST_DWithin`, `ST_DFullyWithin`) (Bborie Park / UC Davis)

Added array variants of `ST_SetValues()` to set many pixel values of a band in one call (Bborie Park / UC Davis)

#1293, `ST_Resize(raster)` to resize rasters based upon width/height

#1627, package `tiger_geocoder` as a PostgreSQL extension

#1643, **#2076**, Upgrade tiger geocoder to support loading tiger 2011 and 2012 (Regina Obe / Paragon Corporation) Funded by Hunter Systems Group

GEOMETRYCOLLECTION support for `ST_MakeValid` (Sandro Santilli / Vizzuality)

#1709, `ST_NotSameAlignmentReason(raster, raster)`

#1818, `ST_GeomFromGeoHash` and friends (Jason Smith (darkpanda))

#1856, reverse geocoder rating setting for prefer numbered highway name

ST_PixelOfValue (Bborie Park / UC Davis)

Casts to/from PostgreSQL geotypes (point/path/polygon).

Added geomval array variant of ST_SetValues() to set many pixel values of a band using a set of geometries and corresponding values in one call (Bborie Park / UC Davis)

ST_Tile(raster) to break up a raster into tiles (Bborie Park / UC Davis)

#1895, new r-tree node splitting algorithm (Alex Korotkov)

#2011, ST_DumpValues to output raster as array (Bborie Park / UC Davis)

#2018, ST_Distance support for CircularString, CurvePolygon, MultiCurve, MultiSurface, CompoundCurve

#2030, n-raster (and n-band) ST_MapAlgebra (Bborie Park / UC Davis)

#2193, Utilize PAGC parser as drop in replacement for tiger normalizer (Steve Woodbridge, Regina Obe)

#2210, ST_MinConvexHull(raster)

lwgeom_from_geojson in liblwgeom (Sandro Santilli / Vizzuality)

#1687, ST_Simplify for TopoGeometry (Sandro Santilli / Vizzuality)

#2228, TopoJSON output for TopoGeometry (Sandro Santilli / Vizzuality)

#2123, ST_FromGDALRaster

#613, ST_SetGeoReference with numerical parameters instead of text

#2276, ST_AddBand(raster) variant for out-db bands

#2280, ST_Summary(raster)

#2163, ST_TPI for raster (Nathaniel Clay)

#2164, ST_TRI for raster (Nathaniel Clay)

#2302, ST_Roughness for raster (Nathaniel Clay)

#2290, ST_ColorMap(raster) to generate RGBA bands

#2254, Add SFCGAL backend support. (Backend selection through postgres.backend var) Functions available both through GEOS or SFCGAL: ST_Intersects, ST_3DIntersects, ST_Intersection, ST_Area, ST_Distance, ST_3DDistance New functions available only with SFCGAL backend: ST_3DIntersection, ST_Tessellate, ST_3DArea, ST_Extrude, ST_ForceLHR ST_Orientation, ST_Minkowski, ST_StraightSkeleton postgres_sfcgal_version New function available in PostGIS: ST_ForceSFS (Olivier Courtin and Hugo Mercier / Oslandia)

A.49.3 Mejoras

For detail of new functions and function improvements, please refer to Section 15.12.10.

Much faster raster ST_Union, ST_Clip and many more function additions operations

For geometry/geography better planner selectivity and a lot more functions.

#823, tiger geocoder: Make loader_generate_script download portion less greedy

#826, raster2pgsql no longer defaults to padding tiles. Flag -P can be used to pad tiles

#1363, ST_AddBand(raster, ...) array version rewritten in C

#1364, ST_Union(raster, ...) aggregate function rewritten in C

#1655, Additional default values for parameters of ST_Slope

#1661, Add aggregate variant of ST_SameAlignment

#1719, Add support for Point and GeometryCollection ST_MakeValid inputs

- #1780, support ST_GeoHash for geography
 - #1796, Big performance boost for distance calculations in geography
 - #1802, improved function interruptibility.
 - #1823, add parameter in ST_AsGML to use id column for GML 3 output (become mandatory since GML 3.2.1)
 - #1856, tiger geocoder: reverse geocoder rating setting for prefer numbered highway name
 - #1938, Refactor basic ST_AddBand to add multiple new bands in one call
 - #1978, wrong answer when calculating length of a closed circular arc (circle)
 - #1989, Preprocess input geometry to just intersection with raster to be clipped
 - #2021, Added multi-band support to ST_Union(raster, ...) aggregate function
 - #2006, better support of ST_Area(geography) over poles and dateline
 - #2065, ST_Clip(raster, ...) now a C function
 - #2069, Added parameters to ST_Tile(raster) to control padding of tiles
 - #2078, New variants of ST_Slope, ST_Aspect and ST_HillShade to provide solution to handling tiles in a coverage
 - #2097, Added RANGE uniontype option for ST_Union(raster)
 - #2105, Added ST_Transform(raster) variant for aligning output to reference raster
 - #2119, Rasters passed to ST_Resample(), ST_Rescale(), ST_Reskew(), and ST_SnapToGrid() no longer require an SRID
 - #2141, More verbose output when constraints fail to be added to a raster column
 - #2143, Changed blocksize constraint of raster to allow multiple values
 - #2148, Addition of coverage_tile constraint for raster
 - #2149, Addition of spatially_unique constraint for raster
- TopologySummary output now includes unregistered layers and a count of missing TopoGeometry objects from their natural layer.
- ST_HillShade(), ST_Aspect() and ST_Slope() have one new optional parameter to interpolate NODATA pixels before running the operation.
- Point variant of ST_SetValue(raster) is now a wrapper around geomval variant of ST_SetValues(rast).
- Proper support for raster band's isnodata flag in core API and loader.
- Additional default values for parameters of ST_Aspect and ST_HillShade
- #2178, ST_Summary now advertises presence of known srid with an [S] flag
 - #2202, Make libjson-c optional (--without-json configure switch)
 - #2213, Add support libjson-c 0.10+
 - #2231, raster2pgsql supports user naming of filename column with -n
 - #2200, ST_Union(raster, uniontype) unions all bands of all rasters
 - #2264, postgis_restore.pl support for restoring into databases with postgis in a custom schema
 - #2244, emit warning when changing raster's georeference if raster has out-db bands
 - #2222, add parameter OutAsIn to flag whether ST_AsBinary should return out-db bands as in-db bands
-

A.49.4 Fixes

- #1839, handling of subdatasets in GeoTIFF in raster2pgsql.
 - #1840, fix logic of when to compute # of tiles in raster2pgsql.
 - #1870, align the docs and actual behavior of raster's ST_Intersects
 - #1872, fix ST_ApproxSummarystats to prevent division by zero
 - #1875, ST_SummaryStats returns NULL for all parameters except count when count is zero
 - #1932, fix raster2pgsql of syntax for index tablespaces
 - #1936, ST_GeomFromGML on CurvePolygon causes server crash
 - #1939, remove custom data types: summarystats, histogram, quantile, valuecount
 - #1951, remove crash on zero-length linestrings
 - #1957, ST_Distance to a one-point LineString returns NULL
 - #1976, Geography point-in-ring code overhauled for more reliability
 - #1981, cleanup of unused variables causing warnings with gcc 4.6+
 - #1996, support POINT EMPTY in GeoJSON output
 - #2062, improve performance of distance calculations
 - #2057, Fixed linking issue for raster2psql to libpq
 - #2077, Fixed incorrect values returning from ST_Hillshade()
 - #2019, ST_FlipCoordinates does not update bbox
 - #2100, ST_AsRaster may not return raster with specified pixel type
 - #2126, Better handling of empty rasters from ST_ConvexHull()
 - #2165, ST_NumPoints regression failure with CircularString
 - #2168, ST_Distance is not always commutative
 - #2182, Fix issue with outdb rasters with no SRID and ST_Resize
 - #2188, Fix function parameter value overflow that caused problems when copying data from a GDAL dataset
 - #2198, Fix incorrect dimensions used when generating bands of out-db rasters in ST_Tile()
 - #2201, ST_GeoHash wrong on boundaries
 - #2203, Changed how rasters with unknown SRID and default geotransform are handled when passing to GDAL Warp API
 - #2215, Fixed raster exclusion constraint for conflicting name of implicit index
 - #2251, Fix bad dimensions when rescaling rasters with default geotransform matrix
 - #2133, Fix performance regression in expression variant of ST_MapAlgebra
 - #2257, GBOX variables not initialized when testing with empty geometries
 - #2271, Prevent parallel make of raster
 - #2282, Fix call to undefined function nd_stats_to_grid() in debug mode
 - #2307, ST_MakeValid outputs invalid geometries
 - #2309, Remove confusing INFO message when trying to get SRS info
 - #2336, FIPS 20 (KS) causes wildcard expansion to wget all files
 - #2348, Provide raster upgrade path for 2.0 to 2.1
 - #2351, st_distance between geographies wrong
 - #2359, Fix handling of schema name when adding overview constraints
 - #2371, Support GEOS versions with more than 1 digit in micro
 - #2383, Remove unsafe use of \ from raster warning message
 - #2384, Incorrect variable datatypes for ST_Neighborhood
-

A.49.5 Known Issues

#2111, Raster bands can only reference the first 256 bands of out-db rasters

A.50 Versión 2.0.5

Fecha de versión: 2014/03/31

This is a bug fix release, addressing issues that have been filed since the 2.0.4 release. If you are using PostGIS 2.0+ a soft upgrade is required. For users of PostGIS 1.5 or below, a hard upgrade is required.

A.50.1 Corrección de errores

#2494, avoid memcpy in GIST index

#2502, Fix postgis_topology_scripts_installed() install schema

#2504, Fix segfault on bogus pgsql2shp call

#2528, Fix memory leak in ST_Split / lwline_split_by_line

#2532, Add missing raster/geometry commutator operators

#2533, Remove duplicated signatures

#2552, Fix NULL raster handling in ST_AsPNG, ST_AsTIFF and ST_AsJPEG

#2555, Fix parsing issue of range arguments of ST_Reclass

#2589, Remove use of unnecessary void pointers

#2607, Cannot open more than 1024 out-db files in process

#2610, Ensure face splitting algorithm uses the edge index

#2619, Empty ring array in GeoJSON polygon causes crash

#2638, Geography distance on M geometries sometimes wrong

A.50.2 Cambios importantes

##2514, Change raster license from GPL v3+ to v2+, allowing distribution of PostGIS Extension as GPLv2.

A.51 Versión 2.0.4

Fecha de versión: 2013/09/06

This is a bug fix release, addressing issues that have been filed since the 2.0.3 release. If you are using PostGIS 2.0+ a soft upgrade is required. For users of PostGIS 1.5 or below, a hard upgrade is required.

A.51.1 Corrección de errores

#2110, Equality operator between EMPTY and point on origin

Allow adding points at precision distance with TopoGeo_addPoint

#1968, Fix missing edge from toTopoGeom return

#2165, ST_NumPoints regression failure with CircularString

#2168, ST_Distance is not always commutative

#2186, gui progress bar updates too frequent

#2201, ST_GeoHash wrong on boundaries

#2257, GBOX variables not initialized when testing with empty geometries

#2271, Prevent parallel make of raster

#2267, Server crash from analyze table

#2277, potential segfault removed

#2307, ST_MakeValid outputs invalid geometries

#2351, st_distance between geographies wrong

#2359, Incorrect handling of schema for overview constraints

#2371, Support GEOS versions with more than 1 digit in micro

#2372, Cannot parse space-padded KML coordinates

Fix build with systemwide liblwgeom installed

#2383, Fix unsafe use of \ in warning message

#2410, Fix segmentize of collinear curve

#2412, ST_LineToCurve support for lines with less than 4 vertices

#2415, ST_Multi support for COMPOUNDCURVE and CURVEPOLYGON

#2420, ST_LineToCurve: require at least 8 edges to define a full circle

#2423, ST_LineToCurve: require all arc edges to form the same angle

#2424, ST_CurveToLine: add support for COMPOUNDCURVE in MULTICURVE

#2427, Make sure to retain first point of curves on ST_CurveToLine

A.51.2 Mejoras

#2269, Avoid uselessly detoasting full geometries on ANALYZE

A.51.3 Known Issues

#2111, Raster bands can only reference the first 256 bands of out-db rasters

A.52 Versión 2.0.3

Fecha de versión: 2013/03/01

This is a bug fix release, addressing issues that have been filed since the 2.0.2 release. If you are using PostGIS 2.0+ a soft upgrade is required. For users of PostGIS 1.5 or below, a hard upgrade is required.

A.52.1 Corrección de errores

#2126, Better handling of empty rasters from ST_ConvexHull()

#2134, Make sure to process SRS before passing it off to GDAL functions

Fix various memory leaks in liblwgeom

#2173, Fix robustness issue in splitting a line with own vertex also affecting topology building (#2172)

#2174, Fix usage of wrong function lwpoly_free()

#2176, Fix robustness issue with ST_ChangeEdgeGeom

#2184, Properly copy topologies with Z value

postgis_restore.pl support for mixed case geometry column name in dumps

#2188, Fix function parameter value overflow that caused problems when copying data from a GDAL dataset

#2216, More memory errors in MultiPolygon GeoJSON parsing (with holes)

Fix Memory leak in GeoJSON parser

A.52.2 Mejoras

#2141, More verbose output when constraints fail to be added to a raster column

Speedup ST_ChangeEdgeGeom

A.53 Versión 2.0.2

Fecha de versión: 2012/12/03

This is a bug fix release, addressing issues that have been filed since the 2.0.1 release.

A.53.1 Corrección de errores

#1287, Drop of "gist_geometry_ops" broke a few clients package of legacy_gist.sql for these cases

#1391, Errors during upgrade from 1.5

#1828, Poor selectivity estimate on ST_DWithin

#1838, error importing tiger/line data

#1869, ST_AsBinary is not unique added to legacy_minor/legacy.sql scripts

#1885, Missing field from tabblock table in tiger2010 census_loader.sql

#1891, Use LDFLAGS environment when building liblwgeom

#1900, Fix pgsql2shp for big-endian systems

#1932, Fix raster2pgsql for invalid syntax for setting index tablespace

#1936, ST_GeomFromGML on CurvePolygon causes server crash

#1955, ST_ModEdgeHeal and ST_NewEdgeHeal for doubly connected edges

#1957, ST_Distance to a one-point LineString returns NULL

#1976, Geography point-in-ring code overhauled for more reliability

#1978, wrong answer calculating length of closed circular arc (circle)

#1981, Remove unused but set variables as found with gcc 4.6+

#1987, Restore 1.5.x behaviour of ST_Simplify
#1989, Preprocess input geometry to just intersection with raster to be clipped
#1991, geocode really slow on PostgreSQL 9.2
#1996, support POINT EMPTY in GeoJSON output
#1998, Fix ST_{Mod,New}EdgeHeal joining edges sharing both endpoints
#2001, ST_CurveToLine has no effect if the geometry doesn't actually contain an arc
#2015, ST_IsEmpty('POLYGON(EMPTY)') returns False
#2019, ST_FlipCoordinates does not update bbox
#2025, Fix side location conflict at TopoGeo_AddLineString
#2026, improve performance of distance calculations
#2033, Fix adding a splitting point into a 2.5d topology
#2051, Fix excess of precision in ST_AsGeoJSON output
#2052, Fix buffer overflow in lwgeom_to_geojson
#2056, Fixed lack of SRID check of raster and geometry in ST_SetValue()
#2057, Fixed linking issue for raster2psql to libpq
#2060, Fix "dimension" check violation by GetTopoGeomElementArray
#2072, Removed outdated checks preventing ST_Intersects(raster) from working on out-db bands
#2077, Fixed incorrect answers from ST_Hillshade(raster)
#2092, Namespace issue with ST_GeomFromKML, ST_GeomFromGML for libxml 2.8+
#2099, Fix double free on exception in ST_OffsetCurve
#2100, ST_AsRaster() may not return raster with specified pixel type
#2108, Ensure ST_Line_Interpolate_Point always returns POINT
#2109, Ensure ST_Centroid always returns POINT
#2117, Ensure ST_PointOnSurface always returns POINT
#2129, Fix SRID in ST_Homogenize output with collection input
#2130, Fix memory error in MultiPolygon GeoJson parsing
Update URL of Maven jar

A.53.2 Mejoras

#1581, ST_Clip(raster, ...) no longer imposes NODATA on a band if the corresponding band from the source raster did not have NODATA
#1928, Accept array properties in GML input multi-geom input (Kashif Rasul and Shoaib Burq / SpacialDB)
#2082, Add indices on start_node and end_node of topology edge tables
#2087, Speedup topology.GetRingEdges using a recursive CTE

A.54 Versión 2.0.1

Fecha de versión: 2012/06/22

This is a bug fix release, addressing issues that have been filed since the 2.0.0 release.

A.54.1 Corrección de errores

- #1264, fix st_dwithin(geog, geog, 0).
 - #1468 shp2pgsql-gui table column schema get shifted
 - #1694, fix building with clang. (vince)
 - #1708, improve restore of pre-PostGIS 2.0 backups.
 - #1714, more robust handling of high topology tolerance.
 - #1755, ST_GeographyFromText support for higher dimensions.
 - #1759, loading transformed shapefiles in raster enabled db.
 - #1761, handling of subdatasets in NetCDF, HDF4 and HDF5 in raster2pgsql.
 - #1763, topology.toTopoGeom use with custom search_path.
 - #1766, don't let ST_RemEdge* destroy peripheral TopoGeometry objects.
 - #1774, Clearer error on setting an edge geometry to an invalid one.
 - #1775, ST_ChangeEdgeGeom collision detection with 2-vertex target.
 - #1776, fix ST_SymDifference(empty, geom) to return geom.
 - #1779, install SQL comment files.
 - #1782, fix spatial reference string handling in raster.
 - #1789, fix false edge-node crossing report in ValidateTopology.
 - #1790, fix toTopoGeom handling of duplicated primitives.
 - #1791, fix ST_Azimuth with very close but distinct points.
 - #1797, fix (ValidateTopology(xxx)).* syntax calls.
 - #1805, put back the 900913 SRID entry.
 - #1813, Only show readable relations in metadata tables.
 - #1819, fix floating point issues with ST_World2RasterCoord and ST_Raster2WorldCoord variants.
 - #1820 compilation on 9.2beta1.
 - #1822, topology load on PostgreSQL 9.2beta1.
 - #1825, fix prepared geometry cache lookup
 - #1829, fix uninitialized read in GeoJSON parser
 - #1834, revise postgis extension to only backup user specified spatial_ref_sys
 - #1839, handling of subdatasets in GeoTIFF in raster2pgsql.
 - #1840, fix logic of when to compute # of tiles in raster2pgsql.
 - #1851, fix spatial_ref_system parameters for EPSG:3844
 - #1857, fix failure to detect endpoint mismatch in ST_AddEdge*Face*
 - #1865, data loss in postgis_restore.pl when data rows have leading dashes.
 - #1867, catch invalid topology name passed to topogeo_add*
 - #1872, fix ST_ApproxSummarystats to prevent division by zero
 - #1873, fix ptarray_locate_point to return interpolated Z/M values for on-the-line case
 - #1875, ST_SummaryStats returns NULL for all parameters except count when count is zero
 - #1881, shp2pgsql-gui -- editing a field sometimes triggers removing row
 - #1883, Geocoder install fails trying to run create_census_base_tables() (Brian Panulla)
-

A.54.2 Mejoras

More detailed exception message from topology editing functions.

#1786, improved build dependencies

#1806, speedup of ST_BuildArea, ST_MakeValid and ST_GetFaceGeometry.

#1812, Add lwgeom_normalize in LIBLWGEOM for more stable testing.

A.55 Versión 2.0.0

Fecha de versión: 2012/04/03

This is a major release. A hard upgrade is required. Yes this means a full dump reload and some special preparations if you are using obsolete functions. Refer to Section 3.4.2 for details on upgrading. Refer to Section 15.12.12 for more details and changed/new functions.

A.55.1 Testers - Our unsung heroes

We are most indebted to the numerous members in the PostGIS community who were brave enough to test out the new features in this release. No major release can be successful without these folk.

Below are those who have been most valiant, provided very detailed and thorough bug reports, and detailed analysis.

Andrea Peri - Lots of testing on topology, checking for correctness

Andreas Forø Tollefsen - raster testing

Chris English - topology stress testing loader functions

Salvatore Larosa - topology robustness testing

Brian Hamlin - Benchmarking (also experimental experimental branches before they are folded into core) , general testing of various

Mike Pease - Tiger geocoder testing - very detailed reports of issues

Tom van Tilburg - raster testing

A.55.2 Important / Breaking Changes

#722, #302, Most deprecated functions removed (over 250 functions) (Regina Obe, Paul Ramsey)

Unknown SRID changed from -1 to 0. (Paul Ramsey)

-- (most deprecated in 1.2) removed non-ST variants buffer, length, intersects (and internal functions renamed) etc.

-- If you have been using deprecated functions CHANGE your apps or suffer the consequences. If you don't see a function documented -- it ain't supported or it is an internal function. Some constraints in older tables were built with deprecated functions. If you restore you may need to rebuild table constraints with populate_geometry_columns(). If you have applications or tools that rely on deprecated functions, please refer to [?qandaentry] for more details.

#944 geometry_columns is now a view instead of a table (Paul Ramsey, Regina Obe) for tables created the old way reads (srid, type, dims) constraints for geometry columns created with type modifiers reads from column definition

#1081, #1082, #1084, #1088 - Management functions support typmod geometry column creation functions now default to typmod creation (Regina Obe)

#1083 probe_geometry_columns(), rename_geometry_table_constraints(), fix_geometry_columns(); removed - now obsolete with geometry_column view (Regina Obe)

#817 Renaming old 3D functions to the convention ST_3D (Nicklas Avén)

#548 (sorta), ST_NumGeometries, ST_GeometryN now returns 1 (or the geometry) instead of null for single geometries (Sandro Santilli, Maxime van Noppen)

A.55.3 Nuevas características

KNN Gist index based centroid (<->) and box (<#>) distance operators (Paul Ramsey / funded by Vizzuality)

Support for TIN and PolyHedralSurface and enhancement of many functions to support 3D (Olivier Courtin / Oslandia)

Raster support integrated and documented (Pierre Racine, Jorge Arévalo, Mateusz Loskot, Sandro Santilli, David Zwarg, Regina Obe, Bborie Park) (Company developer and funding: University Laval, Deimos Space, CadCorp, Michigan Tech Research Institute, Azavea, Paragon Corporation, UC Davis Center for Vectorborne Diseases)

Making spatial indexes 3D aware - in progress (Paul Ramsey, Mark Cave-Ayland)

Topology support improved (more functions), documented, testing (Sandro Santilli / Faunalia for RT-SIGTA), Andrea Peri, Regina Obe, Jose Carlos Martinez Llari

3D relationship and measurement support functions (Nicklas Avén)

ST_3DDistance, ST_3DClosestPoint, ST_3DIntersects, ST_3DShortestLine and more...

N-Dimensional spatial indexes (Paul Ramsey / OpenGeo)

ST_Split (Sandro Santilli / Faunalia for RT-SIGTA)

ST_IsValidDetail (Sandro Santilli / Faunalia for RT-SIGTA)

ST_MakeValid (Sandro Santilli / Faunalia for RT-SIGTA)

ST_RemoveRepeatedPoints (Sandro Santilli / Faunalia for RT-SIGTA)

ST_GeometryN and ST_NumGeometries support for non-collections (Sandro Santilli)

ST_IsCollection (Sandro Santilli, Maxime van Noppen)

ST_SharedPaths (Sandro Santilli / Faunalia for RT-SIGTA)

ST_Snap (Sandro Santilli)

ST_RelateMatch (Sandro Santilli / Faunalia for RT-SIGTA)

ST_ConcaveHull (Regina Obe and Leo Hsu / Paragon Corporation)

ST_UnaryUnion (Sandro Santilli / Faunalia for RT-SIGTA)

ST_AsX3D (Regina Obe / Arrival 3D funding)

ST_OffsetCurve (Sandro Santilli, Rafal Magda)

ST_GeomFromGeoJSON (Kashif Rasul, Paul Ramsey / Vizzuality funding)

A.55.4 Mejoras

Made shape file loader tolerant of truncated multibyte values found in some free worldwide shapefiles (Sandro Santilli)

Lots of bug fixes and enhancements to shp2pgsql Beefing up regression tests for loaders Reproject support for both geometry and geography during import (Jeff Adams / Azavea, Mark Cave-Ayland)

pgsql2shp conversion from predefined list (Loic Dachary / Mark Cave-Ayland)

Shp-pgsql GUI loader - support loading multiple files at a time. (Mark Leslie)

Extras - upgraded tiger_geocoder from using old TIGER format to use new TIGER shp and file structure format (Stephen Frost)

Extras - revised tiger_geocoder to work with TIGER census 2010 data, addition of reverse geocoder function, various bug fixes, accuracy enhancements, limit max result return, speed improvements, loading routines. (Regina Obe, Leo Hsu / Paragon Corporation / funding provided by Hunter Systems Group)

Overall Documentation proofreading and corrections. (Kasif Rasul)

Cleanup PostGIS JDBC classes, revise to use Maven build. (Maria Arias de Reyna, Sandro Santilli)

A.55.5 Corrección de errores

#1335 ST_AddPoint returns incorrect result on Linux (Even Rouault)

A.55.6 Release specific credits

We thank [U.S Department of State Human Information Unit \(HIU\)](#) and [Vizzuality](#) for general monetary support to get PostGIS 2.0 out the door.

A.56 Versión 1.5.4

Fecha de versión: 2012/05/07

This is a bug fix release, addressing issues that have been filed since the 1.5.3 release.

A.56.1 Corrección de errores

#547, ST_Contains memory problems (Sandro Santilli)

#621, Problem finding intersections with geography (Paul Ramsey)

#627, PostGIS/PostgreSQL process die on invalid geometry (Paul Ramsey)

#810, Increase accuracy of area calculation (Paul Ramsey)

#852, improve spatial predicates robustness (Sandro Santilli, Nicklas Avén)

#877, ST_Estimated_Extent returns NULL on empty tables (Sandro Santilli)

#1028, ST_AsSVG kills whole postgres server when fails (Paul Ramsey)

#1056, Fix boxes of arcs and circle stroking code (Paul Ramsey)

#1121, populate_geometry_columns using deprecated functions (Regin Obe, Paul Ramsey)

#1135, improve testsuite predictability (Andreas 'ads' Scherbaum)

#1146, images generator crashes (bronaugh)

#1170, North Pole intersection fails (Paul Ramsey)

#1179, ST_AsText crash with bad value (kjurka)

#1184, honour DESTDIR in documentation Makefile (Bryce L Nordgren)

#1227, server crash on invalid GML

#1252, SRID appearing in WKT (Paul Ramsey)

#1264, st_dwithin(g, g, 0) doesn't work (Paul Ramsey)

#1344, allow exporting tables with invalid geometries (Sandro Santilli)

#1389, wrong proj4text for SRID 31300 and 31370 (Paul Ramsey)

#1406, shp2pgsql crashes when loading into geography (Sandro Santilli)

#1595, fixed SRID redundancy in ST_Line_SubString (Sandro Santilli)

#1596, check SRID in UpdateGeometrySRID (Mike Toews, Sandro Santilli)

#1602, fix ST_Polygonize to retain Z (Sandro Santilli)

#1697, fix crash with EMPTY entries in GiST index (Paul Ramsey)

#1772, fix ST_Line_Locate_Point with collapsed input (Sandro Santilli)

#1799, Protect ST_Segmentize from max_length=0 (Sandro Santilli)

Alter parameter order in 900913 (Paul Ramsey)

Support builds with "gmake" (Greg Troxel)

A.57 Versión 1.5.3

Fecha de versión: 2011/06/25

This is a bug fix release, addressing issues that have been filed since the 1.5.2 release. If you are running PostGIS 1.3+, a soft upgrade is sufficient otherwise a hard upgrade is recommended.

A.57.1 Corrección de errores

- #1056, produce correct bboxes for arc geometries, fixes index errors (Paul Ramsey)
- #1007, ST_IsValid crash fix requires GEOS 3.3.0+ or 3.2.3+ (Sandro Santilli, reported by Birgit Laggner)
- #940, support for PostgreSQL 9.1 beta 1 (Regina Obe, Paul Ramsey, patch submitted by stl)
- #845, ST_Intersects precision error (Sandro Santilli, Nicklas Avén) Reported by cdestigter
- #884, Unstable results with ST_Within, ST_Intersects (Chris Hodgson)
- #779, shp2pgsql -S option seems to fail on points (Jeff Adams)
- #666, ST_DumpPoints is not null safe (Regina Obe)
- #631, Update NZ projections for grid transformation support (jpalmer)
- #630, Peculiar Null treatment in arrays in ST_Collect (Chris Hodgson) Reported by David Bitner
- #624, Memory leak in ST_GeogFromText (ryang, Paul Ramsey)
- #609, Bad source code in manual section 5.2 Java Clients (simoc, Regina Obe)
- #604, shp2pgsql usage touchups (Mike Toews, Paul Ramsey)
- #573 ST_Union fails on a group of linestrings Not a PostGIS bug, fixed in GEOS 3.3.0
- #457 ST_CollectionExtract returns non-requested type (Nicklas Avén, Paul Ramsey)
- #441 ST_AsGeoJson Bbox on GeometryCollection error (Olivier Courtin)
- #411 Ability to backup invalid geometries (Sandro Santilli) Reported by Regione Toscana
- #409 ST_AsSVG - degraded (Olivier Courtin) Reported by Sdikiy
- #373 Documentation syntax error in hard upgrade (Paul Ramsey) Reported by psvensso

A.58 Versión 1.5.2

Fecha de versión: 2010/09/27

This is a bug fix release, addressing issues that have been filed since the 1.5.1 release. If you are running PostGIS 1.3+, a soft upgrade is sufficient otherwise a hard upgrade is recommended.

A.58.1 Corrección de errores

Loader: fix handling of empty (0-verticed) geometries in shapefiles. (Sandro Santilli)

- #536, Geography ST_Intersects, ST_Covers, ST_CoveredBy and Geometry ST_Equals not using spatial index (Regina Obe, Nicklas Avén)
 - #573, Improvement to ST_Contains geography (Paul Ramsey)
- Loader: Add support for command-q shutdown in Mac GTK build (Paul Ramsey)
- #393, Loader: Add temporary patch for large DBF files (Maxime Guillaud, Paul Ramsey)

- #507, Fix wrong OGC URN in GeoJSON and GML output (Olivier Courtin)
- spatial_ref_sys.sql Add datum conversion for projection SRID 3021 (Paul Ramsey)
- Geography - remove crash for case when all geographies are out of the estimate (Paul Ramsey)
- #469, Fix for array_aggregation error (Greg Stark, Paul Ramsey)
- #532, Temporary geography tables showing up in other user sessions (Paul Ramsey)
- #562, ST_Dwithin errors for large geographies (Paul Ramsey)
- #513, shape loading GUI tries to make spatial index when loading DBF only mode (Paul Ramsey)
- #527, shape loading GUI should always append log messages (Mark Cave-Ayland)
- #504, shp2pgsql should rename xmin/xmax fields (Sandro Santilli)
- #458, postgis_comments being installed in contrib instead of version folder (Mark Cave-Ayland)
- #474, Analyzing a table with geography column crashes server (Paul Ramsey)
- #581, LWGEOM-expand produces inconsistent results (Mark Cave-Ayland)
- #513, Add dbf filter to shp2pgsql-gui and allow uploading dbf only (Paul Ramsey)
- Fix further build issues against PostgreSQL 9.0 (Mark Cave-Ayland)
- #572, Password whitespace for Shape File (Mark Cave-Ayland)
- #603, shp2pgsql: "-w" produces invalid WKT for MULTI* objects. (Mark Cave-Ayland)

A.59 Versión 1.5.1

Fecha de versión: 2010/03/11

This is a bug fix release, addressing issues that have been filed since the 1.4.1 release. If you are running PostGIS 1.3+, a soft upgrade is sufficient otherwise a hard upgrade is recommended.

A.59.1 Corrección de errores

- #410, update embedded bbox when applying ST_SetPoint, ST_AddPoint ST_RemovePoint to a linestring (Paul Ramsey)
- #411, allow dumping tables with invalid geometries (Sandro Santilli, for Regione Toscana-SIGTA)
- #414, include geography_columns view when running upgrade scripts (Paul Ramsey)
- #419, allow support for multilinestring in ST_Line_Substring (Paul Ramsey, for Lidwala Consulting Engineers)
- #421, fix computed string length in ST_AsGML() (Olivier Courtin)
- #441, fix GML generation with heterogeneous collections (Olivier Courtin)
- #443, incorrect coordinate reversal in GML 3 generation (Olivier Courtin)
- #450, #451, wrong area calculation for geography features that cross the date line (Paul Ramsey)
- Ensure support for upcoming 9.0 PostgreSQL release (Paul Ramsey)

A.60 Versión 1.5.0

Fecha de versión: 2010/02/04

This release provides support for geographic coordinates (lat/lon) via a new GEOGRAPHY type. Also performance enhancements, new input format support (GML,KML) and general upkeep.

A.60.1 API Stability

The public API of PostGIS will not change during minor (0.0.X) releases.

The definition of the `=~` operator has changed from an exact geometric equality check to a bounding box equality check.

A.60.2 Compatibility

GEOS, Proj4, and LibXML2 are now mandatory dependencies

The library versions below are the minimum requirements for PostGIS 1.5

PostgreSQL 8.3 and higher on all platforms

GEOS 3.1 and higher only (GEOS 3.2+ to take advantage of all features)

LibXML2 2.5+ related to new ST_GeomFromGML/KML functionality

Proj4 4.5 and higher only

A.60.3 Nuevas características

Section [15.12.14](#)

Added Hausdorff distance calculations ([#209](#)) (Vincent Picavet)

Added parameters argument to ST_Buffer operation to support one-sided buffering and other buffering styles (Sandro Santilli)

Addition of other Distance related visualization and analysis functions (Nicklas Aven)

- ST_ClosestPoint
- ST_DFullyWithin
- ST_LongestLine
- ST_MaxDistance
- ST_ShortestLine

ST_DumpPoints (Maxime van Noppen)

KML, GML input via ST_GeomFromGML and ST_GeomFromKML (Olivier Courtin)

Extract homogeneous collection with ST_CollectionExtract (Paul Ramsey)

Add measure values to an existing linestring with ST_AddMeasure (Paul Ramsey)

History table implementation in utils (George Silva)

Geography type and supporting functions

- Spherical algorithms (Dave Skea)
 - Object/index implementation (Paul Ramsey)
 - Selectivity implementation (Mark Cave-Ayland)
 - Serializations to KML, GML and JSON (Olivier Courtin)
 - ST_Area, ST_Distance, ST_DWithin, ST_GeogFromText, ST_GeogFromWKB, ST_Intersects, ST_Covers, ST_Buffer (Paul Ramsey)
-

A.60.4 Mejoras

Performance improvements to ST_Distance (Nicklas Aven)

Documentation updates and improvements (Regina Obe, Kevin Neufeld)

Testing and quality control (Regina Obe)

PostGIS 1.5 support PostgreSQL 8.5 trunk (Guillaume Lelarge)

Win32 support and improvement of core shp2pgsql-gui (Mark Cave-Ayland)

In place 'make check' support (Paul Ramsey)

A.60.5 Bug fixes

<http://trac.osgeo.org/postgis/query?status=closed&milestone=PostGIS+1.5.0&order=priority>

A.61 Versión 1.4.0

Fecha de versión: 2009/07/24

This release provides performance enhancements, improved internal structures and testing, new features, and upgraded documentation. If you are running PostGIS 1.1+, a soft upgrade is sufficient otherwise a hard upgrade is recommended.

A.61.1 API Stability

As of the 1.4 release series, the public API of PostGIS will not change during minor releases.

A.61.2 Compatibility

The versions below are the *minimum* requirements for PostGIS 1.4

PostgreSQL 8.2 and higher on all platforms

GEOS 3.0 and higher only

PROJ4 4.5 and higher only

A.61.3 Nuevas características

ST_Union() uses high-speed cascaded union when compiled against GEOS 3.1+ (Paul Ramsey)

ST_ContainsProperly() requires GEOS 3.1+

ST_Intersects(), ST_Contains(), ST_Within() use high-speed cached prepared geometry against GEOS 3.1+ (Paul Ramsey / funded by Zonar Systems)

Vastly improved documentation and reference manual (Regina Obe & Kevin Neufeld)

Figures and diagram examples in the reference manual (Kevin Neufeld)

ST_IsValidReason() returns readable explanations for validity failures (Paul Ramsey)

ST_GeoHash() returns a geohash.org signature for geometries (Paul Ramsey)

GTK+ multi-platform GUI for shape file loading (Paul Ramsey)

ST_LineCrossingDirection() returns crossing directions (Paul Ramsey)

ST_LocateBetweenElevations() returns sub-string based on Z-ordinate. (Paul Ramsey)

Geometry parser returns explicit error message about location of syntax errors (Mark Cave-Ayland)

ST_AsGeoJSON() return JSON formatted geometry (Olivier Courtin)

Populate_Geometry_Columns() -- automatically add records to geometry_columns for TABLES and VIEWS (Kevin Neufeld)

ST_MinimumBoundingCircle() -- returns the smallest circle polygon that can encompass a geometry (Bruce Rindahl)

A.61.4 Mejoras

Core geometry system moved into independent library, liblwgeom. (Mark Cave-Ayland)

New build system uses PostgreSQL "pgxs" build bootstrapper. (Mark Cave-Ayland)

Debugging framework formalized and simplified. (Mark Cave-Ayland)

All build-time #defines generated at configure time and placed in headers for easier cross-platform support (Mark Cave-Ayland)

Logging framework formalized and simplified (Mark Cave-Ayland)

Expanded and more stable support for CIRCULARSTRING, COMPOUNDCURVE and CURVEPOLYGON, better parsing, wider support in functions (Mark Leslie & Mark Cave-Ayland)

Improved support for OpenSolaris builds (Paul Ramsey)

Improved support for MSVC builds (Mateusz Loskot)

Updated KML support (Olivier Courtin)

Unit testing framework for liblwgeom (Paul Ramsey)

New testing framework to comprehensively exercise every PostGIS function (Regine Obe)

Performance improvements to all geometry aggregate functions (Paul Ramsey)

Support for the upcoming PostgreSQL 8.4 (Mark Cave-Ayland, Talha Bin Rizwan)

Shp2pgsql and pgsql2shp re-worked to depend on the common parsing/unparsing code in liblwgeom (Mark Cave-Ayland)

Use of PDF DbLatex to build PDF docs and preliminary instructions for build (Jean David Techer)

Automated User documentation build (PDF and HTML) and Developer Doxygen Documentation (Kevin Neufeld)

Automated build of document images using ImageMagick from WKT geometry text files (Kevin Neufeld)

More attractive CSS for HTML documentation (Dane Springmeyer)

A.61.5 Bug fixes

<http://trac.osgeo.org/postgis/query?status=closed&milestone=PostGIS+1.4.0&order=priority>

A.62 Versión 1.3.6

Fecha de versión: 2009/05/04

If you are running PostGIS 1.1+, a soft upgrade is sufficient otherwise a hard upgrade is recommended. This release adds support for PostgreSQL 8.4, exporting prj files from the database with shape data, some crash fixes for shp2pgsql, and several small bug fixes in the handling of "curve" types, logical error importing dbf only files, improved error handling of AddGeometryColumns.

A.63 Versión 1.3.5

Fecha de versión: 2008/12/15

If you are running PostGIS 1.1+, a soft upgrade is sufficient otherwise a hard upgrade is recommended. This release is a bug fix release to address a failure in ST_Force_Collection and related functions that critically affects using MapServer with LINE layers.

A.64 Versión 1.3.4

Fecha de versión: 2008/11/24

This release adds support for GeoJSON output, building with PostgreSQL 8.4, improves documentation quality and output aesthetics, adds function-level SQL documentation, and improves performance for some spatial predicates (point-in-polygon tests).

Bug fixes include removal of crashers in handling circular strings for many functions, some memory leaks removed, a linear referencing failure for measures on vertices, and more. See the NEWS file for details.

A.65 Versión 1.3.3

Fecha de versión: 2008/04/12

This release fixes bugs shp2pgsql, adds enhancements to SVG and KML support, adds a ST_SimplifyPreserveTopology function, makes the build more sensitive to GEOS versions, and fixes a handful of severe but rare failure cases.

A.66 Versión 1.3.2

Fecha de versión: 2007/12/01

This release fixes bugs in ST_EndPoint() and ST_Envelope, improves support for JDBC building and OS/X, and adds better support for GML output with ST_AsGML(), including GML3 output.

A.67 Versión 1.3.1

Fecha de versión: 2007/08/13

This release fixes some oversights in the previous release around version numbering, documentation, and tagging.

A.68 Versión 1.3.0

Fecha de versión: 2007/08/09

This release provides performance enhancements to the relational functions, adds new relational functions and begins the migration of our function names to the SQL-MM convention, using the spatial type (SP) prefix.

A.68.1 Added Functionality

JDBC: Added Hibernate Dialect (thanks to Norman Barker)

Added ST_Covers and ST_CoveredBy relational functions. Description and justification of these functions can be found at <http://lin-ear-th-inking.blogspot.com/2007/06/subtleties-of-ogc-covers-spatial.html>

Added ST_DWithin relational function.

A.68.2 Performance Enhancements

Added cached and indexed point-in-polygon short-circuits for the functions ST_Contains, ST_Intersects, ST_Within and ST_Disjoint

Added inline index support for relational functions (except ST_Disjoint)

A.68.3 Other Changes

Extended curved geometry support into the geometry accessor and some processing functions

Began migration of functions to the SQL-MM naming convention; using a spatial type (ST) prefix.

Added initial support for PostgreSQL 8.3

A.69 Versión 1.2.1

Fecha de versión: 2007/01/11

This release provides bug fixes in PostgreSQL 8.2 support and some small performance enhancements.

A.69.1 Cambios

Fixed point-in-polygon shortcut bug in Within().

Fixed PostgreSQL 8.2 NULL handling for indexes.

Updated RPM spec files.

Added short-circuit for Transform() in no-op case.

JDBC: Fixed JTS handling for multi-dimensional geometries (thanks to Thomas Marti for hint and partial patch). Additionally, now JavaDoc is compiled and packaged. Fixed classpath problems with GCJ. Fixed pgjdbc 8.2 compatibility, losing support for jdk 1.3 and older.

A.70 Versión 1.2.0

Fecha de versión: 2006/12/08

This release provides type definitions along with serialization/deserialization capabilities for SQL-MM defined curved geometries, as well as performance enhancements.

A.70.1 Cambios

Added curved geometry type support for serialization/deserialization

Added point-in-polygon shortcircuit to the Contains and Within functions to improve performance for these cases.

A.71 Versión 1.1.6

Fecha de versión: 2006/11/02

This is a bugfix release, in particular fixing a critical error with GEOS interface in 64bit systems. Includes an updated of the SRS parameters and an improvement in reprojections (take Z in consideration). Upgrade is *encouraged*.

A.71.1 Actualizando

If you are upgrading from release 1.0.3 or later follow the **soft upgrade** procedure.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the **upgrade section** of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an **hard upgrade**.

A.71.2 Bug fixes

fixed CAPI change that broke 64-bit platforms

loader/dumper: fixed regression tests and usage output

Fixed setSRID() bug in JDBC, thanks to Thomas Marti

A.71.3 Otros cambios

use Z ordinate in reprojections

spatial_ref_sys.sql updated to EPSG 6.11.1

Simplified Version.config infrastructure to use a single pack of version variables for everything.

Include the Version.config in loader/dumper USAGE messages

Replace hand-made, fragile JDBC version parser with Properties

A.72 Versión 1.1.5

Fecha de versión: 2006/10/13

This is an bugfix release, including a critical segfault on win32. Upgrade is *encouraged*.

A.72.1 Actualizando

If you are upgrading from release 1.0.3 or later follow the **soft upgrade** procedure.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the **upgrade section** of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an **hard upgrade**.

A.72.2 Bug fixes

Fixed MingW link error that was causing pgsql2shp to segfault on Win32 when compiled for PostgreSQL 8.2

fixed nullpointer Exception in Geometry.equals() method in Java

Added EJB3Spatial.odt to fulfill the GPL requirement of distributing the "preferred form of modification"

Removed obsolete synchronization from JDBC Jts code.

Updated heavily outdated README files for shp2pgsql/pgsql2shp by merging them with the manpages.

Fixed version tag in jdbc code that still said "1.1.3" in the "1.1.4" release.

A.72.3 Nuevas características

Added -S option for non-multi geometries to shp2pgsql

A.73 Versión 1.1.4

Fecha de versión: 2006/09/27

This is an bugfix release including some improvements in the Java interface. Upgrade is *encouraged*.

A.73.1 Actualizando

If you are upgrading from release 1.0.3 or later follow the **soft upgrade** procedure.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the **upgrade section** of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an **hard upgrade**.

A.73.2 Bug fixes

Fixed support for PostgreSQL 8.2

Fixed bug in collect() function discarding SRID of input

Added SRID match check in MakeBox2d and MakeBox3d

Fixed regress tests to pass with GEOS-3.0.0

Improved pgsq2shp run concurrency.

A.73.3 Java changes

reworked JTS support to reflect new upstream JTS developers' attitude to SRID handling. Simplifies code and drops build depend on GNU trove.

Added EJB2 support generously donated by the "Geodetix s.r.l. Company"

Added EJB3 tutorial / examples donated by Norman Barker <nbarker@ittvis.com>

Reorganized java directory layout a little.

A.74 Versión 1.1.3

Fecha de versión: 2006/06/30

This is an bugfix release including also some new functionalities (most notably long transaction support) and portability enhancements. Upgrade is *encouraged*.

A.74.1 Actualizando

If you are upgrading from release 1.0.3 or later follow the **soft upgrade** procedure.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the **upgrade section** of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an **hard upgrade**.

A.74.2 Bug fixes / correctness

BUGFIX in distance(poly,poly) giving wrong results.

BUGFIX in pgsq2shp successful return code.

BUGFIX in shp2pgsql handling of MultiLine WKT.

BUGFIX in affine() failing to update bounding box.

WKT parser: forbidden construction of multigeometries with EMPTY elements (still supported for GEOMETRYCOLLECTION).

A.74.3 New functionalities

NEW Long Transactions support.

NEW DumpRings() function.

NEW AsHEXEWKB(geom, XDR|NDR) function.

A.74.4 JDBC changes

Improved regression tests: MultiPoint and scientific ordinates

Fixed some minor bugs in jdbc code

Added proper accessor functions for all fields in preparation of making those fields private later

A.74.5 Otros cambios

NEW regress test support for loader/dumper.

Added --with-proj-libdir and --with-geos-libdir configure switches.

Support for build Tru64 build.

Use Jade for generating documentation.

Don't link postgres to more libs than required.

Initial support for PostgreSQL 8.2.

A.75 Versión 1.1.2

Fecha de versión: 2006/03/30

This is an bugfix release including some new functions and portability enhancements. Upgrade is *encouraged*.

A.75.1 Actualizando

If you are upgrading from release 1.0.3 or later follow the **soft upgrade** procedure.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the **upgrade section** of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an **hard upgrade**.

A.75.2 Bug fixes

BUGFIX in SnapToGrid() computation of output bounding box

BUGFIX in EnforceRHR()

jdbc2 SRID handling fixes in JTS code

Fixed support for 64bit archs

A.75.3 New functionalities

Regress tests can now be run **before** postgis installation

New affine() matrix transformation functions

New rotate{,X,Y,Z}() function

Old translating and scaling functions now use affine() internally

Embedded access control in estimated_extent() for builds against postgresql >= 8.0.0

A.75.4 Otros cambios

More portable ./configure script

Changed ./run_test script to have more sane default behaviour

A.76 Versión 1.1.1

Fecha de versión: 2006/01/23

This is an important Bugfix release, upgrade is *highly recommended*. Previous version contained a bug in postgis_restore.pl preventing **hard upgrade** procedure to complete and a bug in GEOS-2.2+ connector preventing GeometryCollection objects to be used in topological operations.

A.76.1 Actualizando

If you are upgrading from release 1.0.3 or later follow the **soft upgrade** procedure.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the **upgrade section** of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an **hard upgrade**.

A.76.2 Bug fixes

Fixed a premature exit in postgis_restore.pl

BUGFIX in geometrycollection handling of GEOS-CAPI connector

Solaris 2.7 and MingW support improvements

BUGFIX in line_locate_point()

Fixed handling of postgresql paths

BUGFIX in line_substring()

Added support for localized cluster in regress tester

A.76.3 New functionalities

New Z and M interpolation in line_substring()

New Z and M interpolation in line_interpolate_point()

added NumInteriorRing() alias due to OpenGIS ambiguity

A.77 Versión 1.1.0

Fecha de versión: 2005/12/21

This is a Minor release, containing many improvements and new things. Most notably: build procedure greatly simplified; transform() performance drastically improved; more stable GEOS connectivity (CAPI support); lots of new functions; draft topology support.

It is *highly recommended* that you upgrade to GEOS-2.2.x before installing PostGIS, this will ensure future GEOS upgrades won't require a rebuild of the PostGIS library.

A.77.1 Credits

This release includes code from Mark Cave Ayland for caching of proj4 objects. Markus Schaber added many improvements in his JDBC2 code. Alex Bodnaru helped with PostgreSQL source dependency relief and provided Debian specfiles. Michael Fuhr tested new things on Solaris arch. David Techer and Gerald Fenoy helped testing GEOS C-API connector. Hartmut Tschauner provided code for the azimuth() function. Devrim GUNDUZ provided RPM specfiles. Carl Anderson helped with the new area building functions. See the [credits](#) section for more names.

A.77.2 Actualizando

If you are upgrading from release 1.0.3 or later you *DO NOT* need a dump/reload. Simply sourcing the new lwpostgis_upgrade.sql script in all your existing databases will work. See the [soft upgrade](#) chapter for more information.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the [upgrade section](#) of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an [hard upgrade](#).

A.77.3 New functions

scale() and transscale() companion methods to translate()

line_substring()

line_locate_point()

M(point)

LineMerge(geometry)

shift_longitude(geometry)

azimuth(geometry)

locate_along_measure(geometry, float8)

locate_between_measures(geometry, float8, float8)

SnapToGrid by point offset (up to 4d support)

BuildArea(any_geometry)

OGC BdPolyFromText(linestring_wkt, srid)

OGC BdMPolyFromText(linestring_wkt, srid)

RemovePoint(linestring, offset)

ReplacePoint(linestring, offset, point)

A.77.4 Bug fixes

Fixed memory leak in polygonize()

Fixed bug in lwgeom_as_anytype cast functions

Fixed USE_GEOS, USE_PROJ and USE_STATS elements of postgis_version() output to always reflect library state.

A.77.5 Function semantic changes

SnapToGrid doesn't discard higher dimensions

Changed Z() function to return NULL if requested dimension is not available

A.77.6 Performance improvements

Much faster transform() function, caching proj4 objects

Removed automatic call to fix_geometry_columns() in AddGeometryColumns() and update_geometry_stats()

A.77.7 JDBC2 works

Makefile improvements

JTS support improvements

Improved regression test system

Basic consistency check method for geometry collections

Support for (Hex)(E)wkb

Autoprobing DriverWrapper for HexWKB / EWKT switching

fix compile problems in ValueSetter for ancient jdk releases.

fix EWKT constructors to accept SRID=4711; representation

added preliminary read-only support for java2d geometries

A.77.8 Other new things

Full autoconf-based configuration, with PostgreSQL source dependency relief

GEOS C-API support (2.2.0 and higher)

Initial support for topology modelling

Debian and RPM specfiles

New lwpostgis_upgrade.sql script

A.77.9 Otros cambios

JTS support improvements

Stricter mapping between DBF and SQL integer and string attributes

Wider and cleaner regression test suite

old jdbc code removed from release

obsoleted direct use of postgis_proc_upgrade.pl

scripts version unified with release version

A.78 Versión 1.0.6

Fecha de versión: 2005/12/06

Contains a few bug fixes and improvements.

A.78.1 Actualizando

If you are upgrading from release 1.0.3 or later you *DO NOT* need a dump/reload.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the [upgrade section](#) of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an [hard upgrade](#).

A.78.2 Bug fixes

Fixed palloc(0) call in collection deserializer (only gives problem with --enable-cassert)

Fixed bbox cache handling bugs

Fixed geom_accum(NULL, NULL) segfault

Fixed segfault in addPoint()

Fixed short-allocation in lwcollection_clone()

Fixed bug in segmentize()

Fixed bbox computation of SnapToGrid output

A.78.3 Improvements

Initial support for postgresql 8.2

Added missing SRID mismatch checks in GEOS ops

A.79 Versión 1.0.5

Fecha de versión: 2005/11/25

Contains memory-alignment fixes in the library, a segfault fix in loader's handling of UTF8 attributes and a few improvements and cleanups.



Note

Return code of shp2pgsql changed from previous releases to conform to unix standards (return 0 on success).

A.79.1 Actualizando

If you are upgrading from release 1.0.3 or later you *DO NOT* need a dump/reload.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the [upgrade section](#) of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an [hard upgrade](#).

A.79.2 Library changes

Fixed memory alignment problems

Fixed computation of null values fraction in analyzer

Fixed a small bug in the getPoint4d_p() low-level function

Speedup of serializer functions

Fixed a bug in force_3dm(), force_3dz() and force_4d()

A.79.3 Loader changes

Fixed return code of shp2pgsql

Fixed back-compatibility issue in loader (load of null shapefiles)

Fixed handling of trailing dots in dbf numerical attributes

Segfault fix in shp2pgsql (utf8 encoding)

A.79.4 Otros cambios

Schema aware postgis_proc_upgrade.pl, support for pgsql 7.2+

New "Reporting Bugs" chapter in manual

A.80 Versión 1.0.4

Fecha de versión: 2005/09/09

Contains important bug fixes and a few improvements. In particular, it fixes a memory leak preventing successful build of GiST indexes for large spatial tables.

A.80.1 Actualizando

If you are upgrading from release 1.0.3 you *DO NOT* need a dump/reload.

If you are upgrading from a release *between 1.0.0RC6 and 1.0.2* (inclusive) and really want a live upgrade read the [upgrade section](#) of the 1.0.3 release notes chapter.

Upgrade from any release prior to 1.0.0RC6 requires an [hard upgrade](#).

A.80.2 Bug fixes

Memory leak plugged in GiST indexing

Segfault fix in transform() handling of proj4 errors

Fixed some proj4 texts in spatial_ref_sys (missing +proj)

Loader: fixed string functions usage, reworked NULL objects check, fixed segfault on MULTILINESTRING input.

Fixed bug in MakeLine dimension handling

Fixed bug in translate() corrupting output bounding box

A.80.3 Improvements

Documentation improvements
More robust selectivity estimator
Minor speedup in distance()
Minor cleanups
GiST indexing cleanup
Looser syntax acceptance in box3d parser

A.81 Versión 1.0.3

Fecha de versión: 2005/08/08

Contains some bug fixes - *including a severe one affecting correctness of stored geometries* - and a few improvements.

A.81.1 Actualizando

Due to a bug in a bounding box computation routine, the upgrade procedure requires special attention, as bounding boxes cached in the database could be incorrect.

An **hard upgrade** procedure (dump/reload) will force recomputation of all bounding boxes (not included in dumps). This is *required* if upgrading from releases prior to 1.0.0RC6.

If you are upgrading from versions 1.0.0RC6 or up, this release includes a perl script (utils/rebuild_bbox_caches.pl) to force recomputation of geometries' bounding boxes and invoke all operations required to propagate eventual changes in them (geometry statistics update, reindexing). Invoke the script after a make install (run with no args for syntax help). Optionally run utils/postgis_proc_upgrade.pl to refresh postgis procedures and functions signatures (see **Soft upgrade**).

A.81.2 Bug fixes

Severe bugfix in lwgeom's 2d bounding box computation
Bugfix in WKT (-w) POINT handling in loader
Bugfix in dumper on 64bit machines
Bugfix in dumper handling of user-defined queries
Bugfix in create_undef.pl script

A.81.3 Improvements

Small performance improvement in canonical input function
Minor cleanups in loader
Support for multibyte field names in loader
Improvement in the postgis_restore.pl script
New rebuild_bbox_caches.pl util script

A.82 Versión 1.0.2

Fecha de versión: 2005/07/04

Contains a few bug fixes and improvements.

A.82.1 Actualizando

If you are upgrading from release 1.0.0RC6 or up you *DO NOT* need a dump/reload.

Upgrading from older releases requires a dump/reload. See the [upgrading](#) chapter for more informations.

A.82.2 Bug fixes

Fault tolerant btree ops

Memory leak plugged in pg_error

Rtree index fix

Cleaner build scripts (avoided mix of CFLAGS and CXXFLAGS)

A.82.3 Improvements

New index creation capabilities in loader (-I switch)

Initial support for postgresql 8.1dev

A.83 Versión 1.0.1

Fecha de versión: 2005/05/24

Contains a few bug fixes and some improvements.

A.83.1 Actualizando

If you are upgrading from release 1.0.0RC6 or up you *DO NOT* need a dump/reload.

Upgrading from older releases requires a dump/reload. See the [upgrading](#) chapter for more informations.

A.83.2 Library changes

BUGFIX in 3d computation of length_spheroid()

BUGFIX in join selectivity estimator

A.83.3 Other changes/additions

BUGFIX in shp2pgsql escape functions

better support for concurrent postgis in multiple schemas

documentation fixes

jdbc2: compile with "-target 1.2 -source 1.2" by default

NEW -k switch for postgresql2shp

NEW support for custom createdb options in postgis_restore.pl

BUGFIX in postgresql2shp attribute names unicity enforcement

BUGFIX in Paris projections definitions

postgis_restore.pl cleanups

A.84 Versión 1.0.0

Fecha de versión: 2005/04/19

Final 1.0.0 release. Contains a few bug fixes, some improvements in the loader (most notably support for older postgis versions), and more docs.

A.84.1 Actualizando

If you are upgrading from release 1.0.0RC6 you *DO NOT* need a dump/reload.

Upgrading from any other precedent release requires a dump/reload. See the [upgrading](#) chapter for more informations.

A.84.2 Library changes

BUGFIX in transform() releasing random memory address

BUGFIX in force_3dm() allocating less memory then required

BUGFIX in join selectivity estimator (defaults, leaks, tuplecount, sd)

A.84.3 Other changes/additions

BUGFIX in shp2pgsql escape of values starting with tab or single-quote

NEW manual pages for loader/dumper

NEW shp2pgsql support for old (HWGEOM) postgis versions

NEW -p (prepare) flag for shp2pgsql

NEW manual chapter about OGC compliancy enforcement

NEW autoconf support for JTS lib

BUGFIX in estimator testers (support for LWGEOM and schema parsing)

A.85 Versión 1.0.0RC6

Fecha de versión: 2005/03/30

Sixth release candidate for 1.0.0. Contains a few bug fixes and cleanups.

A.85.1 Actualizando

You need a dump/reload to upgrade from precedent releases. See the [upgrading](#) chapter for more informations.

A.85.2 Library changes

BUGFIX in multi()

early return [when noop] from multi()

A.85.3 Scripts changes

dropped {x,y}{min,max}(box2d) functions

A.85.4 Otros cambios

BUGFIX in postgis_restore.pl scrip

BUGFIX in dumper's 64bit support

A.86 Versión 1.0.0RC5

Fecha de versión: 2005/03/25

Fifth release candidate for 1.0.0. Contains a few bug fixes and a improvements.

A.86.1 Actualizando

If you are upgrading from release 1.0.0RC4 you *DO NOT* need a dump/reload.

Upgrading from any other precedent release requires a dump/reload. See the [upgrading](#) chapter for more informations.

A.86.2 Library changes

BUGFIX (segfaulting) in box3d computation (yes, another!).

BUGFIX (segfaulting) in estimated_extent().

A.86.3 Otros cambios

Small build scripts and utilities refinements.

Additional performance tips documented.

A.87 Versión 1.0.0RC4

Fecha de versión: 2005/03/18

Fourth release candidate for 1.0.0. Contains bug fixes and a few improvements.

A.87.1 Actualizando

You need a dump/reload to upgrade from precedent releases. See the [upgrading](#) chapter for more informations.

A.87.2 Library changes

BUGFIX (segfaulting) in geom_accum().

BUGFIX in 64bit architectures support.

BUGFIX in box3d computation function with collections.

NEW subselects support in selectivity estimator.

Early return from force_collection.

Consistency check fix in SnapToGrid().

Box2d output changed back to 15 significant digits.

A.87.3 Scripts changes

NEW distance_sphere() function.

Changed get_proj4_from_srid implementation to use PL/PGSQL instead of SQL.

A.87.4 Otros cambios

BUGFIX in loader and dumper handling of MultiLine shapes

BUGFIX in loader, skipping all but first hole of polygons.

jdbc2: code cleanups, Makefile improvements

FLEX and YACC variables set `*after*` `pgsql` `Makefile.global` is included and only if the `pgsql` `*stripped*` version evaluates to the empty string

Added already generated parser in release

Build scripts refinements

improved version handling, central `Version.config`

improvements in `postgis_restore.pl`

A.88 Versión 1.0.0RC3

Fecha de versión: 2005/02/24

Third release candidate for 1.0.0. Contains many bug fixes and improvements.

A.88.1 Actualizando

You need a dump/reload to upgrade from precedent releases. See the [upgrading](#) chapter for more informations.

A.88.2 Library changes

BUGFIX in transform(): missing SRID, better error handling.

BUGFIX in memory alignment handling

BUGFIX in force_collection() causing mapserver connector failures on simple (single) geometry types.

BUGFIX in GeometryFromText() missing to add a bbox cache.

reduced precision of box2d output.

prefixed DEBUG macros with `PGIS_` to avoid clash with `pgsql` one

plugged a leak in GEOS2POSTGIS converter

Reduced memory usage by early releasing query-context pallocated one.

A.88.3 Scripts changes

BUGFIX in 72 index bindings.

BUGFIX in probe_geometry_columns() to work with PG72 and support multiple geometry columns in a single table

NEW `bool::text` cast

Some functions made IMMUTABLE from STABLE, for performance improvement.

A.88.4 JDBC changes

jdbc2: small patches, box2d/3d tests, revised docs and license.
jdbc2: bug fix and testcase in for pgjdbc 8.0 type autoregistration
jdbc2: Removed use of jdk1.4 only features to enable build with older jdk releases.
jdbc2: Added support for building against pg72jdbc2.jar
jdbc2: updated and cleaned makefile
jdbc2: added BETA support for jts geometry classes
jdbc2: Skip known-to-fail tests against older PostGIS servers.
jdbc2: Fixed handling of measured geometries in EWKT.

A.88.5 Otros cambios

new performance tips chapter in manual
documentation updates: pgsq172 requirement, lwpostgis.sql
few changes in autoconf
BUILDDATE extraction made more portable
fixed spatial_ref_sys.sql to avoid vacuuming the whole database.
spatial_ref_sys: changed Paris entries to match the ones distributed with 0.x.

A.89 Versión 1.0.0RC2

Fecha de versión: 2005/01/26
Second release candidate for 1.0.0 containing bug fixes and a few improvements.

A.89.1 Actualizando

You need a dump/reload to upgrade from precedent releases. See the [upgrading](#) chapter for more informations.

A.89.2 Library changes

BUGFIX in pointarray box3d computation
BUGFIX in distance_spheroid definition
BUGFIX in transform() missing to update bbox cache
NEW jdbc driver (jdbc2)
GEOMETRYCOLLECTION(EMPTY) syntax support for backward compatibility
Faster binary outputs
Stricter OGC WKB/WKT constructors

A.89.3 Scripts changes

More correct STABLE, IMMUTABLE, STRICT uses in lwpostgis.sql
stricter OGC WKB/WKT constructors

A.89.4 Otros cambios

Faster and more robust loader (both i18n and not)

Initial autoconf script

A.90 Versión 1.0.0RC1

Fecha de versión: 2005/01/13

This is the first candidate of a major postgis release, with internal storage of postgis types redesigned to be smaller and faster on indexed queries.

A.90.1 Actualizando

You need a dump/reload to upgrade from precedent releases. See the [upgrading](#) chapter for more informations.

A.90.2 Cambios

Faster canonical input parsing.

Lossless canonical output.

EWKB Canonical binary IO with PG>73.

Support for up to 4d coordinates, providing lossless shapefile->postgis->shapefile conversion.

Nueva función: UpdateGeometrySRID(), AsGML(), SnapToGrid(), ForceRHR(), estimated_extent(), accum().

Posicionamiento vertical operadores indexados.

Función de selectividad JOIN

Más constructores/editores de geometría.

API extensión PostGIS

Reconoce UTF8 en el cargador.
