Manual PostGIS 2.5.0

Contents

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 2.5.0

Chapter 1

Introducción

PostGIS is a spatial extender 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 as well as corporations 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 OpenGIS 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. Ademas 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.

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

Regina Obe Buildbot Maintenance, windows production and experimental builds, Documentation, alignment of PostGIS with PostgreSQL releases, general user support on PostGIS newsgroup, X3D support, Tiger Geocoder Support, management functions, and smoke testing new functionality or major code changes.

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

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, PointCloud (in development), 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, git mirrors management, 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

Jorge Arévalo Desarrollo raster, soporte del driver GDAL, cargador

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

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

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

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

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

Raúl Marín Rodríguez Bug fixing

Darafei Praliaskouski Index improvements, bug fixing and geometry/geography function improvements, GitHub curator, and Travis bot maintenance.

Pierre Racine Arquitectura, prototipo y soporte en la programación Raster.

1.3 Core Contributors Past

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

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 indices 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.

David Zwarg Raster development (mostly map algebra analytic functions)

1.4 Other Contributors

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Corporate Sponsors Estas son compañías que han contribuido con tiempo de desarrollo, alojamiento o con aportes de capital económico al proyecto PostGIS

In alphabetical order: Arrival 3D, Associazione Italiana per l'Informazione Geografica Libera (GFOSS.it), AusVet, Avencia, Azavea, Cadcorp, CampToCamp, CartoDB, City of Boston (DND), Clever Elephant Solutions, Cooperativa Alveo, Deimos Space, Faunalia, Geographic Data BC, Hunter Systems Group, Lidwala Consulting Engineers, LisaSoft, Logical Tracking & Tracing International AG, Maponics, Michigan Tech Research Institute, Natural Resources Canada, Norwegian Forest and Landscape Institute, Boundless (former OpenGeo), OSGeo, Oslandia, Palantir Technologies, Paragon Corporation, R3 GIS, Refractions Research, Regione Toscana - SITA, Safe Software, Sirius Corporation plc, Stadt Uster, UC Davis Center for Vectorborne Diseases, University of Laval, U.S Department of State (HIU), Zonar Systems

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.

postgis64windows - 20 someodd sponsors each contributed $100 USD to pay for the work needed to work out PostGIS 64-bit issues on windows. It happened. We now have a 64-bit release for PostGIS 2.0.1 available on PostgreSQL stack builder.

Librerías de soporte importantes La libreria de operaciones geométricas GEOS, y el trabajo en los algoritmos de Martin Davis haciendo que funcione, mantenimiento y soporte continuos de Mateusz Loskot, Sandro Santilli (strk), Paul Ramsey y otros.

La libreria Geospatial Data Abstraction GDAL, de Frank Warmerdam y otros, se usa para las funcionalidades raster introducidas en la version PostGIS 2.0.0. De este modo, las mejoras necesarias en GDAL para dar soporte a PostGIS son introducidas en el proyecto GDAL.

La libreria de proyecciones cartográficas Proj4, y el trabajo de Gerald Evenden y Frank Warmerdam en la creación y mantenimiento de la misma.

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.

1.5 Mas información

- The latest software, documentation and news items are available at the PostGIS web site, http://postgis.net.
- Mas información sobre la libreria de operaciones espaciales GEOS esta disponible en http://trac.osgeo.org/geos/.
- Mas información sobre la librería de reproyección Proj4 se encuentra disponible en http://trac.osgeo.org/proj/.
- Mas información sobre el servidor de bases de datos PostgreSQL esta disponible en el sitio web de PostgreSQL http://www.postgresql.o
- Mas información sobre el indexado GiST disponible en el sitio web de desarrollo de PostgreSQL GiST, http://www.sai.msu.su/~megera/postgres/gist/.
- Mas information sobre el servidor de mapas MapServer esta disponible en http://mapserver.org.
- La especificación "Simple Features for Specification for SQL" esta disponible en el sitio web del OpenGIS Consortium: http://www.opengeospatial.org/.

Chapter 2

Instalación de PostGIS

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

2.1 Versión corta

To compile assuming you have all the dependencies in your search path:

```
tar xvfz postgis-2.5.0.tar.gz
cd postgis-2.5.0
./configure
make
make install
```

Once postgis is installed, it needs to be enabled in each individual database you want to use it in.

Note
The raster support is currently optional, but installed by default. For enabling using the PostgreSQL 9.1+ extensions model raster is required. Using the extension enable process is preferred and more user-friendly. To spatially enable your database:

```
psql -d yourdatabase -c "CREATE EXTENSION postgis;"
psql -d yourdatabase -c "CREATE EXTENSION postgis_topology;"
-- if you built with sfcgal support --
psql -d yourdatabase -c "CREATE EXTENSION postgis_sfcgal;"

-- if you want to install tiger geocoder --
psql -d yourdatabase -c "CREATE EXTENSION fuzzystrmatch"
psql -d yourdatabase -c "CREATE EXTENSION postgis_tiger_geocoder;"

-- if you installed with pcre
-- you should have address standardizer extension as well
psql -d yourdatabase -c "CREATE EXTENSION address_standardizer;"
```

Please refer to Section 2.4.3 for more details about querying installed/available extensions and upgrading extensions, or switching from a non-extension install to an extension install.

For those running who decided for some reason not to compile with raster support, or just are old-fashioned, here are longer more painful instructions for you:

All the .sql files once installed will be installed in share/contrib/postgis-2.4 folder of your PostgreSQL install

```
createdb yourdatabase
createlang plpgsql yourdatabase
psql -d yourdatabase -f postgis.sql
psql -d yourdatabase -f postgis_comments.sql
psql -d yourdatabase -f spatial_ref_sys.sql
psql -d yourdatabase -f topology.sql
psql -d yourdatabase -f topology_comments.sql

-- only if you compiled with raster (GDAL)
psql -d yourdatabase -f rtpostgis.sql
psql -d yourdatabase -f raster_comments.sql

--if you built with sfcgal support --
psql -d yourdatabase -f sfcgal.sql
psql -d yourdatabase -f sfcgal_comments.sql
```

El resto del capitulo entra en los detalles de cada uno de los pasos de instalación anteriores.

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 8.2.

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 9.3 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.

2.2 Install Requirements

PostGIS tiene los siguientes requisitos para compilarlo y usarlo:

Requerido

- PostgreSQL 9.4 o superior. Una instalación completa de PostgreSQL (incluyendo las cabeceras del servidor) es necesaria. PostgreSQL esta disponible en 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.

- Proj4 reprojection library, version 4.9.0 or greater. Proj4 4.9 or above is needed to take advantage of improved geodetic. The Proj4 library is used to provide coordinate reprojection support within PostGIS. Proj4 is available for download from http://trac.osgeo.org/proj/ .

- GEOS geometry library, version 3.5 or greater, but GEOS 3.7+ is recommended to take full advantage of all the new functions and features. You should have at least GEOS 3.5, without which you will be missing some major enhancements such as ST_ClipByBox2D and ST_Subdivide. GEOS is available for download from http://trac.osgeo.org/geos/ and 3.5+ is backward-compatible with older versions so fairly safe to upgrade.

- LibXML2, versión 2.5.x o superior. LibXML2 se usa actualmente en alguna funciones para importar (ST_GeomFromGML y ST_GeomFromKML). LibXML2 esta disponible para su descarga en http://xmlsoft.org/downloads.html.

- 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 1.8 or higher (1.9 or higher is strongly recommended since some things will not work well or behavior differently with lower versions). This is required for raster support and to be able to install with `CREATE EXTENSION postgis` so highly recommended for those running 9.1+. http://trac.osgeo.org/gdal/wiki/DownloadSource.

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

Opcional

- GDAL (pseudo optional) only if you don't want raster and don't care about installing with `CREATE EXTENSION postgis` can you leave it out. Keep in mind other extensions may have a requires postgis extension which will prevent you from installing them unless you install postgis as an extension. So it is highly recommended you compile with GDAL support.

  Also make sure to enable the drivers you want to use as described in Section 2.1.

- GTK (GTK+2.0, 2.8+ requerida) para compilar el cargador de shapefiles shp2pgsql-gui. http://www.gtk.org/ .

- SFCGAL, version 1.1 (or higher) could be used to provide additional 2D and 3D advanced analysis functions to PostGIS cf Section 8.10. 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: http://oslandia.github.io/SFCGAL/installation.html) https://github.com/Oslandia/SFCGAL.

- In order to build the Chapter 12 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-stcit` `h`. Chapter 12 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 (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.

- 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.sourceforg .
- ImageMagick (`convert`) es necesario para generar las imágenes empleadas en la documentación. ImageMagick esta disponible enhttp://www.imagemagick.org/ .

2.3 Obteniendo el código fuente

Retrieve the PostGIS source archive from the downloads website http://download.osgeo.org/postgis/source/postgis-2.5.0.tar.gz

```
wget http://download.osgeo.org/postgis/source/postgis-2.5.0.tar.gz
tar -xvzf postgis-2.5.0.tar.gz
```

Esto creara un directorio llamado `postgis-2.5.0` en el directorio de trabajo actual.

De forma alternativa se puede obtener el código fuente del repositorio svn http://svn.osgeo.org/postgis/trunk/ .

```
svn checkout http://svn.osgeo.org/postgis/trunk/ postgis-2.5.0
```

Vaya al nuevo directorio `postgis-2.5.0` creado para continuar con la instalación.

2.4 Compiling and Install from Source: Detailed

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 eres alguien que hace mantenimiento de paquetes.
Esta sección incluye las instrucciones generales de compilado, si estas compilando en Windows o 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 sitio de descragas de PostGIS para Windows También tenemos versiones experimentales para Windows que son publicadas normalmente una o dos veces por semana o cuando algo interesante ocurre. Puedes utilizar estas para experimentar con las versiones de desarrollo de PostGIS

El modulo PostGIS es una extensión del servidor PostgreSQL. Como tal, PostGIS 2.5.0 *requiere* PostgreSQL con acceso completo cabeceras del servidor con el fin de compilar. Puede ser compilado en PostgreSQL versiones 9.4, o superior. Las versiones anteriores de PostgreSQL *no* son compatibles.

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

Note

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

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

Esta es una falsa solución para excepciones de interacción de C++ con herramientas de desarrollo antiguas. Si experimentas problemas extraños (backend cerrado inesperadamente o cosas similares) prueba este truco. Para ello será necesario volver a compilar PostgreSQL desde cero, por supuesto.

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

2.4.1 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**.

--prefix=PREFIX Esta es la localización donde se instalaran 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 avence 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, libreria de geometrías requerida, tiene una utilidad llamada **geos-config** para activar la localización del directorio de instalación del software GEOS. Utiliza este parametro (**--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 libreria necesaria para procesar GeomFromKML/GML. Normalmente encontrara si tienes instalada la libreria libxml, pero si no esta instalada, o quieres usar una versión especifica, necesitaras 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 libreria de reproyecciones necesaria de PostGIS. Utiliza el siguiente parametro (**--with-projdir=/path/to/projdir**) para definir manualmente una instalación personalizada de Proj4 para compilar PostGIS.

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

--with-jsondir=DIR JSON-Ces una libreria con licencia MIT-licensed JSON necesaria para dar soporte a PostGIS ST_GeomFromJSON Utiliza este parametro (**--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-pcredir=DIR PCRE is an BSD-licensed Perl Compatible Regular Expression library required by address_standardizer extension. Use this parameter (**--with-pcredir=/path/to/pcredir**) 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 creara una interfaz gráfica shp2pgsql-gui para el comando shp2pgsql.

--with-raster Compilar con soporte para raster. Esto compilara la libreria rtpostgis-2.5.0 y el fichero rtpostgis.sql. Esto puede no ser necesario en la versión final ya que el plan es dar soporte raster de forma predeterminada.

--without-topology Disable topology support. There is no corresponding library as all logic needed for topology is in postgis-2.5.0 library.

--with-gettext=no PostGIS intentara detectar soporte gettext y compilar con el 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 esta 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.

Note
Si has obtenido PostGIS desde el repositorio SVN, el primer paso es ejecutar el 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**.

2.4.2 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 Guias de Estudio PostGIS / PostgreSQL

make cheatsheets

2.4.3 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 instaldo 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
```

```
make install
cd ..
cd postgis_topology
make clean
make
make install
cd ..
cd postgis_sfcgal
make clean
make
make install

cd ..
cd address_standardizer
make clean
make
make install
make installcheck

cd ..
cd postgis_tiger_geocoder
make clean
make
make install
make installcheck
```

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 raiz 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          | 2.5.0           | 2.5.0
 address_standardizer_data_us  | 2.5.0           | 2.5.0
 postgis                       | 2.5.0           | 2.5.0
 postgis_sfcgal                | 2.5.0           |
 postgis_tiger_geocoder        | 2.5.0           | 2.5.0
 postgis_topology              | 2.5.0           |
(6 rows)
```

Si tienes instalada una extension en la base de datos que estas consultando, deberías verla mencionada la columna `installed_versio`
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     | 2.5.0
Schema      | public
Description | PostGIS geometry, geography, and raster spat..
-[ RECORD 2 ]-------------------------------------------------
-
Name        | postgis_tiger_geocoder
Version     | 2.5.0
Schema      | tiger
Description | PostGIS tiger geocoder and reverse geocoder
-[ RECORD 3 ]-------------------------------------------------
-
Name        | postgis_topology
Version     | 2.5.0
Schema      | topology
Description | PostGIS topology spatial types and functions
```

Warning

No se pueden hacer copias de seguridad explicitas de las tablas de las extensiones `spatial_ref_sys`, `layer`, `topology`. Solo se pueden hacer copias de seguridad explicitas cuando 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. Envia un ticket si encuentras algún problema. La estructura de las tabals de extensiones no se guardan en copias de seguridad si son creadas con `CREATE EXTENSION` y son la misma estructura para una version dada de una extension. Estos comportamientos están incorporados en el modelo de extensiones PostgreSQL actual, así que nada podemos hacer al respecto.

If you installed 2.5.0, without using our wonderful extension system, you can change it to be extension based by first upgrading to the latest micro version running the upgrade scripts: `postgis_upgrade_22_minor.sql`,`raster_upgrade_22_minor.sql`,`topology_upgrade_22_minor.sql`.

Si ha instalado postgis sin el soporte raster, necesitara instalarlo primero (usando el archivo `rtpostgis.sql`

Entonces podrá ejecutar los siguientes comandos para empaquetar las funciones en sus extensiones respectivas.

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

2.4.4 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 version 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` cundo ejecuta las comprobaciones - *no* utiliza la version 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.

Si todo ha ido bien, la salida del comando de test debería ser similar a la siguiente:

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


Suite: computational_geometry
  Test: test_lw_segment_side ...passed
  Test: test_lw_segment_intersects ...passed
  Test: test_lwline_crossing_short_lines ...passed
  Test: test_lwline_crossing_long_lines ...passed
  Test: test_lwline_crossing_bugs ...passed
  Test: test_lwpoint_set_ordinate ...passed
  Test: test_lwpoint_get_ordinate ...passed
  Test: test_point_interpolate ...passed
  Test: test_lwline_clip ...passed
  Test: test_lwline_clip_big ...passed
  Test: test_lwmline_clip ...passed
  Test: test_geohash_point ...passed
  Test: test_geohash_precision ...passed
  Test: test_geohash ...passed
  Test: test_geohash_point_as_int ...passed
  Test: test_isclosed ...passed
  Test: test_lwgeom_simplify ...passed
Suite: buildarea
  Test: buildarea1 ...passed
  Test: buildarea2 ...passed
  Test: buildarea3 ...passed
  Test: buildarea4 ...passed
  Test: buildarea4b ...passed
  Test: buildarea5 ...passed
  Test: buildarea6 ...passed
  Test: buildarea7 ...passed
Suite: geometry_clean
  Test: test_lwgeom_make_valid ...passed
Suite: clip_by_rectangle
  Test: test_lwgeom_clip_by_rect ...passed
Suite: force_sfs
  Test: test_sfs_11 ...passed
```

```
  Test: test_sfs_12 ...passed
  Test: test_sqlmm ...passed
Suite: geodetic
  Test: test_sphere_direction ...passed
  Test: test_sphere_project ...passed
  Test: test_lwgeom_area_sphere ...passed
  Test: test_signum ...passed
  Test: test_gbox_from_spherical_coordinates ...passed
  Test: test_gserialized_get_gbox_geocentric ...passed
  Test: test_clairaut ...passed
  Test: test_edge_intersection ...passed
  Test: test_edge_intersects ...passed
  Test: test_edge_distance_to_point ...passed
  Test: test_edge_distance_to_edge ...passed
  Test: test_lwgeom_distance_sphere ...passed
  Test: test_lwgeom_check_geodetic ...passed
  Test: test_gserialized_from_lwgeom ...passed
  Test: test_spheroid_distance ...passed
  Test: test_spheroid_area ...passed
  Test: test_lwpoly_covers_point2d ...passed
  Test: test_gbox_utils ...passed
  Test: test_vector_angle ...passed
  Test: test_vector_rotate ...passed
  Test: test_lwgeom_segmentize_sphere ...passed
  Test: test_ptarray_contains_point_sphere ...passed
  Test: test_ptarray_contains_point_sphere_iowa ...passed
Suite: GEOS
  Test: test_geos_noop ...passed
  Test: test_geos_subdivide ...passed
  Test: test_geos_linemerge ...passed
Suite: Clustering
  Test: basic_test ...passed
  Test: nonsequential_test ...passed
  Test: basic_distance_test ...passed
  Test: single_input_test ...passed
  Test: empty_inputs_test ...passed
Suite: Clustering Union-Find
  Test: test_unionfind_create ...passed
  Test: test_unionfind_union ...passed
  Test: test_unionfind_ordered_by_cluster ...passed
Suite: homogenize
  Test: test_coll_point ...passed
  Test: test_coll_line ...passed
  Test: test_coll_poly ...passed
  Test: test_coll_coll ...passed
  Test: test_geom ...passed
  Test: test_coll_curve ...passed
Suite: encoded_polyline_input
  Test: in_encoded_polyline_test_geoms ...passed
  Test: in_encoded_polyline_test_precision ...passed
Suite: geojson_input
  Test: in_geojson_test_srid ...passed
  Test: in_geojson_test_bbox ...passed
  Test: in_geojson_test_geoms ...passed
Suite: twkb_input
  Test: test_twkb_in_point ...passed
  Test: test_twkb_in_linestring ...passed
  Test: test_twkb_in_polygon ...passed
  Test: test_twkb_in_multipoint ...passed
  Test: test_twkb_in_multilinestring ...passed
  Test: test_twkb_in_multipolygon ...passed
  Test: test_twkb_in_collection ...passed
```

```
  Test: test_twkb_in_precision ...passed
Suite: serialization/deserialization
  Test: test_typmod_macros ...passed
  Test: test_flags_macros ...passed
  Test: test_serialized_srid ...passed
  Test: test_gserialized_from_lwgeom_size ...passed
  Test: test_gbox_serialized_size ...passed
  Test: test_lwgeom_from_gserialized ...passed
  Test: test_lwgeom_count_vertices ...passed
  Test: test_on_gser_lwgeom_count_vertices ...passed
  Test: test_geometry_type_from_string ...passed
  Test: test_lwcollection_extract ...passed
  Test: test_lwgeom_free ...passed
  Test: test_lwgeom_flip_coordinates ...passed
  Test: test_f2d ...passed
  Test: test_lwgeom_clone ...passed
  Test: test_lwgeom_force_clockwise ...passed
  Test: test_lwgeom_calculate_gbox ...passed
  Test: test_lwgeom_is_empty ...passed
  Test: test_lwgeom_same ...passed
  Test: test_lwline_from_lwmpoint ...passed
  Test: test_lwgeom_as_curve ...passed
  Test: test_lwgeom_scale ...passed
  Test: test_gserialized_is_empty ...passed
  Test: test_gbox_same_2d ...passed
Suite: measures
  Test: test_mindistance2d_tolerance ...passed
  Test: test_rect_tree_contains_point ...passed
  Test: test_rect_tree_intersects_tree ...passed
  Test: test_lwgeom_segmentize2d ...passed
  Test: test_lwgeom_locate_along ...passed
  Test: test_lw_dist2d_pt_arc ...passed
  Test: test_lw_dist2d_seg_arc ...passed
  Test: test_lw_dist2d_arc_arc ...passed
  Test: test_lw_arc_length ...passed
  Test: test_lw_dist2d_pt_ptarrayarc ...passed
  Test: test_lw_dist2d_ptarray_ptarrayarc ...passed
  Test: test_lwgeom_tcpa ...passed
  Test: test_lwgeom_is_trajectory ...passed
Suite: effectivearea
  Test: do_test_lwgeom_effectivearea_lines ...passed
  Test: do_test_lwgeom_effectivearea_polys ...passed
Suite: miscellaneous
  Test: test_misc_force_2d ...passed
  Test: test_misc_simplify ...passed
  Test: test_misc_count_vertices ...passed
  Test: test_misc_area ...passed
  Test: test_misc_wkb ...passed
  Test: test_grid ...passed
Suite: noding
  Test: test_lwgeom_node ...passed
Suite: encoded_polyline_output
  Test: out_encoded_polyline_test_geoms ...passed
  Test: out_encoded_polyline_test_srid ...passed
  Test: out_encoded_polyline_test_precision ...passed
Suite: geojson_output
  Test: out_geojson_test_precision ...passed
  Test: out_geojson_test_dims ...passed
  Test: out_geojson_test_srid ...passed
  Test: out_geojson_test_bbox ...passed
  Test: out_geojson_test_geoms ...passed
Suite: gml_output
```

```
  Test: out_gml_test_precision ...passed
  Test: out_gml_test_srid ...passed
  Test: out_gml_test_dims ...passed
  Test: out_gml_test_geodetic ...passed
  Test: out_gml_test_geoms ...passed
  Test: out_gml_test_geoms_prefix ...passed
  Test: out_gml_test_geoms_nodims ...passed
  Test: out_gml2_extent ...passed
  Test: out_gml3_extent ...passed
Suite: kml_output
  Test: out_kml_test_precision ...passed
  Test: out_kml_test_dims ...passed
  Test: out_kml_test_geoms ...passed
  Test: out_kml_test_prefix ...passed
Suite: svg_output
  Test: out_svg_test_precision ...passed
  Test: out_svg_test_dims ...passed
  Test: out_svg_test_relative ...passed
  Test: out_svg_test_geoms ...passed
  Test: out_svg_test_srid ...passed
Suite: x3d_output
  Test: out_x3d3_test_precision ...passed
  Test: out_x3d3_test_geoms ...passed
  Test: out_x3d3_test_option ...passed
Suite: ptarray
  Test: test_ptarray_append_point ...passed
  Test: test_ptarray_append_ptarray ...passed
  Test: test_ptarray_locate_point ...passed
  Test: test_ptarray_isccw ...passed
  Test: test_ptarray_signed_area ...passed
  Test: test_ptarray_unstroke ...passed
  Test: test_ptarray_insert_point ...passed
  Test: test_ptarray_contains_point ...passed
  Test: test_ptarrayarc_contains_point ...passed
  Test: test_ptarray_scale ...passed
Suite: printing
  Test: test_lwprint_default_format ...passed
  Test: test_lwprint_format_orders ...passed
  Test: test_lwprint_optional_format ...passed
  Test: test_lwprint_oddball_formats ...passed
  Test: test_lwprint_bad_formats ...passed
Suite: SFCGAL
  Test: test_sfcgal_noop ...passed
Suite: split
  Test: test_lwline_split_by_point_to ...passed
  Test: test_lwgeom_split ...passed
Suite: stringbuffer
  Test: test_stringbuffer_append ...passed
  Test: test_stringbuffer_aprintf ...passed
Suite: surface
  Test: triangle_parse ...passed
  Test: tin_parse ...passed
  Test: polyhedralsurface_parse ...passed
  Test: surface_dimension ...passed
Suite: Internal Spatial Trees
  Test: test_tree_circ_create ...passed
  Test: test_tree_circ_pip ...passed
  Test: test_tree_circ_pip2 ...passed
  Test: test_tree_circ_distance ...passed
  Test: test_tree_circ_distance_threshold ...passed
Suite: triangulate
  Test: test_lwgeom_delaunay_triangulation ...passed
```

```
Suite: twkb_output
  Test: test_twkb_out_point ...passed
  Test: test_twkb_out_linestring ...passed
  Test: test_twkb_out_polygon ...passed
  Test: test_twkb_out_multipoint ...passed
  Test: test_twkb_out_multilinestring ...passed
  Test: test_twkb_out_multipolygon ...passed
  Test: test_twkb_out_collection ...passed
  Test: test_twkb_out_idlist ...passed
Suite: varint
  Test: test_zigzag ...passed
  Test: test_varint ...passed
  Test: test_varint_roundtrip ...passed
Suite: wkb_input
  Test: test_wkb_in_point ...passed
  Test: test_wkb_in_linestring ...passed
  Test: test_wkb_in_polygon ...passed
  Test: test_wkb_in_multipoint ...passed
  Test: test_wkb_in_multilinestring ...passed
  Test: test_wkb_in_multipolygon ...passed
  Test: test_wkb_in_collection ...passed
  Test: test_wkb_in_circularstring ...passed
  Test: test_wkb_in_compoundcurve ...passed
  Test: test_wkb_in_curvpolygon ...passed
  Test: test_wkb_in_multicurve ...passed
  Test: test_wkb_in_multisurface ...passed
  Test: test_wkb_in_malformed ...passed
Suite: wkb_output
  Test: test_wkb_out_point ...passed
  Test: test_wkb_out_linestring ...passed
  Test: test_wkb_out_polygon ...passed
  Test: test_wkb_out_multipoint ...passed
  Test: test_wkb_out_multilinestring ...passed
  Test: test_wkb_out_multipolygon ...passed
  Test: test_wkb_out_collection ...passed
  Test: test_wkb_out_circularstring ...passed
  Test: test_wkb_out_compoundcurve ...passed
  Test: test_wkb_out_curvpolygon ...passed
  Test: test_wkb_out_multicurve ...passed
  Test: test_wkb_out_multisurface ...passed
  Test: test_wkb_out_polyhedralsurface ...passed
Suite: wkt_input
  Test: test_wkt_in_point ...passed
  Test: test_wkt_in_linestring ...passed
  Test: test_wkt_in_polygon ...passed
  Test: test_wkt_in_multipoint ...passed
  Test: test_wkt_in_multilinestring ...passed
  Test: test_wkt_in_multipolygon ...passed
  Test: test_wkt_in_collection ...passed
  Test: test_wkt_in_circularstring ...passed
  Test: test_wkt_in_compoundcurve ...passed
  Test: test_wkt_in_curvpolygon ...passed
  Test: test_wkt_in_multicurve ...passed
  Test: test_wkt_in_multisurface ...passed
  Test: test_wkt_in_tin ...passed
  Test: test_wkt_in_polyhedralsurface ...passed
  Test: test_wkt_in_errlocation ...passed
Suite: wkt_output
  Test: test_wkt_out_point ...passed
  Test: test_wkt_out_linestring ...passed
  Test: test_wkt_out_polygon ...passed
  Test: test_wkt_out_multipoint ...passed
```

```
  Test: test_wkt_out_multilinestring ...passed
  Test: test_wkt_out_multipolygon ...passed
  Test: test_wkt_out_collection ...passed
  Test: test_wkt_out_circularstring ...passed
  Test: test_wkt_out_compoundcurve ...passed
  Test: test_wkt_out_curvpolygon ...passed
  Test: test_wkt_out_multicurve ...passed
  Test: test_wkt_out_multisurface ...passed

Run Summary:    Type  Total    Ran Passed Failed Inactive
              suites     38     38    n/a      0        0
               tests    251    251    251      0        0
             asserts   2468   2468   2468      0      n/a

Elapsed time =    0.298 seconds

Creating database 'postgis_reg'
Loading PostGIS into 'postgis_reg'
  /projects/postgis/branches/2.2/regress/00-regress-install/share/contrib/postgis/postgis. ↩
      sql
  /projects/postgis/branches/2.2/regress/00-regress-install/share/contrib/postgis/ ↩
      postgis_comments.sql
Loading SFCGAL into 'postgis_reg'
  /projects/postgis/branches/2.2/regress/00-regress-install/share/contrib/postgis/sfcgal. ↩
      sql
  /projects/postgis/branches/2.2/regress/00-regress-install/share/contrib/postgis/ ↩
      sfcgal_comments.sql
PostgreSQL 9.4.4, compiled by Visual C++ build 1800, 32-bit
  Postgis 2.2.0dev - r13980 - 2015-08-23 06:13:07
  scripts 2.2.0dev r13980
  GEOS: 3.5.0-CAPI-1.9.0 r4088
  PROJ: Rel. 4.9.1, 04 March 2015
  SFCGAL: 1.1.0

Running tests

 loader/Point ............. ok
 loader/PointM ............. ok
 loader/PointZ ............. ok
 loader/MultiPoint ............. ok
 loader/MultiPointM ............. ok
 loader/MultiPointZ ............. ok
 loader/Arc ............. ok
 loader/ArcM ............. ok
 loader/ArcZ ............. ok
 loader/Polygon ............. ok
 loader/PolygonM ............. ok
 loader/PolygonZ ............. ok
 loader/TSTPolygon ......... ok
 loader/TSIPolygon ......... ok
 loader/TSTIPolygon ......... ok
 loader/PointWithSchema ..... ok
 loader/NoTransPoint ......... ok
 loader/NotReallyMultiPoint ......... ok
 loader/MultiToSinglePoint ......... ok
 loader/ReprojectPts ........ ok
 loader/ReprojectPtsGeog ........ ok
 loader/Latin1 .... ok
 loader/Latin1-implicit .... ok
 loader/mfile .... ok
 dumper/literalsrid ....... ok
 dumper/realtable ....... ok
```

```
affine .. ok
bestsrid .. ok
binary .. ok
boundary .. ok
cluster .. ok
concave_hull .. ok
ctors .. ok
dump .. ok
dumppoints .. ok
empty .. ok
forcecurve .. ok
geography .. ok
in_geohash .. ok
in_gml .. ok
in_kml .. ok
in_encodedpolyline .. ok
iscollection .. ok
legacy .. ok
long_xact .. ok
lwgeom_regress .. ok
measures .. ok
operators .. ok
out_geometry .. ok
out_geography .. ok
polygonize .. ok
polyhedralsurface .. ok
postgis_type_name .. ok
regress .. ok
regress_bdpoly .. ok
regress_index .. ok
regress_index_nulls .. ok
regress_management .. ok
regress_selectivity .. ok
regress_lrs .. ok
regress_ogc .. ok
regress_ogc_cover .. ok
regress_ogc_prep .. ok
regress_proj .. ok
relate .. ok
remove_repeated_points .. ok
removepoint .. ok
setpoint .. ok
simplify .. ok
simplifyvw .. ok
size .. ok
snaptogrid .. ok
split .. ok
sql-mm-serialize .. ok
sql-mm-circularstring .. ok
sql-mm-compoundcurve .. ok
sql-mm-curvepoly .. ok
sql-mm-general .. ok
sql-mm-multicurve .. ok
sql-mm-multisurface .. ok
swapordinates .. ok
summary .. ok
temporal .. ok
tickets .. ok
twkb .. ok
typmod .. ok
wkb .. ok
wkt .. ok
```

```
 wmsservers .. ok
 knn .. ok
 hausdorff .. ok
 regress_buffer_params .. ok
 offsetcurve .. ok
 relatematch .. ok
 isvaliddetail .. ok
 sharedpaths .. ok
 snap .. ok
 node .. ok
 unaryunion .. ok
 clean .. ok
 relate_bnr .. ok
 delaunaytriangles .. ok
 clipbybox2d .. ok
 subdivide .. ok
 in_geojson .. ok
 regress_sfcgal .. ok
 sfcgal/empty .. ok
 sfcgal/geography .. ok
 sfcgal/legacy .. ok
 sfcgal/measures .. ok
 sfcgal/regress_ogc_prep .. ok
 sfcgal/regress_ogc .. ok
 sfcgal/regress .. ok
 sfcgal/tickets .. ok
 sfcgal/concave_hull .. ok
 sfcgal/wmsservers .. ok
 sfcgal/approximatemedialaxis .. ok
 uninstall .  /projects/postgis/branches/2.2/regress/00-regress-install/share/contrib/ ↩
     postgis/uninstall_sfcgal.sql
  /projects/postgis/branches/2.2/regress/00-regress-install/share/contrib/postgis/ ↩
      uninstall_postgis.sql
. ok (4336)

Run tests: 118
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/


Suite: Shapefile Loader File shp2pgsql Test
  Test: test_ShpLoaderCreate() ...passed
  Test: test_ShpLoaderDestroy() ...passed
Suite: Shapefile Loader File pgsql2shp Test
  Test: test_ShpDumperCreate() ...passed
  Test: test_ShpDumperDestroy() ...passed

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, currenlty 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-pagc_normalize_address ... ok

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

2.4.5 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**.

2.5 Crear una base de datos espacial utilizando EXTENSIONS

Si estas utilizando PostgreSQL 9.1+ y has compilado e instalado los módulos/extensión PostGIS, puedes crear una base de datos espacial de otra manera.

createdb [subasededatos]

El núcleo de la extensión postgis, instala geometry, geography, raster, spatial_ref_sys y todos los comentarios de las funciones PostGIS con un simple comando:

```
CREATE EXTENSION postgis;
```

.

psql -d [yourdatabase] -c "CREATE EXTENSION postgis;"

Topology esta compilado como una extensión separada y se puede instalar con el comando:

psql -d [yourdatabase] -c "CREATE EXTENSION postgis_topology;"

Si estas pensando en restaurar una copia de seguridad de una vieja base de datos desde una versión anterior en la nueva base de datos, ejecuta:

psql -d [yourdatabase] -f legacy.sql

Note
If you need legacy functions, you'll need to reinstall the legacy.sql script whenever you upgrade the minor version of PostGIS. E.g. if you upgraded from 2.4.3 to 2.5.0, then you need to reinstall the legacy.sql packaged with 2.5.0. This is because some of the functions make reference to the library and the library is named with the minor in it.

Después podrás ejecutar `uninstall_legacy.sql` para obtener el rid de las funciones obsoletas después de haber restaurado y limpiado.

2.6 Create a spatially-enabled database without using extensions

Note
This is generally only needed if you built-PostGIS without raster support. Since raster functions are part of the postgis extension, extension support is not enabled if PostGIS is built without raster.

El primer paso en la creación de una base de datos PostGIS es crear una simple base de datos PostgreSQL.

createdb [subasededatos]

Varias de la funciones PostGIS están escritas en el lenguaje de procedimientos PL/pgSQL. Como tal, el siguiente paso para crear una base de datos PostGIS es habilitar el lenguaje PL/pgSQL en nuestra nueva base de datos. Eso se hace con el comando siguiente. Para PostgreSQL 8.4+ está normalmente ya instalado.

createlang plpgsql [subasededatos]

Ahora carga los objetos y la definición de funciones en tu base de datos cargando el fichero de definiciones `postgis.sql` (este fichero se encuentra en `[prefix]/share/contrib` como se especificó durante la etapa de configuración).

psql -d [yourdatabase] -f postgis.sql

Para tener un juego completo de definiciones de sistemas de coordinas EPSG, también se puede cargar el fichero de definiciones `spatial_ref_sys.sql` y rellenar tabla `spatial_ref_sys`. Esto te permitida hacer operaciones de transformación ST_Transform() en las geometrías.

psql -d [yourdatabase] -f spatial_ref_sys.sql

Si quieres añadir los comentarios de las funciones PostGIS, el paso final es cargar el fichero `postgis_comments.sql` en la base de datos. Para ver los comentarios, simplemente ejecuta el comando **\dd [function_name]** en un terminal psql.

psql -d [yourdatabase] -f postgis_comments.sql

Instalar el soporte raster

psql -d [yourdatabase] -f rtpostgis.sql

Instala los comentarios de soporte raster. Esto te dará información de ayuda de forma rápida para cada función raster utilizando psql, pgAdmin o cualquier otra herramienta PostgreSQL que permita ver los comentarios de las funciones.

psql -d [yourdatabase] -f raster_comments.sql

Instalar el soporte de topología

psql -d [yourdatabase] -f topology/topology.sql

Instala los comentarios de soporte de topología. Esto te dará información de ayuda de forma rápida para cada función red topología utilizando psql, pgAdmin o cualquier otra herramienta PostgreSQL que permita ver los comentarios de las funciones.

psql -d [yourdatabase] -f topology/topology_comments.sql

Si estas pensando en restaurar una copia de seguridad de una vieja base de datos desde una versión anterior en la nueva base de datos, ejecuta:

psql -d [yourdatabase] -f legacy.sql

Note
Hay una alternativa, se puede ejecutar el fichero `legacy_minimal.sql` que instalará los elementos necesarios para reemplazar tablas y que permitida trabajar con aplicaciones como MapServer y GeoServer. Si tienes vistas que utilizan funciones tipo distancia/longitud etc, necesitaras ejecutar el fichero `legacy.sql` completo.

Después podrás ejecutar `uninstall_legacy.sql` para obtener el rid de las funciones obsoletas después de haber restaurado y limpiado.

2.7 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 Chapter 12.

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 2.8.3. 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 2.4.1, 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
```

2.7.1 Installing Regex::Assemble

Perl Regex: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-add tx`, you need to rebuild `parseaddress-stcities.h` which does require Regex:Assemble.

```
cpan Regexp::Assemble
```

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

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

2.8 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.

2.8.1 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 `fuzzystrmatch` extension already installed, you don't need to do the second step either.

```
CREATE EXTENSION postgis;
CREATE EXTENSION fuzzystrmatch;
CREATE EXTENSION postgis_tiger_geocoder;
--this one is optional if you want to use the rules based standardizer ( ↩
    pagc_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.streettypeabbrev, na.zip
        FROM normalize_address('1 Devonshire Place, Boston, MA 02109') AS na;
```

Which should output

```
address | streetname | streettypeabbrev |  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 = 'zcta510';
```

   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 whereever 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;
```

2.8.1.1 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 2.8.5 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;
```

2.8.2 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://download.osgeo.org/postgis/source/postgis-2.5.0.tar.gz

tar xvfz postgis-2.5.0.tar.gz

cd postgis-2.5.0/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
```

2.8.3 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 2.7 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_Ad 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.

2.8.4 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 geocodificacion en una dirección del estado descargado utilizando Geocode

2.8.5 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://download.osgeo.org/postgis/source/postgis-2.5.0.tar.gz

tar xvfz postgis-2.5.0.tar.gz

cd postgis-2.5.0/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 2.8.4. 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.

2.9 Crear una base de datos espacial desde una plantilla

Algunas de las distribuciones precompiladas de PostGIS (en particular los instaladores de Postgis >= 1.1.5 para sistemas Win32) carga las funciones de PostGIS en una base de datos plantilla llamada `template_postgis`. Si la base de datos `template_postgis` existe ya en nuestra instalación de PostgreSQL, los usuarios y aplicaciones podrán crear bases de datos espaciales con un simple comando. En ambos casos, el usuario de la base de datos debe tener privilegios para crear nuevas bases de datos

En la linea de comandos:

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

Desde SQL:

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

2.10 Actualizando

Actualizar una base de datos espacial puede ser complejo ya que requiere reemplazar o introducir nuevas definiciones de objetos PostGIS.

Desafortunadamente, no todas las definiciones pueden reemplazarse fácilmente en una base de datos activa, así que algunas veces lo mejor es un proceso copia de seguridad/recarga.

PostGIS incluye una SOFT UPGRADE (actualización ligera) para actualizaciones menores o corrección de errores, y una HARD UPGRADE (Actualización pesada) para versiones mayores.

Antes de realizar una actualización de PostGIS, es recomendable hacer una copia de seguridad de los datos. Si utilizas la opción -Fc en el comando pg_dump siempre podrás restaurar la copia realizada con un HARD UPDATE.

2.10.1 Actualizacion Ligera

Si instalaste la base de datos utilizando extensiones, necesitaras actualizar utilizando el modelo de extensiones tambien. Si instalaste utilizando el antiguo metodo de script sql, necesitaras actualizar el metodo de script sql. Consulta el metodo adecuado.

2.10.1.1 Actualización ligera anterior a la versión PostgreSQL 9.1+ o sin extensiones

Esta sección describe el método para quienes instalaron PostGIS sin utilizar extensiones solamente. Si tienes extensiones e intentas actualizar con este metodo, tendras mensajes como los siguientes:

```
no se puede suprimir ... porque la extensión postgis depende de el
```

After compiling and installing (make install) you should find a `postgis_upgrade.sql` and `rtpostgis_upgrade.sql` in the installation folders. For example `/usr/share/postgresql/9.3/contrib/postgis_upgrade.sql`. Install the `postgis_upgrade.sql`. If you have raster functionality installed, you will also need to install the `/usr/share/postgresql/9.3/contrib/postgis_upgrade.sql`. If you are moving from PostGIS 1.* to PostGIS 2.* or from PostGIS 2.* prior to r7409, you need to do a HARD UPGRADE.

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

El mimo proceso se emplea para las extensiones raster y topology, con ficheros de actualizacion llamados `rtpostgis_upgrade*.sql` y `topology_upgrade*.sql` respectivamente. Si lo necesitas, entoces:

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

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

Note
Si no puedes encontrar el fichero `postgis_upgrade*.sql` especifico para actualizar tu version, estas utilizando una version previa para una actualización ligera y necesitas hacer una actualización completa o HARD UPGRADE.

La función PostGIS_Full_Version debe darte la información sobre la necesidad de ejecutar este tipo de actualización utilizando el mensaje "procs need upgrade".

2.10.1.2 Actualizacion ligera 9.1+ utilizando extensiones

Si has instalado originalmente PostGIS con extensiones, entonces necesitas actualizar utilizando extensiones también. Hacer una actualización menor con extensiones es bastante sencillo.

```
ALTER EXTENSION postgis UPDATE TO "2.5.0";
ALTER EXTENSION postgis_topology UPDATE TO "2.5.0";
```

Si obtienes un error parecido a:

```
No migration path defined for ... to 2.5.0
```

Then you'll need to backup your database, create a fresh one as described in Section 2.5 and then restore your backup ontop of this new database.

If you get a notice message like:

```
Version "2.5.0" 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 SVN 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 "2.5.0next";
ALTER EXTENSION postgis_topology UPDATE TO "2.5.0next";
```

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.

2.10.2 Actualizacion pesada o HARD UPDATE

Por actualización pesada se entiende una copia de seguridad/recarga completa de datos en la base de datos espacial. Necesitas una actualización pesada cuando los objetos internos de almacenamiento de PostGIS cambian o cuando una actualización ligera no es posible. Las notas Release Notes del apéndice hay informes de cada version y de si necesitas hacer una copia de seguridad/recarga de datos (HARD UPGRADE) para actualizar.

El proceso copia de seguridad/recarga de datos esta asistido por el script postgis_restore.pl te toma en cuenta ignorar en la copia de seguridad todas las definiciones que pertenecen a PostGIS (incluyendo las antiguas), permitiéndote restaurar tus esquemas y datos en una base de datos con PostGIS instalado sin tener que duplicar errores o trayendo objetos rechazados.

Instruciones complementarias para windows están disponibles en Windows Hard upgrade.

El procedimiento es como sigue:

1. Crea un "formato personalizado" de copia de seguridad de la base de datos que asieres actualizar (llamemosla `olddb`) incluye binarios bolb (-b) y salida verbose (-v). El usuario puede ser el propietario de la base de datos, no necesitas una cuenta de superusuario postgres.

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

2. Haz una nueva instalación de PsotGIS en una nueva base de datos --la llamaremos `newdb` en este ejemplo. Puedes obtener información de como hacer esto en Section 2.6 y Section 2.5

   Las entradas que se encuentren en tu copia de seguridad de la tabla spatial_ref_sys serán restauradas, pero pero no reescribiran las existentes en la nueva tabla spatial_ref_sys. Esto es para asegurar que las soluciones en el conjunto oficial se propagarán correctamente para las bases de datos restauradas. Si por algún motivo, realmente quieres que tus entradas reemplacen las entradas estándar simplemente no cargues el archivo spatial_ref_sys.sql al crear la nueva db.

   Si tu base de datos es muy antigua o sabes que has estado utilizando funciones rechazadas en tus vistas y funciones, necesitaras cargar el fichero `legacy.sql` para todas tus funciones y vistas para que funcionen correctamente. Haz esto solamente si es indispensable. Considera actualizar tus vistas y funciones antes de hacer una copia de seguridad si es posible. Las funciones rechazadas pueden borrarse cargando el fichero `uninstall_legacy.sql` después.

3. Restaura tu copia de seguridad en tu nueva base de datos `newdb` utilizando el script postgis_restore.pl. Si aparecen errores inesperados, se imprimirán en la consola de psql. Ten un inventario de estos.

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

Los errores se producirán en alguno de estos casos:

1. Alguna de tus vistas o funciones hacen uso de funciones rechazadas de objetos PostGIS. Para corregir estos deberás intentar cargar el script `legacy.sql` antes de restaurar o deberás restaurar a una version de PsotGIS que todavía contenga estos objetos e intentar hacer la migración otra vez después de migrar tu código. Si el uso del fichero `legacy.sql` funciona, no olvides corregir tu código para dejar de utilizar funciones rechazadas, y elimina el script `legacy.sql` ejecutando `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).

   Para corregir esto deberías copiar tus SRS personalizados en in SRID con un valor (quizás en el rango de valores 910000..910999), convertir todas las tablas al nuevo srid (ver como hacer esto en UpdateGeometrySRID), borrar las entradas invalidas de la tabla spatial_ref_sys y reconstruir la o las restricciones chek con:

```
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));
```

2.11 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 9.4 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 9.4 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.

2.12 Cargador/Dumper

El cargador y dumper de datos se compila e instala de forma automática como parte de la distribución de PostGIS. Para compilar e instalar de forma manual puedes ejecutar:

```
# cd postgis-2.5.0/loader
# make
# make install
```

El cargador se llama `shp2pgsql` y convierte ficheros Shape de ESRI en sentencias SQL necesarias para cargarlo en PostGIS/-PostgreSQL. El dumper se llama `pgsql2shp` y convierte tablas PostGIS (o sentencias) en ficheros Shape de ESRI. Para mayor información, puedes ver la información en linea y las pagnas del manual.

Chapter 3

Preguntas frecuentes sobre PostGIS

1. *Donde puedo encontrar tutoriales, guías y talleres de trabajo con PostGIS*

   OpenGeo tiene un tutorial paso a paso taller de guía Introducción a PostGIS. Incluye los datos empaquetados así como introducción al trabajo con OpenGeo Suite. Es probablemente el mejor tutorial sobre 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_aliases 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.htmlSi 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 entrySi 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 10 y Chapter 9 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 14.11 para ver lo que actualmente se soporta y lo que no. Respuesta larga: Te invitamos a nuestro largo debate en Section 4.2.2 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 4.2.3.

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 4.2.1. 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 2.4.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 boleanos a devolver en SQL.Para las consultas espaciales, hay dos problemas importantes que hay que tener en cuenta mientras se construyen las consultas: ¿Hay indices espaciales que puedo utilizar? y ¿Estoy haciendo cálculos pesados en un gran numero de geometrias?En general, querras utilizar el operador "intersects" (&&) que comprueba que los limites de los objetos geograficos intersectan. La razón por la que el operador && es útil, es por que si un indice 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 indices y funciones espaciales. El test de indices 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, the_geom
    FROM thetable
    WHERE
      ST_Contains(the_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 indices es importante.Para construir un indice 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 indice GiST (Arbol de búsqueda generalizado).

    Note
    Los indices GiST se supone que son "lossy". Los indices "lossy" utilizan un objeto proxy (en el caso espacial, las cajas) para construir el indice.

También debes estar seguro que el planificador de consultas de PostgreSQL tiene suficiente información sobre tus indices 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 indices R-Tree de PostgreSQL?*

    En las primeras versiones de PostGIS se utilizaban los indices R-Tree de PostgreSQL. Sin embargo, desde la version 0.6 han sido descartados los indices 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 par indices nativos R-Tree y GiST son comparables. El indice 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 indices R-Tree en PostgreSQL no pueden manejar elementos mayores de 8K de tamaño. Los indices GiST pueden, utilizando el truco "lossy" para substituir la caja del elemento en si mismo.
    - Los indices r-Tree de PostgreSQL no son seguros con valores nulos, así que construir un indice 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 geometrias tendrán un valor de -1 en el SRID, y las tablas de metadatos OpenGIS *no* se cumplimentaran correctamente. De todas cromas, 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 indices 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 indice 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?*

    Para realizar una reproyección, el sistema de coordenadas de las tablas origen y destino debe estar definido en la tabla SPATIAL_REF_SYS, y las geometrías reproyectadas deben tener definido un sistema de coordenadas SRID en ellas. Una vez hecho esto, una reprojección es tan simple como hacer una referencia al SRID deseado. La consulta siguen reproyecta una geometría a NAD 83 long lat. La consulta siguiente solo funcionará si el srid de la geometría no es -1 (referencia espacial no definida)

    ```
    SELECT ST_Transform(the_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.

    ```
    -- Para comprobar el numero de geometrías que están realmente en blanco
                                    SELECT count(gid) FROM geotable WHERE the_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?*

    Almost certainly not. As an example, consider Oracle database running on Linux. Linux is GPL, Oracle is not: does Oracle running on Linux have to be distributed using the GPL? No. Similarly your software can use a PostgreSQL/PostGIS database as much as it wants and be under any license you like.The only exception would be if you made changes to the PostGIS source code, and *distributed your changed version* of PostGIS. In that case you would have to share the code of your changed PostGIS (but not the code of applications running on top of it). Even in this limited case, you would still only have to distribute source code to people you distributed binaries to. The GPL does not require that you *publish* your source code, only that you share it with people you give binaries to.The above remains true even if you use PostGIS in conjunction with the optional CGAL-enabled functions. Portions of CGAL are GPL, but so is all of PostGIS already: using CGAL does not make PostGIS any more GPL than it was to start with.

Chapter 4

Utilizando PostGIS: Gestión de Datos y Consultas

4.1 Objetos SIG

Los objetos SIG soportados por PostGIS son una colección de "Simple Features" definidas por el OpenGIS Consortium (OGC). A partir de la versión 0.9, PostGIS soporta todos los objetos y funciones de la especificación "Simple Features for SQL" del OGC.

PostGIS extiende el estándar con soporte para coordenadas 3DZ,3DM y 4D.

4.1.1 OpenGIS WKB y WKT

La especificación OpenGIS define dos formas estándar de expresar objetos espaciales: la forma Well-Known Text (WKT) y la forma Well-Known Binary (WKB). Ambas WKT y WKB, incluyen información sobre el tipo de objeto y el sistema de coordenadas del objeto.

Algunos ejemplos de representaciones (WKT) de objetos espaciales de objetos geográficos son de la siguiente manera:

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

La especificación OpenGIS también requiere que el almacenamiento interno de objetos espaciales incluya el sistema de referencia espacial (SRID). El SRID es necesario al crear objetos espaciales para añadirlos a la base de datos.

La Entrada/Salida de estos formatos están disponibles utilizando las interfaces siguientes:

```
bytea WKB = ST_AsBinary(geometry);
text WKT = ST_AsText(geometry);
geometry = ST_GeomFromWKB(bytea WKB, SRID);
geometry = ST_GeometryFromText(text WKT, SRID);
```

Por ejemplo un comando valido de inserción para crear e insertar un objeto espacial OGC podría ser:

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

4.1.2 En PostGIS EWKB, EWKT y foma Canonica

Los formatos OGC solo soportan geometrías 2D, y los SRID asociados nunca son embebidos en las representaciones de entrada/salida.

Los formatos extendidos de PostGIS son un superconjunto de los OGC actualmente (todo WKB/WKT valido es un EWKB/EWKT valido) pero esto puede variar en el futuro, especialmente si el OGC saca un nuevo formato que crea conflictos con nuestras extensiones. ¡Por lo tanto NO DEBERIAS confiar en esta característica!

PostGIS EWKB/EWKT añade soporte a coordenadas 3dm, 3dz y 4d y a información embebida del SRID.

Algunos ejemplos de representaciones (WKT) de objetos espaciales de objetos geográficos son de la siguiente manera:

- 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 9, 9 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)))

La Entrada/Salida de estos formatos están disponibles utilizando las interfaces siguientes:

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

Por ejemplo, una consulta "insert" valida para crear e insertas un objeto espacial PostGIS debería ser:

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

Las formas "canónicas" de un tipo PostgreSQL son las representaciones que obtienes con una consulta simple (sin ninguna llamada a funciones) y la única que esta garantizada en ser aceptada con un simple "insert", "update" o "copy". para los tipos 'geómetra' de PostGIS son:

```
- Output
  - binary: EWKB
        ascii: HEXEWKB (EWKB in hex form)
- Input
  - binary: EWKB
        ascii: HEXEWKB|EWKT
```

Por ejemplo, esta consulta lee EWKT y devuelve HEXEWKB en el proceso de entrada/salida ascii canónico.

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

geometry
----------------------------------------------------
0101000020040000000000000000000000000000000000000000
(1 row)
```

4.1.3 SQL-MM Parte 3

La especificación SQL Multimedia Applications Spatial extiende los objetos simples para la especificación SQL definiendo un numero de curvas interpoladas.

Las definiciones SQL-MM incluyen coordenadas 3dm, 3dz y 4d, pero no permiten integrar la información SRID.

Las extensiones de well-know text no están aún completamente soportadas. A continuación se muestran ejemplos de algunas geometrías simples curvadas:

- CIRCULARSTRING(0 0, 1 1, 1 0)

  CIRCULARSTRING(0 0, 4 0, 4 4, 0 4, 0 0)

  CIRCULARSTRING es el tipo básico de curva, similar a LINESTRING en el mundo lineal. Un segmento simple necesita tres puntos, los puntos de inicio y fin (primero y tercero) y cualquier otro punto del arco. La excepción a esto es para un círculo cerrado, donde el punto de inicio y fin son el mismo. En este caso, el segundo punto DEBE ser el centro del arco, esto es el lado opuesto del círculo. Para encadenar arcos juntos, el último punto del arco previo, se convierte en el primero del siguiente, como ocurre con LINESTRING. Esto quiere decir que una cadena circular válida debe tener un número impar de puntos mayor que 1.

- COMPOUNDCURVE(CIRCULARSTRING(0 0, 1 1, 1 0),(1 0, 0 1))

  Una curva compuesta es una curva simple y continua, que tiene segmentos curvos (circular) y segmentos lineales. Esto significa que ademas de tener componentes bien formados, el punto final de cada componente (excepto el ultimo) debe coincidir con el punto inicial del componente siguiente.

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

  Ejemplo de curva compuesta en un polígono curvo: 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))

  Un CURVEPOLYGON es como un poligono, con un anillo externo y cero o mas anillos internos. La diferencia es que que este anillo puede tomar la forma de una cadena circular, cadena lineal o una cadena de curva compuesta.

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

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

  Una MULTICURVE es una colección de curvas, que puede incluir cadenas lineales, cadenas curvas o curvas compuestas.

- 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)))

  Esto es una colección de superficies, que pueden ser polígonos (lineales) o polígonos curvos.

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

4.2 Tipo Geography en PostGIS

El tipo "geography" proporciona soporte nativo para objetos espaciales representados por coordenadas geográficas (a veces llamadas coordenadas geodésicas, o "lat/lon", o "lob/lat"). Las coordenadas geográficas son coordenadas esféricas expresadas en unidades angulares (grados).

La base del tipo "geometry" de PostGIS es un plano. El camino mas corto entre dos puntos en un plano es una linea recta. Esto significa que los cálculos en geometrías (áreas, distancias, longitudes, intersecciones, etc) pueden calcularse utilizando matemáticas cartesiana y vectores lineales.

La base del tipo geografico de PostGIS es una esfera. El camino mas corto entre dos puntos en la esfera es el arco de circunferencia mas corto que une los dos puntos. esto significa que los cálculos geográficos (áreas, distancias, longitudes, intersecciones, etc) deben calcularse en la esfera, utilizando matemáticas mas complejas. Para medidas mas precisas, los cálculos deben tomar la forma esferoidal actual del mundo en cuenta, y las matemáticas se vuelven aun mas complejas.

Debido a que las matemáticas subyacentes son mas complejas, hay varias funciones definidas para el tipo geográfico y no para el tipo geométrico. Con el tiempo, conforme se añadan nuevos algoritmos, las capacidades del tipo geográfico se irán expandiendo.

Una restricción es que sólo soporta longitud y latitud en WGS84 (SRID:4326). Utiliza un nuevo tipo llamado "geography". Ninguna de las funciones de GEOS soporta este nuevo tipo. Para solucionar este problema se puede convertir entre los tipos de "geometry" y "geography".

Prior to PostGIS 2.2, the geography type only supported WGS 84 long lat (SRID:4326). For PostGIS 2.2 and above, any long/lat based spatial reference system defined in the `spatial_ref_sys` table can be used. You can even add your own custom spheroidal spatial reference system as described in geography type is not limited to earth.

Regardless which spatial reference system you use, the units returned by the measurement (ST_Distance, ST_Length, ST_Perimeter, ST_Area) and for input of ST_DWithin are in meters.

El nuevo tipo "geography" utiliza el formato de definición typmod de PostgreSQL 8.3+ así se puede añadir una tabla con un campo geográfico de forma sencilla. Todos los formatos OGC excepto la curva están soportados.

4.2.1 Bases del tipo "Geography"

El tipo "geography" solo soporta el mas simple de los objetos simples. Datos del tipo de geometría estándar serán moldeados al tipo "geography" si esta en SRID 4326. También puedes emplear las convenciones EWKT y EWKB para añadir datos.

- POINT: Creating a table with 2D point geography when srid is not specified defaults to 4326 WGS 84 long lat:

```
CREATE TABLE testgeog(gid serial PRIMARY KEY, the_geog geography(POINT,4326) );
```

PUNTO: Creando una tabla con una geometría puntual 2D:

```
CREATE TABLE testgeog(gid serial PRIMARY KEY, the_geog geography(POINT,4326) );
```

Creando una tabla con un punto con coordenada z

```
CREATE TABLE testgeog(gid serial PRIMARY KEY, the_geog geography(POINTZ,4326) );
```

- LINESTRING

```
CREATE TABLE testgeog(gid serial PRIMARY KEY, the_geog geography(POINT,4326) );
```

- POLYGON

```
CREATE TABLE testgeog(gid serial PRIMARY KEY, the_geog geography(POINT,4326) );
```

- MULTIPOINT
- MULTILINESTRING
- MULTIPOLYGON
- GEOMETRYCOLLECTION

The geography fields get registered in the `geography_columns` system view.

Ahora, comprueba la vista "geography_columns" y mira si tu tabla está listada

You can create a new table with a GEOGRAPHY column using the CREATE TABLE syntax.

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

Se puede notar que la columna de localización es de tipo GEOGRAPHY y este tipo geográfico soporta dos modificadores opcionales: un modificador de tipo que restringe la clase de formas y dimensiones permitidas en la columna; y un modificador SRID que restringe el identificador de las coordenadas de referencia a un número particular.

Valores permitdos para el modificador de tipo son: POINT, LINESTRING, POLYGON, MULTIPOINT, MULTILINESTRING, MULTIPOLYGON. El modificador también acepta restricciones dimensionales a través de sufijos: Z, M Y ZM. Así, por ejemplo, un modificador de 'LINESTRINGM' permitirá sólo líneas con tres dimensiones, y trataría la tercera dimensión como una medida. De forma similar, 'POINTZM' esperará datos de cuatro dimensiones.

If you do not specify an SRID, the SRID will default to 4326 WGS 84 long/lat will be used, and all calculations will proceed using WGS84.

Una vez hayas creado tu tabla, podras verla en en la tabla GEOGRAPHY_COLUMNS:

```
-- Ver el contenido de la vista de metadatos
SELECT * FROM geography_columns;
```

Puedes añadir datos en la tabla de la misma forma que si fuera una columna GEOMETRY:

```
-- Añade algunos datos en la tabla de test
INSERT INTO global_points (name, location) VALUES ('Town', ST_GeographyFromText('SRID=4326; ↩
    POINT(-110 30)') );
INSERT INTO global_points (name, location) VALUES ('Forest', ST_GeographyFromText('SRID ↩
    =4326;POINT(-109 29)') );
INSERT INTO global_points (name, location) VALUES ('London', ST_GeographyFromText('SRID ↩
    =4326;POINT(0 49)') );
```

Crear un indice es igual que para GEOMETRY. PostGIS detectará que el tipo de columna es GEOGRAPHY y creara un indice basado en una esfera apropiado en vez de el indice usual basado en plano utilizado para columnas GEOMETRY

```
-- Crea un indice en la tabla de test con un indice esferico
  CREATE INDEX global_points_gix ON global_points USING GIST ( location );
```

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)

```
-- Muestra una consulta de distancia y observa que , Londres esta fuera de la tolerancia de ↩
     1000km
  SELECT name FROM global_points WHERE ST_DWithin(location, ST_GeographyFromText('SRID ↩
      =4326;POINT(-110 29)'), 1000000);
```

Puedes observar la potencia de GEOGRAPHY en directo calculando como de próximo, un avión volando de Seattle a Londres (LINESTRING(-122.33 47.606, 0.0 51.5)) viene a Reykjavik (POINT(-21.96 64.15)).

```
-- Calculo de distancia utilizando GEOGRAPHY (122.2km)
  SELECT ST_Distance('LINESTRING(-122.33 47.606, 0.0 51.5)'::geography, 'POINT(-21.96  ↩
      64.15)':: geography);
```

```
-- Calculo de distancia utilizando GEOMETRY (13.3 "degrees")
  SELECT ST_Distance('LINESTRING(-122.33 47.606, 0.0 51.5)'::geometry, 'POINT(-21.96 64.15) ↩
      ':: geometry);
```

Testing different lon/lat projects. Any long lat spatial reference system listed in `spatial_ref_sys` table is allowed.

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

geometry
----------------------------------------------------
0101000020040000000000000000000000000000000000000000
(1 row)
```

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

geometry
----------------------------------------------------
0101000020040000000000000000000000000000000000000000
(1 row)
```

```
-- NAD83 UTM zone meters, yields error since its a meter based projection
SELECT 'SRID=26910;POINT(-123 34)'::geography;

ERROR:  Only lon/lat coordinate systems are supported in geography.
LINE 1: SELECT 'SRID=26910;POINT(-123 34)'::geography;
```

El tipo GEOGRAPHY calcula la distancia real mas corta sobre la esfera entre Reykjavik y el camino circular mayor de vuelo entre Seattle y London.

Great Circle mapper El tipo GEOMETRY calcula una distancia cartesiana sin sentido entre Reykjavik y el camino recto desde Seattle a Londres dibujado en un mapa plano del mundo. Las unidades nominales del resultado debe llamarse "grados", pero el resultado no corresponde con ninguna diferencia angular entre los puntos, así que incluso llamándolo "grados" es inexacta.

4.2.2 ¿Cuando utilizar el tipo Geografico en vez de Geometrico?

El nuevo tipo GEOGRAPHY te permite almacenar datos en coordenadas longitud/latitud, pero con un coste: hay algunas funciones definidas en GEOGRAPHY que están en GEOMETRY; estas funciones que están definidas toman mas tiempo en la CPU a ejecutarse

El tipo que elijas debe estar condicionado por la extension del área de trabajo de la aplicación que estas construyendo. ¿Tus datos se extienden por el globo o una zona continental grande? ¿O es un estado, región o municipio?

- Si tus datos están un área pequeña, la mejor solución seria 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 14.11. Para obtener una lista con la descripción de las funciones Geography ve a Section 14.4

4.2.3 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 boleano 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 pude procesar?*

   Utilizamos grandes arcos de circulo como la "linea 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 traves 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 poligono es condenadamente grande! Las grandes áreas son malas por dos razones: Sus limites son grandes, así que el indice 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). Como con GEOMETRY, recomendamos que cuando tengas polígonos muy grandes, pero haces consultas en áreas pequeñas, deberías "desnormalizar" tus datos geométricos en trozos pequeños así el indice puede hacer subconsultas eficientes del objeto y las consultas no tienen que utilizar el objeto entero cada vez. Solo por que *puedas* almacenar toda Europa en un polígono no significa que *debas*.

4.3 Utilizando estandares OpenGIS

La especificación "Simple Features Specification for SQL"del OpenGIS, define estándares del tipo de objetos GIS, las funciones necesarias para manipularlos, y un conjunto de tablas de metadatos. Para asegurar que los metadatos permanecen consistentes, operaciones como crear o borrar una columna espacial están llevados a cabo a través de procedimientos especiales definidos por el OpenGIS.

Hay dos tablas de metadatos definidas por el OpenGIS: `SPATIAL_REF_SYS` y `GEOMETRY_COLUMNS`. La tabla `SPATIAL_REF_SYS` almacena los IDs numéricos y las descripciones textuales de los sistemas de coordenadas utilizados en la base de datos espaciales.

4.3.1 La tabla SPATIAL_REF_SYS y los Sistemas de Referencia Espacial

La tabla spatial_ref_sys es una tabla incluida en PostGIS y cumple con el estafar OGC, que contiene una lista de unos 3000 sistemas de referencia espaciales conocidos y los detalles necesarios para transformar/reproyectar entre ellos.

Aunque la tabla spatial_ref_sys de PostGIS contiene unas 3000 definiciones de sistemas de referencia espaciales mas comunes, esto puede ser manejado con la librería proj, no contiene todos los sistemas conocidos y puedes definir tus propias proyecciones si estas familiarizado con el constructor de proj4. Piensa que la mayoría de sistemas de referencia son regionales y no tiene sentido utilizarlos fuera de los limites para los cuales fueron definidos.

Un recurso muy bueno para encontrar sistemas de referencia espaciales no definidos en el núcleo de la librería es http://spatialreference.or

Algunos de los sistemas de referencia espaciales mas comunes en Estados Unidos son: 4326 - WGS 84 Long Lat , 4269 - NAD 83 Long Lat (en Norte America), 3395 - WGS 84 World Mercator, 2163 - US National Atlas Equal Area (en Estados Unidos),Sistemas de referencia espaciales para cada zona, NAD 83, WGS 84 UTM y UTM son de los mas idóneos para medidas, pero solo cubren regiones de 6 grados.

Algunos sistemas de referencia espaciales planos de Estados Unidos (basados en metros o pies) - normalmente existen uno o 2 por Estado de Estados Unidos. La mayoría de los basados en metros están en el núcleo de definiciones, pero algunos de los basados en pies o los creados por ESRI deberás crearlos desde spatialreference.org.

Para saber detalles sobre como determinar la zona UTM a utilizar en tu área de interés, echalé un vistazo a la función de ayuda utmzone PostGIS plpgsql .

La definición de la tabla `SPATIAL_REF_SYS` es la siguiente:

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

Las columnas `SPATIAL_REF_SYS` son como sigue:

SRID Un valor entero único que identifica el Sistema de Referencia Espacial (SRS de sus siglas en ingles) con la base de datos.

AUTH_NAME El nombre del estándar o estándares que es citado para este sistema de referencia. Por ejemplo, "EPSG" seria un `AUTH_NAME` valido.

AUTH_SRID El ID del Sistema de Referencia Espacial definido por el Autor citado en `AUTH_NAME`. En el caso de EPSG, este es lugar donde deberá ir el código de la proyección EPSG.

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]
]
```

Para obtener una lista de los códigos EPSG y sus correspondientes representaciones WKT, visita http://www.opengeospatial.org/- . Para obtener información general sobre WKT, visita el OpenGIS "Coordinate Transformation Services Implementation Specification" en http://www.opengeospatial.org/standards. Para obtener información del European Petroleum Survey Group (EPSG) y su base de datos de sistemas de referencia espacial, visita http://www.epsg.org.

PROJ4TEXT PostGIS utiliza la libreria Proj4 para ejecutar transformaciones de coordenadas. La columna `PROJ4TEXT` contiene la cadena de definición de coordenadas Proj4 para un SRID particular. Por ejemplo:

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

Para obtener mas información, puedes visitar el sitio web de Proj4 en http://trac.osgeo.org/proj/. El fichero `spatial_ref_sys.sql` contiene ambas definiciones `SRTEXT` y `PROJ4TEXT` para todas las proyecciones EPSG.

4.3.2 La VISTA GEOMETRY_COLUMNS

GEOMETRY_COLUMNS is a view reading from database system catalogs. Its structure is as follows:

```
\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)  |
```

Las opciones del comando son:

F_TABLE_CATALOG, F_TABLE_SCHEMA, F_TABLE_NAME El nombre completo de la tabla de entidad que contiene la columna de geometría. Observa que los términos "catalog" y "schema" son como en Oracle. No hay analogía en PostgreSQL para "catalogo" así que esta columna esta en blanco -- para "schema" se usa el nombre de esquema de PostgreSQL (public es por defecto).

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

COORD_DIMENSION Dimension espacial (2, 3 o 4 dimensiones) de la columna.

SRID El ID del sistema de referencia espacial utilizado para las coordenadas de las geometrías en la tabla. Es una clave foránea con referencia a la tabla SPATIAL_REF_SYS.

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.

Note
Este no es (probablemente) parte de la especificación OpenGIS, pero es necesario para asegurar la homogeneidad de tipos.

4.3.3 Crear una tabla espacial

Crear una tabla con datos espaciales se puede hacer en un solo paso. Como se muestra en el siguiente ejemplo que crea una tabla de carreteras con una columna de tipo lineal de 2D en WGS84 long lat.

```
CREATE TABLE ROADS ( ID int4
                  , ROAD_NAME varchar(25), geom geometry(LINESTRING,4326) );
```

Podemos añadir columnas adicionales utilizando el comando estándar ALTER TABLE como se muestra en el siguiente ejemplo donde añadimos una columna de lineas en 3D.

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

4.3.4 Registrando la columna de geometrias de forma manual en la tabla geometry_columns

Dos de los casos en lo que esto ocurre, pero no puedes utilizar AddGeometryColumn, es el caso de vistas SQL e inserciones masivas. Para esto casos, puedes corregir el registro en la tabla geometry_columns creando una restricción en la columna. A saber que en PostGIS 2.0+, si tu columna esta basada en typmod, el proceso de creación lo registrará correctamente, así que no necesitas hacer nada.

```
--Imaginemos que tienes una vista creada de la siguiente manera
CREATE VIEW  public.vwmytablemercator AS
        SELECT gid, ST_Transform(geom,3395) As geom, f_name
        FROM public.mytable;

-- Para registrarla de forma correcta en  PostGIS 2.0+
-- Necesitas hacer una conversión de tipos cast
--
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;

-- Si sabes que el tipo de geometria de forma segura es 2D POLYGON entonces puedes hacer
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;
```

```
--Supongamos que has creado una tabla derivada al hacer una inserción masiva
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);

--Creamos un indice 2d en la tabla nueva
CREATE INDEX idx_myschema_myspecialpois_geom_gist
  ON myschema.my_special_pois USING gist(geom);

-- Si tus puntos son 3D o 3M,
-- Entonces querrás crear un indice nd en vez de un indice 2d
-- de la siguiente manera
CREATE INDEX my_special_pois_geom_gist_nd
        ON my_special_pois USING gist(geom gist_geometry_ops_nd);

--Para registrar de forma manual la columna geometrica de la nueva tabla en tu tabla  ↩
    geometry_columns
-- Fijate que este método funcionara en ambas versiones PostGIS 2.0+ y PostGIS 1.4+
-- Para PostGIS 2.0 también cambiará  la estructura subyacente de la tabla para
-- hacer la columna basada en typmod.
-- Para PostGIS anterior a 2.0, también se puede utilizar para registrar vistas
SELECT populate_geometry_columns('myschema.my_special_pois'::regclass);

--Si esta utilizando PostGIS 2.0 y por cualquier razón,
-- necesitas la definición basada en las antiguas restricciones
-- (como el caso de tablas heredadas donde todas las tablas dependientes no tienen el mismo ↩
     tipo y srid)
-- selecciona el nuevo argumento opcional  use_typmod como false
SELECT populate_geometry_columns('myschema.my_special_pois'::regclass, false);
```

Aunque el método antiguo basado en restricciones aún se puede utilizar, una columna geométrica basada en el uso de restricciones utilizada directamente en la vista, no se registrará correctamente en geometry_columns, al igual que una typmod. En este ejemplo se define una columna utilizando typmod y otro mediante restricciones.

```
CREATE TABLE pois_ny(gid SERIAL PRIMARY KEY
```

```
   , poi_name text, cat varchar(20)
   , 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
```

Esto puede cambiar en versiones futuras de PostGIS, pero por el momento, para forzar a las vistas basadas en restricciones a registrarse de forma correcta, debemos hacer lo siguiente:

```
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
```

4.3.5 Asegurando la compatibilidad de geometrias con OpenGIS

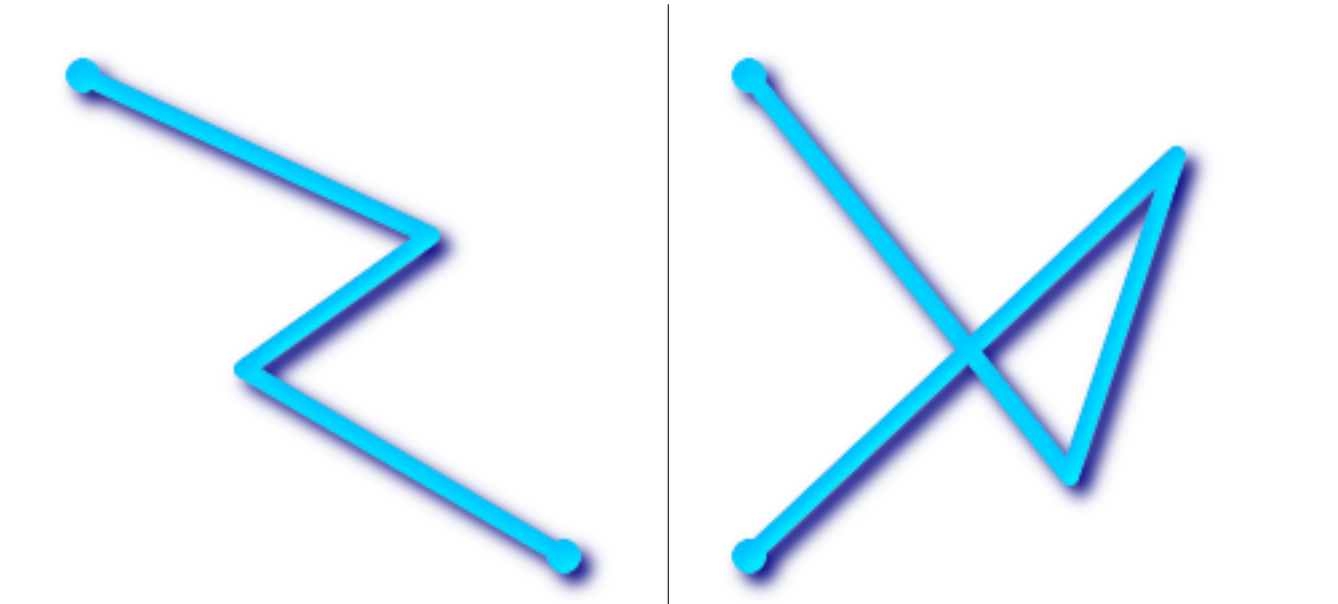
PostGIS es compatible con la especificación Open Geospatial Consortium's (OGC) OpenGIS Specifications. Como tal, muchos métodos PostGIS requieren, o más exactamente, asume que las geometrías con las que se opera son a la vez simples y válidas. Por ejemplo, no tiene sentido calcular el área de un polígono que tiene un agujero definido fuera del polígono, o para la construcción de un polígono a partir de una línea de límite no simple.

Según las especificaciones OGC, una geometría *simple*, es aquella que no tiene puntos geométricos anómalos, con autointersección o auto tangencia y principalmente se refiere a geometrías de 0 o 1 dimensiones (i.e. `[MULTI]POINT`, `[MULTI]LINESTRING`). La validez de geometrias, por otro lado, se refiere a geometrias de dimension 2 (i.e. `[MULTI]POLYGON`) y define el conjunto afirmaciones que caracterizan un polígono valido. La descripción de cada clase de geometría incluye condiciones especificas que simplemente detalles de simplicidad y validez geométricas.

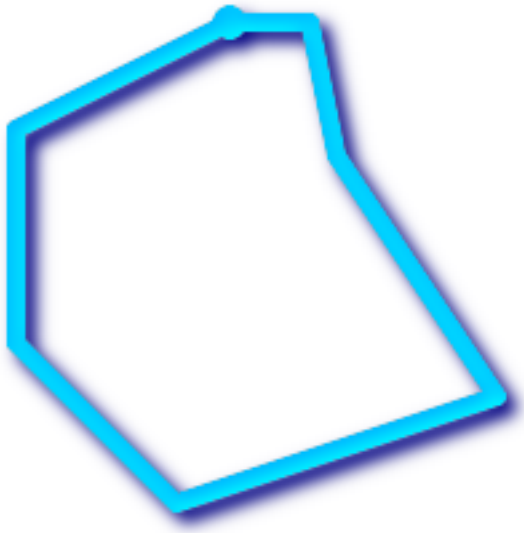
Un `POINT` es hereditariamente *simple* como un objeto de geometría 0-dimensional.

`MULTIPOINT`s son simples *simple* si dos coordenadas (`POINT`s) no son iguales (tienen valores de coordenadas identicos).

Una `LINESTRING` es *simple* si no pasa dos veces por el mismo `POINT` (excepto para puntos finales, en cuyo caso nos referimos como linear ring y considerado como cerrado).



(a) ***(b)***

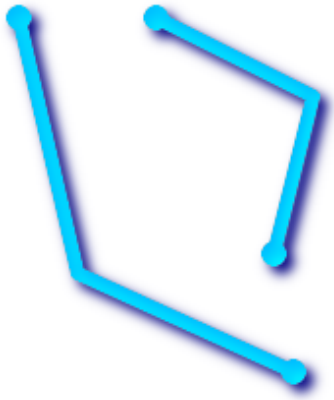


(c)

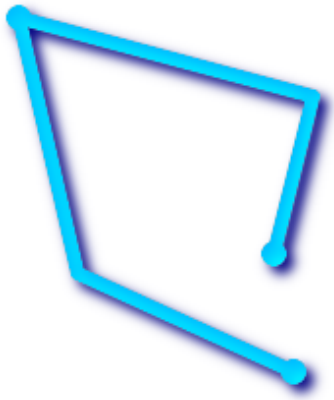
(d)

(a) y **(c)**son `LINESTRING`s simples, **(b)** y **(d)** no lo son.

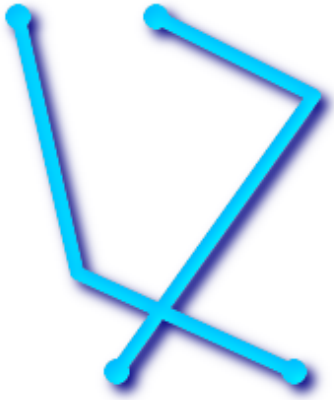
Una `MULTILINESTRING` es *simple* solo si todos sus elementos son simples y las únicas intersecciones entre cualquiera de sus elementos, se produce en `POINT`s que están en los limites de ambos elementos.



(e)



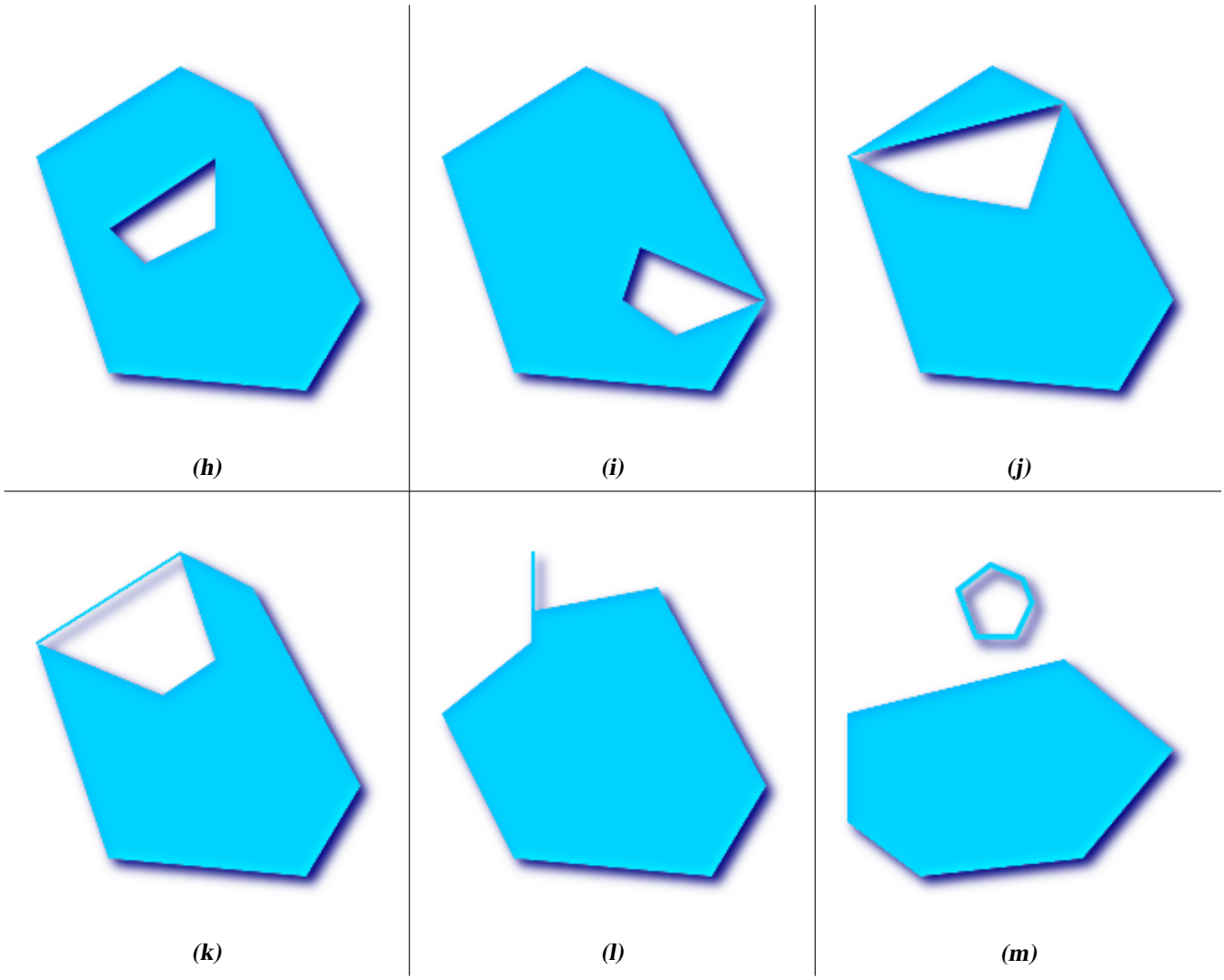
(f)



(g)

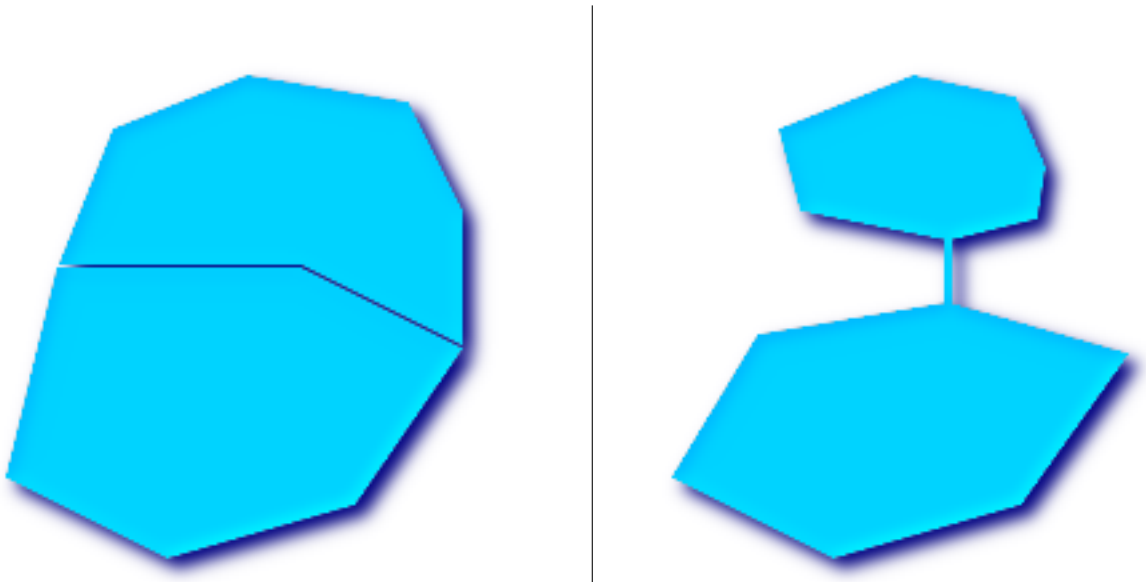
(e) y **(f)** son `MULTILINESTRING`s simples, **(g)** no lo es.

Por definición, un `POLYGON` siempre será *simple*. Es *valido* si dos anillos del borde (formado por un anillo exterior y los anillos interiores) no se cruzan. El borde de un `POLYGON` debe intersectarse en un `POINT` pero solo como tangente (i.e. no en una linea). Un `POLYGON`no debe tener lineas de corte o picos y los anillos interiores deben estar contenidos por entero por el anillo exterior.



(h) y **(i)** son `POLYGON`s validos, **(j-m)** no se pueden representar como `POLYGON`s simples, pero **(j)** y **(m)** pueden representarse como un `MULTIPOLYGON` valido.

Un `MULTIPOLYGON` es *válido* si y sólo si todos sus elementos son válidos y no se producen intersecciones entre los interiores de ningún par de elementos. Los límietes de cualquiera de los dos elementos pueden tocarse, pero sólo en un número finito de `POINT`s.



(n) *(o)*

(n) y **(o)** no son MULTIPOLYGONs validos. **(p)**, sin embargo, es valido.

La mayoría de las funciones implementadas por la biblioteca GEOS dependen de la asunción de que las geometrías son válidad según lo especificado en la OpenGIS Simple Feature Specification. Para comprobar la simplicidad o validez de geometrías se puede usar ST_IsSimple() and ST_IsValid()

```
--Normalmente, no tiene sentido hacer la comprobación
-- de validez o elementos lineales, ya que siempre devolverá TRUE.
-- Pero en este ejemplo, PostGIS extiende la deficinción del IsValid de OGC
--devolviendo FALSE si una LineString tiene menos de 2 vértices *distintos*.
gisdb=# SELECT
ST_IsValid('LINESTRING(0 0, 1 1)'),
ST_IsValid('LINESTRING(0 0, 0 0, 0 0)');

st_isvalid | st_isvalid
------------+-----------
t | f
```

Por defecto, PostGIS no comprueba la validez en las geometrías entrantes, porque los test de validez necesitan gran cantidad de tiempo de CPU para geometrías complejas, en especial polígonos. Si no se está seguro de la fuente de datos se puede forzar manualmente a realizar la comprobación de las tablas añadiendo una restricción de comprobación:

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

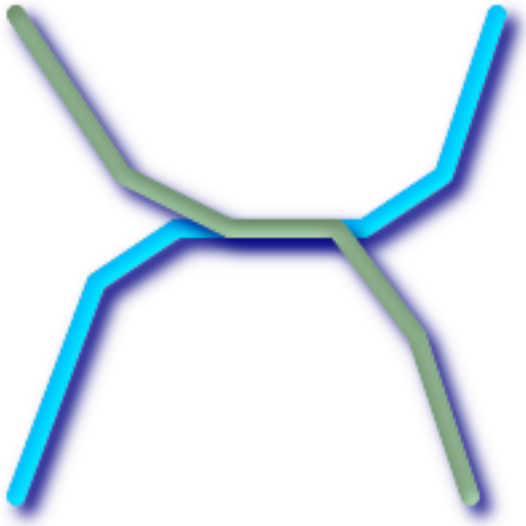
Si eincuentras algún mensaje de error extraño como "GEOS Intersection() threw an error!" o "JTS Intersection() threw an error!" al llamar a las funciones de PostGIS con geometrías de entrada válidas, seguramente se deba a algún error bien en PostGIS o en una de las bibliotecas que usa, y deberías contactar con el equipo de desarrollo de PostGIS. Lo mismo es aplicable si una función de PostGIS devuelve una geometría inválida a partir de una entrada válida.

Note

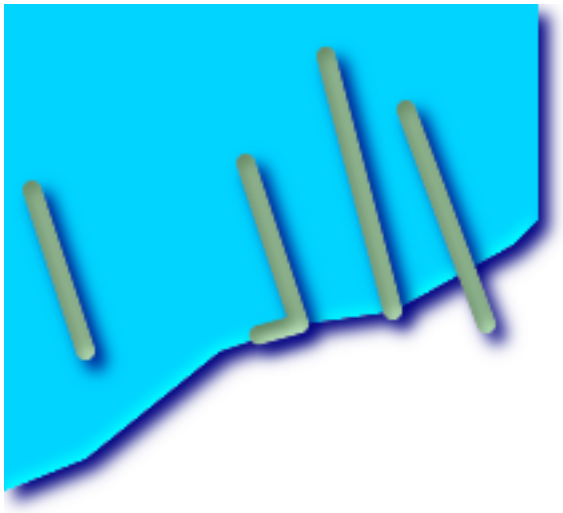
Geometrías estrictamente compatibles con OGC no pueden tener valores Z o M.¡La función ST_IsValid() no considerará invalidas las geometrías con mas dimensiones! Llamadas a AddGeometryColumn() añadirá restricciones al comprobar las dimensiones de las geometrías, así que es suficiente con especificar 2.

4.3.6 Modelo de intersección 9 dimensionalmente extendido(DE-9IM)

A veces se da el caso que los predicados espaciales típicos (ST_Contains, ST_Crosses, ST_Intersects, ST_Touches, ...) son insuficientes en si mismos para proveer el filtro espacial deseado.



Por ejemplo, considera un conjunto de datos lineales representando una red de transportes. Es tarea del analista SIG identificar todos los segmentos de carreteras que se intersectan con otros, no en un punto, pero en una linea, quizás invalidando algunas reglas. En este caso, ST_Crosses no nos proporcionara el filtro espacial adecuado ya que , para elementos lineales, devolverá `true` solo en el caso de intersección en un punto.
Una solución en dos pasos podría ser, primero hacer una consulta de las intersecciones (ST_Intersection) de los pares de vías de comunicación que se intersectan espacialmente (ST_Intersects), y entonces comparar las intersecciones ST_GeometryType con '`LINESTRING`' (gestionando correctamente los casos que devuelvan `GEOMETRYCOLLECTION` de `[MULTI]POINT`s, `[MULTI]LINESTRING`s, etc.).
Una solución mas elegante/rápida de hecho puede ser deseable.



Un [teórico] segundo ejemplo puede ser el de un analista SIG intentando localizar todos los muelles que intersectan los limites de un lago en una linea y donde solo un extremo del muelle este en la orilla. En otras palabras, cuando el muelle este contenido , pero no completamente en el lago, intersectando el borde del lago en una linea, y donde los puntos finales del muelle estén completamente en el borde del lago. El analista necesitará utilizar una combinación de predicados espaciales para aislar el problema:

- 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

  ... (ni que decir tiene que esto podría llegar a ser muy complicado)

Así que introducimos el Modelo de Intersección 9 Dimensionalmente Extendido, o DE-9IM para abreviar.

4.3.6.1 Teoria

Según la especificación OpenGIS Simple Features Implementation Specification for SQL, "El enfoque básico para comparar dos geometrías es hacer un test por pares de la intersección entre los interiores, bordes y exteriores de las dos geometrías y clasificar las relaciones entre las dos geometrías basandose en las entradas de la 'matriz de intersección' resultante."

Borde

El borde de una geometría es el conjunto de geometrias de la dimension menor siguiente. Para `POINT`s, que tienen dimension 0, el borde es un conjunto vacío. El borde para un `LINESTRING` son los dos puntos de los extremos. Para `POLYGON`s, el borde son las lineas que delimitan los anillos exteriores e interiores.

Interior

El interior de una geometría son los puntos de la geometría que quedan cuando el borde es eliminado. Para `POINT`s, el interior es el propio `POINT`. El interior de una `LINESTRING` es el conjunto de puntos reales entre los puntos de los extremos. Para `POLYGON`s, el interior es una superficie real dentro del polígono.

Exterior

El Exterior de una geometría es el universo, una superficie real, que no se encuentra en el interior o en el borde de la geometría.

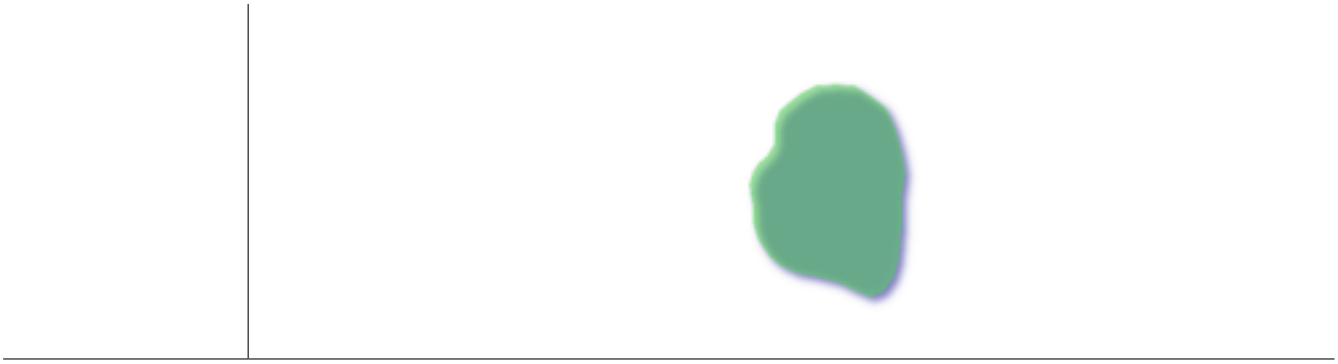
Dada una geometria *a*, donde *I(a)*, *B(a)*, y *E(a)* son el *Interior*, *Borde*, y *Exterior* de a, la representación matemática de la matriz es:

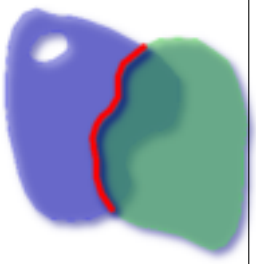
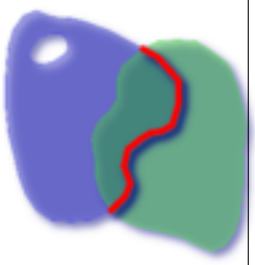
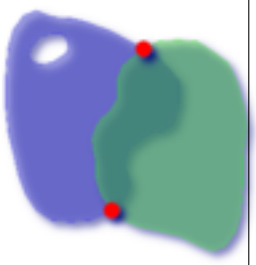
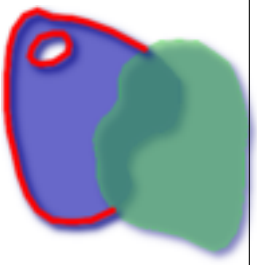
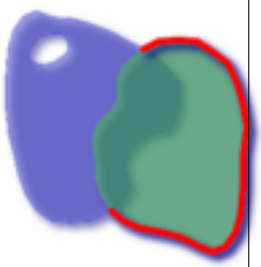
	Interior	**Borde**	**Exterior**
Interior	*dim(I(a) ∩ I(b))*	*dim(I(a) ∩ B(b))*	*dim(I(a) ∩ E(b))*
Borde	*dim(B(a) ∩ I(b))*	*dim(B(a) ∩ B(b))*	*dim(B(a) ∩ E(b))*
Exterior	*dim(E(a) ∩ I(b))*	*dim(E(a) ∩ B(b))*	*dim(E(a) ∩ E(b))*

Donde *dim(a)* representa la dimensión de *a* como se especifica en ST_Dimension pero tiene un dominio de `{0,1,2,T,F,*}`

- `0` => punto
- `1` => linea
- `2` => area
- `T` => `{0,1,2}`
- `F` => empty set
- `*` => no importa que valor

Visualmente, para dos geometriías que se superponen, debera parecerse a:



	Interior	Borde	Exterior
Interior	 *dim(...)* = **2**	 *dim(...)* = **1**	 *dim(...)* = **2**
Borde	 *dim(...)* = **1**	 *dim(...)* = **0**	 *dim(...)* = **1**
Exterior	 *dim(...)* = **2**	 *dim(...)* = **1**	 *dim(...)* = **2**

Si leemos la matriz de izquierda a derecha y de arriba a bajo, la matriz dimensional esta representada por, '**212101212**'.

Una matriz que representaría el ejemplo anterior de las dos lineas que se interceptan en una linea seria: '**1*1***1****'

```
-- Identificar los segmentos de lineas que se cruzan en una linea
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**');
```

La matriz que representaría el segundo ejemplo de los muelles en los lagos seria: '**102101FF2**'

```
-- Identificar los muelles que están parcialmente en la orilla del lago
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');
```

Para mas información o documentación, visita:

- OpenGIS Simple Features Implementation Specification for SQL (versión 1.1, sección 2.1.13.2)
- Modelo de intersección 9 dimensionalmente extendido(DE-9IM)
- GeoTools: Point Set Theory and the DE-9IM Matrix
- *Encyclopedia of GIS* por Hui Xiong

4.4 Cargando Datos SIG

Una vez creada la tabla espacial, estas listo para cargar datos SIG en la base de datos. Actualmente, existen dos formas de poner los datos en una base de datos PostGIS/PostgreSQL: utilizando sentencias SQL formateadas, o utilizando el cargador de ficheros Shape.

4.4.1 Cargando Datos SIG

Si puedes convertir tus datos en una representación de texto, entonces utilizar SQL formateado debería ser la forma mas sencilla de cargar tus datos en PostGIS. Asi como en Oracle o otras bases de datos SQL, los datos pueden ser cargados en masa mediante la canalización de un fichero de texto grande, lleno de sentencias SQL "INSERT" en el terminal SQL.

Un fichero de carga (`roads.sql` por ejemplo) debería parecerse a esto:

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

El fichero de datos puede canalizarse en PostgreSQL de manera sencilla con el terminar de comandos SQL "psql":

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

4.4.2 shp2pgsql: Using the ESRI Shapefile Loader

El cargador de datos Shape `shp2pgsql` convierte fichero Shape de ESRI en comandos SQL para la inserción en bases de datos PostGIS/PostgreSQL en formatos geometry o geography. El cargador tiene diferentes modos de operar según las opciones escritas en el comando:

Ademas del cargador por linea de comandos shp2pgsql, existe una interfaz gráfica llamada `shp2pgsql-gui`, con la mayoría de las opciones del cargador por linea de comandos, pero puede ser mas sencillo de utilizar para aquellas que no estén en scripts o ficheros único o si eres nuevo en PostGIS. También se puede configurara como un plugin de PgAdminIII.

(c|a|d|p) Estas opciones son exclusivas entre ellas:

-c Crea una nueva tabla y la rellena desde el shapefile. *Esta es la opción por defecto.*

-a Añade los datos del shapefile en la tabla de la base de datos. Observa que para utilizar esta opción para cargar varios ficheros, los ficheros deben tener los mismos atributos y los mismos tipos de datos.

-d Borra la tabla de la base de datos antes de crear una nueva tabla con los datos del shapefile en su interior.

-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%gt;:]<SRID> Crea y rellena las tablas geométricas con el SRID especificado. Opcionalmente especifica que el fichero shapefile utiliza el dado en FROM_SRID, en tal caso las geometrías se reproyectarán al SRID destino. FROM_SRID no puede espeficarse con -D

-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 indice GiST de la columna de geometrias.

-c -m `a_file_name` Specify a file containing a set of mappings of (long) column names to 10 character DBF column names. The content of the file is one or more lines of two names separated by white space and no trailing or leading space. For example:

```
COLUMNNAME DBFFIELD1
AVERYLONGCOLUMNNAME DBFFIELD2
```

-S Genera geometrías simples en lugar de MULTI geometrías. Solo funcionará si todas las geometrias 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 indices 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 indices de la nueva tabla. Esto se aplica a los indices de clave primaria y a los indices espaciales GiST si se usa también la opción -l.

Un ejemplo de sesión utilizando el cargador para crear un fichero de entrada y cargarlo debe parecerse a esto:

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

Una conversion y carga puede hacerse en un solo paso utilizando el símbolo tubería en sistemas UNIX:

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

4.5 Recuperando datos SIG

Los datos se pueden extraer de la base de datos utilizando SQL o el cargador/dumper de ficheros Shape. En la sección SQL hablaremos de algunos de los operadores disponibles para hacer comparaciones y consultas en tablas espaciales.

4.5.1 Using SQL to Retrieve Data

El medio más directo para hacer una extracción de datos de la base de datos es utilizar una consulta de selección SQL para reducir el número de registros y columnas devueltas y volcar las columnas resultantes en un archivo de texto analizable:

```
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)
```

Sin embargo, habrá ocasiones que debido a algún tipo de restricción será necesario reducir el número de campos que se devuelven . En el caso de restricciones basadas en los atributos, sólo tienes que utilizar la misma sintaxis SQL de forma normal como con una tabla no espacial. En el caso de restricciones espaciales, están disponibles los siguientes operadores:

ST_Intersects This function tells whether two geometries share any space.

= Este test comprueba si dos geometrías son geométricamente 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).

Note: before PostGIS 2.4 this compared only boxes of geometries.

A continuación, puedes utilizar estos operadores en las consultas. Ten en cuenta que al especificar geometrías y cajas en la línea de comandos SQL, debes activar de forma explícita las representaciones de cadena en geometrías utilizando la función "ST_GeomFromText ()". El 312 es un sistema de referencia espacial ficticio que coincide con nuestros datos. Así que, por ejemplo:

```
SELECT road_id, road_name
  FROM roads
  WHERE ST_OrderingEquals(roads_geom , ST_GeomFromText('LINESTRING(191232 243118,191108  ↩
      243242)',312) ) ;
```

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 roads_geom && ST_GeomFromText('POLYGON((...))',312);
```

La consulta espacial más común probablemente será una consulta "basada en cuadros", utilizada por el software cliente, como navegadores de datos o aplicaciones webmapping, para tomar un valor del "marco del mapa " de los datos para su visualización. La consulta para el uso de un objeto "BOX3D" para el marco, se parece a esto:

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 espeficar la proyección de la envolvente.

4.5.2 Uso del Dumper

El comando dump de las tablas `pgsql2shp` conecta directamente con la base de datos y convierte la tabla (posiblemente definido por una consulta) en un fichero shape. La sintaxis básica es:

```
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 hada las operaciones mas rápido, pero no funcionará si algún atributo NO-geométrico de la tabla carece de conversion 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.

4.6 Contruir Indices

Los índices son los que hacen posible el uso de una base de datos espacial para conjuntos de datos muy grandes. Sin indexación, cualquier búsqueda de una característica requeriría un "recorrido secuencial" de cada registro en la base de datos. La Indexación acelera la búsqueda mediante la organización de los datos en un árbol de búsqueda que puede ser recorrido con rapidez para encontrar un registro en particular. PostgreSQL soporta tres tipos de índices por defecto: índices B-Tree, índices R-Tree, e índices GIST.

- B-Trees se utiliza para datos que pueden ser ordenados a lo largo de un eje, por ejemplo, números, letras, fechas.Los datos SIG no pueden ser racionalmente ordenados a lo largo de un eje (¿cual es mayor? ¿(0,0) o (0,1) o (1,0)?) así que los indices B-Tree no son de ninguna utilidad para nosotros.
- Los indices GiST (Generalized Search Trees o Arbol de búsquedas generalizado) dividen los datos en "cosas a un lado", "cosas que se solapan", "cosas que están dentro" y se pueden utilizar en una amplia gama de tipos de datos, incluyendo los datos SIG. PostGIS utiliza un índice R-Tree implementado sobre GiST para indexar datos GIS.

4.6.1 Indices GiST

GiST significa "Generalized Search Tree" de sus siglas en inglés o "Arbol de Búsqueda Generalizado" y es una forma genérica de indexación. Además de la indexación de datos SIG, GiST se utiliza para acelerar las búsquedas en todo tipo de estructuras irregulares de datos (arrays de enteros, datos espectrales, etc) que no son susceptibles de indexación por árbol normal.

Una vez que una tabla de datos GIS supera unos pocos miles de filas, tendrás que construir un índice para acelerar las búsquedas espaciales de los datos (a menos que todas las búsquedas se basen en atributos, en cuyo caso querrás construir un índice normal en los campos de atributo).

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

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

La sintaxis anterior siempre construirá un índice 2D. Para obtener el índice de dimensión n soportado en PostGIS 2.0 + para el tipo geometría, puedes crearlo utilizando esta sintaxis

```
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 [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)];
```

4.6.2 Indices GiST

BRIN stands for "Block Range Index" and is a generic form of indexing that has been introduced in PostgreSQL 9.5. BRIN is a lossy kind of index, and its main usage is to provide a compromise for both read and write performance. Its primary goal is to handle very large tables for which some of the columns have some natural correlation with their physical location within the table. In addition to GIS indexing, BRIN is used to speed up searches on various kinds of regular or irregular data structures (integer, arrays etc).

Una vez que una tabla de datos GIS supera unos pocos miles de filas, tendrás que construir un índice para acelerar las búsquedas espaciales de los datos (a menos que todas las búsquedas se basen en atributos, en cuyo caso querrás construir un índice normal en los campos de atributo).

The idea of a BRIN index is to store only the bouding box englobing all the geometries contained in all the rows in a set of table blocks, called a range. Obviously, this indexing method will only be efficient if the data is physically ordered in a way where the resulting bouding boxes for block ranges will be mutually exclusive. The resulting index will be really small, but will be less efficient than a GiST index in many cases.

Building a BRIN index is way less intensive than building a GiST index. It's quite common to build a BRIN index in more than ten time less than a GiST index would have required. As a BRIN index only store one bouding box for one to many table blocks, it's pretty common to consume up to a thousand time less disk space for this kind of indexes.

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 help to get better performance.

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

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

La sintaxis anterior siempre construirá un índice 2D. Para obtener el índice de dimensión n soportado en PostGIS 2.0 + para el tipo geometría, puedes crearlo utilizando esta sintaxis

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

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

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

These above syntaxes will use the default number or block in a range, which is 128. To specify the number of blocks you want to summarise in a range, you can create one using this syntax

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

Also, keep in mind that a BRIN index will only store one index value 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 drop of performance by choosing the operator class whith the least number of dimensions of the stored geometries

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

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

La sintaxis anterior siempre construirá un índice 2D. Para obtener el índice de dimensión n soportado en PostGIS 2.0 + para el tipo geometría, puedes crearlo utilizando esta sintaxis

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

4.6.3 Indices GiST

SP-GiST stands for "Space-Partitioned Generalized Search Tree" and is a generic form of indexing 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 GIS indexing, SP-GiST is used to speed up searches on many kinds of data, such as phone routing, ip routing, substring search, etc.

As it is the case for GiST indexes, SP-GiST indexes are lossy, in the sense that they store the bounding box englobing the spatial objects. SP-GiST indexes can be considered as an alternative to GiST indexes. The performance tests reveal that SP-GiST indexes are especially beneficial when there are many overlapping objects, that is, with so-called "spaghetti data".

Una vez que una tabla de datos GIS supera unos pocos miles de filas, tendrás que construir un índice para acelerar las búsquedas espaciales de los datos (a menos que todas las búsquedas se basen en atributos, en cuyo caso querrás construir un índice normal en los campos de atributo).

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

La sintaxis anterior siempre construirá un índice 2D. Para obtener el índice de dimensión n soportado en PostGIS 2.0 + para el tipo geometría, puedes crearlo utilizando esta sintaxis

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

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 in a slower CONCURRENTLY-aware way:

```
CREATE INDEX [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)];
```

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.

4.6.4 Utilizando Indices

Por lo general, los índices aceleran el acceso de datos de forma invisible: una vez construido el índice, el optimizador de consultas decide de manera transparente cuándo utilizar la información del índice para acelerar un plan de consulta. Por desgracia, el planeador de consultas de PostgreSQL no optimiza el uso de índices GiST bien, así que a veces las búsquedas que deben utilizar un índice espacial en lugar del indice por defecto, explora toda la tabla de forma secuencia.

Si observas que los indices espaciales no se están utilizando (o tus indices de atributos, en su defecto) hay un par de cosas que puedes hacer:

- Firstly, read query plan and check your query actually tries to compute the thing you need. A runaway JOIN condition, either forgotten or to the wrong table, can unexpectedly bring you all of your table multiple times. To get query plan, add EXPLAIN keyword in front of your query.
- Second, 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 have **VACUUM** run as an off-peak cron job on a regular basis.
- Si ejecutando vacuum no funciona, se puede forzar al planificador para utilizar la información de índice utilizando el comando **SET ENABLE_SEQSCAN=OFF**. Debes utilizar este comando con moderación y sólo en consultas sobre datos indexados espacialmente: en términos generales, el planificador sabe más que tu acerca de cuándo utilizar los índices de B-Tree normales. Una vez que hayas ejecutado la consulta, debes considerar el restablecimiento de la variable `ENABLE_SEQSCAN` de nuevo, de manera que las demás consultas utilizarán el planificador de la forma habitual.
- Si ves que el planificador se equivoca sobre el costo de exploraciones secuenciales vs índices, intenta reducir el valor de random_page_cost en postgresql.conf o usando SET random_page_cost = #. El valor por defecto para el parámetro es de 4, prueba a ajustarlo a 1 o 2. Disminuyendo el valor, haces que el planificador se incline mas por utilizar exploraciones con índice.
- If **set enable_seqscan to off;** does not help your query, it may happen you use a construction Postgres is not yet able to untangle. A subquery with inline select is one example - you need to rewrite it to the form planner can optimize, say, a LATERAL JOIN.

4.7 Consultas Complejas

La *razón de ser* de la funcionalidad de base de datos espaciales es la de realizar consultas dentro de la base de datos que normalmente requieren la funcionalidad GIS de escritorio. Usando PostGIS de forma eficiente requiere saber que funciones espaciales están disponibles, y asegurar que los índices adecuados estén en su lugar para proporcionar un buen rendimiento. El SRID 312 utilizado en estos ejemplos es únicamente para la demostración . Debes estar utilizando un SRID VERDADERO de los enumerados en la tabla spatial_ref_sys y uno que coincida con la proyección de tus datos. Si los datos no tiene ningún sistema de referencia espacial especificado, debes pensar muy cuidadosamente por qué no lo hace y tal vez debería. Si el motivo se debe a que estás modelando algo que no tiene un sistema de referencia espacial geográfico definido, como la parte interna de una molécula o una buena ubicación en Marte para el transporte de la raza humana en caso de un holocausto nuclear, entonces simplemente deja de lado el SRID o inventa uno e insertarlo en la tabla `spatial_ref_sys`.

If your reason is because you are modeling something that doesn't have a geographic spatial reference system defined such as the internals of a molecule or the floorplan of a not yet built amusement park then that's fine. If the location of the amusement park has been planned however, then it would make sense to use a suitable planar coordinate system for that location if nothing more than to ensure the amusement part is not trespassing on already existing structures.

Even in the case where you are planning a Mars expedition to transport the human race in the event of a nuclear holocaust and you want to map out the Mars planet for rehabitation, you can use a non-earthly coordinate system such as Mars 2000 make one up and insert it in the `spatial_ref_sys` table. Though this Mars coordinate system is a non-planar one (it's in degrees spheroidal), you can use it with the geography type to have your length and proximity measurements in meters instead of degrees.

4.7.1 Aprovechando los Indices

Conuando construyes una consulta, es importante recordar que solo los operadores basados en cajas (bounding box) como && pueden aprovechar los indices espaciales GiST. funciones como `ST_Distance()` no pueden utilizar el indice para optimizar las operaciones. Por ejemplo, la consulta siguiente sera algo lenta en una tabla grande:

```
SELECT the_geom
FROM geom_table
WHERE ST_Distance(the_geom, ST_GeomFromText('POINT(100000 200000)', 312)) < 100
```

Esta consulta es la selección de todas las geometrías en geom_table que están a menos de 100 unidades del punto (100000, 200000). La consulta será lenta porque está calculando la distancia entre cada punto en la tabla y nuestro punto especificado, es decir, un cálculo `ST_Distance()` para cada fila de la tabla. Podemos evitar esto mediante el operador && para reducir el número de cálculos de distancia requeridos:

```
SELECT the_geom
FROM geom_table
WHERE ST_Distance(the_geom, ST_GeomFromText('POINT(100000 200000)', 312)) < 100
```

Esta consulta selecciona las mismas geometrías, pero lo hace de una manera más eficiente. Suponiendo que hay un índice GiST en the_geom, el planificador de consultas reconocerá que se puede utilizar el índice para reducir el número de filas antes de calcular el resultado de la función `ST_Distance()`. Fijate como la geometría de `ST_MakeEnvelope` que se utiliza en la operación &&, es una caja cuadrada de 200 unidades centrada en el punto de origen - esta es nuestra "caja de búsqueda" o "query box". El operador && utiliza el índice para reducir rápidamente el conjunto de resultados a sólo aquellas geometrías que tienen su caja o "bounding box" que se superponen a la "caja de búsqueda". Suponiendo que nuestra caja de consulta es mucho más pequeña que la extensión de toda la tabla de geometría, esto reducirá drásticamente el número de cálculos de distancia que hay que hacer.

4.7.2 Ejemplos de consultas espaciales SQL

Los ejemplos en esta sección utilizan dos tablas, una tabla de vías de comunicación lineales, y una tabla de polígonos con limites municipales. La definición de la tabla `bc_roads` es:

```
Column      | Type              | Description
------------+-------------------+--------------------
```

```
gid         | integer           | Unique ID
name        | character varying | Road Name
the_geom    | geometry          | Location Geometry (Linestring)
```

La definición de la tabla `bc_municipality` es:

```
Column     | Type              | Description
-----------+-------------------+-------------------
gid        | integer           | Unique ID
code       | integer           | Unique ID
name       | character varying | City / Town Name
the_geom   | geometry          | Location Geometry (Polygon)
```

1. *¿Cual es la longitud total de todas las carreteras expresadas en kilómetros?*

   Puedes contestar a esta pregunta con una consulta SQL muy simple:

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

   km_roads
   ------------------
   70842.1243039643
   (1 row)
   ```

2. *¿Cual es la superficie de la ciudad Prince George en hectáreas?*

   Esta consulta combina una condición de atributo (en el nombre del municipio) con un calculo espacial (del area):

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

   hectares
   ------------------
   32657.9103824927
   (1 row)
   ```

3. *¿Cual es el municipio con mayor superficie de la provincia?*

   Esta consulta incluye un calculo espacial en la condición de la consulta. Hay varias formas de plantear el problema, pero la mas eficiente es la siguiente:

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

   name           | hectares
   ---------------+-----------------
   TUMBLER RIDGE  | 155020.02556131
   (1 row)
   ```

   Observa que para responder a esta consulta debemos calcular el area de todos los polígonos. Si estuviéramos haciendo esto mucho tendría sentido crear una columna de area en la tabla que podríamos indexar por motivos de rendimiento. Ordenar el resultado de forma descendente, y utilizando el comando "LIMIT" de PostgreSQL podemos extraer el valor mas grande de forma sencilla sin utilizar una función agregada como max().

4. *¿Cuál es la longitud de las carreteras contenidas por completo dentro de cada municipio?*

   Este es un ejemplo de "unión espacial", ya que estamos utilizando datos de dos tablas (haciendo una unión) pero utilizando una condición de interacción espacial ("contained") como la condición de unión en lugar del enfoque relacional habitual de unión de la clave primaria:

```
SELECT
  m.name,
  sum(ST_Length(r.the_geom))/1000 as roads_km
FROM
  bc_roads AS r,
  bc_municipality AS m
WHERE
  ST_Contains(m.the_geom,r.the_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
...
```

   Esta consulta toma un tiempo, ya que todas las carreteras de la tabla se resume en el resultado final (unas 250k carreteras para nuestra tabla del ejemplo). Para superposiciones mas pequeñas (de algunos cientos o miles de registros) la respuesta puede ser muy rápida.

5. *Crear una tabla con todas las carreteras de la ciudad Prince George.*

   Este es un ejemplo de "superposición", que tomo dos tablas y extrae una tabla nueva que contiene un resultado de un recorte espacial. A diferencia de la "Unión espacial" del ejemplo anterior, esta consulta en realidad crea nuevas geometrías. Una superposición es como una unión espacial "turbo-cargada", y es útil para un trabajo de análisis mas exacto:

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

6. *¿Cual es la longitud en kilómetros de "Douglas St" en Victoria?*

```
SELECT
  sum(ST_Length(r.the_geom))/1000 AS kilometers
FROM
  bc_roads r,
  bc_municipality m
WHERE  r.name = 'Douglas St' AND m.name = 'VICTORIA'
        AND ST_Contains(m.the_geom, r.the_geom) ;

kilometers
------------------
4.89151904172838
(1 row)
```

7. *¿Cual es el polígono de municipios mas grande que tiene un agujero?*

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

gid  | name         | area
-----+--------------+------------------
12   | SPALLUMCHEEN | 257374619.430216
(1 row)
```

Chapter 5

Gestión, Consulta y Aplicaciones de Datos Raster

5.1 Cargando y Creando Rasters

En la mayoría de casos, crearás rasters PostGIS cargando un fichero raster utilizando el paquete de carga raster `raster2pgsql`.

5.1.1 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 rater.

Como raster2pgsql se compila como parte de PostGIS, a menudo (a menos que compiles tu propia librería GDAL), los tipos de raster que admite el ejecutable serán los mismos que los compilados en la librería de dependencias de GDAL. Para obtener una lista de tipos de raster que tu comando raster2pgsql soporta, utiliza el valor `-G` . Estos deben ser los mismos que los previstos por tu instalación de PostGIS, documentado aquí ST_GDALDrivers si utilizas la misma librería GDAL en ambos casos.

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.

(c|a|d|p) 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 especifico 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 Indice (en base 1) de la banda para extraer del raster. Para indices 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

-q Identificadores Wrap de PostgreSQL entre comillas

-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 Skip NODATA value checks for each raster band.

-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 Utiliza el comando copia en lugar del comando insertar.

-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 previsualizaciones 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 (.sdat)
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
```

5.1.2 Crear rastrees 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 indices espaciales funcionen correctamente necesitaras borrarlos y reemplazarlos por los indices basados en la envolvente convexa.

4. Aplica las restricciones raster con AddRasterConstraints

5.2 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.

5.2.1 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 4.3.1.
- `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_SameAlignm 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.

5.2.2 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` interuptor 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 especificas 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) .

5.3 Contruyendo aplicaciones personalizadas con PostGIS Raster

El hecho de que PostGIS raster te proporcione las funciones de SQL para crear rasters en formatos de imagen conocidos te da un montón de opciones para crearlas. Por ejemplo, puedes usar OpenOffice / LibreOffice para una representación como se demuestra en Renderizar Gráficos PostGIS Raster con LibreOffice. Además se puede utilizar una amplia variedad de lenguajes de programación como se demuestra en esta sección.

5.3.1 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 nadas 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 especifico 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]);
?>
```

5.3.2 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 nadas 1,2,3 de un raster a una consulta PHP que puede incluirse como una marca html imv src.

Necesitarás el driver npgsql .NET PostgreSQL para este ejercicio que puedes obtener en http://npgsql.projects.postgresql.org/ en su ultima versión. Simplemente descarga la última versión y copialo 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 especifico 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 5.3.1 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 sección de string de conexion --
<connectionStrings>
    <add name="DSN"
        connectionString="server=localhost;database=mydb;Port=5432;User Id=myuser;password= ↩
           mypwd"/>
</connectionStrings
>
```

```
// Codigo para  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;
        }
}
```

5.3.3 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
```

```
// Codigo para 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);
      }
  }
}
```

5.3.4 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;
```

```
-- escribe 5 imágenes en el servidor PostgreSQL cambiando los tamaños
-- observa que la cuenta del daemon postgresql necesita permisos de escritura en la carpeta
```

```
-- esto devuelve echo en los nombres de los ficheros creados
 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
```

5.3.5 Extraer un raster con PSQL

PSQL no tiene un uso fácil de la funcionalidad integrada para la salida de binarios. Esto es un pequeño truco y se basa en una de las propuestas que contiene el Clever Trick Challenge -- Outputting bytes with psql que respalda en PostgreSQL algo del legado de soporte de objetos. Para utilizarlo, primero lanza la línea de comandos psql conectando a tu base de datos.

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 aerials.boston WHERE rid=1) )
  ) ) As v(oid,png);
-- obtendras una salida similar a la siguiente --
   oid   | num_bytes
---------+-----------
 2630819 |     74860

-- obten el oid y hazlo reemplazando c:/test.png por el directorio
-- de tu equipo local
 \lo_export 2630819 'C:/temp/aerial_samp.png'

-- Esto borra el fichero de almacenamiento de objetos grandes en la db
SELECT lo_unlink(2630819);
```

Chapter 6

Usando PostGIS Geometry: Construyendo Aplicaciones

6.1 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.

6.1.1 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 grososr
    EXPRESSION ([numlanes] >= 6)
    STYLE
      COLOR 255 22 22
      WIDTH 2
    END
  END
  CLASS
    # El resto son más oscuras y de sólo 1 pixel de grososr
    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.

6.1.2 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"
   ```

6.1.3 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`.

6.1.4 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
  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`.

6.2 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 incluídos 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 pgsql 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 "PGeometry" 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.

6.3 Clientes C (libpq)

...

6.3.1 Cursores de Texto

...

6.3.2 Cursores Binarios

...

Chapter 7

Consejos de rendimiento

7.1 Tablas pequeñas de geometrías grandes

7.1.1 Descripcion 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 paginas 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 escaseo 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 limites, 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

7.1.2 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 indices. Envia "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 escaseo secuencia tan rápido como el planificador de consultas cree. Esto, se puede lograr creando una consulta que "cachee" los limites 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.

7.2 CLUSTERing o indices 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 indices GiST de PostGIS por que los indices 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 CHEK como "ALTER TABLE blubb ADD CHECK (geómetra is not nulo);" no funcionara.

7.3 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.

7.4 Ajusta tu configuración

Tuning for PostGIS is much like tuning for any PostgreSQL workload. The only additional note to keep in mind is that geometries and rasters are heavy 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+ all these 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 will force, 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 these settings, PostGIS also has some custom settings which you can find listed in Section 8.2.

7.4.1 Puesta en marcha

Estas opciones se configuran en postgresql.conf:

constraint_exclusion

- Por defecto: 1MB
- Esto se utiliza generalmente para la partición de tablas. Si estás ejecutando versiones anteriores a PostgreSQL 8.4 , se establece en "on" para garantizar que el planeador de consultas optimizará. A partir de PostgreSQL 8.4, el valor predeterminado para este está ajustado a "partición", que es ideal para PostgreSQL 8.4 y superiores, ya que obligará al planificador a analizar sólo las tablas para considerar las restricciones si están en una jerarquía hereditaria y no penalizar al planificador de otra manera .

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.

work_mem (memoria utilizada para operaciones cortas y consultas complejas)

- Por defecto: 1MB
- Sets the maximum number of background processes that the system can support. This parameter can only be set at server start.

7.4.2 Runtime

work_mem (memoria utilizada para operaciones cortas y consultas complejas)

- Por defecto: 1MB
- Ajuste para bases de datos grandes, consultas complejas, mucha RAM
- Ajuste para muchos usuarios concurrentes o menos RAM
- Si tienes mucha RAM y algunos desarrolladores:

```
SET work_mem TO 1200000;
```

maintenance_work_mem (utilizado en operaciones de VACUUM, CREATE INDEX, etc.)

- Por defecto: 16MB
- Generalmente muy bajo - cierra I/O, bloquea objetos en la memoria de intercambio
- Se recomienda de 32MB a 256MB en servidores de producción con mucha RAM, pero depende del numero de usuarios simultáneos. Si tienes mucha memoria RAM y algunos desarrolladores:

```
SET maintainence_work_mem TO 1200000;
```

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.

- Por defecto: 1MB
- 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.

Chapter 8

Manual de Referencia PostGIS

Las siguientes funciones son las que probablemente necesite un usuario PortGIS . 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 — Una caja compuesta por xmin, ymin, xmax, ymax. Usada a menudo para devolver la caja 2d que contiene una geometría.

Descripción

box2d es un tipo de dato espacial usado para representar la caja que contiene una geometría o un grupo de geometrías. En versiones anteriores a PostGIS 1.4, ST_Extent devolvía un objeto box2d.

8.1.2 box3d

box3d — Una caja compuesta por xmin, ymin, zmin, xmax, ymax, zmax. Usada habitualmente para devolver la extensión 3d de una geometría o grupo de geometrías.

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 objecto box3d.

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

8.1.3 geometry

geometry — Tipo de dato espacial planar

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 are using units of the Spatial Reference System the geomtry 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

8.1.4 geometry_dump

geometry_dump — Un tipo de datos espacial con dos campos: geom (que contiene el objeto geometry) y path[] (un array 1-d que contiene la posición de la geometría dentro el objeto volcado).

Descripción

geometry_dump es un tipo de datos compuesto, que consiste en un objeto geometry referenciado por el campo .geom y path[], un array 1-dimensional de integers (que empeza por el elemento 1. path[1] contiene el primer elemento). Este array define el camino de navegación en la geometría volcada para encontrar el elemento. Es usado por la familia de funciones ST_Dump* como tipo de salida para separar un tipo de geometría complejo en las partes que la componen y su localización.

Vea también

Section 14.6

8.1.5 geography

geography — Tipo de dato espacial elipsoidal

Descripción

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

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
geometry	explicit

Vea también

Section 14.4, Section 4.2

8.2 PostGIS Grand Unified Custom Variables (GUCs)

8.2.1 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 8.10

8.2.2 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

8.2.3 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_EN` 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 not 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

8.2.4 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_` with a non-zero value to the process starting PostgreSQL.

Note
Even if `postgis.enable_outdb_rasters` is True, the GUC `postgis.enable_outdb_rasters` 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`

```
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;
```

Ver también

postgis.gdal_enabled_drivers

8.3 Funciones de Gestión

8.3.1 AddGeometryColumn

AddGeometryColumn — Añade una columna de geometrías a una tabla de atributos existente. Por defecto utiliza el modificador de tipo en vez de restricciones. Si se cambia a falso use_typmode se utilizará el metido antiguo basado en restricciones

Synopsis

text **AddGeometryColumn**(varchar table_name, varchar column_name, integer srid, varchar type, integer dimension, boolean use_typmod=true);
text **AddGeometryColumn**(varchar schema_name, varchar table_name, varchar column_name, integer srid, varchar type, integer dimension, boolean use_typmod=true);
text **AddGeometryColumn**(varchar catalog_name, varchar schema_name, varchar table_name, varchar column_name, integer srid, varchar type, integer dimension, boolean use_typmod=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 dede 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_typmod`, 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 typmod de las tablas de geometrías y sean utilizadas sin funciones wrapper se registraran correctamente porque heredan el comportamiento typmod de su columna de la tabla padre. Las vistas que utilizan funciones de geometría que devuelvan geometrías necesitarán de transformación cast a geometrías typmod para esta columnas de geometrías de la vista y que se registren correctamente en geometry_columns. Consulta Section 4.3.4.

This method implements the OpenGIS 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_typmod. El valor predeterminado es crearcolumnas de geometrías basadas en typmod 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
                                                  Table "my_schema.my_spatial_table"
 Column |  Type   |                                  Modifiers
--------+---------+------------------------------------------------------------------------------ ↩

 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 4.3.2, Section 4.3.4

8.3.2 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 OpenGIS 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 4.3.2

8.3.3 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 geómetra_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 4.3.2

8.3.4 PostGIS_Extensions_Upgrade

PostGIS_Extensions_Upgrade — Upgrades installed postgis packaged extensions (e.g. postgis_sfcgal, postgis_topology, postgis_sfcgal) to latest installed version. Reports full postgis version and build configuration infos after.

Synopsis

text **PostGIS_Extensions_Upgrade**();

Descripción

Upgrades installed postgis packaged extensions to latest installed version. Only extensions you have installed in the database will be upgraded and if they are already at last installed version, they will not be upgraded. Reports full postgis version and build configuration infos after. This is short-hand for doing multiple ALTER EXTENSION .. UPDATE for each postgis extension. Currently only tries to upgrade extensions postgis, postgis_sfcgal, postgis_topology, and postgis_tiger_geocoder.

Availability: 2.5.0

Ejemplos

```
SELECT PostGIS_Extensions_Upgrade();
```

```
NOTICE:  ALTER EXTENSION postgis_tiger_geocoder UPDATE TO "2.5.0dev";
CONTEXT:  PL/pgSQL function postgis_extensions_upgrade() line 10 at RAISE
NOTICE:  ALTER EXTENSION postgis_topology UPDATE TO "2.5.0dev";
CONTEXT:  PL/pgSQL function postgis_extensions_upgrade() line 10 at RAISE

                                                          postgis_extensions_upgrade
------------------------------------------------------------------------------------
POSTGIS="2.5.0dev r15966" [EXTENSION] PGSQL="100"
GEOS="3.7.0dev-CAPI-1.11.0 8fe2ce6" SFCGAL="1.3.1"
PROJ="Rel. 4.9.3, 15 August 2016" GDAL="GDAL 2.2.2, released 2017/09/15"
LIBXML="2.7.8" LIBJSON="0.12" LIBPROTOBUF="1.2.1" TOPOLOGY RASTER
(1 row)
```

También puedes ver

Section 2.10, PostGIS_GEOS_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_PROJ_Version, PostGIS_Version

8.3.5 PostGIS_Full_Version

PostGIS_Full_Version — Devuelve la versión completa e informaciones de compilación de postgis.

Synopsis

text **PostGIS_Full_Version**();

Descripción

Devuelve la versión completa e informaciones de compilación de postgis. También informa sobre la sincronización entre librerías y scripts, y además sugiere si son necesarias actualizaciones.

Ejemplos

```
SELECT PostGIS_Full_Version();
                                                                postgis_full_version
-------------------------------------------------------------------------------------
POSTGIS="2.2.0dev r12699" GEOS="3.5.0dev-CAPI-1.9.0 r3989" SFCGAL="1.0.4" PROJ="Rel. 4.8.0, ↩
     6 March 2012"
GDAL="GDAL 1.11.0, released 2014/04/16" LIBXML="2.7.8" LIBJSON="0.12" RASTER
(1 row)
```

También puedes ver

Section 2.10, PostGIS_GEOS_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_PROJ_Version, PostGIS_Version

8.3.6 PostGIS_GEOS_Version

PostGIS_GEOS_Version — Devuelve el numero de versión de la libreria GEOS.

Synopsis

text **PostGIS_GEOS_Version**();

Descripción

Devuelve el numero de versión de la libreria GEOS, o `NULL` si el soporte de GEOS no esta activo.

Ejemplos

```
SELECT PostGIS_GEOS_Version();
 postgis_geos_version
----------------------
 3.1.0-CAPI-1.5.0
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_PROJ_Version, PostGIS_Version

8.3.7 PostGIS_Liblwgeom_Version

PostGIS_Liblwgeom_Version — Devuelve el número de versión de la biblioteca liblwgeom. Esto debe coincidir con la versión de PostGIS.

Synopsis

texto **PostGIS_Liblwgeom_Version**();

Descripción

Devuelve el número de versión de la biblioteca liblwgeom/

Ejemplos

```
SELECT PostGIS_Liblwgeom_Version();
postgis_liblwgeom_version
--------------------------
2.3.3 r15473
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_PROJ_Version, PostGIS_Version

8.3.8 PostGIS_LibXML_Version

PostGIS_LibXML_Version — Devuelve el numero de la versión de la libreria libxml2.

Synopsis

text **PostGIS_LibXML_Version**();

Descripción

Devuelve el numero de la versión de la libreria LibXML2.

Disponibilidad: 1.5

Ejemplos

```
SELECT PostGIS_LibXML_Version();
 postgis_libxml_version
----------------------
 2.7.6
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_Lib_Version, PostGIS_PROJ_Version, PostGIS_GEOS_Version, PostGIS_Version

8.3.9 PostGIS_Lib_Build_Date

PostGIS_Lib_Build_Date — Devuelve la fecha de compilación de la librería PostGIS.

Synopsis

text **PostGIS_Lib_Build_Date**();

Descripción

Devuelve la fecha de compilación de la librería PostGIS.

Ejemplos

```
SELECT PostGIS_Lib_Build_Date();
 postgis_lib_build_date
------------------------
 2008-06-21 17:53:21
(1 row)
```

8.3.10 PostGIS_Lib_Version

PostGIS_Lib_Version — Devuelve el numero de versión de la librería PostGIS.

Synopsis

text **PostGIS_Lib_Version**();

Descripción

Devuelve el numero de versión de la librería PostGIS.

Ejemplos

```
SELECT PostGIS_Lib_Version();
 postgis_lib_version
---------------------
 1.3.3
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_GEOS_Version, PostGIS_LibXML_Version, PostGIS_PROJ_Version, PostGIS_Version

8.3.11 PostGIS_PROJ_Version

PostGIS_PROJ_Version — Devuelve el numero de versión de la librería PROJ4

Synopsis

text **PostGIS_PROJ_Version**();

Descripción

Devuelve el numero de versión de la librería PROJ4, o `NULL` si el soporte de PROJ4 no esta activado.

Ejemplos

```
SELECT PostGIS_PROJ_Version();
  postgis_proj_version
-------------------------
 Rel. 4.4.9, 29 Oct 2004
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_GEOS_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_Version

8.3.12 PostGIS_Scripts_Build_Date

PostGIS_Scripts_Build_Date — Devuelve la fecha de compilación del script PostGIS.

Synopsis

text **PostGIS_Scripts_Build_Date**();

Descripción

Devuelve la fecha de compilación del script PostGIS.

Disponibilidad: 1.0.0RC1

Ejemplos

```
SELECT PostGIS_Scripts_Build_Date();
  postgis_scripts_build_date
-------------------------
 2007-08-18 09:09:26
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_GEOS_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_Version

8.3.13 PostGIS_Scripts_Installed

PostGIS_Scripts_Installed — Devuelve la versión del script postgis instalado en la base de datos.

Synopsis

text **PostGIS_Scripts_Installed**();

Descripción

Devuelve la versión del script postgis instalado en la base de datos.

Note
Si la salida de esta función no se corresponde con la de PostGIS_Scripts_Released probablemente no has actualizado correctamente la base de datos existente. Ve a la sección Actualización para mas información.

Disponibilidad: 0.9.0

Ejemplos

```
SELECT PostGIS_Scripts_Installed();
  postgis_scripts_installed
---------------------------
 1.5.0SVN
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_Scripts_Released, PostGIS_Version

8.3.14 PostGIS_Scripts_Released

PostGIS_Scripts_Released — Devuelve el numero de versión del script postgis.sql liberado con la libreria instalada postgis.

Synopsis

text **PostGIS_Scripts_Released**();

Descripción

Devuelve el numero de versión del script postgis.sql liberado con la libreria instalada postgis.

Note
Desde la versión 1.1.0 esta función devuelve el mismo valor que PostGIS_Lib_Version. Mantenido por compatibilidad con versiones anteriores.

Disponibilidad: 0.9.0

Ejemplos

```
SELECT PostGIS_Scripts_Released();
  postgis_scripts_released
--------------------------
 1.3.4SVN
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_Scripts_Installed, PostGIS_Lib_Version

8.3.15 PostGIS_Version

PostGIS_Version — Devuelve el numero de versión e información sobre su compilación de PostGIS.

Synopsis

text **PostGIS_Version**();

Descripción

Devuelve el numero de versión e información sobre su compilación de PostGIS.

Ejemplos

```
SELECT PostGIS_Version();
                        postgis_version
---------------------------------------
 1.3 USE_GEOS=1 USE_PROJ=1 USE_STATS=1
(1 row)
```

También puedes ver

PostGIS_Full_Version, PostGIS_GEOS_Version, PostGIS_Lib_Version, PostGIS_LibXML_Version, PostGIS_PROJ_Version

8.3.16 Populate_Geometry_Columns

Populate_Geometry_Columns — 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`

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`.

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 `oíd`, como en el caso de una tabla oíd, 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 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 numeroque se insertaron en la tabla `geometry_columns`. La versión con parámetros simplemente devuelve el numero de filas insertado en la tabla `geometry_column`

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)
```

8.3.17 UpdateGeometrySRID

UpdateGeometrySRID — Actualiza el SRID de todos los objetos espaciales de una columna de geometría, GEOMETRY_COLUMNS metadatos y srid. Si se cumple con las limitaciones, las restricciones se actualizarán con una nueva restricción srid. Si el viejo se impuso por tipo de definición, se cambiará la definición de tipo.

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 pgsql 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

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

8.4 Contructores Geométricos

8.4.1 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
Envia 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 especifico de postgis.

This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1. s3.2.6.2

Disponibilidad: 1.1.0 - requiere GEOS >= 2.1.0.

Ejemplos

```
Proximamente
```

Ver también

ST_BuildArea, ST_BdMPolyFromText

8.4.2 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
Envia 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 OpenGIS Simple Features Implementation Specification for SQL 1.1. s3.2.6.2

Disponibilidad: 1.1.0 - requiere GEOS >= 2.1.0.

Ejemplos

```
Proximamente
```

Ver también

ST_BuildArea, ST_BdPolyFromText

8.4.3 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.

Si no es especificada la `precisión` ST_Box2dFromGeoHash devuelve un BOX2D basado en la precisión completa de la cadena de GeoHash de entrada.

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('9qqj7nmxncgyy4d0dbxqz0');

                st_geomfromgeohash
-----------------------------------------------
 BOX(-115.172816 36.114646,-115.172816 36.114646)

SELECT ST_Box2dFromGeoHash('9qqj7nmxncgyy4d0dbxqz0', 0);

 st_box2dfromgeohash
----------------------
 BOX(-180 -90,180 90)

 SELECT ST_Box2dFromGeoHash('9qqj7nmxncgyy4d0dbxqz0', 10);
                           st_box2dfromgeohash
-------------------------------------------------------------------------
 BOX(-115.17282128334 36.1146408319473,-115.172810554504 36.1146461963654)
```

Ver también

ST_GeoHash, ST_GeomFromGeoHash, ST_PointFromGeoHash

8.4.4 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

8.4.5 ST_GeographyFromText

ST_GeographyFromText — Devuelve un valor especifico "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

8.4.6 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

8.4.7 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 geometía.

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

8.4.8 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 OpenGIS 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

8.4.9 ST_GeomFromEWKB

ST_GeomFromEWKB — Devuelve un valor especifico 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 especifico 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. Asi 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

8.4.10 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 especifico 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

8.4.11 ST_GeometryFromText

ST_GeometryFromText — Devuelve un valor especifico 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 OpenGIS 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

8.4.12 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('9qqj7nmxncgyy4d0dbxqz0'));
                                                    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('9qqj7nmxncgyy4d0dbxqz0', 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('9qqj7nmxncgyy4d0dbxqz0', 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

8.4.13 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 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 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 2.4.1, ST_AsGML, ST_GMLToSQL

8.4.14 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: 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 2.4.1.

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;
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 2.4.1

8.4.15 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:

Disponibilidad: 1.5, 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 2.4.1, ST_AsKML

8.4.16 ST_GMLToSQL

ST_GMLToSQL — Devuelve un valor especifico 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 2.4.1, ST_GeomFromGML, ST_AsGML

8.4.17 ST_GeomFromText

ST_GeomFromText — Devuelve un valor especifico 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 OpenGIS 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

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. 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

8.4.18 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 OpenGIS 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

8.4.19 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

8.4.20 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.

 This function supports 3d and will not drop the z-index.

Ejemplos

```
--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_Collect, ST_MakeLine

8.4.21 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 OpenGIS 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
-----------------------------------------------
0102000000020000000000000000F ... | t
```

Ver también

ST_GeomFromText

8.4.22 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 OpenGIS 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
------------------------------------------------
0102000000020000000000000000F ... | t
```

Ver también

ST_GeomFromWKB, ST_LinestringFromWKB

8.4.23 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 OpenGIS 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
--------------------------------------------------
0102000000020000000000000000F ... | t
```

Ver también

ST_GeomFromWKB, ST_LineFromWKB

8.4.24 ST_MakeBox2D

ST_MakeBox2D — Crea una BOX2D definida por los puntos de la geometría dada.

Synopsis

box2d **ST_MakeBox2D**(geometry pointLowLeft, geometry pointUpRight);

Descripción

Crea una BOX2D definida por los puntos de la geometría dada. Esto es útil para hacer consultas de rango

Ejemplos

```
--Devuelve todos los registros que residen por completo o solo una parte en la bounding box ↩
     de un atlas nacional de USA
--Se asume que las geometrias estan guardadas con SRID = 2163 (US National atlas equal area ↩
    )
SELECT feature_id, feature_name, the_geom
```

```
FROM features
WHERE the_geom && ST_SetSRID(ST_MakeBox2D(ST_Point(-989502.1875, 528439.5625),
        ST_Point(-987121.375 ,529933.1875)),2163)
```

Ver también

ST_MakePoint, ST_Point, ST_SetSRID, ST_SRID

8.4.25 ST_3DMakeBox

ST_3DMakeBox — Crea una BOX3D definida por las geometrías puntuales 3D.

Synopsis

box3d **ST_3DMakeBox**(geometry point3DLowLeftBottom, geometry point3DUpRightTop);

Descripción

Crea una BOX3D definida por las geometrías puntuales 2 3D dadas.

 Esta función soporta 3D y no suprime el indice z.

Cambiado: 2.0.0 En versiones anteriores se solía llamar ST_MakeBox3D

Ejemplos

```
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)
```

Ver también

ST_MakePoint, ST_SetSRID, ST_SRID

8.4.26 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

ST_MakeLine viene en 3 formas: un agregado espacial que toma filas de geometrías de punto, multipunto o de línea y devuelve una cadena de línea, una función que toma una matriz de punto, multipunto, o línea, y una función regular que toma dos puntos, multipunto, o geometrías de línea. Es posible que desee utilizar una subselección para ordenar los puntos antes de alimentarlos a la versión global de esta función.

Las entradas que no sean de punto, multipunto o líneas se omiten.

Al agregar componentes de línea, los nodos comunes al principio de las líneas se eliminan de la salida. Los nodos comunes en las entradas Point y multipunto no se eliminan.

 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: 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.

```
-- For pre-PostgreSQL 9.0 - this usually works,
-- but the planner may on occasion choose not to respect the order of the subquery
SELECT gps.gps_track, ST_MakeLine(gps.the_geom) As newgeom
        FROM (SELECT gps_track, gps_time, the_geom
                        FROM gps_points ORDER BY gps_track, gps_time) As gps
        GROUP BY gps.gps_track;
```

```
-- Si está usando PostgreSQL 9.0 +
-- (puede utilizar el nuevo pedido mediante soporte para agregados)
-- esta es una forma garantizada de obtener una cadena de línea correctamente ordenada
-- Su orden por parte puede ordenar por más de una columna si es necesario
SELECT gps.gps_track, ST_MakeLine(gps.the_geom ORDER BY gps_time) As newgeom
        FROM gps_points As gps
        GROUP BY gps.gps_track;
```

Ejemplos: Version Agregado No-Espacial

El primer ejemplo es un ejemplo simple de una cadena lineal compuesta por 2 puntos. El segundo formula una cadena lineal a partir de dos puntos dibujados por el usuario. El tercero es un hecho aislado que une 2 puntos 3D para crear una línea en el espacio 3D.

```
SELECT ST_AsText(ST_MakeLine(ST_MakePoint(1,2), ST_MakePoint(3,4)));
          st_astext
---------------------
 LINESTRING(1 2,3 4)

SELECT userpoints.id, ST_MakeLine(startpoint, endpoint) As drawn_line
        FROM userpoints ;

SELECT ST_AsEWKT(ST_MakeLine(ST_MakePoint(1,2,3), ST_MakePoint(3,4,5)));
                st_asewkt
-------------------------
 LINESTRING(1 2 3,3 4 5)
```

Ejemplos: Utilizando la versión Array

```
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)
```

Ver también

ST_AsEWKT, ST_AsText, ST_GeomFromText, ST_MakePoint

8.4.27 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_MakeLine, ST_MakePolygon

8.4.28 ST_MakePolygon

ST_MakePolygon — Crea un polígono formado por el contorno dado. Las geometrías de entrada deben ser LINESTRINGS cerradas.

Synopsis

geometry **ST_MakePolygon**(geometry linestring);

geometry **ST_MakePolygon**(geometry outerlinestring, geometry[] interiorlinestrings);

Descripción

Crea un polígono formado por el contorno dado. Las geometrias de entrada deben ser LINESTRINGS cerradas. Viene en 2 variantes.

Variante 1: Toma una cadena de líneas cerrada.

Variante 2: Crea un Poligono formado por el contorno dado y un array con huecos. Puedes construir un array de geometría utilizando ST_Accum o los constructores ARRAY[] y ARRAY() de PostgreSQL. Las geometrías de entrada deben ser LINESTRINGS cerradas.

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: LINESTRING única y cerrada

```
--linea 2d
SELECT ST_MakePolygon(ST_GeomFromText('LINESTRING(75.15 29.53,77 29,77.6 29.5, 75.15 29.53) ↩
    '));
--Si la cadena lineal no es cerrada
--puedes añadir el punto de inicio para cerrarla
SELECT ST_MakePolygon(ST_AddPoint(foo.open_line, ST_StartPoint(foo.open_line)))
FROM (
SELECT ST_GeomFromText('LINESTRING(75.15 29.53,77 29,77.6 29.5)') As open_line) As foo;

--linea cerrada 3d
SELECT ST_MakePolygon(ST_GeomFromText('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))

--linea medida --
SELECT ST_MakePolygon(ST_GeomFromText('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 carcasas interiores

Contruye 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;
```

Construya los límites de la provincia con los agujeros que representan los lagos en la provincia de un sistema polígonos/multi-polígonos de la provincia y de cadena de línea de agua. Este es un ejemplo de uso de PostGIS ST_Acc

Note
El constructor CASE se utiliza porque la alimentación de una matriz nula en ST_MakePolygon resulta en NULL.

Note
Un unión por la izquierda se utiliza para garantizar que se devuelva a todas las provincias, incluso si no tienen lagos.

```
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_Boundary, ST_Accum, ST_AddPoint, ST_GeometryType, ST_IsClosed, ST_LineMerge, ST_BuildArea

8.4.29 ST_MakePoint

ST_MakePoint — Creates a 2D, 3DZ or 4D point geometry.

Synopsis

geometry **ST_MakePoint**(double precision x, double precision y);

geometry **ST_MakePoint**(double precision x, double precision y, double precision z);

geometry **ST_MakePoint**(double precision x, double precision y, double precision z, double precision m);

Descripción

Creates a 2D, 3DZ or 4D point geometry (geometry with measure). `ST_MakePoint` while not being OGC compliant is generally faster and more precise than ST_GeomFromText and ST_PointFromText. It is also easier to use if you have raw coordinates rather than WKT.

Note
Nota que x es la longitud e y es la latitud

Note
Use ST_MakePointM if you need to make a point with x, y and m.

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

8.4.30 ST_MakePointM

ST_MakePointM — Crea una geometria puntual con coordenadas x, y y m.

Synopsis

geometry **ST_MakePointM**(float x, float y, float m);

Descripción

Crea un punto con coordenadas x, y y un valor de medida.

Note
Nota que x es la longitud e y es la latitud

Ejemplos

Utilizaremos ST_AsEWKT en el ejemplo para mostrar la representación como texto en lugar de ST_AsText, ya que ST_AsText no soporta devolver el valor M.

```
--Devuelve la representación EWKT del punto con un SRID desconocido
SELECT ST_AsEWKT(ST_MakePointM(-71.1043443253471, 42.3150676015829, 10));

--result
                                  st_asewkt
-----------------------------------------------
 POINTM(-71.1043443253471 42.3150676015829 10)

--Devuelve la representación EWKT del punto con medida como WGS 84 long lat
SELECT ST_AsEWKT(ST_SetSRID(ST_MakePointM(-71.1043443253471, 42.3150676015829,10),4326));

                                                st_asewkt
----------------------------------------------------------
SRID=4326;POINTM(-71.1043443253471 42.3150676015829 10)

--Devuelve un punto 3D (por ejemplo, tiene altitud)
SELECT ST_MakePoint(1, 2,1.5);

--Obtiene el valor m del punto
SELECT ST_M(ST_MakePointM(-71.1043443253471, 42.3150676015829,10));
result
-------
10
```

Ver también

ST_AsEWKT, ST_MakePoint, ST_SetSRID

8.4.31 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 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 OpenGIS 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

8.4.32 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 OpenGIS 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

8.4.33 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 OpenGIS 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

8.4.34 ST_Point

ST_Point — Devuelve un ST_Point con el valor de coordenadas dado. Es un alias de ST_MakePoint del OGC.

Synopsis

geometry **ST_Point**(float x_lon, float y_lat);

Descripción

Devuelve un ST_Point con el valor de coordenadas dado. Conforme con el alias MM para ST_MakePoint que toma únicamente una x y una y.

 This method implements the SQL/MM specification. SQL-MM 3: 6.1.2

Ejemplos: Geometry

```
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829),4326)
```

Ejemplos: Geography

```
SELECT CAST(ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829),4326) As geography);
```

```
-- el :: es el alias de PostgreSQL para conversiones cast.
SELECT ST_SetSRID(ST_Point(-71.1043443253471, 42.3150676015829),4326)::geography;
```

```
--Si las coordenadas de tus puntos están en sistemas de reference espaciales diferentes que ↩
     WGS-84 long lat, tendras que transformarlos antes de hacer una conversión de tipo cast
-- En este ejemplo convertimos un punto desde coordenadas planas en pies del estado de  ↩
    Pennsylvania en WGS 84 y después transformamos el tipo a  geography
SELECT ST_Transform(ST_SetSRID(ST_Point(3637510, 3014852),2273),4326)::geography;
```

Ver también

Section 4.2.1, ST_MakePoint, ST_SetSRID, ST_Transform

8.4.35 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('9qqj7nmxncgyy4d0dbxqz0'));
          st_astext
------------------------------
 POINT(-115.172816 36.114646)

SELECT ST_AsText(ST_PointFromGeoHash('9qqj7nmxncgyy4d0dbxqz0', 4));
             st_astext
-----------------------------------
 POINT(-115.13671875 36.123046875)

SELECT ST_AsText(ST_PointFromGeoHash('9qqj7nmxncgyy4d0dbxqz0', 10));
                 st_astext
-------------------------------------------
 POINT(-115.172815918922 36.1146435141563)
```

Ver también

ST_GeoHash, ST_Box2dFromGeoHash, ST_GeomFromGeoHash

8.4.36 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 OGCST_Point.

 This method implements the OpenGIS 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

8.4.37 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 OpenGIS 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

8.4.38 ST_Polygon

ST_Polygon — Devuelve un polygon construido desde un linestring especifico y un SRID.

Synopsis

geometry **ST_Polygon**(geometry aLineString, integer srid);

Descripción

Devuelve un polygon construido desde un linestring especifico y un SRID.

Note
ST_Polygon es similar a la primera versión de ST_MakePolygon excepto que también establece el sistema de referencia espacial (SRID) del polígono. No funcionará con MULTILINESTRINGS así que utilice LineMerge para combinar multilines. Tampoco crea polígonos con agujeros. Utilice ST_MakePolygon para eso.

This method implements the OpenGIS 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

```
--un poligono 2d
SELECT ST_Polygon(ST_GeomFromText('LINESTRING(75.15 29.53,77 29,77.6 29.5, 75.15 29.53)'),  ↩
    4326);

--resultado--
POLYGON((75.15 29.53,77 29,77.6 29.5,75.15 29.53))
--un poligono 3d
SELECT ST_AsEWKT(ST_Polygon(ST_GeomFromEWKT('LINESTRING(75.15 29.53 1,77 29 1,77.6 29.5 1,  ↩
    75.15 29.53 1)'), 4326));

result
------
SRID=4326;POLYGON((75.15 29.53 1,77 29 1,77.6 29.5 1,75.15 29.53 1))
```

Ver también

ST_AsEWKT, ST_AsText, ST_GeomFromEWKT, ST_GeomFromText, ST_LineMerge, ST_MakePolygon

8.4.39 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 OpenGIS 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
------------------
0103000000010000000500000006...


SELECT ST_PolygonFromText('POINT(1 2)') IS NULL as point_is_notpoly;

point_is_not_poly
----------
t
```

Ver también

ST_GeomFromText

8.4.40 ST_WKBToSQL

ST_WKBToSQL — Devuelve un valor especifico 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

8.4.41 ST_WKTToSQL

ST_WKTToSQL — Devuelve un valor especifico de ST_Geometry desde una representación "Well-Known Text" (WKT). Es un alias para ST_GeomFromText

Synopsis

geometry **ST_WKTToSQL**(text WKT);

Descripción

 This method implements the SQL/MM specification. SQL-MM 3: 5.1.34

Ver también

ST_GeomFromText

8.5 Métodos de Acceso a Geometrías

8.5.1 GeometryType

GeometryType — Devuelve el tipo de geometría como una cadena de texto. Ej: 'LINESTRING', 'POLYGON', 'MULTIPOINT', etc.

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 OpenGIS 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

8.5.2 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 OpenGIS Simple Features Implementation Specification for SQL 1.1. OGC SPEC s2.1.1.1

✓ This method implements the SQL/MM specification. SQL-MM 3: 5.1.14

✓ This function supports 3d and will not drop the z-index.

Mejorado: 2.1.0 Se ha introducido soporte para Triangle

Ejemplos

LineString con puntos de límite superpuestos

```
SELECT ST_Boundary(geom)
FROM (SELECT 'LINESTRING(100 150,50 60,  ↩
     70 80, 160 170)'::geometry As geom) As f;

-- Salida de ST_AsText
MULTIPOINT(100 150,160 170)
```

Agujeros de polígono con límite multilinestring

```
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))
```

```
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)

--Utilizando un poligono 3d
```

```
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)

--Utilizando una multilinestring 3d
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

8.5.3 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 OpenGIS 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

8.5.4 ST_Dimension

ST_Dimension — La dimensión inherente del objeto Geometry, la cual debe ser menor o igual a la dimensión de coordenadas.

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 envia 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

8.5.5 ST_EndPoint

ST_EndPoint — Devuelve el último punto de una geometría `LINESTRING` o `CIRCULARLINESTRING` como un `POINT`.

Synopsis

boolean **ST_EndPoint**(geometry g);

Descripción

Devuelve el último punto de una geometría `LINESTRING` como `POINT` o `NULL` si el parametro de entrada no es una `LINESTRING`.

 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

```
postgis=# SELECT ST_AsText(ST_EndPoint('LINESTRING(1 1, 2 2, 3 3)'::geometry));
 st_astext
------------
 POINT(3 3)
(1 row)

postgis=# SELECT ST_EndPoint('POINT(1 1)'::geometry) IS NULL AS is_null;
  is_null
----------
 t
(1 row)

--punto final 3d
SELECT ST_AsEWKT(ST_EndPoint('LINESTRING(1 1 2, 1 2 3, 0 0 5)'));
  st_asewkt
--------------
 POINT(0 0 5)
(1 row)
```

Ver también

ST_PointN, ST_StartPoint

8.5.6 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(lineas 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 OpenGIS Simple Features Implementation Specification for SQL 1.1. s2.1.1.1

 This method implements the SQL/MM specification. SQL-MM 3: 5.1.15

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

8.5.7 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.

La geometría cadena de línea devuelta siempre conserva SRID y dimensionalidad (z y m presente) de la geometría de entrada.

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.

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, &&&

8.5.8 ST_ExteriorRing

ST_ExteriorRing — Devuelve una linestring representando el anillo exterior de una geometria tipo `POLYGON`. Devuelve NULL si la geometria no es un poligono. No funcionará con MULTIPOLYGON

Synopsis

geometry **ST_ExteriorRing**(geometry a_polygon);

Descripción

Devuelve una linestring representando el anillo exterior de una geometria tipo `POLYGON`. Devuelve NULL si la geometria no es un poligono. No funcionará con MULTIPOLYGON

Note
Solo funciona con geometrias de tipo POLYGON

This method implements the OpenGIS 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

8.5.9 ST_GeometryN

ST_GeometryN — 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.

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)LINESTI una MULTICURVE o un (MULTI)POLYGON, una POLYHEDRALSURFACE si no devuelve NULL.

Note
El indice 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 geometrias simples. Esto ha sido cambiado para devolver la geometría en el caso de ST_GeometryN(..,1) .

 This method implements the OpenGIS 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

```
--Extrayendo un conjunto de puntos desde una geometría 3d multipoint
SELECT n, ST_AsEWKT(ST_GeometryN(the_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(the_geom)
        CROSS JOIN generate_series(1,100) n
WHERE n <= ST_NumGeometries(the_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)


--Extracción de todas las geometrías (tip cuando quieres asignar un id)
SELECT gid, n, ST_GeometryN(the_geom, n)
FROM sometable CROSS JOIN generate_series(1,100) n
WHERE n <= ST_NumGeometries(the_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

8.5.10 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

8.5.11 ST_InteriorRingN

ST_InteriorRingN — Devuelve la cadena de texto del anillo interior N del poligono. Devuelve NULL si la geometría no es un polígono o el indice N dado esta fuera de rango.

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 indice N dado esta fuera de rango. El indice empieza en 1.

Note
Esto no funcionara con MULTIPOLYGONs. Para MULTIPOLYGONs utilizaba junto a ST_Dump.

 This method implements the OpenGIS 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_BuildArea, ST_Collect, ST_Dump, ST_NumInteriorRing, ST_NumInteriorRings

8.5.12 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.

This function supports 3d and will not drop the z-index.

This function supports M coordinates.

Ver también

ST_ForcePolygonCW , ST_ForcePolygonCCW , ST_IsPolygonCW

8.5.13 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.

This function supports 3d and will not drop the z-index.

This function supports M coordinates.

Ver también

ST_ForcePolygonCW , ST_ForcePolygonCCW , ST_IsPolygonCW

8.5.14 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 OpenGIS 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 lineas 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

8.5.15 ST_IsCollection

ST_IsCollection — Devuelve `TRUE` si el argumento es una colección (`MULTI*`, `GEOMETRYCOLLECTION`, ...)

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

8.5.16 ST_IsEmpty

ST_IsEmpty — Devuelve True si la Geometría es una colección vacía, polígono vacio, punto vacío etc.

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 OpenGIS 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)
```

8.5.17 ST_IsRing

ST_IsRing — Devuelve `TRUE` si esta `LINESTRING` es simple y cerrada.

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 OpenGIS 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

8.5.18 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 OpenGIS 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

8.5.19 ST_IsValid

ST_IsValid — Devuelve `true` si la `ST_Geometry` esta bien formada.

Synopsis

boolean **ST_IsValid**(geometry g);
boolean **ST_IsValid**(geometry g, integer flags);

Descripción

Prueba si el valor de una ST_Geometry esta bien formado. Para las geometrías que no son validas, PostgreSQL NOTICE nos dará detalles del porque no es valida. Para mas información sobre la definición de simplicidad y validez de geometrías del OGC, visita el enlace "Ensuring OpenGIS compliancy of geometries"

Note
SQL-MM define que el resultado de ST_IsValid(NULL) debe ser 0, mientras que PostGIS devuelve NULL.

La versión que acepta parámetros esta disponible desde la 2.0.0 y requiere GEOS >= 3.3.0. Dicha versión no imprime un aviso explicando la invalidez. Los parámetros permitidos están documentados en ST_IsValidDetail.

This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1.

This method implements the SQL/MM specification. SQL-MM 3: 5.1.9

Note
Ni las especificaciones OGC-SFS ni SQL-MM incluyen un argumento de indicador para ST_IsValid. La bandera es una extensión PostGIS.

Ejemplos

```
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
--resultados
NOTICE:  Self-intersection at or near point 0 0
 good_line | bad_poly
-----------+----------
 t         | f
```

Ver también

ST_IsSimple, ST_IsValidReason, ST_IsValidDetail, ST_Summary

8.5.20 ST_IsValidReason

ST_IsValidReason — Devuelve un texto indicando si una geometría es valida o no, y el porque.

Synopsis

text **ST_IsValidReason**(geometry geomA);
text **ST_IsValidReason**(geometry geomA, integer flags);

Descripción

Devuelve un texto indicando si una geometría es valida o no, y el porque.

Util en combinación con ST_IsValid para generar un informe detallado de geometrías invalidas y el porque.

Los `parametros` permitidos están documentados en ST_IsValidDetail.

Disponibilidad: 1.4 - necesita GEOS >=3.1.0.

Disponibilidad: 2.0 - necesita GEOS >= 3.3.0 para la version que toma parámetros.

Ejemplos

```
--Primeros 3 rechazados de un quinteto de prueba
SELECT gid, ST_IsValidReason(the_geom) as validity_info
FROM
(SELECT ST_MakePolygon(ST_ExteriorRing(e.buff), ST_Accum(f.line)) As the_geom, gid
FROM (SELECT ST_Buffer(ST_MakePoint(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_MakePoint(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(the_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]

 -- ejemplo simple
SELECT ST_IsValidReason('LINESTRING(220227 150406,2220227 150407,222020 150410)');

 st_isvalidreason
------------------
 Valid Geometry
```

Ver también

ST_IsValid, ST_Summary

8.5.21 ST_IsValidDetail

ST_IsValidDetail — Devuelve una fila de estado valid_detail (validez,razón ,lugar) si una geometría es valida o no y si no lo es , una razón del porque y el lugar donde no lo es.

Synopsis

valid_detail **ST_IsValidDetail**(geometry geom);
valid_detail **ST_IsValidDetail**(geometry geom, integer flags);

Descripción

Devuelve una fila valid_detail, formada por un valor boleano (valido) de estado si la geometría es valida, un texto (razón) explicando la razón por la cual es valida y una geometría (lugar) señalando donde no es valida la geometría.

Util para sustituir y mejorar la combinación de ST_IsValid y ST_IsValidReason para generar un informe detallado de geometrías no validas.

Los argumentos 'parámetro' son un campo de bits. Pueden tener los siguientes valores:

- 1: Considera anillos que se auto intersectan como validos. Esto también es conocido como "the ESRI flag". Observa que esto es contrario al modelo OGC.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

Ejemplos

```
-- 3 primeros rechazos de un exitoso experimento quíntuple
SELECT gid, reason(ST_IsValidDetail(the_geom)), ST_AsText(location(ST_IsValidDetail( ↩
    the_geom))) as location
FROM
(SELECT ST_MakePolygon(ST_ExteriorRing(e.buff), ST_Accum(f.line)) As the_geom, gid
FROM (SELECT ST_Buffer(ST_MakePoint(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_MakePoint(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(the_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)

 -- ejemplo simple
SELECT * FROM ST_IsValidDetail('LINESTRING(220227 150406,2220227 150407,222020 150410)');

 valid | reason | location
-------+--------+----------
 t     |        |
```

Ver también

ST_IsValid, ST_IsValidReason

8.5.22 ST_M

ST_M — Devuelve la coordenada M del punto, o NULL si no seta disponible. La entrada debe ser un punto.

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 OpenGIS 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

8.5.23 ST_NDims

ST_NDims — Devuelve la dimension de las coordenadas de la geometría como un entero "small int". Los valores son: 2,3 o 4.

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 mediadas 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

8.5.24 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 geometrias 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

8.5.25 ST_NRings

ST_NRings — Si la geometria es un polígono o un multi-polígono devuelve el numero de anillos.

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 anille 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

8.5.26 ST_NumGeometries

ST_NumGeometries — Si la geometría es una GEOMETRYCOLLECTION (o MULTI*) devuelve el numero de geometrías, para geometrias simples devuelve 1, si no devuelve NULL.

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 geometrias 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

```
--En versiones anteriores esto habría devuelto NULL
-- en 2.0.0 devuelve 1
SELECT ST_NumGeometries(ST_GeomFromText('LINESTRING(77.29 29.07,77.42 29.26,77.27  ↩
    29.31,77.29 29.07)'));
--resultado
1

--Ejemplo de Colección de geometrías - al contar las geometrías múltiples cuentan como 1 en ↩
     una colección
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)))'));
--resultado
3
```

Ver también

ST_GeometryN, ST_Multi

8.5.27 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

8.5.28 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

8.5.29 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 OpenGIS Simple Features Implementation Specification for SQL 1.1.

 This method implements the SQL/MM specification. SQL-MM 3: ?

 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

8.5.30 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 OpenGIS 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

8.5.31 ST_PatchN

ST_PatchN — Devuelve la 1 geometría de base n-ésima (cara) si la geometría es un POLYHEDRALSURFACE, POLYHEDRALSURFACEM. De lo contrario, devuelve NULL.

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_GemoetryN 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 3: ?


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

8.5.32 ST_PointN

ST_PointN — Devuelve el punto enésimo en la primera cadena de línea o cadena de linea circular en la geometría. Los valores negativos se contabilizan hacia atrás desde el final de la cadena de línea. Devuelve NULL si no hay cadena de línea en la geometría.

Synopsis

geometry **ST_PointN**(geometry a_linestring, integer n);

Descripción

Devuelve el punto enésimo 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 OpenGIS 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

8.5.33 ST_Points

ST_Points — Devuelve un MultiPoint que contiene todas las coordenadas de una geometría.

Synopsis

geometry **ST_Points**(geometry geom);

Descripción

Devuelve un Multipoint que contiene todas las coordenadas de una geometría. No elimina los puntos que se duplican en la geometría de entrada, incluidos los puntos de inicio y fin de las geometrías de los anillos. (si este comportamiento no es deseado, los duplicados se pueden quitar usando ST_RemoveRepeatedPoints).

Las coordenadas M y Z se conservarán si están presentes.

 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

8.5.34 ST_SRID

ST_SRID — Devuelve el identificador de referencia espacial para el ST_Geometry como se define en la tabla spatial_ref_sys.

Synopsis

integer **ST_SRID**(geometry g1);

Descripción

Devuelve el identificador de referencia espacial para el ST_Geometry como se define en la tabla spatial_ref_sys. Section 4.3.1

Note
La tabla spatial_ref_sys es una tabla que cataloga todos los sistemas de referencia espacial conocidos por PostGIS y se utiliza para transformaciones de un sistema de referencia espacial a otro. Por tanto verificar que tiene el identificador de sistema de referencia espacial adecuado es importante si usted planea transformar alguna vez sus geometrías.

 This method implements the OpenGIS 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

Ejemplos

```
SELECT ST_SRID(ST_GeomFromText('POINT(-71.1043 42.315)',4326));
                --result
                4326
```

Ver también

Section 4.3.1, ST_GeomFromText, ST_SetSRID, ST_Transform

8.5.35 ST_StartPoint

ST_StartPoint — Devuelve el primer punto de una geometría LINESTRING como un POINT.

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

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

```
SELECT ST_AsText(ST_StartPoint('LINESTRING(0 1, 0 2)'::geometry));
 st_astext
------------
 POINT(0 1)
(1 row)

SELECT ST_StartPoint('POINT(0 1)'::geometry) IS NULL AS is_null;
  is_null
----------
 t
(1 row)

--3d line
```

```
SELECT ST_AsEWKT(ST_StartPoint('LINESTRING(0 1 1, 0 2 2)'::geometry));
 st_asewkt
------------
 POINT(0 1 1)
(1 row)

-- circular linestring --
SELECT ST_AsText(ST_StartPoint('CIRCULARSTRING(5 2,-3 1.999999, -2 1, -4 2, 5 2)'::geometry ↩
    ));
 st_astext
------------
 POINT(5 2)
```

Ver también

ST_EndPoint, ST_PointN

8.5.36 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

8.5.37 ST_X

ST_X — Devuelve la coordenada X del punto, o NULL si no está disponible. La entrada debe ser un punto.

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
Si desea obtener los valores mínimos y máximos de x de cualquier geometría, vea las funciones de ST_XMin, 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

8.5.38 ST_XMax

ST_XMax — Devuelve la X máxima de un cuadro delimitador 2d o 3d o una geometría.

Synopsis

float **ST_XMax**(box3d aGeomorBox2DorBox3D);

Descripción

Devuelve la X máxima de un cuadro delimitador 2d o 3d o una geometría.

Note
Aunque esta función sólo está definida para box3d, trabajará para box2d y geometry debido al comportamiento de auto-casting definido para geometries y box2d. Sin embargo usted no puede alimentarlo con una representación del texto de geometry o box2d, puesto que eso no se auto-Cast.


This function supports 3d and will not drop the z-index.


This method supports Circular Strings and Curves

Ejemplos

```
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 ESTO NO FUNCIONA porque intentará autoemitir la representación de cadena a un ↩
    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
```

Ver también

ST_XMin, ST_YMax, ST_YMin, ST_ZMax, ST_ZMin

8.5.39 ST_XMin

ST_XMin — Devuelve la X mínima de un cuadro delimitador 2d o 3d o una geometría.

Synopsis

float **ST_XMin**(box3d aGeomorBox2DorBox3D);

Descripción

Devuelve la X mínima de un cuadro delimitador 2D o 3D o una geometría.

Note
Aunque esta función sólo está definida para box3d, trabajará para box2d y geometry debido al comportamiento de auto-casting definido para geometries y box2d. Sin embargo usted no puede alimentarlo con una representación del texto de geometry o box2d, puesto que eso no se auto-Cast.

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves

Ejemplos

```
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 ESTO NO FUNCIONA porque intentará autoemitir la representación de cadena a un  ↩
    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
```

Ver también

ST_XMax, ST_YMax, ST_YMin, ST_ZMax, ST_ZMin

8.5.40 ST_Y

ST_Y — Devuelve la coordenada Y del punto, o NULL si no está disponible. La entrada debe ser un punto.

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.

 This method implements the OpenGIS 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

8.5.41 ST_YMax

ST_YMax — Devuelve la Y máxima de un cuadro delimitador 2d o 3d o una geometría.

Synopsis

float **ST_YMax**(box3d aGeomorBox2DorBox3D);

Descripción

Devuelve la Y máxima de un cuadro delimitador 2d o 3d o una geometría.

Note
Aunque esta función sólo está definida para box3d, trabajará para box2d y geometry debido al comportamiento de auto-casting definido para geometries y box2d. Sin embargo usted no puede alimentarlo con una representación del texto de geometry o box2d, puesto que eso no se auto-Cast.

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves

Ejemplos

```
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 ESTO NO FUNCIONA porque intentará autoemitir la representación de cadena a un  ↩
    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
```

Ver también

ST_XMin, ST_XMax, ST_YMin, ST_ZMax, ST_ZMin

8.5.42 ST_YMin

ST_YMin — Devuelve la Y mínima de un cuadro delimitador 2d o 3d o una geometría.

Synopsis

float **ST_YMin**(box3d aGeomorBox2DorBox3D);

Descripción

Devuelve la X mínima de un cuadro delimitador 2d o 3d o una geometría.

Note
Aunque esta función sólo está definida para box3d, trabajará para box2d y geometry debido al comportamiento de auto-casting definido para geometries y box2d. Sin embargo usted no puede alimentarlo con una representación del texto de geometry o box2d, puesto que eso no se auto-Cast.


This function supports 3d and will not drop the z-index.


This method supports Circular Strings and Curves

Ejemplos

```
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 ESTO NO FUNCIONA porque intentará autoemitir la representación de cadena a un  ↩
    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
```

Ver también

ST_GeomFromEWKT, ST_XMin, ST_XMax, ST_YMax, ST_ZMax, ST_ZMin

8.5.43 ST_Z

ST_Z — Devuelve la coordenada Z del punto, o NULL si no está disponible. La entrada debe ser un punto.

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.

 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

8.5.44 ST_ZMax

ST_ZMax — Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.

Synopsis

float **ST_ZMax**(box3d aGeomorBox2DorBox3D);

Descripción

Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.

Note
Aunque esta función sólo está definida para box3d, trabajará para box2d y geometry debido al comportamiento de auto-casting definido para geometries y box2d. Sin embargo usted no puede alimentarlo con una representación del texto de geometry o box2d, puesto que eso no se auto-Cast.

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves

Ejemplos

```
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 ESTO NO FUNCIONA porque intentará autoemitir la representación de cadena a un  ↩
    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
```

Ver también

ST_GeomFromEWKT, ST_XMin, ST_XMax, ST_YMax, ST_YMin, ST_ZMax

8.5.45 ST_Zmflag

ST_Zmflag — Devuelve el indicador ZM (dimensión semántica) de las geometrías como un small int. los valores son: 0=2d, 1=3dm, 2=3dz, 3=4d.

Synopsis

smallint **ST_Zmflag**(geometry geomA);

Descripción

Devuelve el indicador ZM (dimensión semántica) de las geometrías como un small int. los valores son: 0=2d, 1=3dm, 2=3dz, 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

8.5.46 ST_ZMin

ST_ZMin — Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.

Synopsis

float **ST_ZMin**(box3d aGeomorBox2DorBox3D);

Descripción

Devuelve la Z mínima de un cuadro delimitador 2d o 3d o una geometría.

Note
Aunque esta función sólo está definida para box3d, trabajará para box2d y geometry debido al comportamiento de auto-casting definido para geometries y box2d. Sin embargo usted no puede alimentarlo con una representación del texto de geometry o box2d, puesto que eso no se auto-Cast.

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves

Ejemplos

```
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 ESTO NO FUNCIONA porque intentará autoemitir la representación de cadena a un  ↩
    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
```

Ver también

ST_GeomFromEWKT, ST_GeomFromText, ST_XMin, ST_XMax, ST_YMax, ST_YMin, ST_ZMax

8.6 Editores de Geometría

8.6.1 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);

Descripción

Agrega un punto a un LineString antes del punto <position> (índice basado en 0). El tercer parámetro puede omitirse o establecerse en -1 para anexar.

Disponibilidad: 1.1.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
--Garantizar que todos los LineStrings en una tabla estén cerrados
                --añadiendo el punto de inicio de cada LineString al final de la cadena de  ↩
                    línea
                --sólo para aquellos que no están cerrados
                UPDATE sometable
                SET the_geom = ST_AddPoint(the_geom, ST_StartPoint(the_geom))
                FROM sometable
                WHERE ST_IsClosed(the_geom) = false;

                --Agregar punto a una línea tridimensional
                SELECT ST_AsEWKT(ST_AddPoint(ST_GeomFromEWKT('LINESTRING(0 0 1, 1 1 1)'),  ↩
                    ST_MakePoint(1, 2, 3)));

                --result
                st_asewkt
                ----------
                LINESTRING(0 0 1,1 1 1,1 2 3)
```

Ver también

ST_RemovePoint, ST_SetPoint

8.6.2 ST_Affine

ST_Affine — Aplicar una transformación de afinidad 3D a una geometría.

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);

Descripción

Aplica una transformación de afinidad 3D a una geometría para hacer cosas como trasladar, rotar, escalar en un solo paso.

Versión 1: la llamada

```
ST_Affine(geom, a, b, c, d, e, f, g, h, i, xoff, yoff, zoff)
```

representa la matriz de transformación

```
/ a  b  c  xoff \
| d  e  f  yoff |
| g  h  i  zoff |
\ 0  0  0     1 /
```

y los vértices se transforman de la siguiente manera:

```
x' = a*x + b*y + c*z + xoff
y' = d*x + e*y + f*z + yoff
z' = g*x + h*y + i*z + zoff
```

Todas las funciones de traslación/escala se expresan a través de la búsqueda de una transformación afín.

Versión 2: aplica una transformación de afinidad 2D a la geometría. La llamada

```
ST_Affine(geom, a, b, d, e, xoff, yoff)
```

representa la matriz de transformación

```
/  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  /
```

y los vértices se transforman de la siguiente manera:

```
x' = a*x + b*y + xoff
y' = d*x + e*y + yoff
z' = z
```

Este método es un subcaso del método 3D anterior.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Disponibilidad: 1.1.2. cambio de nombre de Affine a ST_Affine en 1.2.2

Note
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 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

Ejemplos

```
--Gire una línea 3D 180 grados sobre el eje Z. Tenga en cuenta que esto es de larga  ↩
    duración para hacer ST_Rotate ();
 SELECT ST_AsEWKT(ST_Affine(the_geom,  cos(pi()), -sin(pi()), 0,  sin(pi()), cos(pi()), 0,  ↩
      0, 0, 1,  0, 0, 0)) As using_affine,
          ST_AsEWKT(ST_Rotate(the_geom, pi())) As using_rotate
        FROM (SELECT ST_GeomFromEWKT('LINESTRING(1 2 3, 1 4 3)') As the_geom) As foo;
        using_affine         |        using_rotate
-----------------------------+-----------------------------
 LINESTRING(-1 -2 3,-1 -4 3) | LINESTRING(-1 -2 3,-1 -4 3)
(1 row)

--Rotar una línea 3D 180 grados en el eje X y Z
```

```
SELECT ST_AsEWKT(ST_Affine(the_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 the_geom) As foo;
           st_asewkt
-------------------------------
 LINESTRING(-1 -2 -3,-1 -4 -3)
(1 row)
```

Ver también

ST_Rotate, ST_Scale, ST_Translate, ST_TransScale

8.6.3 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

8.6.4 ST_Force3D

ST_Force3D — Forzar las geometrías en modo XYZ. Este es un alias para ST_Force3DZ.

Synopsis

geometry **ST_Force3D**(geometry geomA);

Descripción

Fuerza las geometrías en modo XYZ. Este es un alias para ST_Force_3DZ. Si una geometría no tiene componente z, entonces un 0 se agrega a la coordenada Z.

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.

 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

8.6.5 ST_Force3DZ

ST_Force3DZ — Fuerza las geometrías en modo XYZ.

Synopsis

geometry **ST_Force3DZ**(geometry geomA);

Descripción

Fuerza las geometrías en modo XYZ. Este es un sinónimo de ST_Force3DZ. Si una geometría no tiene componente z, entonces un 0 se agrega a la coordenada Z.

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.

 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))
```

Ver también

ST_AsEWKT, ST_Force2D, ST_Force3DM, ST_Force3D

8.6.6 ST_Force3DM

ST_Force3DM — Fuerza las geometrías en modo XYM.

Synopsis

geometry **ST_Force3DM**(geometry geomA);

Descripción

Fuerza las geometrías en modo XYM. Si una geometría no tiene componente M, entonces un 0 se agrega a la coordenada M. Si tiene un componente Z, entonces Z se quita

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_3DM.

 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

8.6.7 ST_Force4D

ST_Force4D — Fuerza las geometrías en modo XYZM.

Synopsis

geometry **ST_Force4D**(geometry geomA);

Descripción

Fuerza las geometrías en modo XYZM. Un 0 es agregado para las coordenadas Z y M faltantes.

Cambiado: 2.1.0. Hasta la 2.0.x esto se llamaba ST_Force_4D.

 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

8.6.8 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.

 This function supports 3d and will not drop the z-index.

 This function supports M coordinates.

Ver también

ST_ForcePolygonCW , ST_IsPolygonCCW , ST_IsPolygonCW

8.6.9 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 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

8.6.10 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.

 This function supports 3d and will not drop the z-index.

 This function supports M coordinates.

Ver también

ST_ForcePolygonCCW , ST_IsPolygonCCW , ST_IsPolygonCW

8.6.11 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.

8.6.12 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

8.6.13 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 multilíneas 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

8.6.14 ST_LineMerge

ST_LineMerge — Devuelve un (conjunto de) LineString (s) formado por un agrupamiento formando un MULTILINESTRING.

Synopsis

geometry **ST_LineMerge**(geometry amultilinestring);

Descripción

Devuelve un (conjunto de) LineString (s) formado por un agrupamiento la linea de trabajo constituyente de un MULTILINESTRING.

Note
Utilice solamente con MULTILINESTRING/LINESTRINGs. Si se alimenta un polígono o una colección geométrica en esta función, se devolverá un GEOMETRYCOLLECTION vacío

Disponibilidad: 1.1.0

Note
Requiere GEOS >= 2.1.0

Warning
Will strip the M dimension.

Ejemplos

```
SELECT ST_AsText(ST_LineMerge(
ST_GeomFromText('MULTILINESTRING((-29 -27,-30 -29.7,-36 -31,-45 -33),(-45 -33,-46 -32))')
                )
);
st_astext
------------------------------------------------------------------------------------------------ ←

LINESTRING(-29 -27,-30 -29.7,-36 -31,-45 -33,-46 -32)
(1 row)

--If can't be merged - original MULTILINESTRING is returned
SELECT ST_AsText(ST_LineMerge(
ST_GeomFromText('MULTILINESTRING((-29 -27,-30 -29.7,-36 -31,-45 -33),(-45.2 -33.2,-46 -32)) ↩
    ')
)
);
st_astext
----------------
MULTILINESTRING((-45.2 -33.2,-46 -32),(-29 -27,-30 -29.7,-36 -31,-45 -33))

-- example with Z dimension
SELECT ST_AsText(ST_LineMerge(
ST_GeomFromText('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))')
                )
);
st_astext
------------------------------------------------------------------------------------------------ ←

LINESTRING Z (-30 -29.7 5,-29 -27 11,-30 -29.7 10,-36 -31 5,-45 -33 1,-46 -32 11)
(1 row)
```

Ver también

ST_Segmentize, ST_LineSubstring

8.6.15 ST_CollectionExtract

ST_CollectionExtract — Dada una (multi)geometría, devuelve una (multi)geometría que consiste sólo en elementos del tipo especificado.

Synopsis

geometry **ST_CollectionExtract**(geometry collection, integer type);

Descripción

Dada una (multi)geometría, devuelve una (multi)geometría que consiste sólo en elementos del tipo especificado. Las subgeometrías que no son el tipo especificado se omiten. Si no hay subgeometrías del tipo correcto, se devolverá una geometría EMPTY. Sólo se admiten puntos, líneas y polígonos. Los números de tipo son 1 == POINT, 2 == LINESTRING, 3 == POLYGON.

Disponibilidad: 1.5.0

Note
Antes de 1.5.3 esta función devolvió intactos las entradas sin colección, sin importar el tipo. En 1.5.3 las geometrías individuales que no coinciden resultan en un retorno NULL. En de 2.0.0 cada caso de falta de coincidencia resulta en retorno de tipo EMPTY.

Warning
Al especificar 3 == POLYGON se devuelve un multipolígono incluso cuando se comparten los bordes. Esto da lugar a un multipolígono no válido para muchos casos, como la aplicación de esta función en un resultado ST_Split.

Ejemplos

```
-- Constantes: 1 == POINT, 2 == LINESTRING, 3 == POLYGON
SELECT ST_AsText(ST_CollectionExtract(ST_GeomFromText('GEOMETRYCOLLECTION( ↩
    GEOMETRYCOLLECTION(POINT(0 0)))'),1));
st_astext
---------------
MULTIPOINT(0 0)
(1 row)

SELECT ST_AsText(ST_CollectionExtract(ST_GeomFromText('GEOMETRYCOLLECTION( ↩
    GEOMETRYCOLLECTION(LINESTRING(0 0, 1 1)),LINESTRING(2 2, 3 3))'),2));
st_astext
---------------
MULTILINESTRING((0 0, 1 1), (2 2, 3 3))
(1 row)
```

Ver también

ST_Multi, ST_Dump, ST_CollectionHomogenize

8.6.16 ST_CollectionHomogenize

ST_CollectionHomogenize — Dada una colección geométrica, devuelva la representación "más simple" del contenido.

Synopsis

geometry **ST_CollectionHomogenize**(geometry collection);

Descripción

Dada una colección geométrica, devuelve la representación "más simple" del contenido. Los singletons se devolverán como singletons. Las colecciones que sean homogéneas se devolverán como el multitipo apropiado.

Warning
Al especificar 3 == POLYGON se devuelve un multipolígono incluso cuando se comparten los bordes. Esto da lugar a un multipolígono no válido para muchos casos, como la aplicación de esta función en un resultado ST_Split.

Disponibilidad: 2.0.0

Ejemplos

```
SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION(POINT(0 0))'));

        st_astext
        ------------
         POINT(0 0)
        (1 row)

  SELECT ST_AsText(ST_CollectionHomogenize('GEOMETRYCOLLECTION(POINT(0 0),POINT(1 1))'));

        st_astext
        ---------------------
         MULTIPOINT(0 0,1 1)
        (1 row)
```

Ver también

ST_Multi, ST_CollectionExtract

8.6.17 ST_Multi

ST_Multi — Devuelve la geometría como una geometría MULTI*.

Synopsis

geometry **ST_Multi**(geometry g1);

Descripción

Devuelve la geometría como una geometría MULTI*. Si la geometría ya es MULTI*, esta se devuelve sin cambios.

Ejemplos

```
SELECT ST_AsText(ST_Multi(ST_GeomFromText('POLYGON((743238 2967416,743238 2967450,
                        743265 2967450,743265.625 2967416,743238 2967416))')));
                        st_astext
                        ----------------------------------------------------------------------------

                        MULTIPOLYGON(((743238 2967416,743238 2967450,743265  ↩
                            2967450,743265.625 2967416,
                        743238 2967416)))
                        (1 row)
```

Ver también

ST_AsText

8.6.18 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,

8.6.19 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 compressiblity. 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 precsion 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 effeciently.

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       | 0101000000000000003cdd5e40000000003cdd5e40 | POINT(123.456787109375  ↩
    123.456787109375)
2       | 0101000000000000038dd5e400000000038dd5e40 | POINT(123.45654296875  ↩
    123.45654296875)
1       | 0101000000000000000dd5e400000000000dd5e40 | POINT(123.453125 123.453125)
0       | 0101000000000000000dc5e400000000000dc5e40 | POINT(123.4375 123.4375)
-1      | 0101000000000000000c05e400000000000c05e40 | POINT(123 123)
-2      | 01010000000000000000005e400000000000005e40 | POINT(120 120)
-3      | 0101000000000000000005840000000000005840 | POINT(96 96)
-4      | 0101000000000000000005840000000000005840 | POINT(96 96)
-5      | 0101000000000000000005840000000000005840 | POINT(96 96)
-6      | 0101000000000000000005840000000000005840 | POINT(96 96)
-7      | 0101000000000000000005840000000000005840 | POINT(96 96)
-8      | 0101000000000000000005840000000000005840 | POINT(96 96)
-9      | 0101000000000000000005840000000000005840 | POINT(96 96)
-10     | 0101000000000000000005840000000000005840 | POINT(96 96)
-11     | 0101000000000000000005840000000000005840 | POINT(96 96)
-12     | 0101000000000000000005840000000000005840 | POINT(96 96)
-13     | 0101000000000000000005840000000000005840 | POINT(96 96)
-14     | 0101000000000000000005840000000000005840 | POINT(96 96)
-15     | 0101000000000000000005840000000000005840 | POINT(96 96)
```

Ver también

ST_SnapToGrid

8.6.20 ST_RemovePoint

ST_RemovePoint — Eliminar el punto de una cadena de líneas.

Synopsis

geometry **ST_RemovePoint**(geometry linestring, integer offset);

Descripción

Elimine un punto de una cadena de línea, dado su índice basado en 0. Útil para convertir un anillo cerrado en una cadena de línea abierta

Disponibilidad: 1.1.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
--garantiza que ningún LINESTRINGs está cerrado
--quitando el punto final.  La siguiente asume que the_geom es de tipo LINESTRING
UPDATE sometable
        SET the_geom = ST_RemovePoint(the_geom, ST_NPoints(the_geom) - 1)
        FROM sometable
        WHERE ST_IsClosed(the_geom) = true;
```

Ver también

ST_AddPoint, ST_NPoints, ST_NumPoints

8.6.21 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(the_geom) as line, ST_AsText(ST_Reverse(the_geom)) As reverseline
FROM
(SELECT ST_MakeLine(ST_MakePoint(1,2),
                ST_MakePoint(1,10)) As the_geom) as foo;
--result
                line         |     reverseline
--------------------+---------------------
LINESTRING(1 2,1 10) | LINESTRING(1 10,1 2)
```

8.6.22 ST_Rotate

ST_Rotate — Gira una geometría rotRadians en sentido contrario a las manecillas del reloj sobre un origen.

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);

Descripción

Gira una geometría rotRadians en sentido contrario a las manecillas del reloj sobre un origen. El origen de la rotación se puede especificar ya sea como una geometría de punto, o como coordenadas x e y. Si no se especifica el origen, la geometría se gira sobre POINT(0 0).

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Mejorado: 2.0.0 se agregaron parámetros adicionales para especificar el origen de la rotación.

Disponibilidad: 1.1.2. Nombre cambiado de Rotate a ST_Rotate en 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).

Ejemplos

```
--Gira 180 grados
SELECT ST_AsEWKT(ST_Rotate('LINESTRING (50 160, 50 50, 100 50)', pi()));
               st_asewkt
---------------------------------------
 LINESTRING(-50 -160,-50 -50,-100 -50)
(1 row)

--Gira 30 grados en sentido contrario a las manecillas del reloj desde 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)

--Gira 60 grados a la derecha desde el centroide
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)
```

Ver también

ST_Affine, ST_RotateX, ST_RotateY, ST_RotateZ

8.6.23 ST_RotateX

ST_RotateX — Gira una geometría rotRadians sobre el eje X.

Synopsis

geometry **ST_RotateX**(geometry geomA, float rotRadians);

Descripción

Gira una geometría geomA - rotRadians sobre el eje X.

> **Note**
> `ST_RotateX(geomA, rotRadians)` es de acceso rápido para `ST_Affine(geomA, 1, 0, 0, 0, cos(rotRadians), -sin(rotRadians), 0, sin(rotRadians), cos(rotRadians), 0, 0, 0).`

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Disponibilidad: 1.1.2. El nombre cambió de RotateX a ST_RotateX en 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).

Ejemplos

```
--Gira una línea 90 grados a lo largo del eje x
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)
```

Ver también

ST_Affine, ST_RotateY, ST_RotateZ

8.6.24 ST_RotateY

ST_RotateY — Gira una geometría rotRadians sobre el eje Y.

Synopsis

geometry **ST_RotateY**(geometry geomA, float rotRadians);

Descripción

Gira una geometría geomA - rotRadians sobre el eje y.

> **Note**
> `ST_RotateY(geomA, rotRadians)` es el acceso rápido para `ST_Affine(geomA, cos(rotRadians), 0, sin(rotRadians), 0, 1, 0, -sin(rotRadians), 0, cos(rotRadians), 0, 0, 0).`

Disponibilidad: 1.1.2. El nombre cambió de RotateY a ST_RotateY en 1.2.2

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

 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).

Ejemplos

```
--Gira una línea 90 grados a lo largo del eje y
 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)
```

Ver también

ST_Affine, ST_RotateX, ST_RotateZ

8.6.25 ST_RotateZ

ST_RotateZ — Gira una geometría rotRadians sobre el eje Z.

Synopsis

geometry **ST_RotateZ**(geometry geomA, float rotRadians);

Descripción

Gira una geometría geomA - rotRadians sobre el eje Z.

Note
Este es un sinónimo de ST_Rotate

Note
`ST_RotateZ(geomA, rotRadians)` es el accero rápido para `SELECT ST_Affine(geomA, cos(rotRadians), -sin(rotRadians), 0, sin(rotRadians), cos(rotRadians), 0, 0, 0, 1, 0, 0, 0).`

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Disponibilidad: 1.1.2. El nombre cambió de RotateZ a ST_RotateZ en 1.2.2

Note
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 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).

Ejemplos

```
--Gira una línea 90 grados a lo largo del eje z
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)

 --Gira un círculo curvo alrededor del eje z
SELECT ST_AsEWKT(ST_RotateZ(the_geom, pi()/2))
FROM (SELECT ST_LineToCurve(ST_Buffer(ST_GeomFromText('POINT(234 567)'), 3)) As the_geom)  ↩
    As foo;



-------------------------------------------------------------------------------------------------------------

 CURVEPOLYGON(CIRCULARSTRING(-567 237,-564.87867965644 236.12132034356,-564  ↩
     234,-569.12132034356 231.87867965644,-567 237))
```

Ver también

ST_Affine, ST_RotateX, ST_RotateY

8.6.26 ST_Scale

ST_Scale — Escalar una geometría por factores dados.

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);

Descripción

Escala la geometría a un nuevo tamaño multiplicando las ordenadas con los parámetros de factor correspondientes.

La versión que toma una geometría como parámetro de `factor` permite pasar un punto 2d, 3dm, 3dz o 4d para definir el factor de escalado para todas las dimensiones soportadas. Las dimensiones que faltan en el punto `factor` es equivalente a no escalar la dimensión correspondiente.

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 multipled by the scale factor.

Note
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 1.3.4+

Disponibilidad: 1.1.0

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Mejorada: 2.2.0 se introdujo soporte para escalar todas las dimensiones (parámetro de geometría).

 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.

Ejemplos

```
--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)
```

Ver también

ST_Affine, ST_TransScale

8.6.27 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('LINESTR 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

8.6.28 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 comineza 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

```
--Cambiar el primer punto de la cadena de línea de -1 3 a -1 1
SELECT ST_AsText(ST_SetPoint('LINESTRING(-1 2,-1 3)', 0, 'POINT(-1 1)'));
           st_astext
-----------------------
 LINESTRING(-1 1,-1 3)

---Cambiar el último punto de una cadena de líneas (permite jugar con cadena de línea 3d  ↩
    esta vez)
SELECT ST_AsEWKT(ST_SetPoint(foo.the_geom, ST_NumPoints(foo.the_geom) - 1, ST_GeomFromEWKT ↩
    ('POINT(-1 1 3)')))
FROM (SELECT ST_GeomFromEWKT('LINESTRING(-1 2 3,-1 3 4, 5 6 7)') As the_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

8.6.29 ST_SetSRID

ST_SetSRID — Establezca el SRID en una geometría en un valor entero determinado.

Synopsis

geometry **ST_SetSRID**(geometry geom, integer srid);

Descripción

Establezca el SRID en una geometría en un valor entero determinado. Útil en la construcción de cuadros delimitadores para consultas.

Note
Esta función no transforma las coordenadas de geometría de ninguna manera-simplemente establece los metadatos que definen el sistema de referencia espacial en el que se supone que se encuentra la geometría. Utilice ST_Transform si desea transformar la geometría en una nueva proyección.

 This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1.

 This method supports Circular Strings and Curves

Ejemplos

-- Marca un punto como WGS 84 longitud latitud --

```
SELECT ST_SetSRID(ST_Point(-123.365556, 48.428611),4326) As wgs84long_lat;
-- la representation ewkt (envolver con ST_AsEWKT) -
SRID=4326;POINT(-123.365556 48.428611)
```

-- Marcar un punto como WGS 84 longitud latitud y luego transformar a web Mercator (Mercator esférico) --

```
SELECT ST_Transform(ST_SetSRID(ST_Point(-123.365556, 48.428611),4326),3785) As spere_merc;
-- la representation ewkt (envolver con ST_AsEWKT) -
SRID=3785;POINT(-13732990.8753491 6178458.96425423)
```

Ver también

Section 4.3.1, ST_AsEWKT, ST_Point, ST_SRID, ST_Transform, UpdateGeometrySRID

8.6.30 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

```
--Ajustar las geometrías a una cuadrícula de precisión 10^-3
UPDATE mytable
   SET the_geom = ST_SnapToGrid(the_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)
 --Ajustar una geometría 4d
SELECT ST_AsEWKT(ST_SnapToGrid(
        ST_GeomFromEWKT('LINESTRING(-1.1115678 2.123 2.3456 1.11111,
                4.111111 3.2374897 3.1234 1.1111, -1.11111112 2.123 2.3456 1.1111112)'),
 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)


--Con una geometría 4d - ST_SnapToGrid (geom,size) sólo toca las coordenadas x e y, pero ↩
    mantiene el mismo m y z
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

8.6.31 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

Ajusta los vértices y segmentos de una geometría a los vértices de otra geometría. Se utiliza una tolerancia de la distancia de ajuste para controlar dónde se realiza el ajuste. La geometría resultante es la geometría de entrada con los vértices ajustados. Si no se produce un ajuste, la geometría de entrada se devuelve sin cambios.

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).

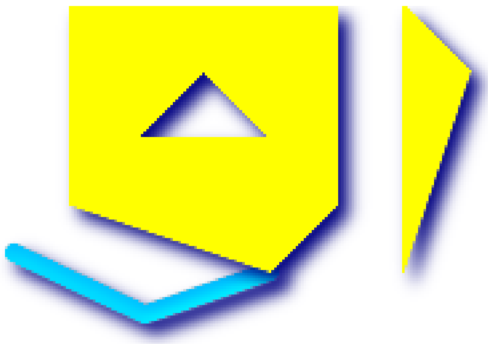
Un ajuste excesivo puede resultar en la creación de una topología no válida, por lo que el número y la ubicación de los vértices ajustados se deciden usando heurísticas para determinar cuándo es seguro ajustar. Sin embargo, esto puede resultar en que algunos potenciales ajustes se omitan.

Note
La geometría devuelta puede perder su simplicidad (ver ST_IsSimple) y su validez (ver ST_IsValid).

Disponibilidad: 2.0.0 requiere GEOS >= 3.3.0.

Ejemplos

Un multipolígono mostrado con una cadena de líneas (antes de cualquier ajuste)



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

```
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;

                             polysnapped
------------------------------------------------------------------------------------ ↩

 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)))
```

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

```
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;

polysnapped
---------------------------------------------------------------------------------

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)))
```

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

8.6.32 ST_Transform

ST_Transform — Devuelve una nueva geometría con sus coordenadas transformadas a una referencia espacial diferente.

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);

Descripción

Devuelve una nueva geometría con sus coordenadas transformadas en un sistema de referencia espacial diferente. La referencia espacial de destino `to_srid` puede identificarse mediante un parámetro de tipo entero SRID válido (es decir, debe existir en la tabla `spatial_ref_sys`). Alternativamente, se puede utilizar una referencia espacial definida como una cadena de PROJ.4 para `to_proj` y/o `from_proj`, sin embargo estos métodos no están optimizados. Si el sistema de referencia espacial de destino se expresa con una cadena de PROJ.4 en lugar de un SRID, el SRID de la geometría de salida se establecerá en cero. Con la excepción de funciones con `from_proj`, las geometrías de entrada deben tener un SRID definido.

ST_Transform se confunde a menudo con ST_SetSRID(). ST_Transform realmente cambia las coordenadas de una geometría de un sistema de referencia espacial a otro, mientras que ST_SetSRID() simplemente cambia el identificador SRID de la geometría.

Note
Requiere que PostGIS sea compilado con soporte de Proj. Utilice PostGIS_Full_Version para confirmar que ha compilado el soporte de proyectos.

Note
Si se utiliza más de una transformación, es útil disponer de un índice funcional sobre las transformaciones utilizadas comúnmente para aprovechar el uso del índice.

Note
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 1.3.4+

Mejorado: 2.0.0 soporte para superficies poliédricas fue introducida.

Mejorado: 2.3.0 se introdujo el soporte para el texto directo PROJ.4.

 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.

Ejemplos

Cambia la geometría en pies del plano del estado de Massachusetts de los Estados Unidos a WGS 84 longitud latitud

```
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)
```

```
--ejemplo de cadena circular 3D
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)
```

Ejemplo de creación de un índice funcional parcial. Para las tablas en las que no está seguro de que todas las geometrías se rellenan, es mejor utilizar un índice parcial que deja fuera las geometrías nulas por tanto ahorrar espacio y hacer su índice más pequeño y más eficiente.

```
CREATE INDEX idx_the_geom_26986_parcels
  ON parcels
  USING gist
  (ST_Transform(the_geom, 26986))
  WHERE the_geom IS NOT NULL;
```

Ejemplos de uso de texto PROJ.4 para transformar con referencias espaciales personalizadas.

```
-- Encuentre la intersección de dos polígonos cerca del Polo Norte, usando una proyección  ↩
    Gnomic personalizada
-- Ver 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) ↩
      )
```

Configuración del comportamiento de transformación

A veces, la transformación de coordenadas que implica un cambio de cuadrícula puede fallar, por ejemplo, si PROJ.4 no se ha construido con archivos de desplazamiento por cuadrícula o la coordenada no se encuentra dentro del intervalo para el que se define el desplazamiento de cuadrícula. De forma predeterminada, PostGIS lanzará un error si un archivo de cambio de cuadrícula no está presente, pero este comportamiento se puede configurar sobre una base pre-SRID, ya sea probando diferentes valores de `to_proj` del texto PROJ.4, o alterando el valor `proj4text` dentro de la tabla `spatial_ref_sys`.

Por ejemplo, el parámetro proj4text +datum=NAD87 es una forma abreviada para el parámetro +nadgrids siguiente:

```
+nadgrids=@conus,@alaska,@ntv2_0.gsb,@ntv1_can.dat
```

El prefijo @ significa que no se reporta ningún error si los archivos no están presentes, pero si se llega al final de la lista sin que el archivo haya sido apropiado (es decir, se encuentra y se superpone), se emite un error.

Si, por el contrario, quería asegurarse de que al menos los archivos estándar estaban presentes, pero que si todos los archivos fueron escaneados sin un éxito, una transformación nula se podría utilizar:

```
+nadgrids=@conus,@alaska,@ntv2_0.gsb,@ntv1_can.dat,null
```

El archivo de cambio de cuadrícula nulo es un archivo de desplazamiento de cuadrícula válido que cubre el mundo entero y no aplica ningún cambio. Así que para un ejemplo completo, si quería modificar PostGIS para que las transformaciones a SRID 4267 que no se encuentran dentro del rango correcto no lanzar un error, se utiliza lo siguiente:

```
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;
```

Ver también

PostGIS_Full_Version, ST_AsText, ST_SetSRID, UpdateGeometrySRID

8.6.33 ST_Translate

ST_Translate — Trasladar una geometría por desplazamientos dados.

Synopsis

geometry **ST_Translate**(geometry g1, float deltax, float deltay);
geometry **ST_Translate**(geometry g1, float deltax, float deltay, float deltaz);

Descripción

Devuelve una nueva geometría cuyas coordenadas se trasladan en las unidades Delta x, Delta y, Delta z. Las unidades se basan en las unidades definidas en la referencia espacial (SRID) para esta geometría.

Note
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 1.3.4+

Disponibilidad: 1.2.2

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves

Ejemplos

Mover un punto 1 grado de longitud

```
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)
```

Muever una cadena de línea 1 grados de longitud y 1/2 grado de latitud

```
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)
```

Mover un punto 3d

```
SELECT ST_AsEWKT(ST_Translate(CAST('POINT(0 0 0)' As geometry), 5, 12,3));
        st_asewkt
        ---------
        POINT(5 12 3)
```

Mover una curva y un punto

```
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))
```

Ver también

ST_Affine, ST_AsText, ST_GeomFromText

8.6.34 ST_TransScale

ST_TransScale — Traslada una geometría por factores y offsets dados.

Synopsis

geometry **ST_TransScale**(geometry geomA, float deltaX, float deltaY, float XFactor, float YFactor);

Descripción

Traslada la geometría usando los argumentos deltaX y deltaY y a continuación, lo escala utilizando los argumentos XFactor, YFactor, trabaja sólo en 2D.

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
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 1.3.4+

Disponibilidad: 1.1.0

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves

Ejemplos

```
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 de un punto para obtener una aproximación de un círculo, convertir a curva y, a  ↩
    continuación, trasladar a 1, 2 y escalar a 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))
```

Ver también

ST_Affine, ST_Translate

8.7 Geometry Outputs

8.7.1 ST_AsBinary

ST_AsBinary — Return the Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.

Synopsis

bytea **ST_AsBinary**(geometry g1);
bytea **ST_AsBinary**(geometry g1, text NDR_or_XDR);
bytea **ST_AsBinary**(geography g1);
bytea **ST_AsBinary**(geography g1, text NDR_or_XDR);

Descripción

Returns the Well-Known Binary representation of the geometry. There are 2 variants of the function. The first variant takes no endian encoding parameter and defaults to server machine endian. The second variant takes a second argument denoting the encoding - using little-endian ('NDR') or big-endian ('XDR') encoding.

This is useful in binary cursors to pull data out of the database without converting it to a string representation.

Note
The WKB spec does not include the SRID. To get the WKB with SRID format use ST_AsEWKB

Note
ST_AsBinary is the reverse of ST_GeomFromWKB for geometry. Use ST_GeomFromWKB to convert to a postgis geometry from ST_AsBinary representation.

Note
The default behavior in PostgreSQL 9.0 has been changed to output bytea in hex encoding. ST_AsBinary is the reverse of ST_GeomFromWKB for geometry. 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 OpenGIS 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

```
SELECT ST_AsBinary(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326));

                    st_asbinary
---------------------------------
\001\003\000\000\000\001\000\000\000\005
\000\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000
\000\000\000\360?\000\000\000\000\000\000
\360?\000\000\000\000\000\000\360?\000\000
\000\000\000\000\360?\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000
(1 row)
```

```
SELECT ST_AsBinary(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326), 'XDR');
                  st_asbinary
--------------------------------
\000\000\000\000\003\000\000\000\001\000\000\000\005\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000
\000?\360\000\000\000\000\000\000?\360\000\000\000\000\000\000?\360\000\000
\000\000\000\000?\360\000\000\000\000\000\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000
(1 row)
```

Ver también

ST_GeomFromWKB, ST_AsEWKB, ST_AsTWKB, ST_AsText,

8.7.2 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

8.7.3 ST_AsEWKB

ST_AsEWKB — Return the Well-Known Binary (WKB) representation of the geometry with SRID meta data.

Synopsis

bytea **ST_AsEWKB**(geometry g1);
bytea **ST_AsEWKB**(geometry g1, text NDR_or_XDR);

Descripción

Returns the Well-Known Binary representation of the geometry with SRID metadata. There are 2 variants of the function. The first variant takes no endian encoding parameter and defaults to little endian. The second variant takes a second argument denoting the encoding - using little-endian ('NDR') or big-endian ('XDR') encoding.

This is useful in binary cursors to pull data out of the database without converting it to a string representation.

Note
The WKB spec does not include the SRID. To get the OGC WKB format use ST_AsBinary

---

Note
ST_AsEWKB is the reverse of ST_GeomFromEWKB. Use ST_GeomFromEWKB to convert to a postgis geometry from ST_AsEWKB representation.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

 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_AsEWKB(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326));

                   st_asewkb
---------------------------------
\001\003\000\000 \346\020\000\000\001\000
\000\000\005\000\000\000\000
\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000
\000\000\360?\000\000\000\000\000\000\360?
\000\000\000\000\000\000\360?\000\000\000\000\000
\000\360?\000\000\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000\000\000\000
(1 row)
```

```
SELECT ST_AsEWKB(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326), 'XDR');
                   st_asewkb
---------------------------------
\000 \000\000\003\000\000\020\346\000\000\000\001\000\000\000\005\000\000\000\000\
000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000?
\360\000\000\000\000\000\000?\360\000\000\000\000\000\000?\360\000\000\000\000
\000\000?\360\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000
\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000\000
```

Ver también

ST_AsBinary, ST_AsEWKT, ST_AsText, ST_GeomFromEWKT, ST_SRID

8.7.4 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**(geography g1);

Descripción

Returns the Well-Known Text representation of the geometry prefixed with the SRID.

Note
The WKT spec does not include the SRID. To get the OGC WKT format use ST_AsText.

WKT format does not maintain precision so to prevent floating truncation, use ST_AsBinary or ST_AsEWKB format for transport.

Note
ST_AsEWKT is the reverse of ST_GeomFromEWKT. Use ST_GeomFromEWKT to convert to a postgis geometry from ST_AsEWKT representation.

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
                        0000000000000000000000000000000000000000000000000000
                        F03F000000000000F03F000000000000F03F000000000000F03
                        F0000000000000000000000000000000000000000000000000'::geometry);

                   st_asewkt
---------------------------------
SRID=4326;POLYGON((0 0,0 1,1 1,1 0,0 0))
(1 row)

SELECT ST_AsEWKT('0108000080030000000000000060 ↩
    E30A4100000000785C0241000000000000F03F0000000018
E20A4100000000485F024100000000000000400000000018
E20A4100000000305C0241000000000000840')

--st_asewkt---
CIRCULARSTRING(220268 150415 1,220227 150505 2,220227 150406 3)
```

Ver también

ST_AsBinary, ST_AsEWKB, ST_AsText, ST_GeomFromEWKT

8.7.5 ST_AsGeoJSON

ST_AsGeoJSON — Return the geometry as a GeoJSON element.

Synopsis

text **ST_AsGeoJSON**(geometry geom, integer maxdecimaldigits=15, integer options=0);
text **ST_AsGeoJSON**(geography geog, integer maxdecimaldigits=15, integer options=0);
text **ST_AsGeoJSON**(integer gj_version, geometry geom, integer maxdecimaldigits=15, integer options=0);
text **ST_AsGeoJSON**(integer gj_version, geography geog, integer maxdecimaldigits=15, integer options=0);

Descripción

Return the geometry as a Geometry Javascript Object Notation (GeoJSON) element. (Cf GeoJSON specifications 1.0). 2D and 3D Geometries are both supported. GeoJSON only support SFS 1.1 geometry type (no curve support for example).

The gj_version parameter is the major version of the GeoJSON spec. If specified, must be 1. This represents the spec version of GeoJSON.

The third argument may be used to reduce the maximum number of decimal places used in output (defaults to 15).

The last 'options' argument could be used to add Bbox or Crs in GeoJSON output:

- 0: means no option (default value)
- 1: GeoJSON Bbox
- 2: GeoJSON Short CRS (e.g EPSG:4326)
- 4: GeoJSON Long CRS (e.g urn:ogc:def:crs:EPSG::4326)

Version 1: ST_AsGeoJSON(geom) / maxdecimaldigits=15 version=1 options=0

Version 2: ST_AsGeoJSON(geom, maxdecimaldigits) / version=1 options=0

Version 3: ST_AsGeoJSON(geom, maxdecimaldigits, options) / version=1

Version 4: ST_AsGeoJSON(gj_version, geom) / maxdecimaldigits=15 options=0

Version 5: ST_AsGeoJSON(gj_version, geom, maxdecimaldigits) / options=0

Version 6: ST_AsGeoJSON(gj_version, geom, maxdecimaldigits, options)

Disponibilidad: 1.3.4

Availability: 1.5.0 geography support was introduced.

Changed: 2.0.0 support default args and named args.

 This function supports 3d and will not drop the z-index.

Ejemplos

GeoJSON format is generally more efficient than other formats for use in ajax mapping. One popular javascript client that supports this is Open Layers. Example of its use is OpenLayers GeoJSON Example

```
SELECT ST_AsGeoJSON(the_geom) from fe_edges limit 1;
                                                st_asgeojson
-----------------------------------------------------------------------------------------------------------


{"type":"MultiLineString","coordinates":[[[-89.734634999999997,31.492072000000000],
[-89.734955999999997,31.492237999999997]]]}
(1 row)
--3d point
SELECT ST_AsGeoJSON('LINESTRING(1 2 3, 4 5 6)');

st_asgeojson
-----------------------------------------------------------------------------------------
 {"type":"LineString","coordinates":[[1,2,3],[4,5,6]]}
```

8.7.6 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 **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).

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 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:polygonPatches>
   <gml:PolygonPatch>
                <gml:exterior>
                        <gml:LinearRing>
                                <gml:posList srsDimension="3">0 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 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

8.7.7 ST_AsHEXEWKB

ST_AsHEXEWKB — Returns a Geometry in HEXEWKB format (as text) using either little-endian (NDR) or big-endian (XDR) encoding.

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
                00000000000000000000000000000000
                000000000000000000000000000000000F03F
                00000000000F03F0000000000000F03F000000000000F03
                F000000000000000000000000000000000000000000000000000
```

8.7.8 ST_AsKML

ST_AsKML — Return the geometry as a KML element. Several variants. Default version=2, default maxdecimaldigits=15

Synopsis

text **ST_AsKML**(geometry geom, integer maxdecimaldigits=15);
text **ST_AsKML**(geography geog, integer maxdecimaldigits=15);
text **ST_AsKML**(integer version, geometry geom, integer maxdecimaldigits=15, text nprefix=NULL);
text **ST_AsKML**(integer version, geography geog, integer maxdecimaldigits=15, text nprefix=NULL);

Descripción

Return the geometry as a Keyhole Markup Language (KML) element. There are several variants of this function. maximum number of decimal places used in output (defaults to 15), version default to 2 and default namespace is no prefix.

Version 1: ST_AsKML(geom_or_geog, maxdecimaldigits) / version=2 / maxdecimaldigits=15

Version 2: ST_AsKML(version, geom_or_geog, maxdecimaldigits, nprefix) maxdecimaldigits=15 / nprefix=NULL

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. Default is no prefix

Note
Changed: 2.0.0 - uses default args and supports named args

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

8.7.9 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
```

8.7.10 ST_AsSVG

ST_AsSVG — Returns a Geometry in SVG path data given a geometry or geography object.

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(ST_GeomFromText('POLYGON((0 0,0 1,1 1,1 0,0 0))',4326));

                st_assvg
                --------
                M 0 0 L 0 -1 1 -1 1 0 Z
```

8.7.11 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 Well-Known Text representation of the geometry/geography. Optional argument may be used to reduce the maximum number of decimal digits after floating point used in output (defaults to 15).

Note
The WKT spec does not include the SRID. To get the SRID as part of the data, use the non-standard PostGIS ST_AsEWKT

WKT format does not maintain precision so to prevent floating truncation, use ST_AsBinary or ST_AsEWKB format for transport.

Note
ST_AsText is the reverse of ST_GeomFromText. Use ST_GeomFromText to convert to a postgis geometry from ST_AsText representation.

Availability: 1.5 - support for geography was introduced.

Enhanced: 2.5 - optional parameter precision introduced.

This method implements the OpenGIS 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

Ejemplos

```
SELECT ST_AsText('0103000000010000000500000000000000000000
0000000000000000000000000000000000000000000000000000
F03F000000000000F03F000000000000F03F000000000000F03
F000000000000000000000000000000000000000000000000000');

                   st_astext
---------------------------------
 POLYGON((0 0,0 1,1 1,1 0,0 0))
(1 row)
```

Providing the precision is optional.

```
SELECT ST_AsText(GeomFromEWKT('SRID=4326;POINT(111.1111111 1.1111111)'))
          st_astext
-----------------------------
 POINT(111.1111111 1.1111111)
(1 row)
```

```
SELECT ST_AsText(GeomFromEWKT('SRID=4326;POINT(111.1111111 1.1111111)'),2)
st_astext
--------------------
POINT(111.11 1.11)
(1 row)
```

Ver también

ST_AsBinary, ST_AsEWKB, ST_AsEWKT, ST_GeomFromText

8.7.12 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
-------------------------------------------
\x02000202020808
```

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

8.7.13 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 `maxdecimaldigits` (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 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>
```

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,
                0 1 0,
                1 1 0,
                0 0 0
            ))
            )')) As x3dfrag;

                x3dfrag
                --------
<IndexedTriangleSet  index='0 1 2 3 4 5'><Coordinate point='0 0 0 0 0 1 0 1 0 0 0 0 0 1 0 1 ↩
     1 0'/></IndexedTriangleSet>
```

Example: Closed multilinestring (the boundary of a polygon with holes)

```
SELECT ST_AsX3D(
                    ST_GeomFromEWKT('MULTILINESTRING((20 0 10,16 -12 10,0 -16 10,-12 -12  ↩
                        10,-20 0 10,-12 16 10,0 24 10,16 16 10,20 0 10),
  (12 0 10,8 8 10,0 12 10,-8 8 10,-8 0 10,-8 -4 10,0 -8 10,8 -4 10,12 0 10))')
) As x3dfrag;

                x3dfrag
                --------
<IndexedLineSet  coordIndex='0 1 2 3 4 5 6 7 0 -1 8 9 10 11 12 13 14 15 8'>
    <Coordinate point='20 0 10 16 -12 10 0 -16 10 -12 -12 10 -20 0 10 -12 16 10 0 24 10 16  ↩
        16 10 12 0 10 8 8 10 0 12 10 -8 8 10 -8 0 10 -8 -4 10 0 -8 10 8 -4 10 ' />
 </IndexedLineSet>
```

8.7.14 ST_GeoHash

ST_GeoHash — Return a GeoHash representation of the geometry.

Synopsis

text **ST_GeoHash**(geometry geom, integer maxchars=full_precision_of_point);

Descripción

Return a GeoHash representation (http://en.wikipedia.org/wiki/Geohash) of the geometry. A GeoHash encodes a point into a text form that is sortable and searchable based on prefixing. A shorter GeoHash is a less precise representation of a point. It can also be thought of as a box, that contains the actual point.

If no `maxchars` is specified ST_GeoHash returns a GeoHash based on full precision of the input geometry type. Points return a GeoHash with 20 characters of precision (about enough to hold the full double precision of the input). Other types return a GeoHash with a variable amount of precision, based on the size of the feature. Larger features are represented with less precision, smaller features with more precision. The idea is that the box implied by the GeoHash will always contain the input feature.

If `maxchars` is specified ST_GeoHash returns a GeoHash with at most that many characters so a possibly lower precision representation of the input geometry. For non-points, the starting point of the calculation is the center of the bounding box of the geometry.

Disponibilidad: 1.4.0

Note
ST_GeoHash will not work with geometries that are not in geographic (lon/lat) coordinates.

This method supports Circular Strings and Curves

Ejemplos

```
SELECT ST_GeoHash(ST_SetSRID(ST_MakePoint(-126,48),4326));

         st_geohash
----------------------
 c0w3hf1s70w3hf1s70w3

SELECT ST_GeoHash(ST_SetSRID(ST_MakePoint(-126,48),4326),5);

 st_geohash
------------
 c0w3h
```

Ver también

ST_GeomFromGeoHash

8.7.15 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=
```

8.7.16 ST_AsMVTGeom

ST_AsMVTGeom — Transform a geometry into the coordinate space of a Mapbox Vector Tile.

Synopsis

geometry **ST_AsMVTGeom**(geometry geom, box2d bounds, integer extent=4096, integer buffer=256, boolean clip_geom=true);

Descripción

Transform a geometry into the coordinate space of a Mapbox Vector Tile of a set of rows corresponding to a Layer. Makes best effort to keep and even correct validity and might collapse geometry into a lower dimension in the process.

`geom` is the geometry to transform.

`bounds` is the geometric bounds of the tile contents without buffer.

`extent` is the tile extent in tile coordinate space as defined by the specification. If NULL it will default to 4096.

`buffer` is the buffer distance in tile coordinate space to optionally clip geometries. If NULL it will default to 256.

`clip_geom` is a boolean to control if geometries should be clipped or encoded as is. If NULL it will default to true.

Availability: 2.4.0

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 4096,10 4091,5 4096)),((5 4096,0 4096,0 4101,5 4096)))
```

8.7.17 ST_AsMVT

ST_AsMVT — Return a Mapbox Vector Tile 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);

Descripción

Return a Mapbox Vector Tile representation of a set of rows corresponding to a Layer. Multiple calls can be concatenated to a tile with multiple Layers. Geometry is assumed to be in tile coordinate space and valid as per specification. Typically ST_AsMVTGeom can be used to transform geometry into tile coordinate space. Other row data will be encoded as attributes.

The Mapbox Vector Tile format can store features with a different set of attributes per feature. To make use of this feature supply a JSONB column in the row data containing Json objects one level deep. The keys and values in the object will be parsed into feature attributes.

Important
Do not call with a `GEOMETRYCOLLECTION` as an element in the row. However you can use ST_AsMVTGeom to prep a geometry collection for inclusion.

`row` row data with at least a geometry column.

`name` is the name of the Layer. If NULL it will use the string "default".

`extent` is the tile extent in screen space as defined by the specification. If NULL it will default to 4096.

`geom_name` is the name of the geometry column in the row data. If NULL it will default to the first found geometry column.

Enhanced: 2.5.0 - added support parallel query.

Availability: 2.4.0

Ejemplos

```
SELECT ST_AsMVT(q, 'test', 4096, 'geom') FROM (SELECT 1 AS c1,
    ST_AsMVTGeom(ST_GeomFromText('POLYGON ((35 10, 45 45, 15 40, 10 20, 35 10), (20 30, 35  ↩
        35, 30 20, 20 30))'),
    ST_MakeBox2D(ST_Point(0, 0), ST_Point(4096, 4096)), 4096, 0, false) AS geom) AS q;
                              st_asmvt
-----------------------------------------------------------------------
 \ ↩
     x1a320a0474657374121d120200001803221509 46ec3f1a14453b0a09280f091413121e09091e0f1a026331220228012
```

Ver también

ST_AsMVTGeom

8.8 Operadores

8.8.1 &&

&& — 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

|&>, &>, &<|, &<, ~, @

8.8.2 &&(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_MakePoint(1,1) && ST_MakeBox2D(ST_MakePoint(0,0), ST_MakePoint(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)

8.8.3 &&(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_MakePoint(0,0), ST_MakePoint(2,2)) && ST_MakePoint(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)

8.8.4 &&(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 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_MakePoint(0,0), ST_MakePoint(2,2)) && ST_MakeBox2D(ST_MakePoint(1,1) ↩
    , ST_MakePoint(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)

8.8.5 &&&

&&& — 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

&&

8.8.6 &&&(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)

8.8.7 &&&(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)

8.8.8 &&&(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)

8.8.9 &<

&< — 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

&&, |&>, &>, &<|

8.8.10 &<|

&<| — 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

&&, |&>, &>, &<

8.8.11 &>

&> — 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

&&, |&>, &<|, &<

8.8.12 <<

<< — 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

>>, |>>, <<|

8.8.13 <<|

<<| — 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

<<, >>, |>>

8.8.14 =

= — 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, ~=

8.8.15 >>

>> — 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

<<, |>>, <<|

8.8.16 @

@ — 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

~, &&

8.8.17 @(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 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(2 2)'), 1) @ ST_MakeBox2D(ST_MakePoint(0,0),  ↩
    ST_MakePoint(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)

8.8.18 @(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 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_MakePoint(2,2), ST_MakePoint(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)

8.8.19 @(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 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_MakePoint(2,2), ST_MakePoint(3,3)) @ ST_MakeBox2D(ST_MakePoint(0,0), ↩
     ST_MakePoint(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)

8.8.20 |&>

|&> — 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

&&, &>, &<|, &<

8.8.21 |>>

|>> — 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

<<, >>, <<|

8.8.22 ~

~ — 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

@, &&

8.8.23 ~(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_MakePoint(0,0),  ↩
    ST_MakePoint(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)

8.8.24 ~(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 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_MakePoint(0,0), ST_MakePoint(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)

8.8.25 ~(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_MakePoint(0,0), ST_MakePoint(5,5)) ~ ST_MakeBox2D(ST_MakePoint(2,2), ↩
     ST_MakePoint(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)

8.8.26 ~=

~= — 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, =

8.8.27 <->

<-> — 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 OpenGeo workshop: Nearest-Neighbour Searching for real live 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, <#>

8.8.28 |=|

|=| — 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 neightbor 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

8.8.29 <#>

<#> — 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, <->

8.8.30 <<->>

<<->> — 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

<<#>>, <->

8.8.31 <<#>>

<<#>> — 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

<<->>, <#>

8.9 Relaciones Espaciales y Mediciones

8.9.1 ST_3DClosestPoint

ST_3DClosestPoint — Returns the 3-dimensional 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

8.9.2 ST_3DDistance

ST_3DDistance — For geometry type Returns the 3-dimensional cartesian minimum distance (based on spatial ref) between two geometries in projected units.

Synopsis

float **ST_3DDistance**(geometry g1, geometry g2);

Descripción

For geometry type 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 ?

 This method is also provided by SFCGAL backend.

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_3DDistance(
                        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)
                ) As dist_3d,
                ST_Distance(
                        ST_Transform(ST_GeomFromText('POINT(-72.1235 42.3521)',4326),2163),
                        ST_Transform(ST_GeomFromText('LINESTRING(-72.1260 42.45, -72.123  ↩
                            42.1546)', 4326),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  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;
      dist3d       | dist2d
-------------------+--------
 0.716635696066337 |      0
```

Ver también

ST_Distance, ST_3DClosestPoint, ST_3DDWithin, ST_3DMaxDistance, ST_3DShortestLine, ST_Transform

8.9.3 ST_3DDWithin

ST_3DDWithin — For 3d (z) geometry type Returns true if two geometries 3d distance is within number of units.

Synopsis

boolean **ST_3DDWithin**(geometry g1, geometry g2, double precision distance_of_srid);

Descripción

For geometry type returns true if the 3d distance between two objects is within distance_of_srid specified 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 ?

Disponibilidad: 2.0.0

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_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
```

Ver también

ST_3DDistance, ST_Distance, ST_DWithin, ST_3DMaxDistance, ST_Transform

8.9.4 ST_3DDFullyWithin

ST_3DDFullyWithin — Returns true if all of the 3D geometries are within the specified distance of one another.

Synopsis

boolean **ST_3DDFullyWithin**(geometry g1, geometry g2, double precision distance);

Descripción

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 call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries.

Disponibilidad: 2.0.0


This function supports 3d and will not drop the z-index.


This function supports Polyhedral surfaces.

Ejemplos

```
-- 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
```

Ver también

ST_3DMaxDistance, ST_3DDWithin, ST_DWithin, ST_DFullyWithin

8.9.5 ST_3DIntersects

ST_3DIntersects — Returns TRUE if the Geometries "spatially intersect" in 3d - only for points, linestrings, polygons, polyhedral surface (area). With SFCGAL backend enabled also supports TINS

Synopsis

boolean **ST_3DIntersects**(geometry geomA , geometry geomB);

Descripción

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.

Disponibilidad: 2.0.0

Note
This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries.

Note
In order to take advantage of support for TINS, you need to enable the SFCGAL backend. This can be done at session time with: `set postgis.backend = sfcgal;` or at the database or system level. Database level can be done with `ALTER DATABASE gisdb SET postgis.backend = sfcgal;`.

 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 is also provided by SFCGAL backend.

 This method implements the SQL/MM specification. SQL-MM 3: ?

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

```
set postgis.backend = sfcgal;
SELECT ST_3DIntersects('TIN(((0 0,1 0,0 1,0 0)))'::geometry, 'POINT(.1 .1)'::geometry);
 st_3dintersects
-----------------
 t
```

Ver también

ST_Intersects

8.9.6 ST_3DLongestLine

ST_3DLongestLine — Returns the 3-dimensional 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 will only return the first longest line if more than one. 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_3DMaxDistance 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 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

8.9.7 ST_3DMaxDistance

ST_3DMaxDistance — For geometry type Returns the 3-dimensional cartesian maximum distance (based on spatial ref) between two geometries in projected units.

Synopsis

float **ST_3DMaxDistance**(geometry g1, geometry g2);

Descripción

For geometry type 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

8.9.8 ST_3DShortestLine

ST_3DShortestLine — Returns the 3-dimensional 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

8.9.9 ST_Area

ST_Area — Returns the area of the surface if it is a Polygon or MultiPolygon. For geometry, a 2D Cartesian area is determined with units specified by the SRID. For geography, area is determined on a curved surface with units in square meters.

Synopsis

float **ST_Area**(geometry g1);
float **ST_Area**(geography geog, boolean use_spheroid=true);

Descripción

Returns the area of the geometry if it is a Polygon or MultiPolygon. Return the area measurement of an ST_Surface or ST_MultiSurface value. For geometry, a 2D Cartesian area is determined with units specified by the SRID. For geography, by default area is determined on a spheroid with units in square meters. To measure around the faster but less accurate sphere, 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.

 This method implements the OpenGIS 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.

 This method is also provided by SFCGAL backend.

Ejemplos

Return area in square feet for a plot of Massachusetts land and multiply by conversion to get square meters. Note this is in square feet because EPSG:2249 is Massachusetts State Plane Feet

```
SELECT ST_Area(the_geom) As sqft, ST_Area(the_geom)*POWER(0.3048,2) As sqm
                FROM (SELECT
                ST_GeomFromText('POLYGON((743238 2967416,743238 2967450,
                        743265 2967450,743265.625 2967416,743238 2967416))',2249) ) As foo( ↩
                    the_geom);
  sqft    |     sqm
---------+-------------
 928.625 | 86.27208552
```

Return area square feet and transform to Massachusetts state plane meters (EPSG:26986) to get square meters. Note this is in square feet because 2249 is Massachusetts State Plane Feet and transformed area is in square meters since EPSG:26986 is state plane Massachusetts meters

```
SELECT ST_Area(the_geom) As sqft, ST_Area(ST_Transform(the_geom,26986)) As sqm
                FROM (SELECT
                ST_GeomFromText('POLYGON((743238 2967416,743238 2967450,
                        743265 2967450,743265.625 2967416,743238 2967416))',2249) ) As foo( ↩
                            the_geom);
  sqft    |       sqm
---------+------------------
 928.625 | 86.2724304199219
```

Return area square feet and square meters using geography data type. Note that we transform to our geometry to geography (before you can do that make sure your geometry is in WGS 84 long lat 4326). Geography always measures in meters. This is just for demonstration to compare. Normally your table will be stored in geography data type already.

```
SELECT ST_Area(the_geog)/POWER(0.3048,2) As sqft_spheroid,  ST_Area(the_geog,false)/POWER ↩
    (0.3048,2) As sqft_sphere, ST_Area(the_geog) As sqm_spheroid
                FROM (SELECT
                geography(
                ST_Transform(
                        ST_GeomFromText('POLYGON((743238 2967416,743238 2967450,743265  ↩
                            2967450,743265.625 2967416,743238 2967416))',
                                2249
                                ) ,4326
                        )
                )
        ) As foo(the_geog);
  sqft_spheroid    |   sqft_sphere    |   sqm_spheroid
-------------------+------------------+------------------
 928.684403538925 | 927.049336105925 | 86.2776042893529

 --if your data is in geography already
 SELECT ST_Area(the_geog)/POWER(0.3048,2) As  sqft, ST_Area(the_geog) As sqm
        FROM somegeogtable;
```

Ver también

ST_GeomFromText, ST_GeographyFromText, ST_SetSRID, ST_Transform

8.9.10 ST_Azimuth

ST_Azimuth — Returns the north-based azimuth as the angle in radians measured clockwise from the vertical on pointA to pointB.

Synopsis

float **ST_Azimuth**(geometry pointA, geometry pointB);
float **ST_Azimuth**(geography pointA, geography pointB);

Descripción

Returns the azimuth in radians of the segment defined by the given point geometries, or NULL if the two points are coincident. The azimuth is angle is referenced from north, and is positive clockwise: North = 0; East = $\pi/2$; South = π; West = $3\pi/2$.

For the geography type, the forward azimuth is solved as part of the inverse geodesic problem.

The azimuth is mathematical concept defined as the angle between a reference plane and a point, with angular units in radians. Units can be converted to degrees using a built-in PostgreSQL function degrees(), as shown in the example.

Disponibilidad: 1.1.0

Enhanced: 2.0.0 support for geography was introduced.

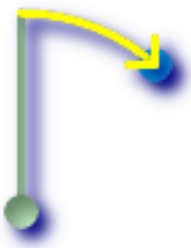
Enhanced: 2.2.0 measurement on spheroid performed with GeographicLib for improved accuracy and robustness. Requires Proj >= 4.9.0 to take advantage of the new feature.

Azimuth is especially useful in conjunction with ST_Translate for shifting an object along its perpendicular axis. See upgis_lineshift Plpgsqlfunctions PostGIS wiki section for example of this.

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
```



Green: the start Point(25,45) with its vertical. Yellow: degA_B as the path to travel (azimuth).

Green: the start Point(75,100) with its vertical. Yellow: degB_A as the path to travel (azimuth).

Ver también

ST_Point, ST_Translate, ST_Project, PostgreSQL Math Functions

8.9.11 ST_Angle

ST_Angle — Returns the angle between 3 points, or between 2 vectors (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

For 3 points, computes the angle measured clockwise of P1P2P3. If input are 2 lines, get first and last point of the lines as 4 points. For 4 points,compute the angle measured clockwise of P1P2,P3P4. Results are always positive, between 0 and 2*Pi radians. Uses azimuth of pairs or points.

ST_Angle(P1,P2,P3) = ST_Angle(P2,P1,P2,P3)

Result is in radian and can be converted to degrees using a built-in PostgreSQL function degrees(), as shown in the example.

Availability: 2.5.0

Ejemplos

Geometry Azimuth in degrees

```
WITH rand AS (
                SELECT s, random() * 2 * PI() AS rad1
                        , random() * 2 * PI() AS rad2
                FROM  generate_series(1,2,2) AS s
        )
         , points AS (
                SELECT s, rad1,rad2, ST_MakePoint(cos1+s,sin1+s) as p1, ST_MakePoint(s,s)  ↩
                    AS p2, ST_MakePoint(cos2+s,sin2+s) as p3
                FROM rand
                        ,cos(rad1) cos1, sin(rad1) sin1
                        ,cos(rad2) cos2, sin(rad2) sin2
        )
        SELECT s, ST_AsText(ST_SnapToGrid(ST_MakeLine(ARRAY[p1,p2,p3]),0.001)) AS line
                , degrees(ST_Angle(p1,p2,p3)) as computed_angle
                , round(degrees(2*PI()-rad2 -2*PI()+rad1+2*PI()))::int%360 AS reference
                , round(degrees(2*PI()-rad2 -2*PI()+rad1+2*PI()))::int%360 AS reference
        FROM points ;

1 | line |~computed_angle |~reference
------------------+------------------
1 | LINESTRING(1.511 1.86,1 1,0.896 0.005) | 155.27033848688 | 155
```

8.9.12 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 the geometric center of a geometry, or equivalently, the center of mass of the geometry as a POINT. For [MULTI]POINTs, this is computed as the arithmetic mean of the input coordinates. For [MULTI]LINESTRINGs, this is computed as the weighted length of each line segment. For [MULTI]POLYGONs, "weight" is thought 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 wtih CurveToLine first, then same than for LINESTRING

New in 2.3.0 : support CIRCULARSTRING and COMPOUNDCURVE (using CurveToLine)

Availability: 2.4.0 support for geography was introduced.

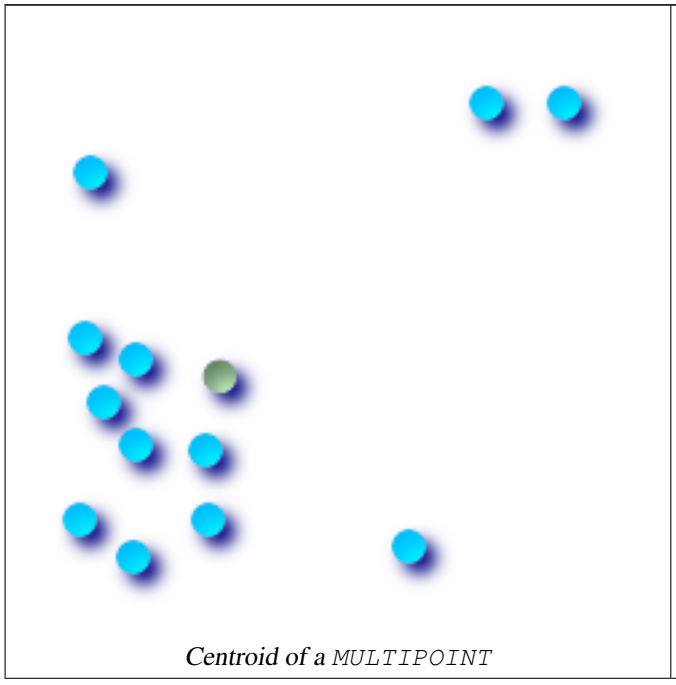
The centroid is equal to the centroid of the set of component Geometries of highest dimension (since the lower-dimension geometries contribute zero "weight" to the centroid).

 This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1.

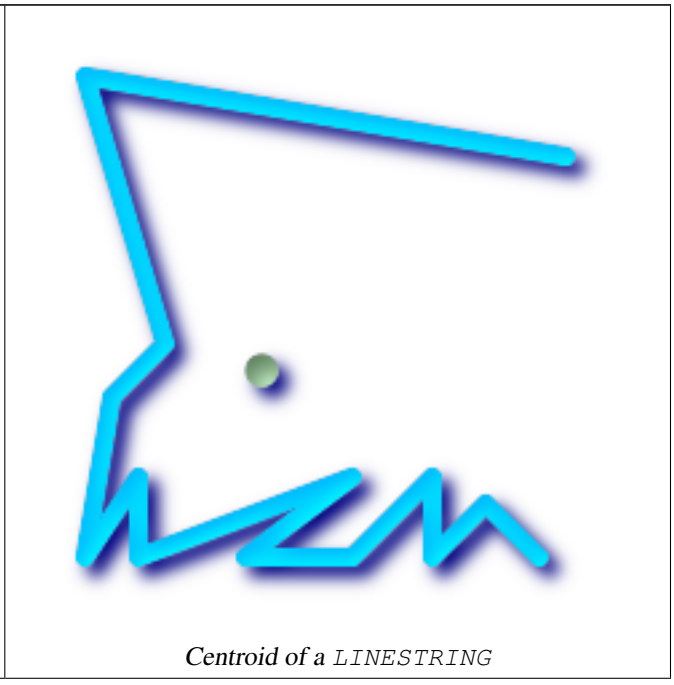
 This method implements the SQL/MM specification. SQL-MM 3: 8.1.4, 9.5.5

Ejemplos

In each of the following illustrations, the green dot represents the centroid of the source geometry.



Centroid of a MULTIPOINT



Centroid of a LINESTRING

Centroid of a `POLYGON`

Centroid of a `GEOMETRYCOLLECTION`

```
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

8.9.13 ST_ClosestPoint

ST_ClosestPoint — Returns the 2-dimensional point on g1 that is closest to g2. This is the first point of the shortest line.

Synopsis

geometry **ST_ClosestPoint**(geometry g1, geometry g2);

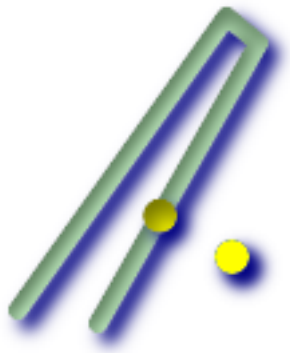
Descripción

Returns the 2-dimensional point on g1 that is closest to g2. This is the first point of the shortest line.

Note
If you have a 3D Geometry, you may prefer to use ST_3DClosestPoint.

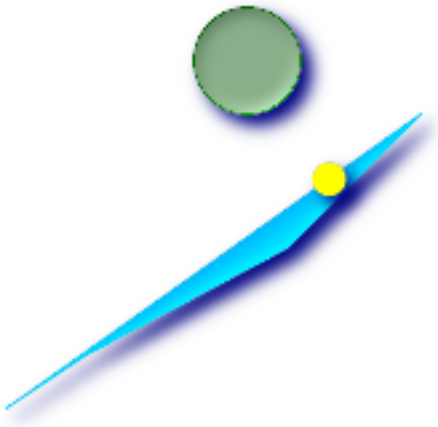
Disponibilidad: 1.5.0

Ejemplos



Closest between point and linestring is the point itself, but closest point between a linestring and point is the point on line string that is closest.

```
SELECT ST_AsText(ST_ClosestPoint(pt,line) ↩
    ) AS cp_pt_line,
        ST_AsText(ST_ClosestPoint(line,pt ↩
    )) As cp_line_pt
FROM (SELECT 'POINT(100 100)'::geometry  ↩
    As pt,
                'LINESTRING (20 80, 98  ↩
    190, 110 180, 50 75 )'::geometry As line
        ) As foo;


   cp_pt_line    |                 ↩
    cp_line_pt
-----------------+-----------------------------
 POINT(100 100) | POINT(73.0769230769231  ↩
    115.384615384615)
```



closest point on polygon A to polygon B

```
SELECT ST_AsText(
                ST_ClosestPoint(
                        ST_GeomFromText(' ↩
    POLYGON((175 150, 20 40, 50 60, 125 100, 175 150
                        ST_Buffer( ↩
    ST_GeomFromText('POINT(110 170)'), 20)
                        )
                ) As ptwkt;

                  ptwkt
------------------------------------------ ↩

 POINT(140.752120669087 125.695053378061)
```

Ver también

ST_3DClosestPoint,ST_Distance, ST_LongestLine, ST_ShortestLine, ST_MaxDistance

8.9.14 ST_ClusterDBSCAN

ST_ClusterDBSCAN — Windowing function that returns integer id for the cluster each input geometry is in based on 2D implementation of Density-based spatial clustering of applications with noise (DBSCAN) algorithm.

Synopsis

integer **ST_ClusterDBSCAN**(geometry winset geom, float8 eps, integer minpoints);

Descripción

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.

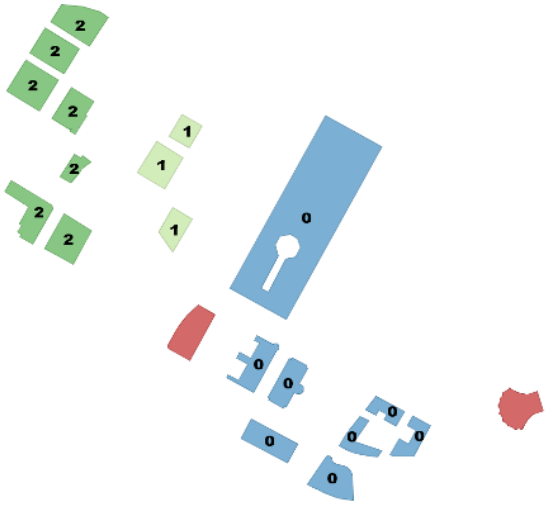
Note that border geometries may be within `eps` distance of core geometries in more than one cluster; in this case, either assignment would be correct, and the border geometry will be arbitrarily asssigned to one of the available clusters. In these cases, it is possible for a correct cluster to be generated 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.

Disponibilidad: 2.3.0 - requiere GEOS

Ejemplos

Assigning a cluster number to each polygon within 50 meters of each other. Require at least 2 polygons per cluster



within 50 meters at least 2 per cluster. singletons have NULL for cid

```
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);
```

```
                name                   |  ↩
   bucket
--------------------------------------+-------- ↩

 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)
```

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;
```

Ver también

ST_DWithin, ST_ClusterKMeans, ST_ClusterIntersecting, ST_ClusterWithin

8.9.15 ST_ClusterIntersecting

ST_ClusterIntersecting — Aggregate. Returns an array with the connected components of a set of geometries

Synopsis

geometry[] **ST_ClusterIntersecting**(geometry set g);

Descripción

ST_ClusterIntersecting is an aggregate function that returns an array of GeometryCollections, where each GeometryCollection represents an interconnected set of geometries.

Disponibilidad: 2.2.0 - requiere GEOS

Ejemplos

```
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))
```

Ver también

ST_ClusterDBSCAN, ST_ClusterKMeans, ST_ClusterWithin

8.9.16 ST_ClusterKMeans

ST_ClusterKMeans — Windowing function that returns integer id for the cluster each input geometry is in.

Synopsis

integer **ST_ClusterKMeans**(geometry winset geom, integer number_of_clusters);

Descripción

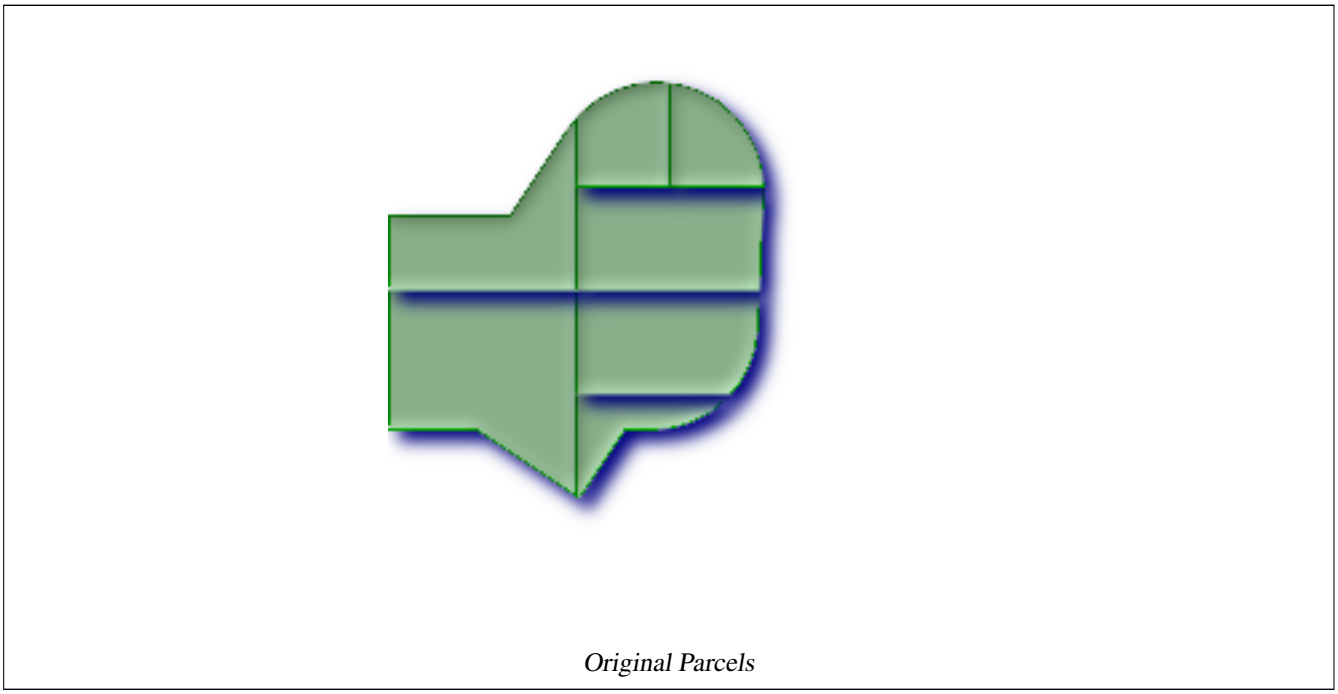
Returns 2D distance based k-means cluster number for each input geometry. The distance used for clustering is the distance between the centroids of the geometries.

Disponibilidad: 2.3.0 - requiere GEOS

Ejemplos

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('LINESTRING(40 100, 98 100, 100 150, 60 90)'::geometry,
    40, 'endcap=square'),12) As geom;
```



Original Parcels

```
-- Partitioning parcel clusters by type
SELECT ST_ClusterKMeans(geom,3) over (PARTITION BY type) AS cid, parcel_id, type
FROM parcels;
-- result
 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
(7 rows)
```

Ver también

ST_ClusterDBSCAN, ST_ClusterIntersecting, ST_ClusterWithin, ST_Subdivide

8.9.17 ST_ClusterWithin

ST_ClusterWithin — Aggregate. Returns an array of GeometryCollections, where each GeometryCollection represents a set of geometries separated by no more than the specified distance.

Synopsis

geometry[] **ST_ClusterWithin**(geometry set g, float8 distance);

Descripción

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.)

Disponibilidad: 2.2.0 - requiere GEOS

Ejemplos

```
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))
```

Ver también

ST_ClusterDBSCAN, ST_ClusterKMeans, ST_ClusterIntersecting

8.9.18 ST_Contains

ST_Contains — Returns true 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.

Synopsis

boolean **ST_Contains**(geometry geomA, geometry geomB);

Descripción

Geometry A contains Geometry 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. An important subtlety of this definition is that A does not contain its boundary, but A does contain itself. Contrast that to ST_ContainsProperly where geometry A does not Contain Properly itself.

Returns TRUE if geometry B is completely inside geometry A. For this function to make sense, the source geometries must both be of the same coordinate projection, having the same SRID. ST_Contains is the inverse of ST_Within. So ST_Contains(A,B) implies ST_Within(B,A) except in the case of invalid geometries where the result is always false regardless or not defined.

Realizado por el módulo de GEOS

Enhanced: 2.3.0 Enhancement to PIP short-circuit extended to support MultiPoints with few points. Prior versions only supported point in polygon.

Important
Do not call with a `GEOMETRYCOLLECTION` as an argument

Important
Do not use this function with invalid geometries. You will get unexpected results.

This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid index use, use the function _ST_Contains.

NOTE: this is the "allowable" version that returns a boolean, not an integer.

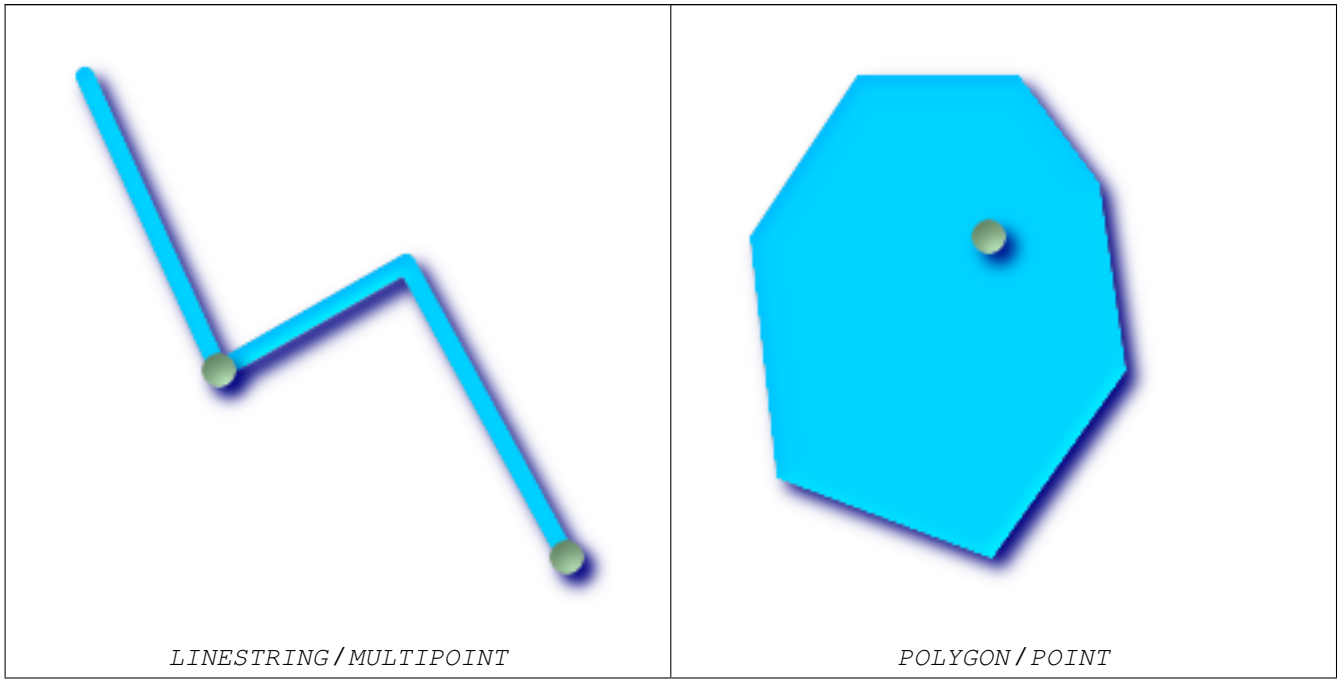
This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1. s2.1.1.2 // s2.1.13.3 - same as within(geometry B, geometry A)

This method implements the SQL/MM specification. SQL-MM 3: 5.1.31

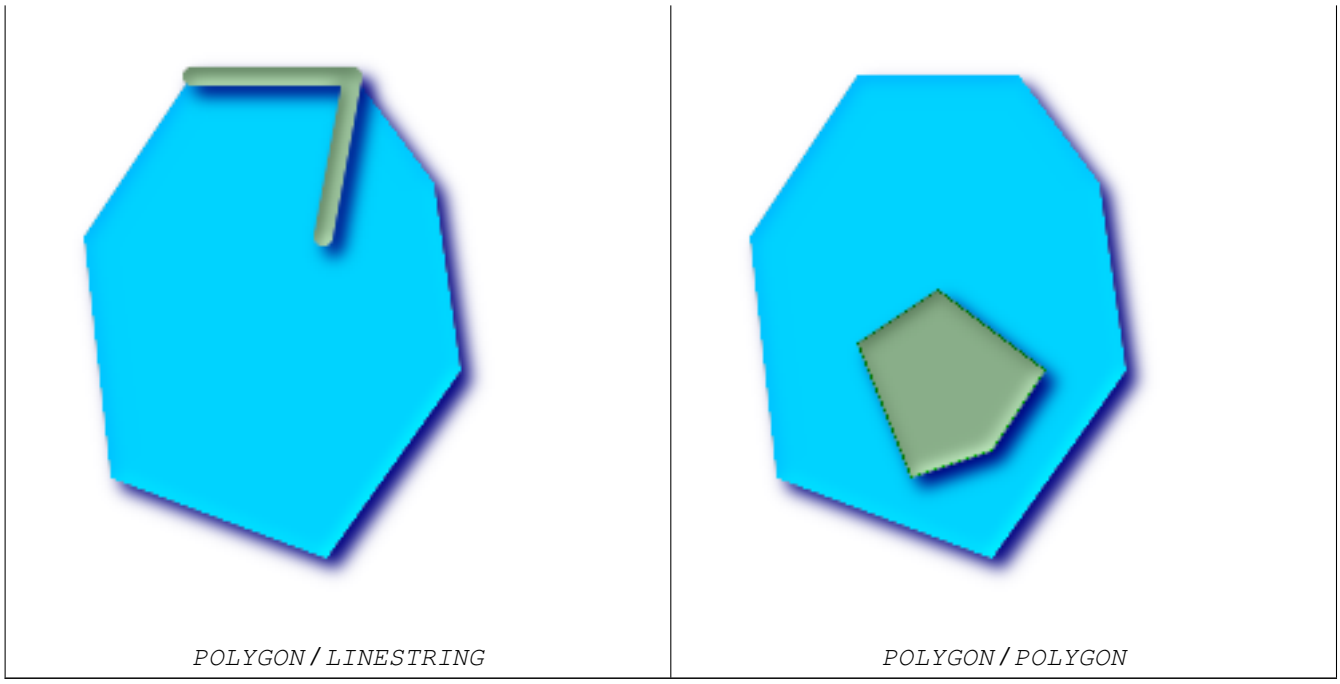
There are certain subtleties to ST_Contains and ST_Within that are not intuitively obvious. For details check out Subtleties of OGC Covers, Contains, Within

Ejemplos

The `ST_Contains` predicate returns `TRUE` in all the following illustrations.

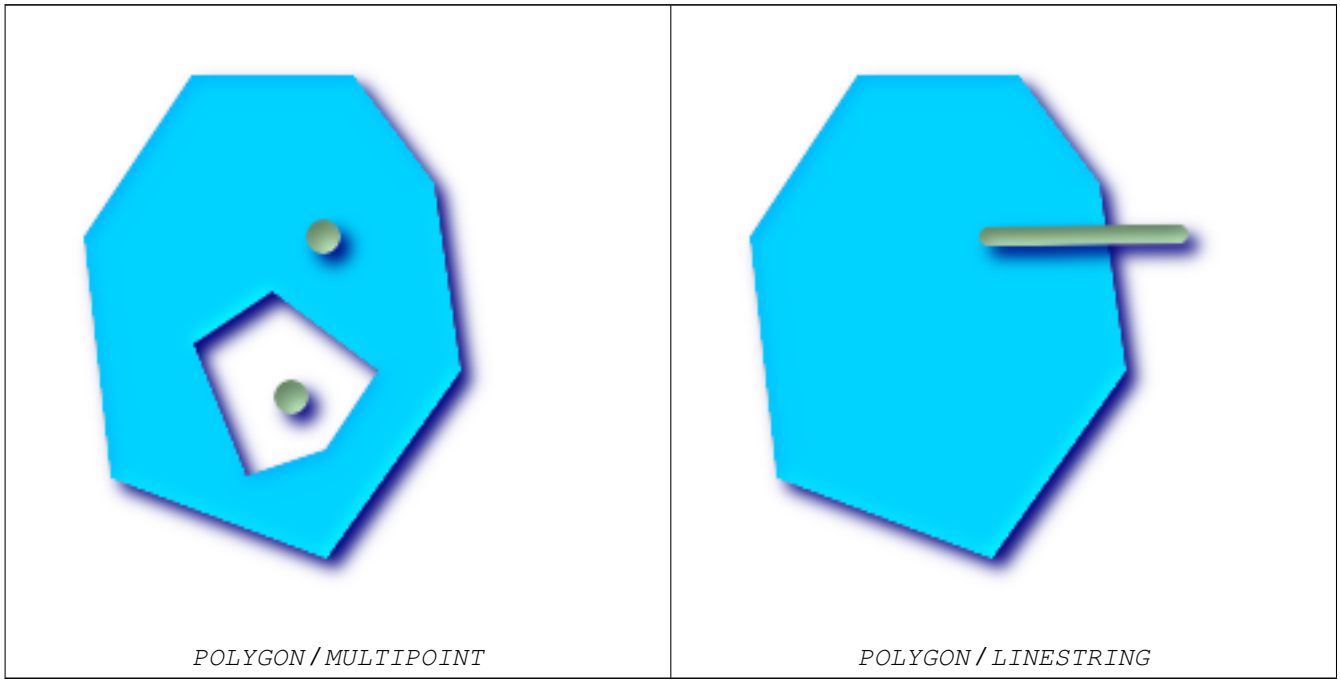


LINESTRING / MULTIPOINT | *POLYGON / POINT*



POLYGON/LINESTRING | *POLYGON/POLYGON*

The `ST_Contains` predicate returns `FALSE` in all the following illustrations.



POLYGON/MULTIPOINT | *POLYGON/LINESTRING*

```
-- 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
```

Ver también

ST_Boundary, ST_ContainsProperly, ST_Covers, ST_CoveredBy, ST_Equals, ST_Within

8.9.19 ST_ContainsProperly

ST_ContainsProperly — Returns true if B intersects the interior of A but not the boundary (or exterior). A does not contain properly itself, but does contain itself.

Synopsis

boolean **ST_ContainsProperly**(geometry geomA, geometry geomB);

Descripción

Returns true if B intersects the interior of A but not the boundary (or exterior).

A does not contain properly 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

Note
From JTS docs slightly reworded: The advantage to using this predicate over ST_Contains and ST_Intersects is that it can be computed efficiently, with no need to compute topology at individual points.
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.

Disponibilidad: 1.4.0 - requiere GEOS >=3.1.0.

Important
Do not call with a GEOMETRYCOLLECTION as an argument

Important
Do not use this function with invalid geometries. You will get unexpected results.

This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid index use, use the function _ST_ContainsProperly.

Ejemplos

```
--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          | 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
```

Ver también

ST_GeometryType, ST_Boundary, ST_Contains, ST_Covers, ST_CoveredBy, ST_Equals, ST_Relate, ST_Within

8.9.20 ST_Covers

ST_Covers — Returns 1 (TRUE) if no point in Geometry B is outside Geometry A

Synopsis

boolean **ST_Covers**(geometry geomA, geometry geomB);
boolean **ST_Covers**(geography geogpolyA, geography geogpointB);

Descripción

Returns 1 (TRUE) if no point in Geometry/Geography B is outside Geometry/Geography A

Realizado por el módulo de GEOS

Important
Do not call with a `GEOMETRYCOLLECTION` as an argument

Important
Do not use this function with invalid geometries. You will get unexpected results.

This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid index use, use the function _ST_Covers.

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.

Disponibilidad: 1.2.2 - requiere GEOS >= 3.0

NOTE: this is the "allowable" version that returns a boolean, not an integer.

Not an OGC standard, but Oracle has it too.

There are certain subtleties to ST_Contains and ST_Within that are not intuitively obvious. For details check out Subtleties of OGC Covers, Contains, Within

Ejemplos

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)
```

Geeography 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
```

Ver también

ST_Contains, ST_CoveredBy, ST_Within

8.9.21 ST_CoveredBy

ST_CoveredBy — Returns 1 (TRUE) if no point in Geometry/Geography A is outside Geometry/Geography B

Synopsis

boolean **ST_CoveredBy**(geometry geomA, geometry geomB);
boolean **ST_CoveredBy**(geography geogA, geography geogB);

Descripción

Returns 1 (TRUE) if no point in Geometry/Geography A is outside Geometry/Geography B

Realizado por el módulo de GEOS

Important
Do not call with a `GEOMETRYCOLLECTION` as an argument

Important
Do not use this function with invalid geometries. You will get unexpected results.

Disponibilidad: 1.2.2 - requiere GEOS >= 3.0

This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid index use, use the function _ST_CoveredBy.

NOTE: this is the "allowable" version that returns a boolean, not an integer.

Not an OGC standard, but Oracle has it too.

There are certain subtleties to ST_Contains and ST_Within that are not intuitively obvious. For details check out Subtleties of OGC Covers, Contains, Within

Ejemplos

```
--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)
```

Ver también

ST_Contains, ST_Covers, ST_ExteriorRing, ST_Within

8.9.22 ST_Crosses

ST_Crosses — Returns TRUE if the supplied geometries have some, but not all, interior points in common.

Synopsis

boolean **ST_Crosses**(geometry g1, geometry g2);

Descripción

ST_Crosses takes 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 not be the empty set and must have a dimensionality 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 expressed as:

$$a.Crosses(b) \Leftrightarrow (dim(I(a) \cap I(b)) < max(dim(I(a)), dim(I(b)))) \wedge (a \cap b \neq a) \wedge (a \cap b \neq b)$$

The DE-9IM Intersection Matrix for the two geometries is:

- 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 any other combination of dimensions 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.

Important
Do not call with a GEOMETRYCOLLECTION as an argument

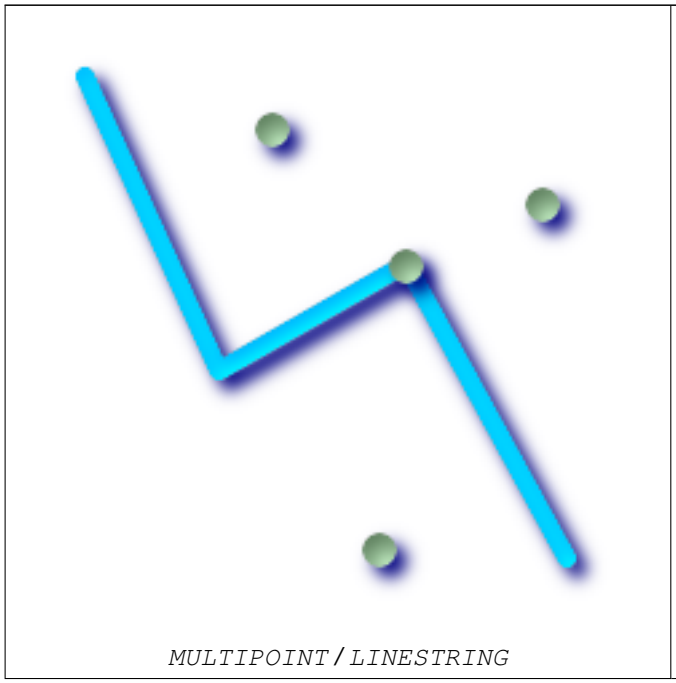
Note
This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries.

This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1. s2.1.13.3

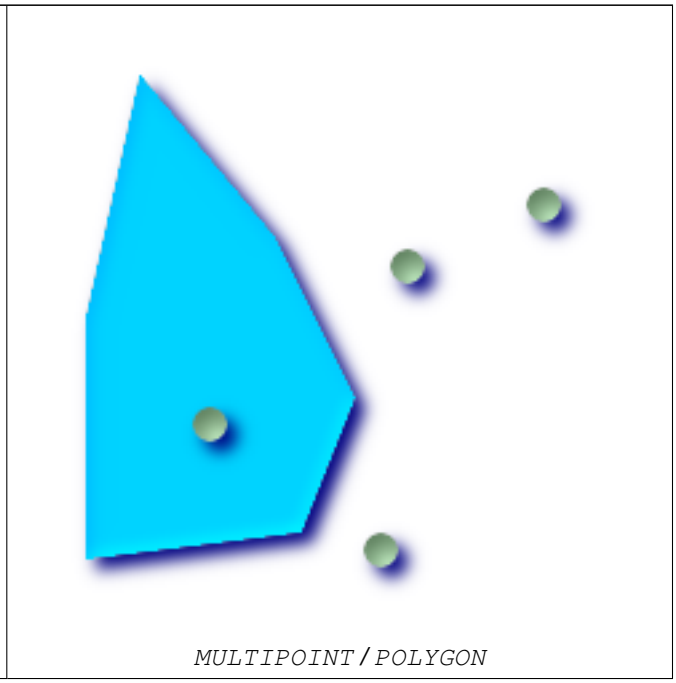
This method implements the SQL/MM specification. SQL-MM 3: 5.1.29

Ejemplos

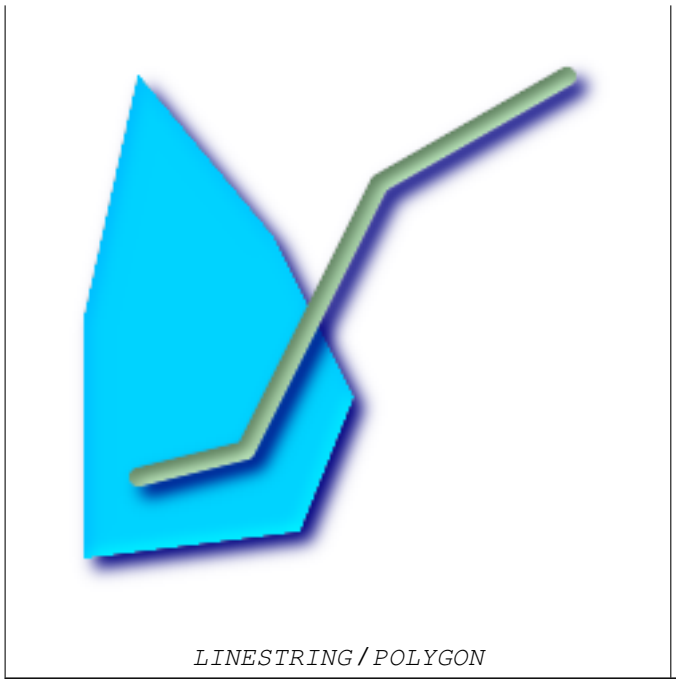
The following illustrations all return `TRUE`.



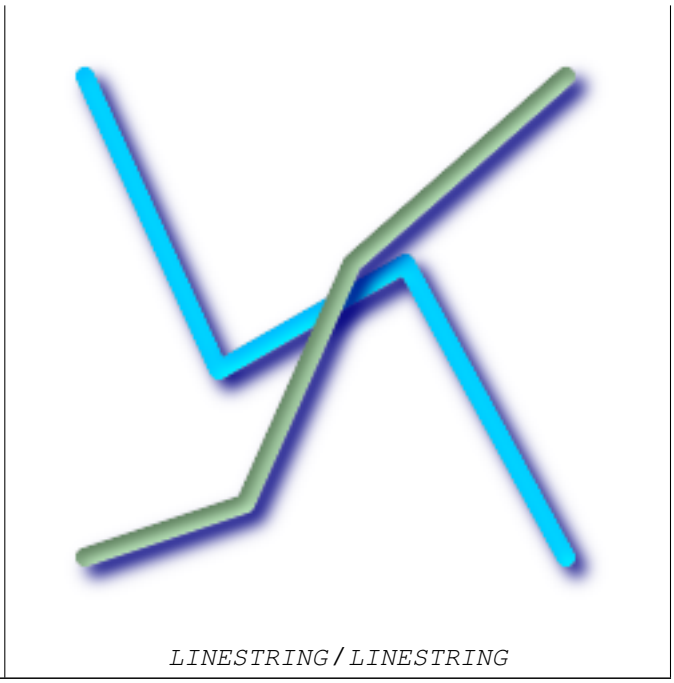
MULTIPOINT / LINESTRING



MULTIPOINT / POLYGON



LINESTRING/POLYGON



LINESTRING/LINESTRING

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,
  the_geom geometry,
  CONSTRAINT roads_pkey PRIMARY KEY ( ↩
    road_id)
);
```

```
CREATE TABLE highways (
  id serial NOT NULL,
  the_gem geometry,
  CONSTRAINT roads_pkey PRIMARY KEY ( ↩
    road_id)
);
```

To determine a list of roads that cross a highway, use a query similiar to:

```
SELECT roads.id
FROM roads, highways
WHERE ST_Crosses(roads.the_geom, highways.the_geom);
```

8.9.23 ST_LineCrossingDirection

ST_LineCrossingDirection — Given 2 linestrings, returns a number between -3 and 3 denoting what kind of crossing behavior. 0 is no crossing.

Synopsis

integer **ST_LineCrossingDirection**(geometry linestringA, geometry linestringB);

Descripción

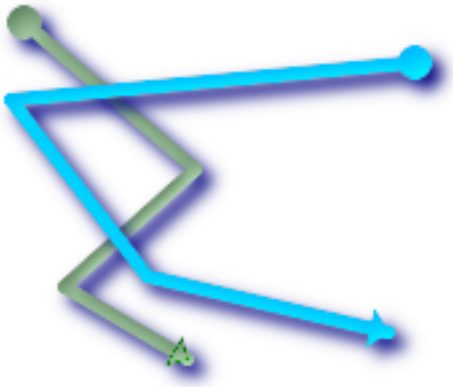
Given 2 linestrings, returns a number between -3 and 3 denoting what kind of crossing behavior. 0 is no crossing. This is only supported for `LINESTRING`

Definition of integer constants is as follows:

- 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

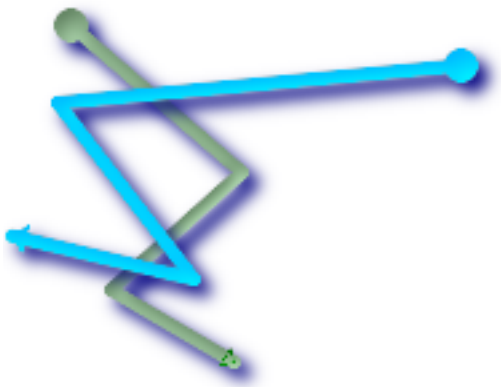
Disponibilidad: 1.4

Ejemplos



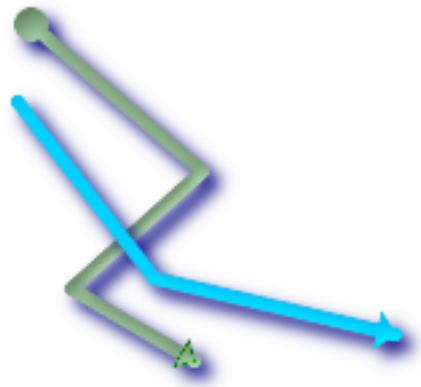
Line 1 (green), Line 2 ball is start point, triangle are end points. Query below.

```
SELECT ST_LineCrossingDirection(foo.line1 ↩
    , foo.line2) As l1_cross_l2 ,
           ST_LineCrossingDirection(foo. ↩
    line2, foo.line1) As l2_cross_l1
FROM (
SELECT
 ST_GeomFromText('LINESTRING(25 169,89  ↩
    114,40 70,86 43)') As line1,
 ST_GeomFromText('LINESTRING(171 154,20  ↩
    140,71 74,161 53)') As line2
        ) As foo;

 l1_cross_l2 | l2_cross_l1
-------------+-------------
           3 |          -3
```



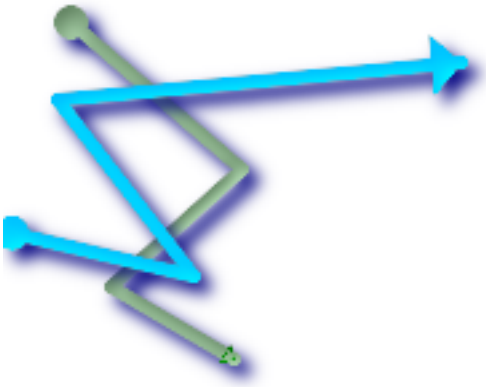
Line 1 (green), Line 2 (blue) ball is start point, triangle are end points. Query below.

```
SELECT ST_LineCrossingDirection(foo.line1 ↩
    , foo.line2) As l1_cross_l2 ,
           ST_LineCrossingDirection(foo. ↩
    line2, foo.line1) As l2_cross_l1
FROM (
 SELECT
  ST_GeomFromText('LINESTRING(25 169,89  ↩
    114,40 70,86 43)') As line1,
  ST_GeomFromText('LINESTRING (171 154,  ↩
    20 140, 71 74, 2.99 90.16)') As line2
) As foo;

 l1_cross_l2 | l2_cross_l1
-------------+-------------
           2 |          -2
```



Line 1 (green), Line 2 (blue) ball is start point, triangle are end points. Query below.

```
SELECT
        ST_LineCrossingDirection(foo. ↩
    line1, foo.line2) As l1_cross_l2 ,
        ST_LineCrossingDirection(foo. ↩
    line2, foo.line1) As l2_cross_l1
FROM (
 SELECT
  ST_GeomFromText('LINESTRING(25 169,89  ↩
    114,40 70,86 43)') As line1,
  ST_GeomFromText('LINESTRING (20 140, 71 ↩
     74, 161 53)') As line2
  ) As foo;

 l1_cross_l2 | l2_cross_l1
-------------+-------------
          -1 |           1
```



Line 1 (green), Line 2 (blue) ball is start point, triangle are end points. Query below.

```
SELECT ST_LineCrossingDirection(foo.line1 ↩
    , foo.line2) As l1_cross_l2 ,
        ST_LineCrossingDirection(foo. ↩
    line2, foo.line1) As l2_cross_l1
FROM (SELECT
        ST_GeomFromText('LINESTRING(25  ↩
    169,89 114,40 70,86 43)') As line1,
        ST_GeomFromText('LINESTRING(2.99  ↩
    90.16,71 74,20 140,171 154)') As line2
        ) As foo;

 l1_cross_l2 | l2_cross_l1
-------------+-------------
          -2 |           2
```

```
SELECT s1.gid, s2.gid, ST_LineCrossingDirection(s1.the_geom, s2.the_geom)
        FROM streets s1 CROSS JOIN streets s2 ON (s1.gid != s2.gid AND s1.the_geom && s2. ↩
            the_geom )
WHERE ST_CrossingDirection(s1.the_geom, s2.the_geom) > 0;
```

Ver también

ST_Crosses

8.9.24 ST_Disjoint

ST_Disjoint — Returns TRUE if the Geometries do not "spatially intersect" - if they do not share any space together.

Synopsis

boolean **ST_Disjoint**(geometry A , geometry B);

Descripción

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
Do not call with a `GEOMETRYCOLLECTION` as an argument

Realizado por el módulo de GEOS

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 OpenGIS 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

Ejemplos

```
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)
```

Ver también

ST_Intersects

8.9.25 ST_Distance

ST_Distance — For geometry type returns the 2D Cartesian distance between two geometries in projected units (based on spatial reference system). For geography type defaults to return minimum geodesic distance between two geographies in meters.

Synopsis

float **ST_Distance**(geometry g1, geometry g2);
float **ST_Distance**(geography gg1, geography gg2);
float **ST_Distance**(geography gg1, geography gg2, boolean use_spheroid);

Descripción

For geometry type returns the minimum 2D Cartesian distance between two geometries in projected units (spatial ref units). For geography type defaults to return the minimum geodesic distance between two geographies in meters. If use_spheroid is false, a faster sphere calculation is used instead of a spheroid.

 This method implements the OpenGIS 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

 This method is also provided by SFCGAL backend.

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.

Basic Geometry Examples

```
--Geometry example - units in planar degrees 4326 is WGS 84 long lat unit=degrees
SELECT ST_Distance(
                'SRID=4326;POINT(-72.1235 42.3521)'::geometry,
                'SRID=4326;LINESTRING(-72.1260 42.45, -72.123 42.1546)'::geometry
        );
st_distance
-----------------
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)
                );
st_distance
-----------------
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);
st_distance
-----------------
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)
                );
st_distance
-----------------
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)
                );

st_distance
------------------
126.664256056812
```

Geography Examples

```
-- same as geometry example but note units in meters - use sphere for slightly faster less  ↩
    accurate
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_FrechetDistan
ST_Transform

8.9.26 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 not uncommon to have a geometry that, while meeting the criteria for validity according to ST_IsValid (polygons) or ST_IsSimple (lines), would become invalid if one of the vertices moved by a slight distance, as can happen during conversion to text-based formats (such as WKT, KML, GML GeoJSON), or binary formats that do not use double-precision floating point coordinates (MapInfo TAB).

A geometry's "minimum clearance" is the smallest distance by which a vertex of the geometry could be moved to produce an invalid geometry. It can be thought of as a quantitative measure of a geometry's robustness, where increasing values of minimum clearance indicate increasing robustness.

If a geometry has a minimum clearance of `e`, it can be said that:

- No two distinct vertices in the geometry are separated by less than `e`.
- No vertex is closer than `e` to a line segement of which it is not an endpoint.

If no minimum clearance exists for a geometry (for example, a single point, or a multipoint whose points are identical), then ST_MinimumClearance will return Infinity.

Availability: 2.3.0 - requires GEOS >= 3.6.0

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

8.9.27 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` will be returned.

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))'));
st_astext
------------------------------
LINESTRING(0.5 0.00032,0.5 0)
```

Ver también

ST_MinimumClearance

8.9.28 ST_HausdorffDistance

ST_HausdorffDistance — Returns the Hausdorff distance between two geometries. Basically a measure of how similar or dissimilar 2 geometries are. Units are in the units of the spatial reference system of the geometries.

Synopsis

float **ST_HausdorffDistance**(geometry g1, geometry g2);
float **ST_HausdorffDistance**(geometry g1, geometry g2, float densifyFrac);

Descripción

Implements algorithm for computing a distance metric which can be thought of as the "Discrete Hausdorff Distance". This is the Hausdorff distance restricted to discrete points for one of the geometries. Wikipedia article on Hausdorff distance Martin Davis note on how Hausdorff Distance calculation was used to prove correctness of the CascadePolygonUnion approach.

When densifyFrac is specified, this function performs a segment densification before computing the discrete hausdorff 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.

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
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 part of this subset 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 - requiere GEOS >=3.2.0.

Ejemplos

For each building, find the parcel that best represents it. First we require the parcel intersect with the geometry. DISTINCT ON guarantees we get each building listed only once, the ORDER BY .. ST_HausdorffDistance gives us a preference of 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);
```

```
postgis=# SELECT ST_HausdorffDistance(
                                 'LINESTRING (0 0, 2 0)'::geometry,
                                 'MULTIPOINT (0 1, 1 0, 2 1)'::geometry);
 st_hausdorffdistance
 ----------------------
                                            1
(1 row)
```

```
postgis=# SELECT st_hausdorffdistance('LINESTRING (130 0, 0 0, 0 150)'::geometry, ' ↩
    LINESTRING (10 10, 10 150, 130 10)'::geometry, 0.5);
 st_hausdorffdistance
 ----------------------
                                          70
(1 row)
```

Ver también

ST_FrechetDistance

8.9.29 ST_FrechetDistance

ST_FrechetDistance — Returns the Fréchet distance between two geometries. This is a measure of similarity between curves that takes into account the location and ordering of the points along the curves. Units are in the units of the spatial reference system of the 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.

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 acurate Fréchet distance we get. But, the computation time and the memory usage increase with the square of the number of subsegments.

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

8.9.30 ST_MaxDistance

ST_MaxDistance — Returns the 2-dimensional largest distance between two geometries in projected units.

Synopsis

float **ST_MaxDistance**(geometry g1, geometry g2);

Descripción

Note
Returns the 2-dimensional maximum distance between two geometries in projected units. If g1 and g2 is the same geometry the function will return the distance between the two vertices most far from each other in that geometry.

Disponibilidad: 1.5.0

Ejemplos

Basic furthest distance the point is to any part of the line

```
postgis=# SELECT ST_MaxDistance('POINT(0 0)'::geometry, 'LINESTRING ( 2 0, 0 2 )'::geometry ↩
    );
   st_maxdistance
------------------
 2
(1 row)

postgis=# SELECT ST_MaxDistance('POINT(0 0)'::geometry, 'LINESTRING ( 2 2, 2 2 )'::geometry ↩
    );
  st_maxdistance
------------------
 2.82842712474619
(1 row)
```

Ver también

ST_Distance, ST_LongestLine, ST_DFullyWithin

8.9.31 ST_DistanceSphere

ST_DistanceSphere — Returns minimum distance in meters between two lon/lat geometries. Uses a spherical earth and radius derived from the spheroid defined by the SRID. Faster than ST_DistanceSpheroid ST_DistanceSpheroid, but less accurate. PostGIS versions prior to 1.5 only implemented for points.

Synopsis

float **ST_DistanceSphere**(geometry geomlonlatA, geometry geomlonlatB);

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(the_geom), ST_GeomFromText('POINT(-118 38) ↩
    ',4326)) As numeric),2) As dist_meters,
round(CAST(ST_Distance(ST_Transform(ST_Centroid(the_geom),32611),
                ST_Transform(ST_GeomFromText('POINT(-118 38)', 4326),32611)) As numeric),2) ↩
                    As dist_utm11_meters,
round(CAST(ST_Distance(ST_Centroid(the_geom), ST_GeomFromText('POINT(-118 38)', 4326)) As  ↩
    numeric),5) As dist_degrees,
round(CAST(ST_Distance(ST_Transform(the_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  ↩
           the_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

8.9.32 ST_DistanceSpheroid

ST_DistanceSpheroid — Returns the minimum distance between two lon/lat geometries given a particular spheroid. PostGIS versions prior to 1.5 only support points.

Synopsis

float **ST_DistanceSpheroid**(geometry geomlonlatA, geometry geomlonlatB, spheroid measurement_spheroid);

Descripción

Returns minimum distance in meters between two lon/lat geometries given a particular spheroid. See the explanation of spheroids given for ST_LengthSpheroid. PostGIS version prior to 1.5 only support points.

Note
This function currently does not look at the SRID of a geometry and will always assume its represented in the coordinates of the passed in spheroid. Prior versions of this function only support 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_Spheroid

Ejemplos

```
SELECT round(CAST(
                ST_DistanceSpheroid(ST_Centroid(the_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(the_geom), ST_GeomFromText('POINT ↩
                    (-118 38)',4326)) As numeric),2) As dist_meters_sphere,
round(CAST(ST_Distance(ST_Transform(ST_Centroid(the_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  ↩
           the_geom) as foo;
 dist_meters_spheroid | dist_meters_sphere | dist_utm11_meters
----------------------+--------------------+-------------------
                       70454.92 |           70424.47 |          70438.00
```

Ver también

ST_Distance, ST_DistanceSphere

8.9.33 ST_DFullyWithin

ST_DFullyWithin — Returns true if all of the geometries are within the specified distance of one another

Synopsis

boolean **ST_DFullyWithin**(geometry g1, geometry g2, double precision distance);

Descripción

Returns true if the geometries is 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 call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries.

Disponibilidad: 1.5.0

Ejemplos

```
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              |
```

Ver también

ST_MaxDistance, ST_DWithin

8.9.34 ST_DWithin

ST_DWithin — Returns true if the geometries are within the specified distance of one another. For geometry units are in those of spatial reference and for geography units are in meters and measurement is defaulted to use_spheroid=true (measure around spheroid), for faster check, use_spheroid=false to measure along sphere.

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 **ST_DWithin**(geography gg1, geography gg2, double precision distance_meters, boolean use_spheroid);

Descripción

Returns true if the geometries are within the specified distance of one another.

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 both be of the same coordinate projection, having the same SRID.

For geography units are in meters and measurement is defaulted to `use_spheroid`=true, for faster check, `use_spheroid`=false to measure along sphere.

Note
This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries.

Note
Prior to 1.3, ST_Expand was commonly used in conjunction with && and ST_Distance to achieve the same effect and in pre-1.3.4 this function was basically short-hand for that construct. From 1.3.4, ST_DWithin uses a more short-circuit distance function which should make it more efficient than prior versions for larger buffer regions.

Note
Use ST_3DDWithin if you have 3D geometries.

This method implements the OpenGIS 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.

Ejemplos

```
-- 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.the_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);
```

Ver también

ST_Distance, ST_Distance, ST_LongestLine, ST_MaxDistance

8.9.35 ST_Equals

ST_Equals — Returns true if the given geometries represent the same geometry. Directionality is ignored.

Synopsis

boolean **ST_Equals**(geometry A, geometry B);

Descripción

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
This function will return false if either geometry is invalid except in the case where they are binary equal.

Important
Do not call with a GEOMETRYCOLLECTION as an argument.

 This method implements the OpenGIS 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

Ejemplos

```
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)
```

Ver también

ST_IsValid, ST_OrderingEquals, ST_Reverse, ST_Within

8.9.36 ST_GeometricMedian

ST_GeometricMedian — Returns the geometric median of a MultiPoint.

Synopsis

geometry **ST_GeometricMedian** (geometry g , float8 tolerance , int max_iter , boolean fail_if_not_converged);

Descripción

Computes the approximate geometric median of a MultiPoint geometry using the Weiszfeld algorithm. The geometric median provides a centrality measure that is less sensitive to outlier points than the centroid.

The algorithm will iterate 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 will produce an error and exit, unless `fail_if_not_converged` is set to false.

If a `tolerance` value is not provided, a default tolerance value will be calculated based on the extent of the input geometry.

M value of points, if present, is interpreted as their relative weight.

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 centroid (turquoise point) and geometric median (red point) of a four-point MultiPoint (yellow points).

```
WITH test AS (
SELECT 'MULTIPOINT((0 0), (1 1), (2 2), (200 200))'::geometry geom)
SELECT
  ST_AsText(ST_Centroid(geom)) centroid,
  ST_AsText(ST_GeometricMedian(geom)) median
```

```
FROM test;
      centroid      |                 median
--------------------+----------------------------------------
 POINT(50.75 50.75) | POINT(1.9761550281255 1.9761550281255)
(1 row)
```

Ver también

ST_Centroid

8.9.37 ST_HasArc

ST_HasArc — Returns true if a geometry or geometry collection contains a circular string

Synopsis

boolean **ST_HasArc**(geometry geomA);

Descripción

Returns true if a geometry or geometry collection contains a circular string

Disponibilidad: 1.2.3?

 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  ↩
    7, 5 6)'));
               st_hasarc
               --------
               t
```

Ver también

ST_CurveToLine, ST_LineToCurve

8.9.38 ST_Intersects

ST_Intersects — Returns TRUE if the Geometries/Geography "spatially intersect in 2D" - (share any portion of space) and FALSE if they don't (they are Disjoint). For geography -- tolerance is 0.00001 meters (so any points that close are considered to intersect)

Synopsis

boolean **ST_Intersects**(geometry geomA , geometry geomB);
boolean **ST_Intersects**(geography geogA , geography geogB);

Descripción

If a geometry or geography shares any portion of space then they intersect. For geography -- tolerance is 0.00001 meters (so any points that are close are considered to intersect)

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.

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
This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries.

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 OpenGIS 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 is also provided by SFCGAL backend.

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)
```

Geography Examples

```
SELECT ST_Intersects(
                ST_GeographyFromText('SRID=4326;LINESTRING(-43.23456 72.4567,-43.23456  ↩
                    72.4568)'),
                ST_GeographyFromText('SRID=4326;POINT(-43.23456 72.4567772)')
                );

 st_intersects
---------------
t
```

Ver también

ST_3DIntersects, ST_Disjoint

8.9.39 ST_Length

ST_Length — Returns the 2D length of the geometry if it is a LineString or MultiLineString. geometry are in units of spatial reference and geography are in meters (default spheroid)

Synopsis

float **ST_Length**(geometry a_2dlinestring);
float **ST_Length**(geography geog, boolean use_spheroid=true);

Descripción

For geometry: Returns the 2D Cartesian length of the geometry if it is a LineString, MultiLineString, ST_Curve, ST_MultiCurve. 0 is returned for areal geometries. For areal geometries use ST_Perimeter. For geometry types, units for length measures are specified by the spatial reference system of the geometry.

For geography types, the calculations are performed using the inverse geodesic problem, where length 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 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 measurement defaults spheroid measurement. To use the faster less accurate sphere use ST_Length(gg,false);

This method implements the OpenGIS 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

```
-- default calculation is using a sphere rather than 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

8.9.40 ST_Length2D

ST_Length2D — Returns the 2-dimensional length of the geometry if it is a linestring or multi-linestring. This is an alias for `ST_Length`

Synopsis

float **ST_Length2D**(geometry a_2dlinestring);

Descripción

Returns the 2-dimensional 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

8.9.41 ST_3DLength

ST_3DLength — Returns the 3-dimensional or 2-dimensional length of the geometry if it is a linestring or multi-linestring.

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 multi-linestring. 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.

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

8.9.42 ST_LengthSpheroid

ST_LengthSpheroid — Calculates the 2D or 3D length/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.

Synopsis

float **ST_LengthSpheroid**(geometry a_geometry, spheroid a_spheroid);

Descripción

Calculates the length/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 ellipsoid is a separate database type and can be constructed as follows:

```
SPHEROID[<NAME>,<SEMI-MAJOR AXIS>,<INVERSE FLATTENING>]

SPHEROID["GRS_1980",6378137,298.257222101]
```

Disponibilidad: 1.2.2

Changed: 2.2.0 In prior versions this used to be called ST_Length_Spheroid and used to have a ST_3DLength_Spheroid alias

 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( the_geom, sph_m ) As tot_len,
ST_LengthSpheroid(ST_GeometryN(the_geom,1), sph_m) As len_line1,
ST_LengthSpheroid(ST_GeometryN(the_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 the_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( the_geom, sph_m ) As tot_len,
ST_LengthSpheroid(ST_GeometryN(the_geom,1), sph_m) As len_line1,
ST_LengthSpheroid(ST_GeometryN(the_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 the_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

8.9.43 ST_Length2D_Spheroid

ST_Length2D_Spheroid — Calculates the 2D length/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.

Synopsis

float **ST_Length2D_Spheroid**(geometry a_geometry, spheroid a_spheroid);

Descripción

Calculates the 2D length/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 ellipsoid is a separate database type and can be constructed as follows:

```
SPHEROID[<NAME>,<SEMI-MAJOR AXIS>,<INVERSE FLATTENING>]

SPHEROID["GRS_1980",6378137,298.257222101]
```

Note
This is much like ST_LengthSpheroid except it will ignore the Z ordinate in calculations.

Ejemplos

```
SELECT ST_Length2D_Spheroid( geometry_column,
                         'SPHEROID["GRS_1980",6378137,298.257222101]' )
                         FROM geometry_table;

SELECT ST_Length2D_Spheroid( the_geom, sph_m ) As tot_len,
ST_Length2D_Spheroid(ST_GeometryN(the_geom,1), sph_m) As len_line1,
ST_Length2D_Spheroid(ST_GeometryN(the_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 the_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 Observe same answer
SELECT ST_Length2D_Spheroid( the_geom, sph_m ) As tot_len,
ST_Length2D_Spheroid(ST_GeometryN(the_geom,1), sph_m) As len_line1,
ST_Length2D_Spheroid(ST_GeometryN(the_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 the_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
```

Ver también

ST_GeometryN, ST_LengthSpheroid

8.9.44 ST_LongestLine

ST_LongestLine — Returns the 2-dimensional longest line points of two geometries. The function will only return the first longest line if more than one, that the function finds. The line returned will always start in g1 and end in g2. The length of the line this function returns will always be the same as st_maxdistance returns for g1 and g2.

Synopsis

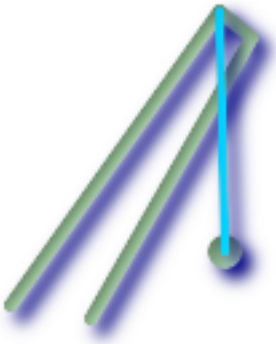
geometry **ST_LongestLine**(geometry g1, geometry g2);

Descripción

Returns the 2-dimensional longest line between the points of two geometries.

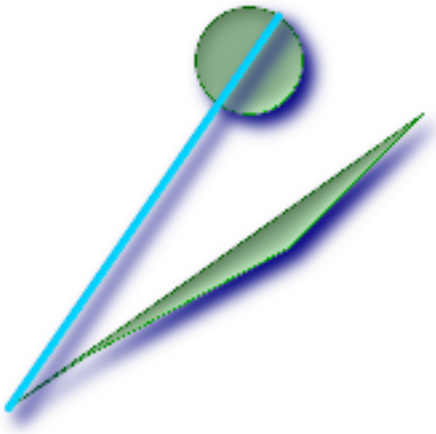
Disponibilidad: 1.5.0

Ejemplos



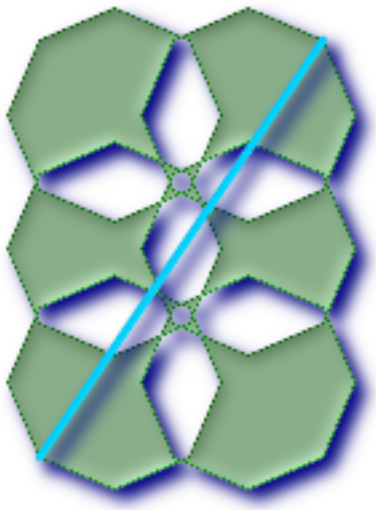
Longest line between point and line

```
SELECT ST_AsText(
        ST_LongestLine('POINT(100 100)':: ↩
    geometry,
                'LINESTRING (20 80, 98  ↩
    190, 110 180, 50 75 )'::geometry)
        ) As lline;


   lline
-----------------
LINESTRING(100 100,98 190)
```



longest line between polygon and polygon

```
SELECT ST_AsText(
        ST_LongestLine(
                ST_GeomFromText('POLYGON ↩
    ((175 150, 20 40,
                        50 60, 125 100,  ↩
    175 150))'),
                ST_Buffer(ST_GeomFromText ↩
    ('POINT(110 170)'), 20)
                )
        ) As llinewkt;

   lline
-----------------
LINESTRING(20 40,121.111404660392  ↩
    186.629392246051)
```



longest straight distance to travel from one part of an elegant city to the other Note the max distance = to the length of the line.

```
SELECT ST_AsText(ST_LongestLine(c.the_geom, c.the_geom)) As llinewkt,
        ST_MaxDistance(c.the_geom,c.the_geom) As max_dist,
        ST_Length(ST_LongestLine(c.the_geom, c.the_geom)) As lenll
FROM (SELECT ST_BuildArea(ST_Collect(the_geom)) As the_geom
        FROM (SELECT ST_Translate(ST_SnapToGrid(ST_Buffer(ST_Point(50 ,generate_series ↩
     (50,190, 50)
                        ),40, 'quad_segs=2'),1), x, 0)  As the_geom
                        FROM generate_series(1,100,50) As x)  AS foo
) As c;

          llinewkt           |     max_dist     |      lenll
-----------------------------+------------------+------------------
 LINESTRING(23 22,129 178) | 188.605408193933 | 188.605408193933
```

Ver también

ST_MaxDistance, ST_ShortestLine, ST_LongestLine

8.9.45 ST_OrderingEquals

ST_OrderingEquals — Returns true if the given geometries represent the same geometry and points are in the same directional order.

Synopsis

boolean **ST_OrderingEquals**(geometry A, geometry B);

Descripción

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

Ejemplos

```
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)
```

Ver también

ST_Equals, ST_Reverse

8.9.46 ST_Overlaps

ST_Overlaps — Returns TRUE if the Geometries share space, are of the same dimension, but are not completely contained by each other.

Synopsis

boolean **ST_Overlaps**(geometry A, geometry B);

Descripción

Returns TRUE if the Geometries "spatially overlap". By that we mean they intersect, but one does not completely contain another.

Realizado por el módulo de GEOS

Note
No llame con un GeometryCollection como argumento

This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid index use, use the function _ST_Overlaps.

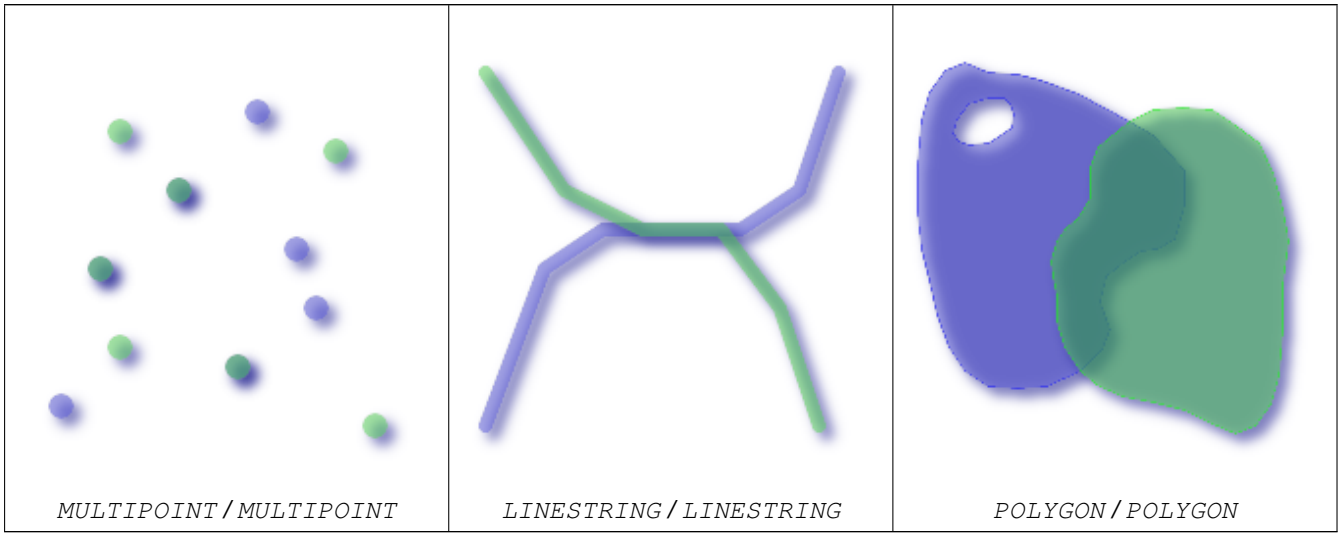
NOTE: this is the "allowable" version that returns a boolean, not an integer.

 This method implements the OpenGIS 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

Ejemplos

The following illustrations all return `TRUE`.



MULTIPOINT/MULTIPOINT | *LINESTRING/LINESTRING* | *POLYGON/POLYGON*

```
--a point on a line is contained by the line and is of a lower dimension, and therefore  ↩
    does not overlap the line
                        nor crosses

SELECT ST_Overlaps(a,b) As a_overlap_b,
        ST_Crosses(a,b) As a_crosses_b,
                ST_Intersects(a, b) As a_intersects_b, ST_Contains(b,a) As b_contains_a
FROM (SELECT ST_GeomFromText('POINT(1 0.5)') As a, ST_GeomFromText('LINESTRING(1 0, 1 1, 3  ↩
    5)')  As b)
        As foo

a_overlap_b | a_crosses_b | a_intersects_b | b_contains_a
------------+-------------+----------------+--------------
f           | f           | t              | t

--a line that is partly contained by circle, but not fully is defined as intersecting and  ↩
    crossing,
-- but since of different dimension it does not overlap
SELECT ST_Overlaps(a,b) As a_overlap_b, ST_Crosses(a,b) As a_crosses_b,
        ST_Intersects(a, b) As a_intersects_b,
        ST_Contains(a,b) As a_contains_b
FROM (SELECT ST_Buffer(ST_GeomFromText('POINT(1 0.5)'), 3)  As a, ST_GeomFromText(' ↩
    LINESTRING(1 0, 1 1, 3 5)')  As b)
        As foo;

 a_overlap_b | a_crosses_b | a_intersects_b | a_contains_b
-------------+-------------+----------------+--------------
```

```
 f           | t           | t              | f

 -- a 2-dimensional bent hot dog (aka buffered line string) that intersects a circle,
 --        but is not fully contained by the circle is defined as overlapping since they  ↩
     are of the same dimension,
--        but it does not cross, because the intersection of the 2 is of the same dimension
--        as the maximum dimension of the 2

SELECT ST_Overlaps(a,b) As a_overlap_b, ST_Crosses(a,b) As a_crosses_b, ST_Intersects(a, b) ↩
     As a_intersects_b,
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  ↩
    dima_intersection_b
FROM (SELECT ST_Buffer(ST_GeomFromText('POINT(1 0.5)'), 3)  As a,
        ST_Buffer(ST_GeomFromText('LINESTRING(1 0, 1 1, 3 5)'),0.5)  As b)
        As foo;

 a_overlap_b | a_crosses_b | a_intersects_b | b_contains_a | dim_a | dim_b |  ↩
     dima_intersection_b
-------------+-------------+----------------+--------------+-------+-------+--------------------- ↩

 t           | f           | t              | f            |     2 |     2 |                    2
```

Ver también

ST_Contains, ST_Crosses, ST_Dimension, ST_Intersects

8.9.47 ST_Perimeter

ST_Perimeter — Return the length measurement of the boundary of an ST_Surface or ST_MultiSurface geometry or geography. (Polygon, MultiPolygon). geometry measurement is in units of spatial reference and geography is in meters.

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 OpenGIS 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

8.9.48 ST_Perimeter2D

ST_Perimeter2D — Returns the 2-dimensional perimeter of the geometry, if it is a polygon or multi-polygon. This is currently an alias for ST_Perimeter.

Synopsis

float **ST_Perimeter2D**(geometry geomA);

Descripción

Returns the 2-dimensional perimeter of the geometry, if it is a polygon or multi-polygon.

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

8.9.49 ST_3DPerimeter

ST_3DPerimeter — Returns the 3-dimensional perimeter of the geometry, if it is a polygon or multi-polygon.

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.

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(the_geom), ST_Perimeter2d(the_geom), ST_Perimeter(the_geom) FROM
                        (SELECT ST_GeomFromEWKT('SRID=2249;POLYGON((743238 2967416 2,743238 ↩
                            2967450 1,
743265.625 2967416 1,743238 2967416 2))') As the_geom) As foo;

  ST_3DPerimeter   |  st_perimeter2d  |   st_perimeter
-------------------+------------------+------------------
 105.465793597674 | 105.432997272188 | 105.432997272188
```

Ver también

ST_GeomFromEWKT, ST_Perimeter, ST_Perimeter2D

8.9.50 ST_PointOnSurface

ST_PointOnSurface — Returns a `POINT` guaranteed to lie on the surface.

Synopsis

geometry **ST_PointOnSurface**(geometry g1);

Descripción

Returns a `POINT` guaranteed to intersect a surface.

 This method implements the OpenGIS 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. According to the specs, ST_PointOnSurface works for surface geometries (POLYGONs, MULTIPOLYGONS, CURVED POLYGONS). So PostGIS seems to be extending what the spec allows here. Most databases Oracle,DB II, ESRI SDE seem to only support this function for surfaces. SQL Server 2008 like PostGIS supports for all common geometries.

 This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsText(ST_PointOnSurface('POINT(0 5)'::geometry));
 st_astext
------------
 POINT(0 5)
(1 row)

SELECT ST_AsText(ST_PointOnSurface('LINESTRING(0 5, 0 10)'::geometry));
 st_astext
------------
 POINT(0 5)
(1 row)
```

```
SELECT ST_AsText(ST_PointOnSurface('POLYGON((0 0, 0 5, 5 5, 5 0, 0 0))'::geometry));
   st_astext
----------------
 POINT(2.5 2.5)
(1 row)

SELECT ST_AsEWKT(ST_PointOnSurface(ST_GeomFromEWKT('LINESTRING(0 5 1, 0 0 1, 0 10 2)')));
   st_asewkt
----------------
 POINT(0 0 1)
(1 row)
```

Ver también

ST_Centroid, ST_PointInsideCircle

8.9.51 ST_Project

ST_Project — Returns a `POINT` projected from a start point using a distance in meters and bearing (azimuth) in radians.

Synopsis

geography **ST_Project**(geography g1, float distance, float azimuth);

Descripción

Returns a `POINT` projected along a geodesic from a start point using an azimuth (bearing) measured in radians and distance measured in meters. This is also called a direct geodesic problem.

The azimuth is sometimes called the heading or the bearing in navigation. It is measured relative to true north (azimuth zero). East is azimuth 90 ($\pi/2$), south is azimuth 180 (π), west is azimuth 270 ($3\pi/2$).

The distance is given in meters.

Disponibilidad: 2.0.0

Enhanced: 2.4.0 Allow negative distance and non-normalized azimuth.

Example: Using degrees - projected point 100,000 meters and bearing 45 degrees

```
SELECT ST_AsText(ST_Project('POINT(0 0)'::geography, 100000, radians(45.0)));

                 st_astext
-------------------------------------------
 POINT(0.635231029125537 0.639472334729198)
(1 row)
```

Ver también

ST_Azimuth, ST_Distance, PostgreSQL Math Functions

8.9.52 ST_Relate

ST_Relate — Returns true if this Geometry is spatially related to anotherGeometry, by testing for intersections between the Interior, Boundary and Exterior of the two geometries as specified by the values in the intersectionMatrixPattern. If no intersectionMatrixPattern is passed in, then returns the maximum intersectionMatrixPattern that relates the 2 geometries.

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);

Descripción

Version 1: Takes geomA, geomB, intersectionMatrix and Returns 1 (TRUE) if this Geometry is spatially related to anotherGeometry, by testing for intersections between the Interior, Boundary and Exterior of the two geometries as specified by the values in the DE-9IM matrix pattern.

This is especially useful for testing compound checks of intersection, crosses, etc in one step.

No llame con un GeometryCollection como argumento

Note
This is the "allowable" version that returns a boolean, not an integer. This is defined in OGC spec

---

Note
This DOES NOT automagically include an index call. The reason for that is some relationships are anti e.g. Disjoint. If you are using a relationship pattern that requires intersection, then include the && index call.

Version 2: Takes geomA and geomB and returns the Section 4.3.6

Version 3: same as version 2, but allows to specify a boundary node rule (1:OGC/MOD2, 2:Endpoint, 3:MultivalentEndpoint, 4:MonovalentEndpoint)

Note
No llame con un GeometryCollection como argumento

---

not in OGC spec, but implied. see s2.1.13.2

Realizado por el módulo de GEOS

 This method implements the OpenGIS 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

Enhanced: 2.0.0 - added support for specifying boundary node rule (requires GEOS >= 3.0).

Ejemplos

```
--Find all compounds that intersect and not touch a poly (interior intersects)
SELECT l.* , b.name As poly_name
        FROM polys As b
INNER JOIN compounds As l
ON (p.the_geom && b.the_geom
AND ST_Relate(l.the_geom, b.the_geom,'T********'));
```

```
SELECT ST_Relate(ST_GeometryFromText('POINT(1 2)'), ST_Buffer(ST_GeometryFromText('POINT(1 ↩
    2)'),2));
st_relate
-----------
0FFFFF212

SELECT ST_Relate(ST_GeometryFromText('LINESTRING(1 2, 3 4)'), ST_GeometryFromText(' ↩
    LINESTRING(5 6, 7 8)'));
st_relate
-----------
FF1FF0102


SELECT ST_Relate(ST_GeometryFromText('POINT(1 2)'), ST_Buffer(ST_GeometryFromText('POINT(1 ↩
    2)'),2), '0FFFFF212');
st_relate
-----------
t

SELECT ST_Relate(ST_GeometryFromText('POINT(1 2)'), ST_Buffer(ST_GeometryFromText('POINT(1 ↩
    2)'),2), '*FF*FF212');
st_relate
-----------
t
```

Ver también

ST_Crosses, Section 4.3.6, ST_Disjoint, ST_Intersects, ST_Touches

8.9.53 ST_RelateMatch

ST_RelateMatch — Returns true if intersectionMattrixPattern1 implies intersectionMatrixPattern2

Synopsis

boolean **ST_RelateMatch**(text intersectionMatrix, text intersectionMatrixPattern);

Descripción

Takes intersectionMatrix and intersectionMatrixPattern and Returns true if the intersectionMatrix satisfies the intersectionMatrixPattern. For more information refer to Section 4.3.6.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

Ejemplos

```
SELECT ST_RelateMatch('101202FFF', 'TTTTTTFFF') ;
-- result --
t
--example of common intersection matrix patterns and example matrices
-- comparing relationships of involving one invalid geometry and ( a line and polygon that ↩
    intersect at interior and boundary)
SELECT mat.name, pat.name, ST_RelateMatch(mat.val, pat.val) As satisfied
    FROM
        ( VALUES ('Equality', 'T1FF1FFF1'),
                ('Overlaps', 'T*T***T**'),
```

```
            ('Within', 'T*F**F***'),
            ('Disjoint', 'FF*FF****') As pat(name,val)
    CROSS JOIN
        (        VALUES ('Self intersections (invalid)', '111111111'),
                ('IE2_BI1_BB0_BE1_EI1_EE2', 'FF2101102'),
                ('IB1_IE1_BB0_BE0_EI2_EI1_EE2', 'F11F00212')
        ) As mat(name,val);
```

Ver también

Section 4.3.6, ST_Relate

8.9.54 ST_ShortestLine

ST_ShortestLine — Returns the 2-dimensional shortest line between two geometries

Synopsis

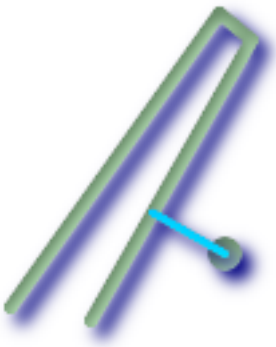
geometry **ST_ShortestLine**(geometry g1, geometry g2);

Descripción

Returns the 2-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 length of the line this function returns will always be the same as ST_Distance returns for g1 and g2.

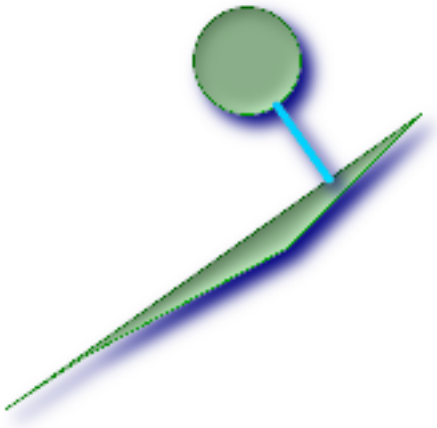
Disponibilidad: 1.5.0

Ejemplos



Shortest line between point and linestring

```
SELECT ST_AsText(
        ST_ShortestLine('POINT(100 100) ↩
                '::geometry,
                'LINESTRING (20 80, 98  ↩
                190, 110 180, 50 75 )'::geometry)
        ) As sline;


   sline
-----------------
LINESTRING(100 100,73.0769230769231  ↩
                115.384615384615)
```



shortest line between polygon and polygon

```
SELECT ST_AsText(
                ST_ShortestLine(
                        ST_GeomFromText(' ↩
                POLYGON((175 150, 20 40, 50 60, 125
                        ST_Buffer( ↩
                ST_GeomFromText('POINT(110 170)'), 2
                        )
                ) As slinewkt;

 LINESTRING(140.752120669087  ↩
                125.695053378061,121.111404660392 15
```

Ver también

ST_ClosestPoint, ST_Distance, ST_LongestLine, ST_MaxDistance

8.9.55 ST_Touches

ST_Touches — Returns `TRUE` if the geometries have at least one point in common, but their interiors do not intersect.

Synopsis

boolean **ST_Touches**(geometry g1, geometry g2);

Descripción

Returns `TRUE` if the only points in common between *g1* and *g2* lie in the union of the boundaries of *g1* and *g2*. The `ST_Touches` relation applies to all Area/Area, Line/Line, Line/Area, Point/Area and Point/Line pairs of relationships, but *not* to the Point/Point pair.

In mathematical terms, this predicate is expressed as:

$$a.Touches(b) \Leftrightarrow (I(a) \cap I(b) = \varnothing) \wedge (a \cap b) \neq \varnothing$$

The allowable DE-9IM Intersection Matrices for the two geometries are:

- FT*******
- F**T*****
- F***T****

Important
Do not call with a `GEOMETRYCOLLECTION` as an argument

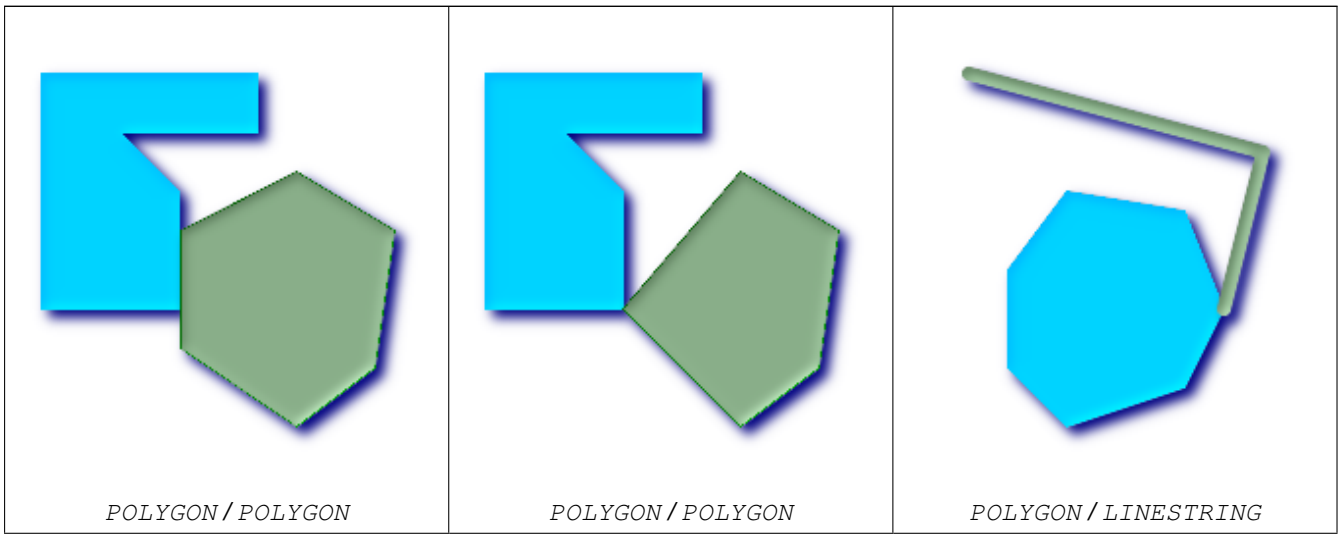
Note
This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid using an index, use `_ST_Touches` instead.

This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1. s2.1.1.2 // s2.1.13.3

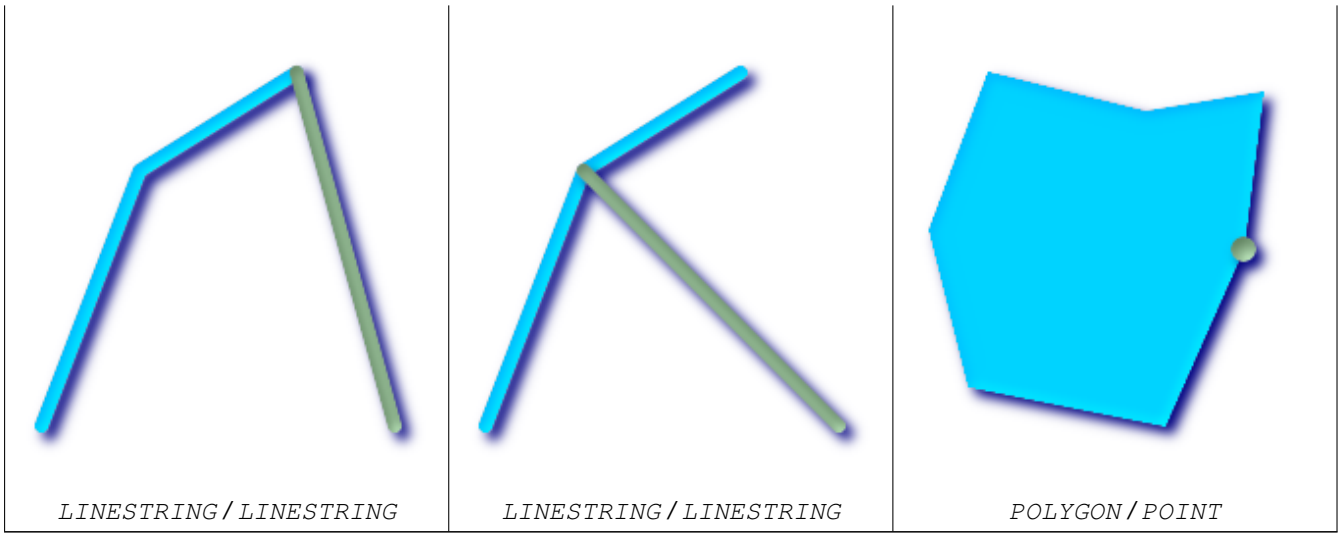
This method implements the SQL/MM specification. SQL-MM 3: 5.1.28

Ejemplos

The `ST_Touches` predicate returns `TRUE` in all the following illustrations.



POLYGON / POLYGON | *POLYGON / POLYGON* | *POLYGON / LINESTRING*



LINESTRING/LINESTRING | *LINESTRING/LINESTRING* | *POLYGON/POINT*

```
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)
```

8.9.56 ST_Within

ST_Within — Returns true if the geometry A is completely inside geometry B

Synopsis

boolean **ST_Within**(geometry A, geometry B);

Descripción

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.

Realizado por el módulo de GEOS

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
Do not call with a `GEOMETRYCOLLECTION` as an argument

Important
Do not use this function with invalid geometries. You will get unexpected results.

This function call will automatically include a bounding box comparison that will make use of any indexes that are available on the geometries. To avoid index use, use the function _ST_Within.

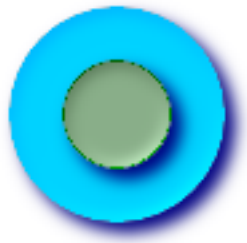
NOTE: this is the "allowable" version that returns a boolean, not an integer.

This method implements the OpenGIS 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

Ejemplos

```
--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 biginunion,
        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 | biginunion | bigisunion
--------------+------------+------------+------------+------------+------------
 t            | t          | f          | t          | t          | t
(1 row)
```



Ver también

ST_Contains, ST_Equals, ST_IsValid

8.10 SFCGAL Functions

8.10.1 postgis_sfcgal_version

postgis_sfcgal_version — Returns the version of SFCGAL in use

Synopsis

text **postgis_sfcgal_version**(void);

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).

8.10.2 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.

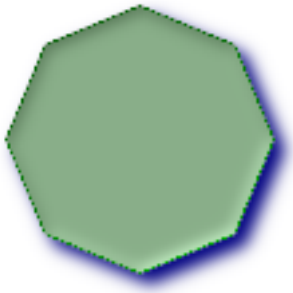
 This function supports Polyhedral surfaces.

 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.

```
SELECT ST_Buffer(ST_GeomFromText('POINT ↩
    (100 90)'),
  50, 'quad_segs=2'),0,0,30);
```



Original octagon formed from buffering point

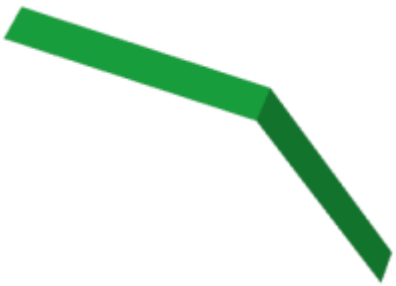
```
ST_Extrude(ST_Buffer(ST_GeomFromText(' ↩
    POINT(100 90)'),
 50, 'quad_segs=2'),0,0,30);
```

Hexagon extruded 30 units along Z produces a PolyhedralSurfaceZ

```
SELECT ST_GeomFromText('LINESTRING(50 50, ↩
     100 90, 95 150)')
```

Original linestring

```
SELECT ST_Extrude(
 ST_GeomFromText('LINESTRING(50 50, 100  ↩
    90, 95 150)'),0,0,10));
```



LineString Extruded along Z produces a PolyhedralSurfaceZ

Ver también

ST_AsX3D

8.10.3 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.

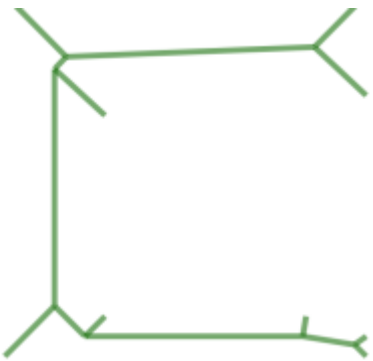
 This function supports Polyhedral surfaces.

 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 ))'));
```

Original polygon



Straight Skeleton of polygon

8.10.4 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 ))'));
```

A polygon and its approximate medial axis

Ver también

ST_StraightSkeleton

8.10.5 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).

8.10.6 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.

8.10.7 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).

8.10.8 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.

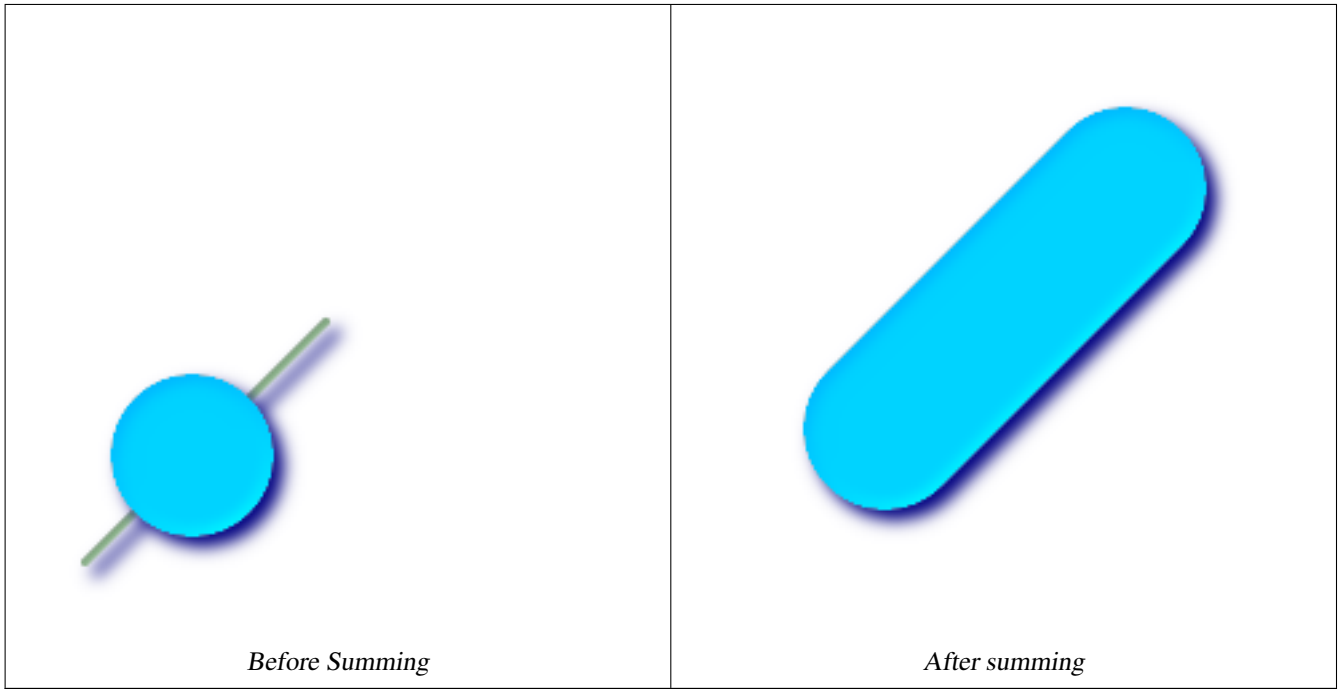
Implementation utilizes CGAL 2D Minkowskisum.

Disponibilidad: 2.1.0

 This method needs SFCGAL backend.

Ejemplos

Minkowski Sum of Linestring and circle polygon where Linestring cuts thru the circle



Before Summing | *After summing*

```
SELECT ST_MinkowskiSum(line, circle))
FROM (SELECT
    ST_MakeLine(ST_MakePoint(10, 10),ST_MakePoint(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

Before Summing

After summing: polygon is duplicated and translated to position of points

```
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))
    )
```

8.10.9 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 function supports 3d and will not drop the z-index.

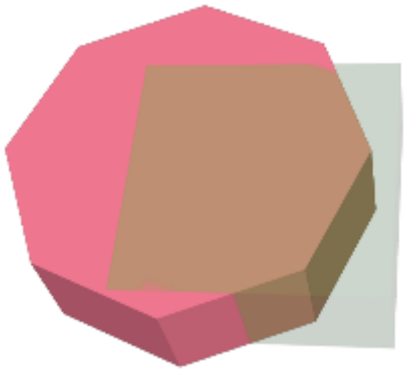
✓ This function supports Polyhedral surfaces.

✓ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

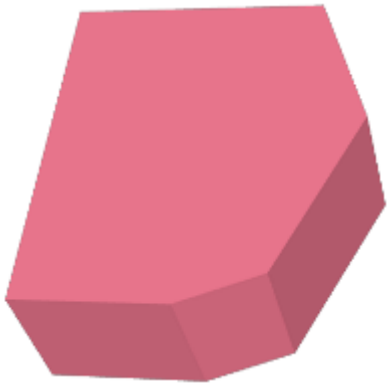
3D images were generated using PostGIS ST_AsX3D and rendering in HTML using X3Dom HTML Javascript rendering library.

```
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;
```



Original 3D geometries overlaid. geom2 is shown semi-transparent

```
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;
```



Intersection of geom1 and geom2

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)))
```

8.10.10 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 function supports 3d and will not drop the z-index.

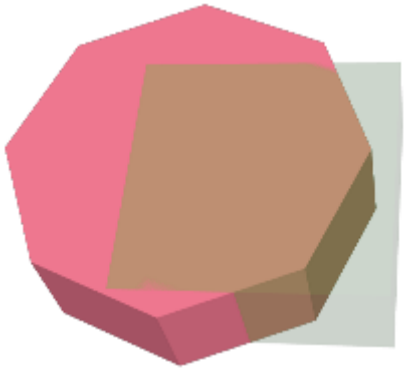
 This function supports Polyhedral surfaces.

 This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

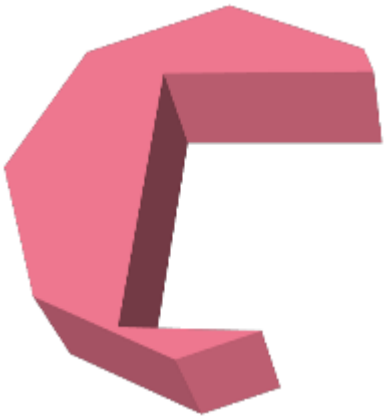
3D images were generated using PostGIS ST_AsX3D and rendering in HTML using X3Dom HTML Javascript rendering library.

```
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;
```



Original 3D geometries overlaid. geom2 is the part that will be removed.

```
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;
```



What's left after removing geom2

Ver también

ST_Extrude, ST_AsX3D, ST_3DIntersection ST_3DUnion

8.10.11 ST_3DUnion

ST_3DUnion — Perform 3D union

Synopsis

geometry **ST_3DUnion**(geometry geom1, geometry geom2);

Descripción

Disponibilidad: 2.2.0

 This method needs SFCGAL backend.

 This function supports 3d and will not drop the z-index.

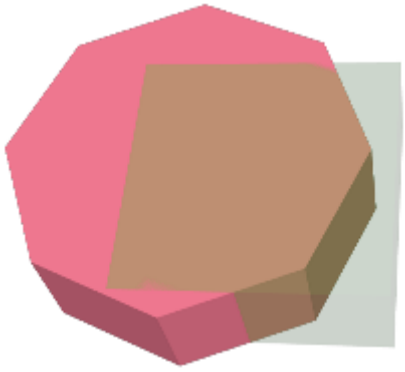
 This function supports Polyhedral surfaces.

 This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

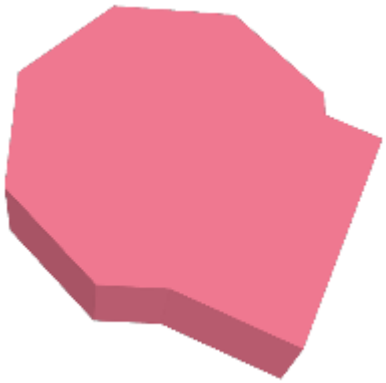
3D images were generated using PostGIS ST_AsX3D and rendering in HTML using X3Dom HTML Javascript rendering library.

```
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;
```



Original 3D geometries overlaid. geom2 is the one with transparency.

```
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;
```



Union of geom1 and geom2

Ver también

ST_Extrude, ST_AsX3D, ST_3DIntersection ST_3DDifference

8.10.12 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 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

8.10.13 ST_Tesselate

ST_Tesselate — Perform surface Tesselation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS

Synopsis

geometry **ST_Tesselate**(geometry geom);

Descripción

Takes as input a surface such a MULTI(POLYGON) or POLYHEDRALSURFACE and returns a TIN representation via the process of tesselation 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.

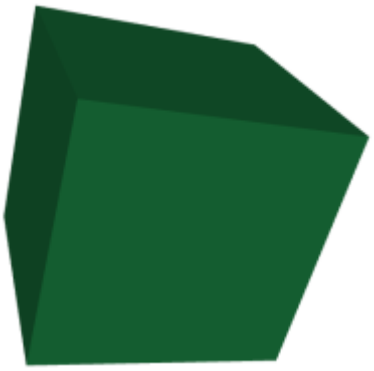
 This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

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, 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:

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



Original Cube

Tesselated Cube with triangles colored

```
SELECT 'POLYGON (( 10 190, 10 70, 80 70,  ↩
                    80 130, 50 160, 120 160,
                    120 190, 10 190 ))'::geometry;
```

Original polygon

```
SELECT
        ST_Tesselate('POLYGON (( 10 190,  ↩
                     10 70, 80 70, 80 130, 50 160, 1
```

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 1
  ((120 190,10 190,50 160,120 190)))
```

Tesselated Polygon

8.10.14 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).

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

8.10.15 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).

8.10.16 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).

8.11 Procesamiento de geometría

8.11.1 ST_Buffer

ST_Buffer — (T) Returns a geometry covering all points within a given distance from the input geometry.

Synopsis

geometry **ST_Buffer**(geometry g1, float radius_of_buffer);
geometry **ST_Buffer**(geometry g1, float radius_of_buffer, integer num_seg_quarter_circle);
geometry **ST_Buffer**(geometry g1, float radius_of_buffer, text buffer_style_parameters);
geography **ST_Buffer**(geography g1, float radius_of_buffer_in_meters);
geography **ST_Buffer**(geography g1, float radius_of_buffer, integer num_seg_quarter_circle);
geography **ST_Buffer**(geography g1, float radius_of_buffer, text buffer_style_parameters);

Descripción

Returns a geometry/geography that represents all points whose distance from this Geometry/geography is less than or equal to distance.

Geometry: Calculations are in the Spatial Reference System of the geometry. Introduced in 1.5 support for different end cap and mitre settings to control shape.

Note
Negative radii: For polygons, a negative radius can be used, which will shrink the polygon rather than expanding it.

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 geography object (favoring UTM, Lambert Azimuthal Equal Area (LAEA) north/south pole, and falling back on mercator in worst case scenario) and then buffers in that planar spatial ref and retransforms back to WGS84 geography.

 For geography this may not behave as expected if object is sufficiently large that it falls between two UTM zones or crosses the dateline

---

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. - requires GEOS >= 3.2 to take advantage of advanced geometry functionality.

The optional third parameter (currently only applies to geometry) can either specify number of segments used to approximate a quarter circle (integer case, defaults to 8) or a list of blank-separated key=value pairs (string case) to tweak operations as follows:

- 'quad_segs=#' : number of segments used to approximate a quarter circle (defaults to 8).
- 'endcap=round|flat|square' : endcap style (defaults to "round", needs GEOS-3.2 or higher for a different value). 'butt' is also accepted as a synonym for 'flat'.
- 'join=round|mitre|bevel' : join style (defaults to "round", needs GEOS-3.2 or higher for a different value). 'miter' is also accepted as a synonym for 'mitre'.
- 'mitre_limit=#.#' : mitre ratio limit (only affects mitered join style). 'miter_limit' is also 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 really relevant to LINESTRING geometry and does not affect POINT or POLYGON geometries. By default end caps are square.

Units of radius are measured in units of the spatial reference system.

The inputs can be POINTS, MULTIPOINTS, LINESTRINGS, MULTILINESTRINGS, POLYGONS, MULTIPOLYGONS, and GeometryCollections.

Note
This function ignores the third dimension (z) and will always give a 2-d buffer even when presented with a 3d-geometry.

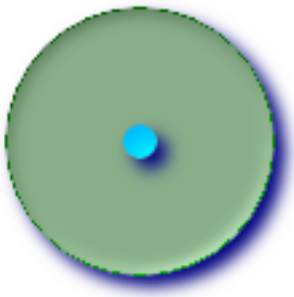
Realizado por el módulo GEOS.

 This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1. s2.1.1.3

 This method implements the SQL/MM specification. SQL-MM 3: 5.1.17

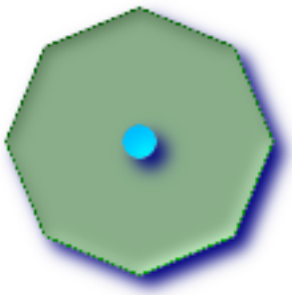
Note
People often make the mistake of using this function to try to do radius searches. Creating a buffer to a radius search is slow and pointless. Use ST_DWithin instead.

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)

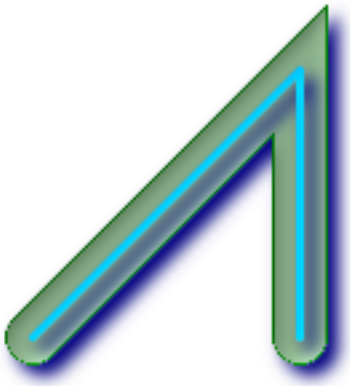
```
SELECT ST_Buffer(
 ST_GeomFromText(
  'LINESTRING(50 50,150 150,150 50)'
 ), 10, 'endcap=round join=round');
```

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)

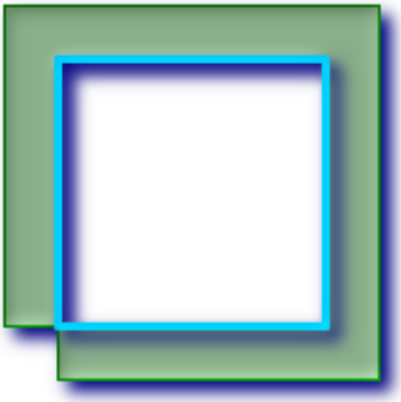
```
SELECT ST_Buffer(
 ST_GeomFromText(
  'LINESTRING(50 50,150 150,150 50)'
 ), 10, 'join=mitre mitre_limit=5.0');
```

side=left

```
SELECT ST_Buffer(
 ST_GeomFromText('POINT(100 90)'),
 50, 'quad_segs=8');
```

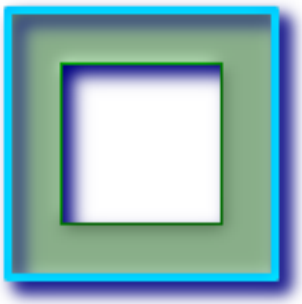
side=right

```
SELECT ST_Buffer(
 ST_GeomFromText('POINT(100 90)'),
 50, 'quad_segs=8');
```



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_MakePoint(-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_Collect, ST_DWithin, ST_SetSRID, ST_Transform, ST_Union

8.11.2 ST_BuildArea

ST_BuildArea — Creates an areal geometry formed by the constituent linework of given geometry

Synopsis

geometry **ST_BuildArea**(geometry A);

Descripción

Creates an areal geometry formed by the constituent linework of given geometry. The return type can be a Polygon or MultiPolygon, depending on input. If the input lineworks do not form polygons NULL is returned. The inputs can be LINESTRINGS, MULTILINESTRINGS, POLYGONS, MULTIPOLYGONS, and GeometryCollections.

This function will assume all inner geometries represent holes

Note
Input linework must be correctly noded for this function to work properly

Disponibilidad: 1.1.0 - requiere GEOS >= 2.1.0.

Ejemplos

This will create a donut

```
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;
```

This will create a gaping hole inside the circle with prongs sticking out

```
SELECT ST_BuildArea(ST_Collect(line,circle))
FROM (SELECT
        ST_Buffer(
                ST_MakeLine(ST_MakePoint(10, 10),ST_MakePoint(190, 190)),
                                5)  As line,
        ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50) As circle) As foo;

--this creates the same gaping hole
--but using linestrings instead of polygons
SELECT ST_BuildArea(
        ST_Collect(ST_ExteriorRing(line),ST_ExteriorRing(circle))
        )
FROM (SELECT ST_Buffer(
        ST_MakeLine(ST_MakePoint(10, 10),ST_MakePoint(190, 190))
                ,5)  As line,
        ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50) As circle) As foo;
```

Ver también

ST_Node, ST_MakePolygon, ST_BdPolyFromText, ST_BdMPolyFromTextwrappers to this function with standard OGC interface

8.11.3 ST_ClipByBox2D

ST_ClipByBox2D — Returns the portion of a geometry falling within a rectangle.

Synopsis

geometry **ST_ClipByBox2D**(geometry geom, box2d box);

Descripción

Clips a geometry by a 2D box in a fast but possibly dirty way. The output geometry is not guaranteed to be valid (self-intersections for a polygon may be introduced). Topologically invalid input geometries do not result in exceptions being thrown.

Realizado por el módulo GEOS.

Note
Requiere GEOS 3.5.0+

Disponibilidad: 2.2.0 - requiere GEOS >= 3.5.0.

Ejemplos

```
-- Rely on implicit cast from geometry to box2d for the second parameter
SELECT ST_ClipByBox2D(the_geom, ST_MakeEnvelope(0,0,10,10)) FROM mytab;
```

Ver también

ST_Intersection, ST_MakeBox2D, ST_MakeEnvelope

8.11.4 ST_Collect

ST_Collect — Return a specified ST_Geometry value from a collection of other geometries.

Synopsis

geometry **ST_Collect**(geometry set g1field);
geometry **ST_Collect**(geometry g1, geometry g2);
geometry **ST_Collect**(geometry[] g1_array);

Descripción

Output type can be a MULTI* or a GEOMETRYCOLLECTION. Comes in 2 variants. Variant 1 collects 2 geometries. Variant 2 is an aggregate function that takes a set of geometries and collects them into a single ST_Geometry.

Aggregate version: This function returns a GEOMETRYCOLLECTION or a MULTI object from a set of geometries. The ST_Collect() 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. For example, "SELECT ST_Collect(GEOM) FROM GEOMTABLE GROUP BY ATTRCOLUMN" will return a separate GEOMETRYCOLLECTION for each distinct value of ATTRCOLUMN.

Non-Aggregate version: This function returns a geometry being a collection of two input geometries. Output type can be a MULTI* or a GEOMETRYCOLLECTION.

Note
ST_Collect and ST_Union are often interchangeable except that ST_Collect will always return a GeometryCollection or MULTI geometry and ST_Union may return single geometries when it dissolves boundaries. ST_Union will also split linestrings at node intersections, whereas ST_Collect will never split linestrings and in turn just return as MULTILINESTRING. To prevent ST_Collect from returning a Geometry Collection when collecting MULTI geometries, one can use the below trick that utilizes ST_Dump to expand the MULTIs out to singles and then regroup them.

Availability: 1.4.0 - ST_Collect(geomarray) was introduced. ST_Collect was enhanced to handle more geometries faster.

 This function supports 3d and will not drop the z-index.

 This method supports Circular Strings and Curves This method supports Circular Strings and Curves, but will never return a MULTICURVE or MULTI as one would expect and PostGIS does not currently support those.

Ejemplos

Aggregate example

```
SELECT stusps, ST_Collect(f.the_geom) as singlegeom
         FROM (SELECT stusps, (ST_Dump(the_geom)).geom As the_geom
                              FROM
                              somestatetable ) As f
GROUP BY stusps
```

Non-Aggregate example

```
SELECT ST_AsText(ST_Collect(ST_GeomFromText('POINT(1 2)'),
        ST_GeomFromText('POINT(-2 3)') ));

st_astext
----------
MULTIPOINT(1 2,-2 3)

--Collect 2 d points
SELECT ST_AsText(ST_Collect(ST_GeomFromText('POINT(1 2)'),
                ST_GeomFromText('POINT(1 2)') ) );

st_astext
----------
MULTIPOINT(1 2,1 2)

--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)

 --Example with curves
SELECT ST_AsText(ST_Collect(ST_GeomFromText('CIRCULARSTRING(220268 150415,220227  ↩
    150505,220227 150406)'),
ST_GeomFromText('CIRCULARSTRING(220227 150406,2220227 150407,220227 150406)')));


--------------------------------------------------------------------------------
 GEOMETRYCOLLECTION(CIRCULARSTRING(220268 150415,220227 150505,220227 150406),
 CIRCULARSTRING(220227 150406,2220227 150407,220227 150406))

--New ST_Collect array construct
SELECT ST_Collect(ARRAY(SELECT the_geom FROM sometable));

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))
```

Ver también

ST_Dump, ST_Union

8.11.5 ST_ConcaveHull

ST_ConcaveHull — The concave hull of a geometry represents a possibly concave geometry that encloses all geometries within the set. You can think of it as shrink wrapping.

Synopsis

geometry **ST_ConcaveHull**(geometry geomA, float target_percent, boolean allow_holes=false);

Descripción

The concave hull of a geometry represents a possibly concave geometry that encloses all geometries within the set. Defaults to false for allowing polygons with holes. The result is never higher than a single polygon.

The target_percent is the target percent of area of convex hull the PostGIS solution will try to approach before giving up or exiting. One can think of the concave hull as the geometry you get by vacuum sealing a set of geometries. The target_percent of 1 will give you the same answer as the convex hull. A target_percent between 0 and 0.99 will give you something that should have a smaller area than the convex hull. This is different from a convex hull which is more like wrapping a rubber band around the set of geometries.

It is usually used with MULTI and Geometry Collections. Although it is not an aggregate - you can use it in conjunction with ST_Collect or ST_Union to get the concave hull of a set of points/linestring/polygons ST_ConcaveHull(ST_Collect(somepointfield), 0.80).

It is much slower to compute than convex hull but encloses the geometry better and is also useful for image recognition.

Realizado por el módulo de GEOS

Note
Note - If you are using with points, linestrings, or geometry collections use ST_Collect. If you are using with polygons, use ST_Union since it may fail with invalid geometries.

Note
Note - The smaller you make the target percent, the longer it takes to process the concave hull and more likely to run into topological exceptions. Also the more floating points and number of points you accrue. First try a 0.99 which does a first hop, is usually very fast, sometimes as fast as computing the convex hull, and usually gives much better than 99% of shrink since it almost always overshoots. Second hope of 0.98 it slower, others get slower usually quadratically. To reduce precision and float points, use ST_SimplifyPreserveTopology or ST_SnapToGrid after ST_ConcaveHull. ST_SnapToGrid is a bit faster, but could result in invalid geometries where as ST_SimplifyPreserveTopology almost always preserves the validity of the geometry.

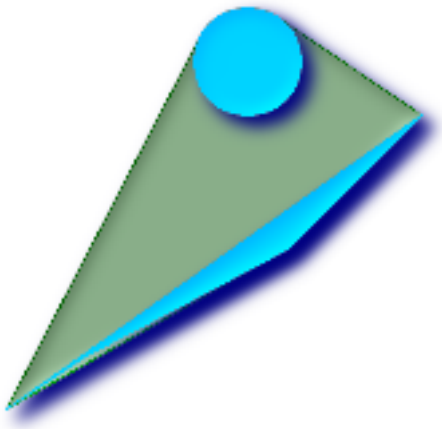
More real world examples and brief explanation of the technique are shown http://www.bostongis.com/postgis_concavehull.snippet

Also check out Simon Greener's article on demonstrating ConcaveHull introduced in Oracle 11G R2. http://www.spatialdbadvisor.com/oracle_spatial_tips_tricks/172/concave-hull-geometries-in-oracle-11gr2. The solution we get at 0.75 target percent of convex hull is similar to the shape Simon gets with Oracle SDO_CONCAVEHULL_BOUNDARY.

Disponibilidad: 2.0.0

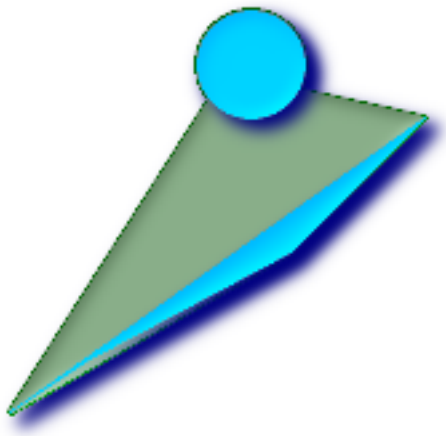
Ejemplos

```
--Get estimate of infected area based on point observations
SELECT d.disease_type,
        ST_ConcaveHull(ST_Collect(d.pnt_geom), 0.99) As geom
        FROM disease_obs As d
        GROUP BY d.disease_type;
```



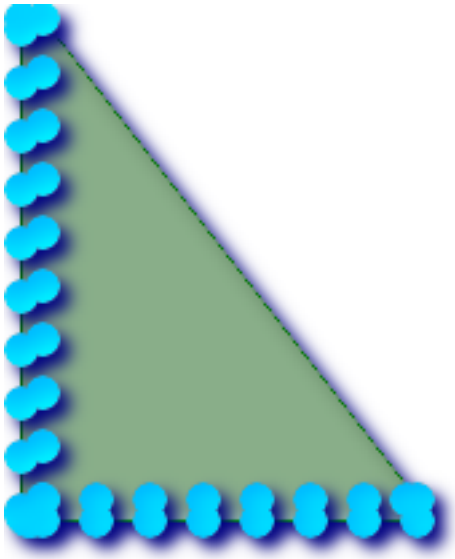
ST_ConcaveHull of 2 polygons encased in target 100% shrink concave hull

```
-- geometries overlaid with concavehull
-- at target 100% shrink (this is the  ↩
            same as convex hull - since no shrink)
SELECT
        ST_ConcaveHull(
                ST_Union(ST_GeomFromText ↩
            ('POLYGON((175 150, 20 40,
                        50 60, 125 100,  ↩
            175 150))'),
                ST_Buffer(ST_GeomFromText ↩
            ('POINT(110 170)'), 20)
                ), 1)
         As convexhull;
```



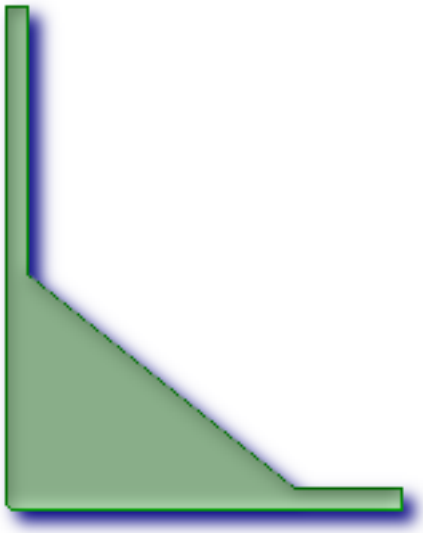
-- geometries overlaid with concavehull at target 90% of convex hull area

```
-- geometries overlaid with concavehull  ↩
            at target 90% shrink
SELECT
        ST_ConcaveHull(
                ST_Union(ST_GeomFromText ↩
            ('POLYGON((175 150, 20 40,
                        50 60, 125 100,  ↩
            175 150))'),
                ST_Buffer(ST_GeomFromText ↩
            ('POINT(110 170)'), 20)
                ), 0.9)
         As target_90;
```



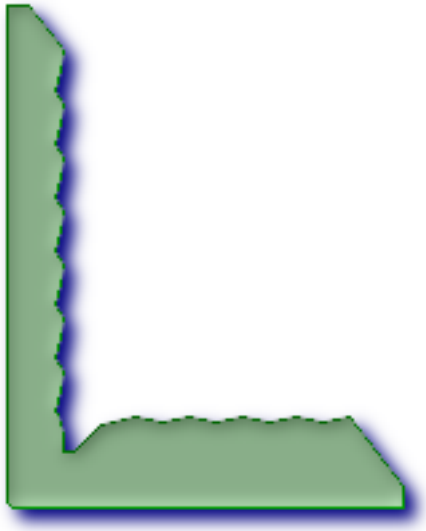
L Shape points overlaid with convex hull

```
-- 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;

SELECT ST_ConvexHull(ST_Collect(geom))
FROM l_shape;
```



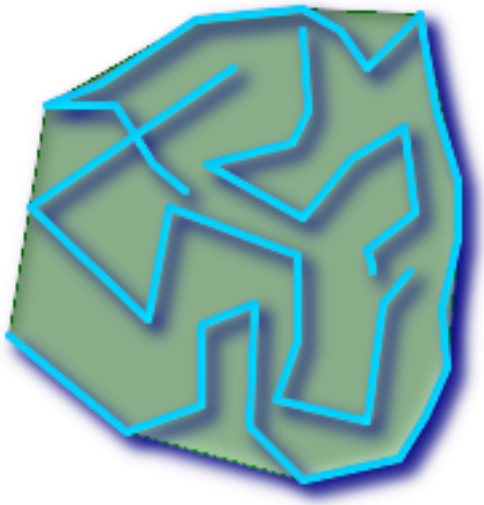
ST_ConcaveHull of L points at target 99% of convex hull

```
SELECT ST_ConcaveHull(ST_Collect(geom),  ↩
            0.99)
        FROM l_shape;
```

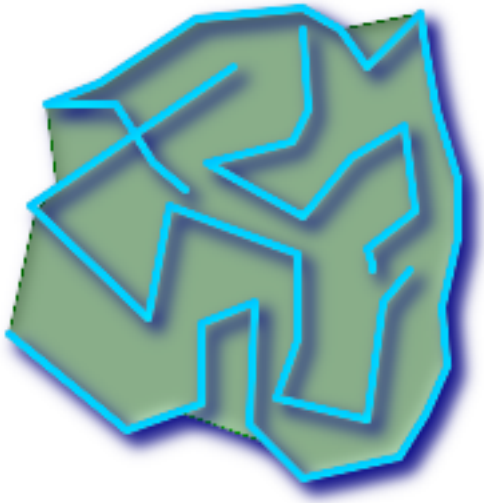


Concave Hull of L points at target 80% convex hull area

```
-- Concave Hull L shape points
        -- at target 80% of convexhull
        SELECT ST_ConcaveHull(ST_Collect( ↩
            geom), 0.80)
        FROM l_shape;
```



multilinestring overlaid with Convex hull



multilinestring with overlaid with Concave hull of linestrings at 99% target -- first hop

```
SELECT ST_ConcaveHull(ST_GeomFromText(' ↩
            MULTILINESTRING((106 164,30 112,74 70,82
          130 62,122 40,156 32,162 76,172  ↩
            88),
(132 178,134 148,128 136,96 128,132  ↩
            108,150 130,
170 142,174 110,156 96,158 90,158 88),
(22 64,66 28,94 38,94 68,114 76,112 30,
132 10,168 18,178 34,186 52,184 74,190  ↩
            100,
190 122,182 148,178 170,176 184,156  ↩
            164,146 178,
132 186,92 182,56 158,36 150,62 150,76  ↩
            128,88 118))'),0.99)
```

Ver también

ST_Collect, ST_ConvexHull, ST_SimplifyPreserveTopology, ST_SnapToGrid

8.11.6 ST_ConvexHull

ST_ConvexHull — The convex hull of a geometry represents the minimum convex geometry that encloses all geometries within the set.

Synopsis

geometry **ST_ConvexHull**(geometry geomA);

Descripción

The convex hull of a geometry represents the minimum convex geometry that encloses all geometries within the set.

One can think of the convex hull as the geometry you get by wrapping an elastic band around a set of geometries. This is different from a concave hull which is analogous to shrink-wrapping your geometries.

It is usually used with MULTI and Geometry Collections. Although it is not an aggregate - you can use it in conjunction with ST_Collect to get the convex hull of a set of points. ST_ConvexHull(ST_Collect(somepointfield)).

It is often used to determine an affected area based on a set of point observations.

Realizado por el módulo de GEOS

 This method implements the OpenGIS Simple Features Implementation Specification for SQL 1.1. s2.1.1.3

 This method implements the SQL/MM specification. SQL-MM 3: 5.1.16

 This function supports 3d and will not drop the z-index.

Ejemplos

```
--Get estimate of infected area based on point observations
SELECT d.disease_type,
        ST_ConvexHull(ST_Collect(d.the_geom)) As the_geom
        FROM disease_obs As d
        GROUP BY d.disease_type;
```

Convex Hull of a MultiLinestring and a MultiPoint seen together with the MultiLinestring and 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))
```

Ver también

ST_Collect, ST_ConcaveHull, ST_MinimumBoundingCircle

8.11.7 ST_CurveToLine

ST_CurveToLine — Converts a CIRCULARSTRING/CURVEPOLYGON to a LINESTRING/POLYGON

Synopsis

geometry **ST_Difference**(geometry geomA, geometry geomB);

Descripción

Converts a CIRCULAR STRING to regular LINESTRING or CURVEPOLYGON to POLYGON. 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 idependent) output.
- 2: Retain angle, avoids reducing angles (segment lengths) when producing symmetric output. Has no effect when Symmetric flag is off.

Disponibilidad: 1.3.3

Enhanced: 2.4.0 added support for max-deviation and max-angle tolerance, and for symmetric output.

 This method implements the OpenGIS 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

8.11.8 ST_DelaunayTriangles

ST_DelaunayTriangles — Return a Delaunay triangulation around the given input points.

Synopsis

geometry **ST_DelaunayTriangles**(geometry g1, float tolerance, int4 flags);

Descripción

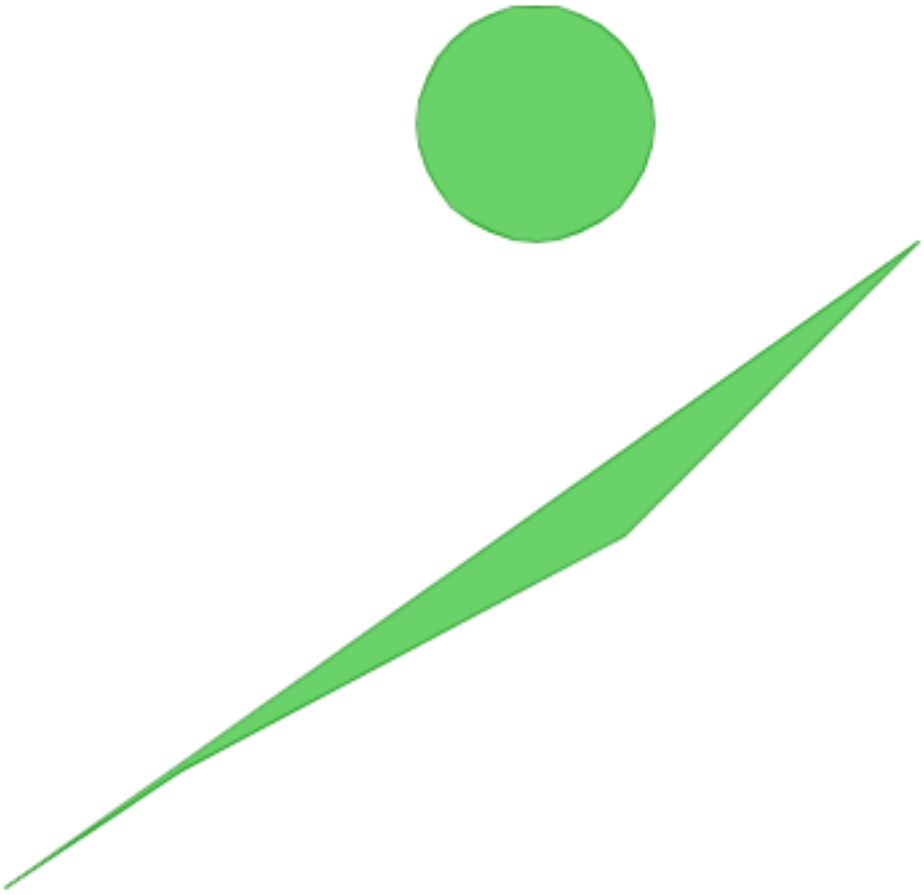
Return a Delaunay triangulation around the vertices of the input geometry. Output is a COLLECTION of polygons (for flags=0) or a MULTILINESTRING (for flags=1) or TIN (for flags=2). The tolerance, if any, is used to snap input vertices togheter.

Disponibilidad: 2.1.0 - requiere GEOS >= 3.4.0.

 This function supports 3d and will not drop the z-index.

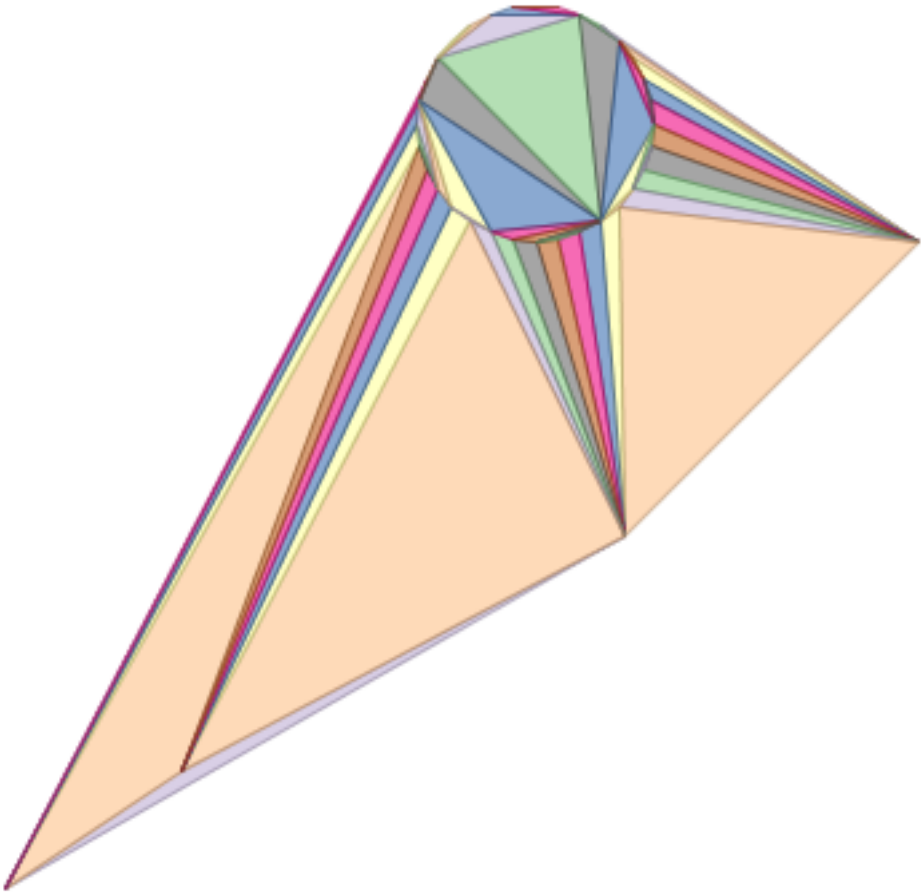
 This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos 2D



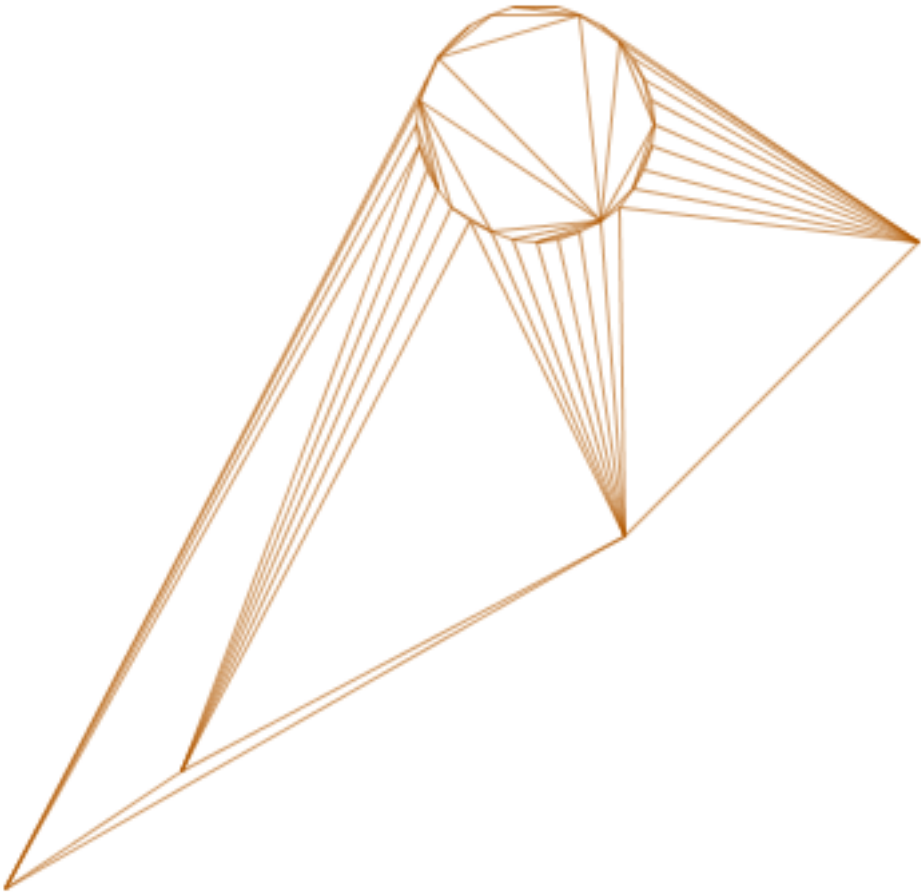
Original polygons

```
-- our original geometry --
        ST_Union(ST_GeomFromText('POLYGON((175 150, 20 40,
                        50 60, 125 100, 175 150))'),
                ST_Buffer(ST_GeomFromText('POINT(110 170)'), 20)
                )
```



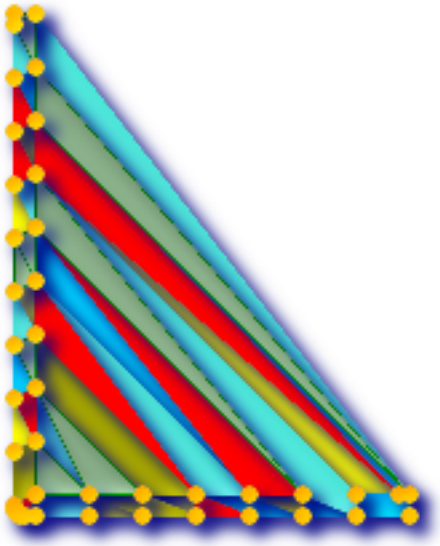
ST_DelaunayTriangles of 2 polygons: delaunay triangle polygons each triangle themed in different color

```
-- 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))
:
:
```

Ejemplos 3D

```
-- 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)))
```

Ver también

ST_ConcaveHull, ST_Dump

8.11.9 ST_Difference

ST_Difference — Devuelve una geometría que representa esa parte de la geometría A que no se intersecta con la geometría B.

Synopsis

geometry **ST_Difference**(geometry geomA, geometry geomB);

Descripción

Devuelve una geometría que representa esa parte de la geometría A que no se intersecta con la geometría B. Uno puede pensar en esto como GeometryA - ST_Intersection(A,B). Si A está completamente contenido en B entonces se devuelve una coleccion de geometría vacia.

Note
Nota - el orden importa. B - A siempre devolverá una parte de B

Realizado por el módulo de GEOS

Note
No llame con un GeometryCollection como argumento


This method implements the OpenGIS 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. Sin embargo, parece que sólo se considera x y cuando se hace la diferencia y se vuelve a pega el Z-Index

Ejemplos

Las cadenas de linea originales se muestran juntas.

Las diferencias de las dos cadenas de lineas

```
--Seguro para 2d. Esta es la misma geometría que se muestra para st_symdifference
SELECT ST_AsText(
        ST_Difference(
                        ST_GeomFromText('LINESTRING(50 100, 50 200)'),
                        ST_GeomFromText('LINESTRING(50 50, 50 150)')
                )
        );

st_astext
---------
LINESTRING(50 150,50 200)
```

```
-- Cuando se utiliza en 3D no hace exactamente lo correcto
SELECT ST_AsEWKT(ST_Difference(ST_GeomFromEWKT('MULTIPOINT(-118.58 38.38 5,-118.60 38.329  ↩
    6,-118.614 38.281 7)'), ST_GeomFromEWKT('POINT(-118.614 38.281 5)')));
st_asewkt
---------
MULTIPOINT(-118.6 38.329 6,-118.58 38.38 5)
```

Ver también

ST_SymDifference

8.11.10 ST_Dump

ST_Dump — Returns a set of geometry_dump (geom,path) rows, that make up a geometry g1.

Synopsis

geometry_dump[] **ST_Dump**(geometry g1);

Descripción

This is a set-returning function (SRF). It returns a set of geometry_dump rows, formed by a geometry (geom) and an array of integers (path). When the input geometry is a simple type (POINT,LINESTRING,POLYGON) a single record will be returned with an empty path array and the input geometry as geom. When the input geometry is a collection or multi it will return a record for each of the collection components, and the path will express the position of the component inside the collection.

ST_Dump is useful for expanding geometries. It is the reverse of a GROUP BY in that it creates new rows. For example it can be use to expand MULTIPOLYGONS into POLYGONS.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Disponibilidad: PostGIS 1.0.0RC1. Requiere PostgreSQL 7.3 o superior.

Note
Antes de 1.3.4, esta función se bloquea si se utiliza con geometrías que contienen curvas. Esto se ha solucionado en la versión 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.the_geom)).geom AS the_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

```
-- Polyhedral surface example
-- Break a Polyhedral surface into its faces
SELECT (a.p_geom).path[1] As path, ST_AsEWKT((a.p_geom).geom) As geom_ewkt
  FROM (SELECT ST_Dump(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;

 path |                geom_ewkt
------+-----------------------------------------
    1 | POLYGON((0 0 0,0 0 1,0 1 1,0 1 0,0 0 0))
    2 | POLYGON((0 0 0,0 1 0,1 1 0,1 0 0,0 0 0))
    3 | POLYGON((0 0 0,1 0 0,1 0 1,0 0 1,0 0 0))
    4 | POLYGON((1 1 0,1 1 1,1 0 1,1 0 0,1 1 0))
    5 | POLYGON((0 1 0,0 1 1,1 1 1,1 1 0,0 1 0))
    6 | POLYGON((0 0 1,1 0 1,1 1 1,0 1 1,0 0 1))
```

```
-- TIN --
SELECT (g.gdump).path, ST_AsEWKT((g.gdump).geom) as wkt
  FROM
    (SELECT
       ST_Dump( 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 gdump
    ) AS g;
-- result --
 path |                 wkt
------+-------------------------------------
 {1}  | TRIANGLE((0 0 0,0 0 1,0 1 0,0 0 0))
 {2}  | TRIANGLE((0 0 0,0 1 0,1 1 0,0 0 0))
```

Ver también

geometry_dump, Section 14.6, ST_Collect, ST_Collect, ST_GeometryN

8.11.11 ST_DumpPoints

ST_DumpPoints — Returns a set of geometry_dump (geom,path) rows of all points that make up a geometry.

Synopsis

geometry_dump[]**ST_DumpPoints**(geometry geom);

Descripción

This set-returning function (SRF) returns a set of `geometry_dump` rows formed by a geometry (`geom`) and an array of integers (`path`).

The *`geom`* component of `geometry_dump` are all the `POINT`s that make up the supplied geometry

The *`path`* component of `geometry_dump` (an `integer[]`) is an index reference enumerating the `POINT`s of the supplied geometry. For example, if a `LINESTRING` is supplied, a path of `{i}` is returned where `i` is the `nth` coordinate in the `LINESTRING`. If a `POLYGON` is supplied, a path of `{i,j}` is returned where `i` is the ring number (1 is outer; inner rings follow) and `j` enumerates the `POINT`s (again 1-based index).

Enhanced: 2.1.0 Faster speed. Reimplemented as native-C.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

Disponibilidad: 1.5.0

✓ This method supports Circular Strings and Curves

✓ This function supports Polyhedral surfaces.

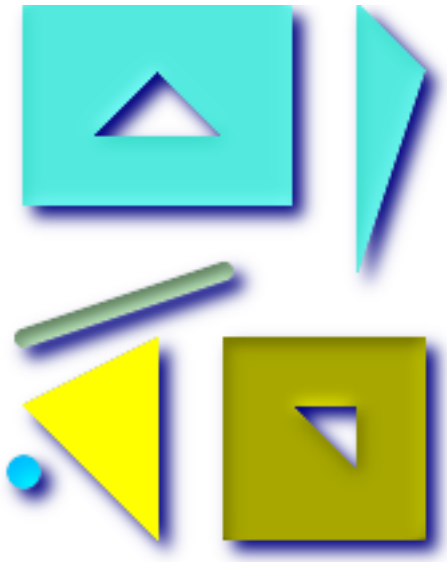
✓ This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

✓ This function supports 3d and will not drop the z-index.

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)
```

Standard Geometry Examples



```
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)
```

```
-- Triangle --
SELECT (g.gdump).path, ST_AsText((g.gdump).geom) as wkt
  FROM
    (SELECT
       ST_DumpPoints( ST_GeomFromEWKT('TRIANGLE ((
                0 0,
                0 9,
                9 0,
                0 0
            ))') ) AS gdump
    ) AS g;
-- result --
 path |    wkt
------+------------
 {1}  | POINT(0 0)
 {2}  | POINT(0 9)
 {3}  | POINT(9 0)
 {4}  | POINT(0 0)
```

```
-- TIN --
```

```
SELECT (g.gdump).path, ST_AsEWKT((g.gdump).geom) as wkt
  FROM
    (SELECT
       ST_DumpPoints( 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 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 0)
 {1,1,4} | 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(0 0 0)
(8 rows)
```

Ver también

geometry_dump, Section 14.6, ST_Dump, ST_DumpRings

8.11.12 ST_DumpRings

ST_DumpRings — Returns a set of `geometry_dump` rows, representing the exterior and interior rings of a polygon.

Synopsis

geometry_dump[] **ST_DumpRings**(geometry a_polygon);

Descripción

This is a set-returning function (SRF). It returns a set of `geometry_dump` rows, defined as an `integer[]` and a `geometry`, aliased "path" and "geom" respectively. The "path" field holds the polygon ring index containing a single integer: 0 for the shell, >0 for holes. The "geom" field contains the corresponding ring as a polygon.

Disponibilidad: PostGIS 1.1.3. Requiere PostgreSQL 7.3 o superior.

Note
This only works for POLYGON geometries. It will not work for MULTIPOLYGONS

This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT sometable.field1, sometable.field1,
          (ST_DumpRings(sometable.the_geom)).geom As the_geom
FROM sometableOfpolys;

SELECT ST_AsEWKT(geom) As the_geom, path
        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 |                                          the_geom
------------------------------------------------------------------------------------------------------------

  {0} | 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))
  {1} | POLYGON((-8149362 5132394 1,-8149446 5132501 1,
          |           -8149548 5132597 1,-8149695 5132675 1,-8149362 5132394 1))
```

Ver también

geometry_dump, Section 14.6, ST_Dump, ST_ExteriorRing, ST_InteriorRingN

8.11.13 ST_FlipCoordinates

ST_FlipCoordinates — Returns a version of the given geometry with X and Y axis flipped. Useful for people who have built latitude/longitude features and need to fix them.

Synopsis

geometry **ST_FlipCoordinates**(geometry geom);

Descripción

Returns a version of the given geometry with X and Y axis flipped.

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

8.11.14 ST_GeneratePoints

ST_GeneratePoints — Converts a polygon or multi-polygon into a multi-point composed of randomly location points within the original areas.

Synopsis

geometry **ST_GeneratePoints**(g geometry , npoints numeric);

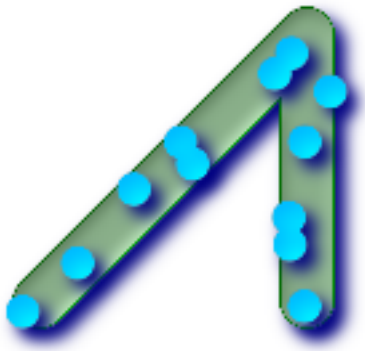
Descripción

ST_GeneratePoints generates pseudo-random points until the requested number are found within the input area.

Disponibilidad: 2.3.0

Ejemplos

Original Polygon



Generated 12 Points overlaid on top of original polygon

```
SELECT ST_GeneratePoints(
        ST_Buffer(
                ST_GeomFromText(
                'LINESTRING(50 50,150  ↩
    150,150 50)'
                ), 10, 'endcap=round join ↩
    =round'), 12);
```

8.11.15 ST_Intersection

ST_Intersection — (T) Returns a geometry that represents the shared portion of geomA and geomB.

Synopsis

geometry **ST_Intersection**(geometry geomA , geometry geomB);
geography **ST_Intersection**(geography geogA , geography geogB);

Descripción

Returns a geometry that represents the point set intersection of the Geometries.

In other words - that portion of geometry A and geometry B that is shared between the two geometries.

If the geometries do not share any space (are disjoint), then an empty geometry collection is returned.

ST_Intersection in conjunction with ST_Intersects is very useful for clipping geometries such as in bounding box, buffer, region queries where you only want to return that portion of a geometry that sits in 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.

Important
Do not call with a `GEOMETRYCOLLECTION` as an argument

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 values when `postgis.backend=geos`. `postgis.backend=sfcgal`, it will return a 2D geometry regardless ignoring the Z-Coordinate. Refer to postgis.backend for details.

Realizado por el módulo de GEOS

This method is also provided by SFCGAL backend.

Availability: 1.5 support for geography data type was introduced.

This method implements the OpenGIS 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

Ejemplos

```
SELECT ST_AsText(ST_Intersection('POINT(0 0)'::geometry, 'LINESTRING ( 2 0, 0 2 )':: ↩
    geometry));
 st_astext
---------------
GEOMETRYCOLLECTION EMPTY
(1 row)
SELECT ST_AsText(ST_Intersection('POINT(0 0)'::geometry, 'LINESTRING ( 0 0, 0 2 )':: ↩
    geometry));
 st_astext
---------------
POINT(0 0)
(1 row)

---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.the_geom, trails. ↩
    the_geom))).geom As clipped_geom
FROM country
        INNER JOIN trails
```

```
        ON ST_Intersects(country.the_geom, trails.the_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.the_geom, poly.the_geom),
                                0.0)
                                ) As clipped_geom
FROM country
        INNER JOIN poly
        ON ST_Intersects(country.the_geom, poly.the_geom)
        WHERE Not ST_IsEmpty(ST_Buffer(ST_Intersection(country.the_geom, poly.the_geom) ↩
            ,0.0));
```

Examples: 2.5Dish

Geos is the default backend if not set. Note this is not a true intersection, compare to the same example using ST_3DIntersection.

```
set postgis.backend=geos;
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)
```

If your PostGIS is compiled with sfcgal support, have option of using sfcgal, but note if basically cases down both geometries to 2D before doing intersection and returns the ST_Force2D equivalent result which is a 2D geometry

```
set postgis.backend=sfcgal;
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;

                     wkt
-----------------------------------------------
 MULTILINESTRING((0.5 0.5,0 0),(1 1,0.5 0.5))
```

Ver también

ST_3DIntersection, ST_Difference, ST_Dimension, ST_Dump, ST_Force2D, ST_SymDifference, ST_Intersects, ST_Multi

8.11.16 ST_LineToCurve

ST_LineToCurve — Converts a LINESTRING/POLYGON to a CIRCULARSTRING, CURVEPOLYGON

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.

Disponibilidad: 1.3.3

 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.the_geom)) As curvedastext,ST_AsText(foo.the_geom) As  ↩
    non_curvedastext
        FROM (SELECT ST_Buffer('POINT(1 3)'::geometry, 3) As the_geom) As foo;

curvedatext                                                                    non_curvedastext
-------------------------------------------------------------------------------|------------------------------

CURVEPOLYGON(CIRCULARSTRING(4 3,3.12132034355964 0.878679656440359, | POLYGON((4  ↩
    3,3.94235584120969 2.41472903395162,3.77163859753386 1.85194970290473,
1 0,-1.12132034355965 5.12132034355963,4 3))                         |  3.49440883690764  ↩
    1.33328930094119,3.12132034355964 0.878679656440359,
                                                                     |  2.66671069905881  ↩
                                                                         0.505591163092366,2.14805029
                                                                          0.228361402466141,
                                                                     |  1.58527096604839  ↩
                                                                         0.0576441587903094,1 ↩
                                                                          0,
                                                                     |  0.414729033951621  ↩
                                                                         0.0576441587903077,-0.148050
                                                                          0.228361402466137,
                                                                     |  -0.666710699058802  ↩
                                                                         0.505591163092361,-1.1213203
                                                                          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

8.11.17 ST_MakeValid

ST_MakeValid — Attempts to make an invalid geometry valid without losing vertices.

Synopsis

geometry **ST_MakeValid**(geometry input);

Descripción

The function attempts to create a valid representation of a given invalid geometry without losing any of the input vertices. Already-valid geometries are returned without further intervention.

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.

Disponibilidad: 2.0.0, requiere GEOS-3.3.0

Enhanced: 2.0.1, speed improvements requires GEOS-3.3.4

Enhanced: 2.1.0 added support for GEOMETRYCOLLECTION and MULTIPOINT.

 This function supports 3d and will not drop the z-index.

Ver también

ST_IsValid ST_CollectionExtract

8.11.18 ST_MemUnion

ST_MemUnion — Same as ST_Union, only memory-friendly (uses less memory and more processor time).

Synopsis

geometry **ST_MemUnion**(geometry set geomfield);

Descripción

Some useful description here.

Note
Same as ST_Union, only memory-friendly (uses less memory and more processor time). This aggregate function works by unioning the geometries one at a time to previous result as opposed to ST_Union aggregate which first creates an array and then unions

 This function supports 3d and will not drop the z-index.

Ejemplos

```
Ver ST_Union
```

Ver también

ST_Union

8.11.19 ST_MinimumBoundingCircle

ST_MinimumBoundingCircle — Returns the smallest circle polygon that can fully contain a geometry. Default uses 48 segments per quarter circle.

Synopsis

geometry **ST_MinimumBoundingCircle**(geometry geomA, integer num_segs_per_qt_circ=48);

Descripción

Returns the smallest circle polygon that can fully contain a geometry.

Note
The 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, with little performance penalty. For applications where a polygonal approximation is not suitable, ST_MinimumBoundingRadius may be used.

It is often used with MULTI and Geometry Collections. Although it is not an aggregate - you can use it in conjunction with ST_Collect to get the minimum bounding circle of a set of geometries. ST_MinimumBoundingCircle(ST_Collect(somepointfield)).

The ratio of the area of a polygon divided by the area of its Minimum Bounding Circle is often referred to as the Roeck test.

Disponibilidad: 1.4.0 - requiere GEOS

Ver también

ST_Collect, ST_MinimumBoundingRadius

Ejemplos

```
SELECT d.disease_type,
        ST_MinimumBoundingCircle(ST_Collect(d.the_geom)) As the_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_Collect, ST_MinimumBoundingRadius

8.11.20 ST_MinimumBoundingRadius

ST_MinimumBoundingRadius — Returns the center point and radius of the smallest circle that can fully contain a geometry.

Synopsis

(geometry, double precision) **ST_MinimumBoundingRadius**(geometry geom);

Descripción

Returns a record containing the center point and radius of the smallest circle that can fully contain a geometry.

Can be used in conjunction with ST_Collect to get the minimum bounding circle of a set of geometries.

Disponibilidad: 2.3.0

Ver también

ST_Collect, 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
```

8.11.21 ST_OrientedEnvelope

ST_OrientedEnvelope — Returns a minimum rotated rectangle enclosing a geometry.

Synopsis

geometry **ST_Difference**(geometry geomA, geometry geomB);

Descripción

Returns a mimimum rotated rectangle enclosing a geometry. Note that more than one minimum rotated rectangle may exist. May return a Point or LineString in the case of degenerate inputs.

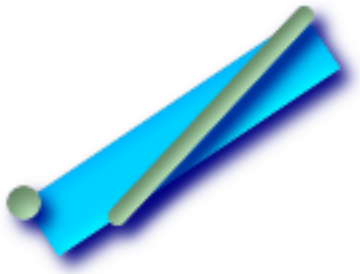
Disponibilidad: 2.0.0

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))
```

8.11.22 ST_Polygonize

ST_Polygonize — Aggregate. Creates a GeometryCollection containing possible polygons formed from the constituent linework of a set of geometries.

Synopsis

geometry **ST_Polygonize**(geometry set geomfield);
geometry **ST_Polygonize**(geometry[] geom_array);

Descripción

Creates a GeometryCollection containing possible polygons formed from the constituent linework of a set of geometries.

Note
Geometry Collections are often difficult to deal with with third party tools, so use ST_Polygonize in conjunction with ST_Dump to dump the polygons out into individual polygons.

Note
Input linework must be correctly noded for this function to work properly

Disponibilidad: 1.1.0RC1 - requiere GEOS >= 2.1.0.

Examples: Polygonizing single linestrings

```
SELECT ST_AsEWKT(ST_Polygonize(the_geom_4269)) As geomtextrep
FROM (SELECT the_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(the_geom_4269) As polycoll
        FROM (SELECT the_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

8.11.23 ST_Node

ST_Node — Node a set of linestrings.

Synopsis

geometry **ST_Node**(geometry geom);

Descripción

Fully node a set of linestrings using the least possible number of nodes while preserving all of the input ones.

 This function supports 3d and will not drop the z-index.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

Note
Due to a bug in GEOS up to 3.3.1 this function fails to node self-intersecting lines. This is fixed with GEOS 3.3.2 or higher.

Note
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.

Ejemplos

```
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))
```

Ver también

ST_UnaryUnion

8.11.24 ST_OffsetCurve

ST_OffsetCurve — Return an offset line at a given distance and side from an input line. Useful for computing parallel lines about a center 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.

For positive distance the offset will be at the left side of the input line and retain the same direction. For a negative distance it'll be at the right side and in the opposite direction.

Availability: 2.0 - requires GEOS >= 3.2, improved with GEOS >= 3.3

Enhanced: 2.5 - added support for GEOMETRYCOLLECTION and MULTILINESTRING

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'.

Units of distance are measured in units of the spatial reference system.

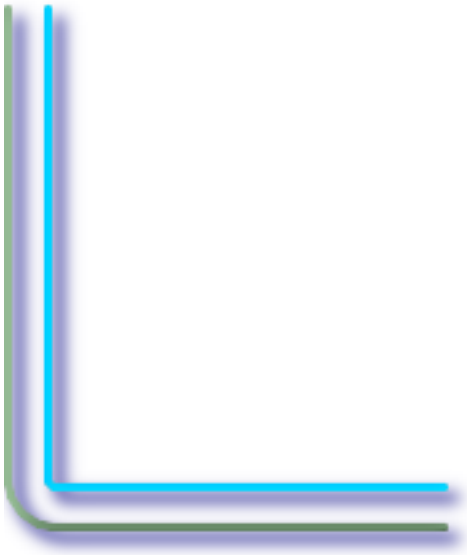
Realizado por el módulo GEOS.

Note
This function ignores the third dimension (z) and will always give a 2-d result even when presented with a 3d-geometry.

Ejemplos

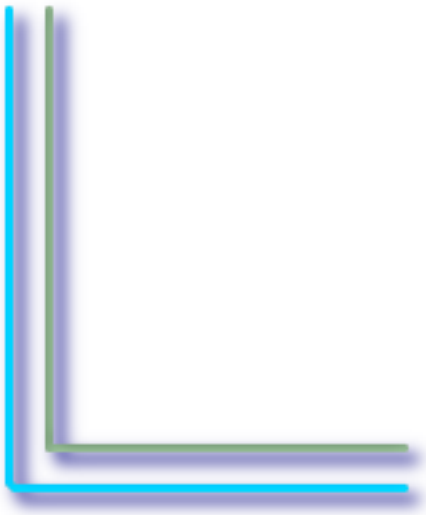
Compute an open buffer around roads

```
SELECT ST_Union(
 ST_OffsetCurve(f.the_geom,  f.width/2, 'quad_segs=4 join=round'),
 ST_OffsetCurve(f.the_geom, -f.width/2, 'quad_segs=4 join=round')
) as track
FROM someroadstable;
```



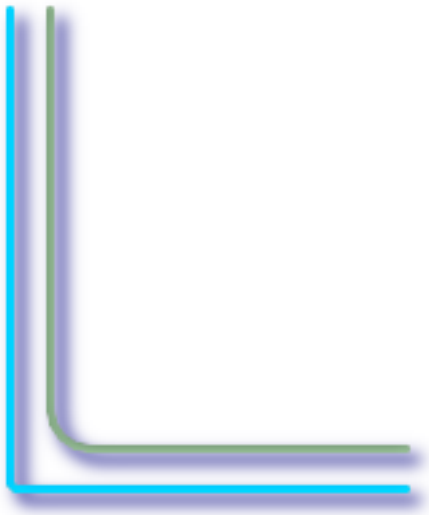
15, 'quad_segs=4 join=round' original line and its offset 15 units.

```
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)
```



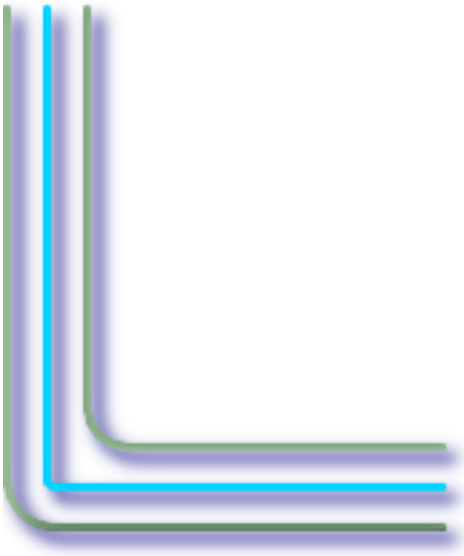
-15, 'quad_segs=4 join=round' original line and its offset -15 units

```
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)
```



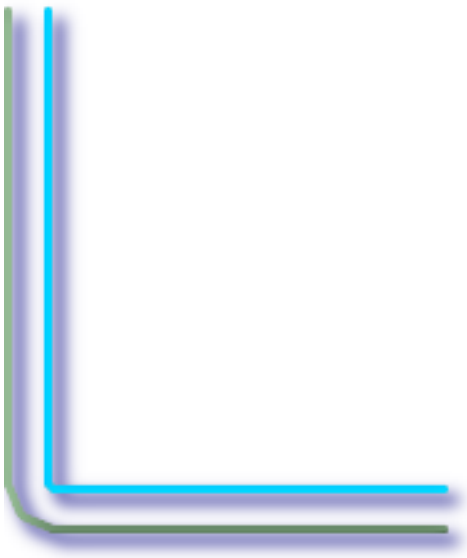
double-offset to get more curvy, note the first reverses direction, so -30 + 15 = -15

```
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 7.393398282201
2.14180701233067 12.2597485145237,1 18,1  ↩
    195),
(164 31,46 31,40.2597485145236  ↩
    32.1418070123307,35.3933982822018 35.39339828220
32.1418070123307 40.2597485145237,31  ↩
    46,31 195))
```



15, 'quad_segs=4 join=bevel' shown with original line

```
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)
```

15,-15 collected, join=mitre mitre_limit=2.1

```
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))
```

Ver también

ST_Buffer

8.11.25 ST_RemoveRepeatedPoints

ST_RemoveRepeatedPoints — Returns a version of the given geometry with duplicated points removed.

Synopsis

geometry **ST_RemoveRepeatedPoints**(geometry geom, float8 tolerance);

Descripción

Returns a version of the given geometry with duplicated points removed. Will actually do something only with (multi)lines, (multi)polygons and multipoints 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.

If the tolerance parameter is provided, vertices within the tolerance of one another will be considered the "same" for the purposes of removal.

Disponibilidad: 2.2.0

 This function supports Polyhedral surfaces.

 This function supports 3d and will not drop the z-index.

Ver también

ST_Simplify

8.11.26 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.

Disponibilidad: 2.0.0 requiere GEOS >= 3.3.0.

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

8.11.27 ST_ShiftLongitude

ST_ShiftLongitude — Toggle geometry coordinates between -180..180 and 0..360 ranges.

Synopsis

geometry **ST_ShiftLongitude**(geometry geomA);

Descripción

Reads every point/vertex in every component of every feature in a geometry, and if the longitude coordinate is <0, adds 360 to it. The result would be a 0-360 version of the data to be plotted in a 180 centric map

---

Note
This is only useful for data in long lat e.g. 4326 (WGS 84 long lat)


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

```
--3d points
SELECT ST_AsEWKT(ST_ShiftLongitude(ST_GeomFromEWKT('SRID=4326;POINT(-118.58 38.38 10)')))  ↩
    As geomA,
         ST_AsEWKT(ST_ShiftLongitude(ST_GeomFromEWKT('SRID=4326;POINT(241.42 38.38 10)')))  ↩
            As geomb
geomA                                                    geomB
----------                                              -----------
SRID=4326;POINT(241.42 38.38 10) SRID=4326;POINT(-118.58 38.38 10)

--regular line string
SELECT ST_AsText(ST_ShiftLongitude(ST_GeomFromText('LINESTRING(-118.58 38.38, -118.20  ↩
    38.45)')))

st_astext
----------
LINESTRING(241.42 38.38,241.8 38.45)
```

Ver también

ST_WrapX

8.11.28 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 togheter.

Note
This is useful to "recenter" long-lat input to have features of interest not spawned from one side to the other.

Disponibilidad: 2.3.0


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(the_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(the_geom, -30, 360);
```

Ver también

ST_ShiftLongitude

8.11.29 ST_Simplify

ST_Simplify — Returns a "simplified" version of the given geometry using the Douglas-Peucker algorithm.

Synopsis

geometry **ST_Simplify**(geometry geomA, float tolerance, boolean preserveCollapsed);

Descripción

Returns a "simplified" version of the given geometry using the Douglas-Peucker 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.

The "preserve collapsed" flag will retain objects that would otherwise be too small given the tolerance. For example, a 1m long line simplified with a 10m tolerance. If the preserve flag is given, the line will not disappear. This flag is useful for rendering engines, to avoid having large numbers of very small objects disappear from a map leaving surprising gaps.

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.

Disponibilidad: 1.2.2

Ejemplos

A circle simplified too much becomes a triangle, medium an octagon,

```
SELECT ST_Npoints(the_geom) As np_before, ST_NPoints(ST_Simplify(the_geom,0.1)) As  ↩
    np01_notbadcircle, ST_NPoints(ST_Simplify(the_geom,0.5)) As np05_notquitecircle,
ST_NPoints(ST_Simplify(the_geom,1)) As np1_octagon, ST_NPoints(ST_Simplify(the_geom,10)) As ↩
     np10_triangle,
(ST_Simplify(the_geom,100) is null) As  np100_geometrygoesaway
FROM (SELECT ST_Buffer('POINT(1 3)', 10,12) As the_geom) As foo;
-result
 np_before | np01_notbadcircle | np05_notquitecircle | np1_octagon | np10_triangle |  ↩
     np100_geometrygoesaway
-----------+-------------------+---------------------+-------------+---------------+----------------

                49 |                33 |                  17 |           9 |             4  ↩
                    | t
```

Ver también

ST_IsSimple, ST_SimplifyPreserveTopology, Topology ST_Simplify

8.11.30 ST_SimplifyPreserveTopology

ST_SimplifyPreserveTopology — Returns a "simplified" version of the given geometry using the Douglas-Peucker algorithm. Will avoid creating derived geometries (polygons in particular) that are invalid.

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.

Note
Requiere GEOS 3.0.0+

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(the_geom) As np_before, ST_NPoints(ST_SimplifyPreserveTopology(the_geom ↩
    ,0.1)) As np01_notbadcircle, ST_NPoints(ST_SimplifyPreserveTopology(the_geom,0.5)) As  ↩
    np05_notquitecircle,
ST_NPoints(ST_SimplifyPreserveTopology(the_geom,1)) As np1_octagon, ST_NPoints( ↩
    ST_SimplifyPreserveTopology(the_geom,10)) As np10_square,
ST_NPoints(ST_SimplifyPreserveTopology(the_geom,100)) As  np100_stillsquare
FROM (SELECT ST_Buffer('POINT(1 3)', 10,12) As the_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

8.11.31 ST_SimplifyVW

ST_SimplifyVW — Returns a "simplified" version of the given 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

8.11.32 ST_ChaikinSmoothing

ST_ChaikinSmoothing — Returns a "smoothed" version of the given geometry using the Chaikin algorithm

Synopsis

geometry **ST_ChaikinSmoothing**(geometry geom, integer nIterations = 1, boolean preserveEndPoints = false);

Descripción

Returns a "smoothed" version of the given geometry using the Chaikin algorithm. See Chaikins-Algorithm for an explanation of the process. For each iteration the number of vertex points will double. The function puts new vertex points at 1/4 of the line before and after each point and removes the original point. To reduce the number of points use one of the simplification functions on the result. The new points gets interpolated values for all included dimensions, also z and m.

Second argument, number of iterations is limited to max 5 iterations

Note third argument is only valid for polygons, and will be ignored for linestrings

This function handles 3D and the third dimension will affect the result.

Note
Note that returned geometry will get more points than the original. To reduce the number of points again use one of the simplification functions on the result. (see ST_Simplify and ST_SimplifyVW)

Disponibilidad: 2.0.0

Ejemplos

A triangle is smoothed

```
select ST_AsText(ST_ChaikinSmoothing(geom)) smoothed
FROM (SELECT  'POLYGON((0 0, 8 8, 0 16, 0 0))'::geometry geom) As foo;
&#x250c;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2
&#x2502;                 smoothed                 &#x2502;
&#x251c;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2
&#x2502; POLYGON((2 2,6 6,6 10,2 14,0 12,0 4,2 2)) &#x2502;
&#x2514;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2500;&#x2
```

Ver también

ST_Simplify, ST_Dump

8.11.33 ST_FilterByM

ST_FilterByM — Filters vertex points based on their m-value

Synopsis

geometry **ST_Difference**(geometry geomA, geometry geomB);

Descripción

Filters away 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 geoemtry. If resulting geometry have too few vertex points left for its geometry type an empty geoemtry will be returned. In a geometry collection geometries without enough points will just be left out silently. If

This function is mainly intended to be used in conjunction with ST_SetEffectiveArea. ST_EffectiveArea sets the effective area of a vertex in it's m-value. With ST_FilterByM it then is possible to get a simplified version of the geoemtry without any calculations, just by filtering

Note
There is a difference in what ST_SimplifyVW returns when not enough points meets the creterias compared to ST_FilterByM. ST_SimplifyVW returns the geometry with enough points while ST_FilterByM returns an empty geometry

Note
Note that the retuned geometry might be invalid

Note
This function returns all dimensions, also the z and m-value

Disponibilidad: 2.0.0

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_Dump

8.11.34 ST_SetEffectiveArea

ST_SetEffectiveArea — Sets the effective area for each vertex, storing the value in the M ordinate. A simplified geometry can then be generated by filtering on the M ordinate.

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

8.11.35 ST_Split

ST_Split — Returns a collection of geometries resulting by splitting a geometry.

Synopsis

geometry **ST_Split**(geometry input, geometry blade);

Descripción

The function supports splitting a line by (multi)point, (multi)line or (multi)polygon boundary, a (multi)polygon by line. The returned geometry is always a collection.

Think of this function as the opposite of ST_Union. Theoretically applying ST_Union to the elements of the returned collection should always yield the original geometry.

Disponibilidad: 2.0.0

Enhanced: 2.2.0 support for splitting a line by a multiline, a multipoint or (multi)polygon boundary was introduced.

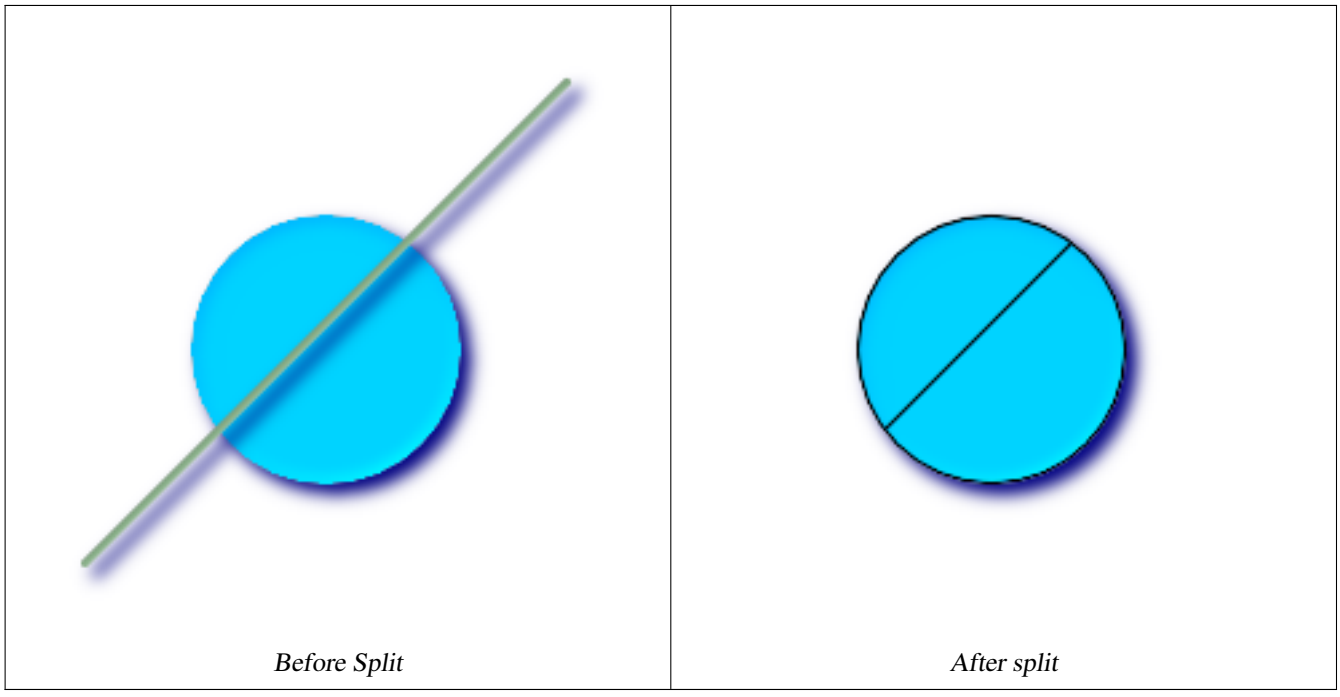
Mejora: 2.0.0 se introdujeron soporte de superficies poliédricas y TIN.

Note
To improve the robustness of ST_Split it may be convenient to ST_Snap the input to the blade in advance using a very low tolerance. Otherwise the internally used coordinate grid may cause tolerance problems, where coordinates of input and blade do not fall onto each other and the input is not being split correctly (see #2192).

Note
When a (multi)polygon is passed as as the blade, its linear component (the boundary) is used for cutting the input.

Ejemplos

Polygon Cut by Line

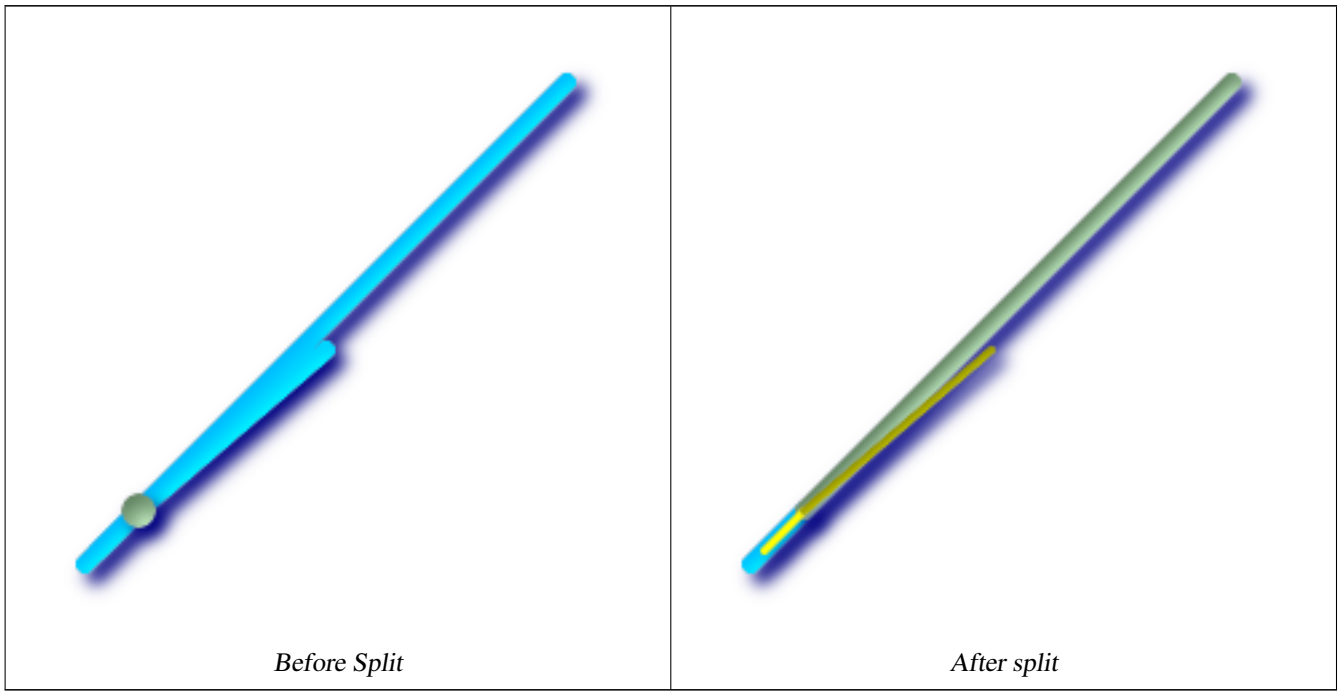


Before Split | *After split*

```
-- this creates a geometry collection consisting of the 2 halves of the polygon
-- this is similar to the example we demonstrated in ST_BuildArea
SELECT ST_Split(circle, line)
FROM (SELECT
    ST_MakeLine(ST_MakePoint(10, 10),ST_MakePoint(190, 190)) As line,
    ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50) As circle) As foo;

-- result --
 GEOMETRYCOLLECTION(POLYGON((150 90,149.039264020162 80.2454838991936,146.193976625564  ↩
     70.8658283817455,..), POLYGON(..)))

-- To convert to individual polygons, you can use ST_Dump or ST_GeometryN
SELECT ST_AsText((ST_Dump(ST_Split(circle, line))).geom) As wkt
```

```
FROM (SELECT
    ST_MakeLine(ST_MakePoint(10, 10),ST_MakePoint(190, 190)) As line,
    ST_Buffer(ST_GeomFromText('POINT(100 90)'), 50) As circle) As foo;

-- result --
wkt
---------------
POLYGON((150 90,149.039264020162 80.2454838991936,..))
POLYGON((60.1371179574584 60.1371179574584,58.4265193848728  ↩
    62.2214883490198,53.8060233744357 ..))
```

Multilinestring Cut by point



Before Split | *After split*

```
SELECT ST_AsText(ST_Split(mline, pt)) As wktcut
        FROM (SELECT
    ST_GeomFromText('MULTILINESTRING((10 10, 190 190), (15 15, 30 30, 100 90))') As mline,
    ST_Point(30,30) As pt) As foo;

wktcut
------
GEOMETRYCOLLECTION(
    LINESTRING(10 10,30 30),
    LINESTRING(30 30,190 190),
    LINESTRING(15 15,30 30),
    LINESTRING(30 30,100 90)
)
```

Ver también

ST_AsText, ST_BuildArea, ST_Dump, ST_GeometryN, ST_Union, ST_Subdivide

8.11.36 ST_SymDifference

ST_SymDifference — Returns a geometry that represents the portions of A and B that do not intersect. It is called a symmetric difference because ST_SymDifference(A,B) = ST_SymDifference(B,A).

Synopsis

geometry **ST_SymDifference**(geometry geomA, geometry geomB);

Descripción

Returns a geometry that represents the portions of A and B that do not intersect. It is called a symmetric difference because ST_SymDifference(A,B) = ST_SymDifference(B,A). One can think of this as ST_Union(geomA,geomB) - ST_Intersection(A,B).

Realizado por el módulo de GEOS

Note
No llame con un GeometryCollection como argumento

 This method implements the OpenGIS 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. Sin embargo, parece que sólo se considera x y cuando se hace la diferencia y se vuelve a pega el Z-Index

Ejemplos

The original linestrings shown together

The symmetric difference of the two linestrings

```
--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))
```

Ver también

ST_Difference, ST_Intersection, ST_Union

8.11.37 ST_Subdivide

ST_Subdivide — Returns a set of geometry where no geometry in the set has more than the specified number of vertices.

Synopsis

setof geometry **ST_Subdivide**(geometry geom, integer max_vertices=256);

Descripción

Divides geometry into parts until a part can be represented using no more than `max_vertices`. Point-in-polygon and other overlay operations are normally faster for indexed subdivided dataset: "miss" cases are faster to check as boxes for all parts typically cover smaller area than original geometry box, "hit" cases are faster because recheck operates on less points. Uses the same envelope clipping as `ST_ClipByBox2D`. `max_vertices` must be 5 or more, as 5 points are needed to represent a closed box.

Disponibilidad: 2.2.0 - requiere GEOS >= 3.5.0.

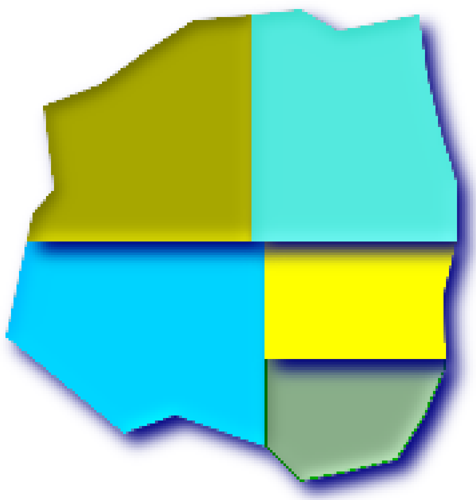
Enhanced: 2.5.0 reuses existing points on polygon split, vertex count is lowered from 8 to 5.

Ejemplos

```
-- Subdivide complex geometries in table, in place
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,
```

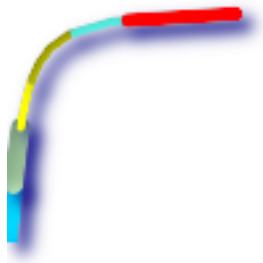
```
        ST_Subdivide(geom, 255) as geom
    from complex_areas_to_subdivide;
```

```
-- Create a new subdivided table suitable for joining to the original
CREATE TABLE subdivided_geoms AS
SELECT pkey, ST_Subdivide(geom) AS geom
FROM original_geoms;
```



Subdivide max 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 \&\#x2502;                                                        wkt
\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x253c;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500 ↩
    ;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500 ↩
    ;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500 ↩
    ;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500 ↩
    ;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500 ↩
    ;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500 ↩
    ;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\# ↩
    x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;\&\#x2500;
  1 \&\#x2502; POLYGON((119 23,85 35,68 29,66 28,32 56,22 64,29.8260869565217 100,119 ↩
    100,119 23))
  2 \&\#x2502; POLYGON((132 10,119 23,119 56,186 56,186 52,178 34,168 18,147 13,132 10) ↩
    )
  3 \&\#x2502; POLYGON((119 56,119 100,190 100,185 79,186 56,119 56))
  4 \&\#x2502; POLYGON((29.8260869565217 100,32 110,40 119,36 150,57 158,75 171,92  ↩
    182,114 184,114 100,29.8260869565217 100))
  5 \&\#x2502; POLYGON((114 184,132 186,146 178,176 184,179 162,184 141,190 122,190  ↩
    100,114 100,114 184))
```



Useful in conjunction with ST_Segmentize(geography) to create additional vertices that can then be used for splitting.

```
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)
```

Ver también

ST_AsText, Section 14.6, ST_Collect, ST_Collect, ST_GeometryN

8.11.38 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

8.11.39 ST_Union

ST_Union — Returns a geometry that represents the point set union of the Geometries.

Synopsis

geometry **ST_Union**(geometry set g1field);
geometry **ST_Union**(geometry g1, geometry g2);
geometry **ST_Union**(geometry[] g1_array);

Descripción

Output type can be a MULTI*, single geometry, or Geometry Collection. Comes in 2 variants. Variant 1 unions 2 geometries resulting in a new geometry with no intersecting regions. Variant 2 is an aggregate function that takes a set of geometries and unions them into a single ST_Geometry resulting in no intersecting regions.

Aggregate version: This function returns a MULTI geometry or NON-MULTI geometry from a set 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.

Non-Aggregate version: This function returns a geometry being a union of two input geometries. Output type can be a MULTI*, NON-MULTI or GEOMETRYCOLLECTION. If any are NULL, then NULL is returned.

Note
ST_Collect and ST_Union are often interchangeable. ST_Union is in general orders of magnitude slower than ST_Collect because it tries to dissolve boundaries and reorder geometries to ensure that a constructed Multi* doesn't have intersecting regions.

Realizado por el módulo GEOS.

NOTE: this function was formerly called GeomUnion(), which was renamed from "Union" because UNION is an SQL reserved word.

Availability: 1.4.0 - ST_Union was enhanced. ST_Union(geomarray) was introduced and also faster aggregate collection in PostgreSQL. If you are using GEOS 3.1.0+ ST_Union will use the faster Cascaded Union algorithm described in http://blog.cleverelephant.ca/2009/01/must-faster-unions-in-postgis-14.html

This method implements the OpenGIS 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.

Ejemplos

Aggregate example

```
SELECT stusps,
           ST_Multi(ST_Union(f.the_geom)) as singlegeom
         FROM sometable As f
GROUP BY stusps
```

Non-Aggregate example

```
SELECT ST_AsText(ST_Union(ST_GeomFromText('POINT(1 2)'),
        ST_GeomFromText('POINT(-2 3)') ) )

st_astext
----------
MULTIPOINT(-2 3,1 2)


SELECT ST_AsText(ST_Union(ST_GeomFromText('POINT(1 2)'),
                ST_GeomFromText('POINT(1 2)') ) );
st_astext
----------
POINT(1 2)

--3d example - sort of supports 3d (and with mixed dimensions!)
SELECT ST_AsEWKT(st_union(the_geom))
FROM
(SELECT ST_GeomFromEWKT('POLYGON((-7 4.2,-7.1 4.2,-7.1 4.3,
-7 4.2))') as the_geom
UNION ALL
SELECT ST_GeomFromEWKT('POINT(5 5 5)') as the_geom
```

```
UNION ALL
        SELECT ST_GeomFromEWKT('POINT(-2 3 1)') as the_geom
UNION ALL
SELECT ST_GeomFromEWKT('LINESTRING(5 5 5, 10 10 10)') as the_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(the_geom))
FROM
(SELECT ST_GeomFromEWKT('POLYGON((-7 4.2 2,-7.1 4.2 3,-7.1 4.3 2,
-7 4.2 2))') as the_geom
UNION ALL
SELECT ST_GeomFromEWKT('POINT(5 5 5)') as the_geom
UNION ALL
        SELECT ST_GeomFromEWKT('POINT(-2 3 1)') as the_geom
UNION ALL
SELECT ST_GeomFromEWKT('LINESTRING(5 5 5, 10 10 10)') as the_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 ↩
    3,-7.1 4.3 2,-7 4.2 2)))

--Examples using new Array construct
SELECT ST_Union(ARRAY(SELECT the_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))
```

Ver también

ST_Collect ST_UnaryUnion

8.11.40 ST_UnaryUnion

ST_UnaryUnion — Like ST_Union, but working at the geometry component level.

Synopsis

geometry **ST_UnaryUnion**(geometry geom);

Descripción

Unlike ST_Union, ST_UnaryUnion does dissolve boundaries between components of a multipolygon (invalid) and does perform union between the components of a geometrycollection. Each components of the input geometry is assumed to be valid, so you won't get a valid multipolygon out of a bow-tie polygon (invalid).

You may use this function to node a set of linestrings. You may mix ST_UnaryUnion with ST_Collect to fine-tune how many geometries at once you want to dissolve to be nice on both memory size and CPU time, finding the balance between ST_Union and ST_MemUnion.

 This function supports 3d and will not drop the z-index.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

Ver también

ST_Union, ST_MemUnion, ST_Collect, ST_Node

8.11.41 ST_VoronoiLines

ST_VoronoiLines — Returns the boundaries between the cells of the Voronoi diagram constructed from the vertices of a geometry.

Synopsis

geometry **ST_VoronoiLines**(g1 geometry , tolerance float8 , extend_to geometry);

Descripción

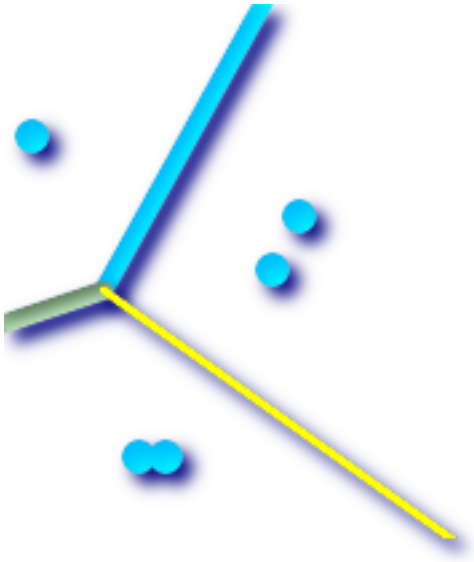
ST_VoronoiLines computes a two-dimensional Voronoi diagram from the vertices of the supplied geometry and returns the boundaries between cells in that diagram as a MultiLineString. Returns null if input geometry is null. Returns an empty geometry collection if the input geometry contains only one vertex. 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).

Availability: 2.3.0 - requires GEOS >= 3.5.0.

Ejemplos



Voronoi lines with tolerance of 30 units

```
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_VoronoiPolygons, ST_Collect

8.11.42 ST_VoronoiPolygons

ST_VoronoiPolygons — Returns the cells of the Voronoi diagram constructed from 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)

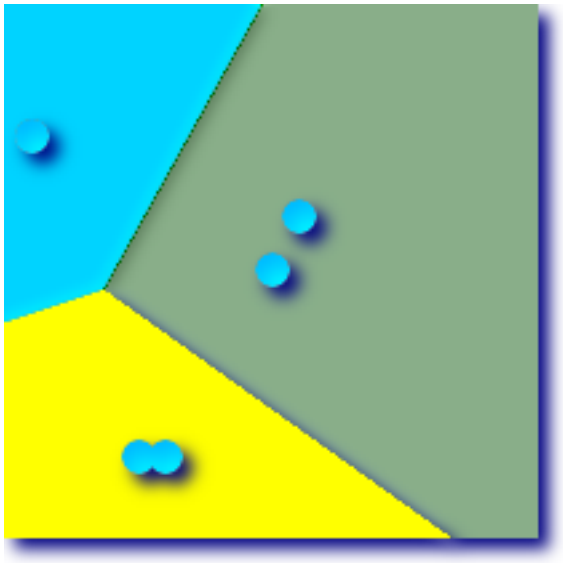
- 'extend_to' : If a geometry is supplied as the "extend_to" parameter, the diagram will be extended to cover the envelope of the "extend_to" geometry, unless that envelope is smaller than the default envelope (default = NULL, default envelope is boundingbox of input geometry extended by about 50% in each direction).

Availability: 2.3.0 - requires GEOS >= 3.5.0.

Ejemplos

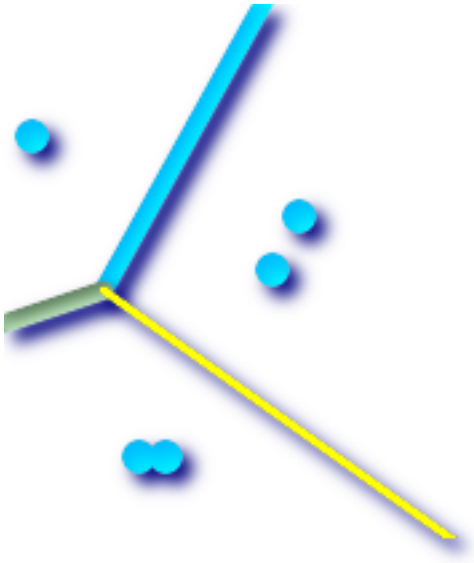
Points overlaid on top of Voronoi diagram

```
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_Collect

8.12 Referencia Lineal

8.12.1 ST_LineInterpolatePoint

ST_LineInterpolatePoint — Devuelve un punto interpolado a lo largo de una línea. El segundo argumento es un float8 entre 0 y 1 que representa la fracción de la longitud total de la cadena de linea el punto tiene que ser localizado.

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.

Ver ST_LineLocatePoint para calcular la ubicación de la línea más cercana a un punto.

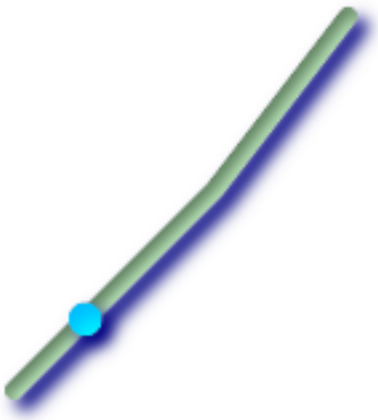
Note
Desde la versión 1.1.1 esta función también interpola los valores M y Z (cuando están presentes), mientras que las versiones anteriores las establecen en 0.0.

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)

```
--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)
```

```
--Punto de retorno el punto medio de la línea 3D
SELECT ST_AsEWKT(ST_LineInterpolatePoint(the_line, 0.5))
        FROM (SELECT ST_GeomFromEWKT('LINESTRING(1 2 3, 4 5 6, 6 7 8)') as the_line) As foo ↩
            ;

        st_asewkt
--------------------
 POINT(3.5 4.5 5.5)


--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_AsText, ST_AsEWKT, ST_Length, ST_LineInterpolatePoints ST_LineLocatePoint O

8.12.2 ST_LineInterpolatePoints

ST_LineInterpolatePoints — Returns one or more points interpolated along a line.

Synopsis

geometry **ST_LineInterpolatePoints**(geometry a_linestring, float8 a_fraction, boolean repeat);

Descripción

Returns one or more points interpolated along a line. First argument must be a LINESTRING. Second argument is a float8 between 0 and 1 representing the spacing between the points as a fraction of total LineString length. If the third argument is false, at most one point will be constructed (the function will be equivalent to ST_LineInterpolatePoint.)

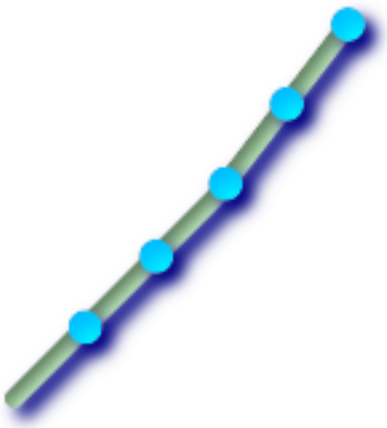
If the result has zero or one points, it will be returned as a POINT. If it has two or more points, it will be returned as a MULTIPOINT.

Availability: 2.5.0

 This function supports 3d and will not drop the z-index.

 This function supports M coordinates.

Ejemplos



A linestring with the interpolated points every 20%

```
--Return points each 20% along a 2D line
SELECT ST_AsText(ST_LineInterpolatePoints('LINESTRING(25 50, 100 125, 150 190)', 0.20))
   st_astext
----------------
 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

8.12.3 ST_LineLocatePoint

ST_LineLocatePoint — 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 línea 2D.

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

8.12.4 ST_LineSubstring

ST_LineSubstring — Devuelve una cadena de linea que es una subcadena de la entrada uno que comienza y termina en las fracciones 2D dadas de la longitud total. Los argumentos segundo y tercero son valores float8 entre 0 y 1.

Synopsis

geometry **ST_LineSubstring**(geometry a_linestring, float8 startfraction, float8 endfraction);

Descripción

Devuelve una cadena de linea que es una subcadena de la entrada uno que comienza y termina en las fracciones 2D dadas de la longitud total. Los argumentos segundo y tercero son valores float8 entre 0 y 1. Esto sólo funciona con LINESTRINGs. Para utilizar con MULTILINESTRINGs contiguos uselo en conjunción con ST_LineMerge.

Si ' Start ' y ' End ' tienen el mismo valor, esto equivale a ST_LineInterpolatePoint.

Ver ST_LineLocatePoint para calcular la ubicación de la línea más cercana a un punto.

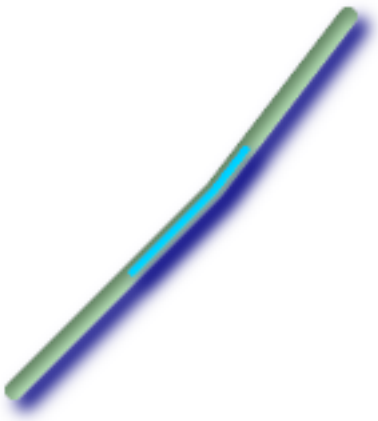
Note
Desde la versión 1.1.1 esta función también interpola los valores M y Z (cuando están presentes), mientras que las versiones anteriores las establecen en valores no especificados.

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)

```
--Devuelve la parte aproximada de 1/3 de rango medio de una cadena de línea
SELECT ST_AsText(ST_Line_SubString(ST_GeomFromText('LINESTRING(25 50, 100 125, 150 190)'),  ↩
    0.333, 0.666));

                                                                                st_astext ↩

------------------------------------------------------------------------------------------- ↩

LINESTRING(69.2846934853974 94.2846934853974,100 125,111.700356260683 140.210463138888)

--El ejemplo siguiente simula un bucle while en
--SQL usando PostgreSQL generate_series() para cortar todas
--las cadenas de líneas en una tabla a 100 segmentos unitarios
-- de los cuales ningún segmento es más largo de 100 unidades
-- unidades se miden en las unidades de medida SRID.
-- También asume que todas las geometrías son LINESTRING o MULTILINESTRING contiguo
--y ninguna geometría es más larga que 100 unidades * 10000
--para un mejor rendimiento, puede reducir los 10000
--para que coincida con el número máximo de segmentos que espera

SELECT field1, field2, ST_LineSubstring(the_geom, 100.00*n/length,
  CASE
        WHEN 100.00*(n+1) < length THEN 100.00*(n+1)/length
        ELSE 1
  END) As the_geom
FROM
  (SELECT sometable.field1, sometable.field2,
  ST_LineMerge(sometable.the_geom) AS the_geom,
  ST_Length(sometable.the_geom) As length
  FROM sometable
  ) AS t
CROSS JOIN generate_series(0,10000) AS n
WHERE n*100.00/length < 1;
```

Ver también

ST_Length, ST_LineInterpolatePoint, ST_LineMerge

8.12.5 ST_LocateAlong

ST_LocateAlong — Devuelve un valor de la colección Geometry derivado con elementos que coinciden con la medida especificada. No se admiten elementos poligonales.

Synopsis

geometry **ST_LocateAlong**(geometry ageom_with_measure, float8 a_measure, 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.

La semántica es especificada por: ISO/IEC CD 13249-3:200x(E) - Texto para la Continuation CD Editing Meeting

Disponibilidad: 1.1.0 por antiguo nombre ST_Locate_Along_Measure.

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.

Note
Utilice esta función sólo para geometrías con un componente M

 This function supports M coordinates.

Ejemplos

```
SELECT ST_AsText(the_geom)
                FROM
                (SELECT ST_LocateAlong(
                        ST_GeomFromText('MULTILINESTRINGM((1 2 3, 3 4 2, 9 4 3),
                (1 2 3, 5 4 5))'),3) As the_geom) As foo;

                                                    st_asewkt
-------------------------------------------------------------
 MULTIPOINT M (1 2 3)

--Geometry collections are difficult animals so dump them
--to make them more digestable
SELECT ST_AsText((ST_Dump(the_geom)).geom)
        FROM
        (SELECT ST_LocateAlong(
                        ST_GeomFromText('MULTILINESTRINGM((1 2 3, 3 4 2, 9 4 3),
        (1 2 3, 5 4 5))'),3) As the_geom) As foo;

   st_asewkt
---------------
 POINTM(1 2 3)
 POINTM(9 4 3)
 POINTM(1 2 3)
```

Ver también

ST_Dump, ST_LocateBetween, ST_LocateBetweenElevations

8.12.6 ST_LocateBetween

ST_LocateBetween — Return a derived geometry collection value with elements that match the specified range of measures inclusively. Polygonal elements are not supported.

Synopsis

geometry **ST_LocateBetween**(geometry geomA, float8 measure_start, float8 measure_end, float8 offset);

Descripción

Return a derived geometry collection with elements that match the specified range of measures inclusively. Polygonal elements are not supported.

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.

La semántica es especificada por: ISO/IEC CD 13249-3:200x(E) - Texto para la Continuation CD Editing Meeting

Disponibilidad: 1.1.0 por nombre antiguo ST_Locate_Between_Measures.

Modificado: 2.0.0 - en versiones anteriores esto solía llamarse ST_Locate_Between_Measures. El nombre antiguo ha quedado obsoleto y se eliminará en el futuro, pero todavía está disponible para compatibilidad con versiones anteriores.

 This function supports M coordinates.

Ejemplos

```
SELECT ST_AsText(the_geom)
                FROM
                (SELECT ST_LocateBetween(
                        ST_GeomFromText('MULTILINESTRING M ((1 2 3, 3 4 2, 9 4 3),
                (1 2 3, 5 4 5))'),1.5, 3) As the_geom) As foo;

                                                        st_asewkt
------------------------------------------------------------------------------
 GEOMETRYCOLLECTION M (LINESTRING M (1 2 3,3 4 2,9 4 3),POINT M (1 2 3))

--Geometry collections are difficult animals so dump them
--to make them more digestable
SELECT ST_AsText((ST_Dump(the_geom)).geom)
                FROM
                (SELECT ST_LocateBetween(
                        ST_GeomFromText('MULTILINESTRING M ((1 2 3, 3 4 2, 9 4 3),
                (1 2 3, 5 4 5))'),1.5, 3) As the_geom) As foo;

                   st_asewkt
---------------------------------
 LINESTRING M (1 2 3,3 4 2,9 4 3)
 POINT M (1 2 3)
```

Ver también

ST_Dump, ST_LocateAlong, ST_LocateBetweenElevations

8.12.7 ST_LocateBetweenElevations

ST_LocateBetweenElevations — Devuelve un valor de geometría (colección) derivada con elementos que intersectan el rango de cotas especificado de forma inclusiva. Solamente 3D, 4D LINESTRINGS y MULTILINESTRINGS son soportados.

Synopsis

geometry **ST_LocateBetweenElevations**(geometry geom_mline, float8 elevation_start, float8 elevation_end);

Descripción

Devuelve un valor de geometría (colección) derivada con elementos que intersectan el rango de cotas especificado de forma inclusiva. Solamente 3D, 4D LINESTRINGS y MULTILINESTRINGS son soportados.

Disponibilidad: 1.4.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
SELECT ST_AsEWKT(ST_LocateBetweenElevations(
                        ST_GeomFromEWKT('LINESTRING(1 2 3, 4 5 6)'),2,4)) As ewelev;
                                                                  ewelev
------------------------------------------------------------------
        MULTILINESTRING((1 2 3,2 3 4))

SELECT ST_AsEWKT(ST_LocateBetweenElevations(
                        ST_GeomFromEWKT('LINESTRING(1 2 6, 4 5 -1, 7 8 9)'),6,9)) As ewelev ↩
                            ;

                                 ewelev
------------------------------------------------------------------
GEOMETRYCOLLECTION(POINT(1 2 6),LINESTRING(6.1 7.1 6,7 8 9))

--Geometry collections are difficult animals so dump them
--to make them more digestable
SELECT ST_AsEWKT((ST_Dump(the_geom)).geom)
                FROM
                (SELECT ST_LocateBetweenElevations(
                        ST_GeomFromEWKT('LINESTRING(1 2 6, 4 5 -1, 7 8 9)'),6,9) As  ↩
                            the_geom) As foo;

                   st_asewkt
--------------------------------
POINT(1 2 6)
LINESTRING(6.1 7.1 6,7 8 9)
```

Ver también

ST_Dump

8.12.8 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 line, geometry point);

Descripción

Devuelve el valor de la dimensión medida de una geometría en el punto cerrado al punto proporcionado.

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)');
 st_interpolatepoint
 --------------------
                                    10
```

Ver también

ST_AddMeasure, ST_LocateAlong, ST_LocateBetween

8.12.9 ST_AddMeasure

ST_AddMeasure — Devuelve una geometría derivada con elementos de medida interpolados linealmente entre los puntos inicial y final.

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;
           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;
                ewelev
---------------------------------------
 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))
```

8.13 Soporte Temporal

8.13.1 ST_IsValidTrajectory

ST_IsValidTrajectory — Devuelve `true` si la geometría es una trayectoria válida.

Synopsis

boolean **ST_IsValidTrajectory**(geometry line);

Descripción

Indica si una geometría codifica una trayectoria valida. Las trayectorias validas se codifican como LINESTRING con el valor de M creciendo desde cada vértice al siguiente.

Se esperan trayectorias validas como entrada para algunas consultas espacio-temporal como ST_ClosestPointOfApproach

Disponibilidad: 2.2.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
-- 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
```

Ver también

ST_ClosestPointOfApproach

8.13.2 ST_ClosestPointOfApproach

ST_ClosestPointOfApproach — Devuelve la medida de los puntos interpolados a lo largo de dos lineas cercanas.

Synopsis

float8 **ST_ClosestPointOfApproach**(geometry track1, geometry track2);

Descripción

Devuelve la medida más pequeña en la que, el punto interpolado a lo largo de las líneas dadas está a la menor distancia. Las entradas deben ser trayectorias válidas según lo verificado por ST_IsValidTrajectory. Se devuelve Null si las trayectorias no se solapan en el rango M.

Ver ST_LocateAlong para obtener los puntos actuales de la medida dada.

Disponibilidad: 2.2.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
-- Devuelve el tiempo en que dos objetos se mueven entre las 10:00 y 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'::timestamptz),
    extract(epoch from '2015-05-26 11:00'::timestamptz)
  ) a,
  ST_AddMeasure('LINESTRING Z (0 2 10, 12 1 2)'::geometry,
    extract(epoch from '2015-05-26 10:00'::timestamptz),
    extract(epoch from '2015-05-26 11:00'::timestamptz)
  ) 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
```

Ver también

ST_IsValidTrajectory, ST_DistanceCPA, ST_LocateAlong, ST_AddMeasure

8.13.3 ST_DistanceCPA

ST_DistanceCPA — Devuelve la distancia entre puntos cercanos de aproximación a dos trayectorias.

Synopsis

float8 **ST_DistanceCPA**(geometry track1, geometry track2);

Descripción

Devuelve la distancia mínima que dos objetos en movimiento han tenido entre uno y otro. Las entradas deben ser trayectorias validas y verificadas por ST_IsValidTrajectory. Se devuelve Null si las trayectorias no se solapan en el rango de M.

Disponibilidad: 2.2.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
-- Devuelve la distancia mínima de dos objetos que se mueven entre las 10:00 y las 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'::timestamptz),
    extract(epoch from '2015-05-26 11:00'::timestamptz)
  ) a,
  ST_AddMeasure('LINESTRING Z (0 2 10, 12 1 2)'::geometry,
    extract(epoch from '2015-05-26 10:00'::timestamptz),
    extract(epoch from '2015-05-26 11:00'::timestamptz)
  ) b
)
SELECT ST_DistanceCPA(a,b) distance FROM inp;

     distance
------------------
 1.96036833151395
```

Ver también

ST_IsValidTrajectory, ST_ClosestPointOfApproach, ST_AddMeasure, |=|

8.13.4 ST_CPAWithin

ST_CPAWithin — Devuelve true si los puntos de aproximación más cercanos de las trayectorias están dentro de la distancia especificada.

Synopsis

float8 **ST_CPAWithin**(geometry track1, geometry track2, float8 maxdist);

Descripción

Verifica si dos objetos en movimiento han estado siempre dentro de la distancia máxima especificada.

Las entradas deben ser trayectorias validas y verificadas por ST_IsValidTrajectory. Se devuelve False si las trayectorias no se solapan en el rando de M.

Disponibilidad: 2.2.0

 This function supports 3d and will not drop the z-index.

Ejemplos

```
WITH inp AS ( SELECT
  ST_AddMeasure('LINESTRING Z (0 0 0, 10 0 5)'::geometry,
    extract(epoch from '2015-05-26 10:00'::timestamptz),
    extract(epoch from '2015-05-26 11:00'::timestamptz)
  ) a,
  ST_AddMeasure('LINESTRING Z (0 2 10, 12 1 2)'::geometry,
    extract(epoch from '2015-05-26 10:00'::timestamptz),
    extract(epoch from '2015-05-26 11:00'::timestamptz)
  ) b
)
SELECT ST_CPAWithin(a,b,2), ST_DistanceCPA(a,b) distance FROM inp;

 st_cpawithin |     distance
--------------+------------------
 t            | 1.96521473776207
```

Ver también

ST_IsValidTrajectory, ST_ClosestPointOfApproach, ST_DistanceCPA, |=|

8.14 Soporte para transacciones grandes

Este módulo y las funciones asociadas pl/pgsql se han implementado para proporcionar soporte a bloqueos extensos que son requeridos por la especificación Web Feature Service

Note
Los usuarios deben usar el nivel de transacción en serie sino se rompería el mecanismo de bloqueo.

8.14.1 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.

Crea/agrega a una tabla temporal llamada temp_lock_have_table el identificador de la transacción actual y la clave del testigo de autorización.

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

8.14.2 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

8.14.3 DisableLongTransactions

DisableLongTransactions — 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.

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

8.14.4 EnableLongTransactions

EnableLongTransactions — 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.

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

8.14.5 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

8.14.6 UnlockRows

UnlockRows — Retira todos los bloqueos mantenidos por el id de la autorización especificada. Devuelve el número de bloqueos liberados.

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

8.15 Miscellaneous Functions

8.15.1 ST_Accum

ST_Accum — Aggregate. Constructs an array of geometries.

Synopsis

geometry[] **ST_Accum**(geometry set geomfield);

Descripción

Aggregate. Constructs an array of geometries.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

 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_Accum(the_geom)) As all_em, ST_AsText((ST_Accum(the_geom))[1]) As grabone,
(ST_Accum(the_geom))[2:4] as grab_rest
                        FROM (SELECT ST_MakePoint(a*CAST(random()*10 As integer), a*CAST( ↩
                            random()*10 As integer), a*CAST(random()*10 As integer)) As  ↩
                            the_geom
                                FROM generate_series(1,4) a) As foo;

all_em|grabone    | grab_rest

------------------------------------------------------------------------------+

 {010100008000000000000014400000000000002440000000000001040:
 0101000080000000000
0001840000000000002C400000000000003040:
0101000080000000000000354000000000000038400000000000001840:
0101000080000000000000404000000000000003C400000000000003040} |
 POINT(5 10) | {010100008000000000000018400000000000002C400000000000003040:
 0101000080000000000000354000000000000038400000000000001840:
 0101000080000000000000404000000000000003C400000000000003040}
(1 row)
```

Ver también

ST_Collect

8.15.2 Box2D

Box2D — Returns a BOX2D representing the maximum extents of the geometry.

Synopsis

box2d **Box2D**(geometry geomA);

Descripción

Returns a BOX2D representing the maximum extents of the geometry.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

 This method supports Circular Strings and Curves

 This function supports Polyhedral surfaces.

 This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

```
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)
```

Ver también

Box3D, ST_GeomFromText

8.15.3 Box3D

Box3D — Returns a BOX3D representing the maximum extents of the geometry.

Synopsis

box3d **Box3D**(geometry geomA);

Descripción

Returns a BOX3D representing the maximum extents of the geometry.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

 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 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)
```

Ver también

Box2D, ST_GeomFromEWKT

8.15.4 ST_EstimatedExtent

ST_EstimatedExtent — Return the 'estimated' extent of the given spatial table. The estimated is taken from the geometry column's statistics. The current schema will be used if not specified.

Synopsis

box2d **ST_EstimatedExtent**(text schema_name, text table_name, text geocolumn_name, boolean parent_ony);
box2d **ST_EstimatedExtent**(text schema_name, text table_name, text geocolumn_name);
box2d **ST_EstimatedExtent**(text table_name, text geocolumn_name);

Descripción

Return the 'estimated' extent of the given spatial table. The estimated is taken from the geometry column's statistics. The current schema will be used if not specified. The default behavior is to also use statistics collected from children tables (tables with INHERITS) if available. If 'parent_ony' is set to TRUE, only statistics for the given table are used and children tables are ignored.

For PostgreSQL>=8.0.0 statistics are gathered by VACUUM ANALYZE and resulting extent will be about 95% of the real one.

Note
In absence of statistics (empty table or no ANALYZE called) this function returns NULL. Prior to version 1.5.4 an exception was thrown instead.

For PostgreSQL<8.0.0 statistics are gathered by update_geometry_stats() and resulting extent will be exact.

Disponibilidad: 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

Ejemplos

```
SELECT ST_EstimatedExtent('ny', 'edges', 'the_geom');
--result--
BOX(-8877653 4912316,-8010225.5 5589284)

SELECT ST_EstimatedExtent('feature_poly', 'the_geom');
--result--
BOX(-124.659652709961 24.6830825805664,-67.7798080444336 49.0012092590332)
```

Ver también

ST_Extent

8.15.5 ST_Expand

ST_Expand — Returns bounding box expanded in all directions from the bounding box of the input geometry. Uses double-precision

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);

Descripción

This function 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 in all directions, or by specifying an expansion distance for each direction. Uses double-precision. Can be very useful for distance queries, or to add a bounding box filter to a query to take advantage of a spatial index.

In addition to the geometry version of ST_Expand, which is the most commonly used, variants are provided that accept and produce internal BOX2D and BOX3D data types.

ST_Expand is similar in concept to ST_Buffer, except while buffer expands the geometry in all directions, ST_Expand expands the bounding box an x,y,z unit amount.

Units are in the units of the spatial reference system in use denoted by the SRID.

Note
Pre 1.3, ST_Expand was used in conjunction with distance to do indexable queries. Something of the form `the_geom && ST_Expand('POINT(10 20)', 10) AND ST_Distance(the_geom, 'POINT(10 20)') < 10` Post 1.2, this was replaced with the easier ST_DWithin construct.

Note
Availability: 1.5.0 behavior changed to output double precision instead of float4 coordinates.
Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.
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).

Ejemplos

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))
```

Ver también

ST_AsEWKT, ST_Buffer, ST_DWithin, ST_GeomFromEWKT, ST_GeomFromText, ST_SRID

8.15.6 ST_Extent

ST_Extent — an aggregate function that returns the bounding box that bounds rows of geometries.

Synopsis

box2d **ST_Extent**(geometry set geomfield);

Descripción

ST_Extent returns a bounding box that encloses a set of geometries. The ST_Extent function is an "aggregate" function in the terminology of SQL. That means that it operates on lists of data, in the same way the SUM() and AVG() functions do.

Since it returns a bounding box, the spatial Units are in the units of the spatial reference system in use denoted by the SRID

ST_Extent is similar in concept to Oracle Spatial/Locator's SDO_AGGR_MBR

Note
Since ST_Extent returns a bounding box, the SRID meta-data is lost. Use ST_SetSRID to force it back into a geometry with SRID meta data. The coordinates are in the units of the spatial ref of the orginal geometries.

Note
ST_Extent will return boxes with only an x and y component even with (x,y,z) coordinate geometries. To maintain x,y,z use ST_3DExtent instead.

Note
Disponibilidad: 1.4.0

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

 This function supports Polyhedral surfaces.

 This function supports Triangles and Triangulated Irregular Network Surfaces (TIN).

Ejemplos

Note
Examples below use Massachusetts State Plane ft (SRID=2249)

```
SELECT ST_Extent(the_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(the_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(the_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))
```

Ver también

ST_AsEWKT, ST_3DExtent, ST_SetSRID, ST_SRID

8.15.7 ST_3DExtent

ST_3DExtent — an aggregate function that returns the box3D bounding box that bounds rows of geometries.

Synopsis

box3d **ST_3DExtent**(geometry set geomfield);

Descripción

ST_3DExtent returns a box3d (includes Z coordinate) bounding box that encloses a set of geometries. The ST_3DExtent function is an "aggregate" function in the terminology of SQL. That means that it operates on lists of data, in the same way the SUM() and AVG() functions do.

Since it returns a bounding box, the spatial Units are in the units of the spatial reference system in use denoted by the SRID

Note
Since ST_3DExtent returns a bounding box, the SRID meta-data is lost. Use ST_SetSRID to force it back into a geometry with SRID meta data. The coordinates are in the units of the spatial ref of the orginal geometries.

Mejorado: 2.0.0 soporte para superficies poliédricas, triángulos y TIN fue introducida.

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).

Ejemplos

```
SELECT ST_3DExtent(foo.the_geom) As b3extent
FROM (SELECT ST_MakePoint(x,y,z) As the_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.the_geom) As b3extent
FROM (SELECT ST_Translate(ST_Force_3DZ(ST_LineToCurve(ST_Buffer(ST_MakePoint(x,y),1))),0,0, ↩
    z) As the_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)
```

Ver también

ST_Extent, ST_Force3DZ

8.15.8 Find_SRID

Find_SRID — The syntax is find_srid(a_db_schema, a_table, a_column) and the function returns the integer SRID of the specified column by searching through the GEOMETRY_COLUMNS table.

Synopsis

integer **Find_SRID**(varchar a_schema_name, varchar a_table_name, varchar a_geomfield_name);

Descripción

The syntax is find_srid(<db/schema>, <table>, <column>) and the function returns the integer SRID of the specified column by searching through the GEOMETRY_COLUMNS table. If the geometry column has not been properly added with the AddGeometryColumns() function, this function will not work either.

Ejemplos

```
SELECT Find_SRID('public', 'tiger_us_state_2007', 'the_geom_4269');
find_srid
----------
4269
```

Ver también

ST_SRID

8.15.9 ST_MemSize

ST_MemSize — Returns the amount of space (in bytes) the geometry takes.

Synopsis

integer **ST_MemSize**(geometry geomA);

Descripción

Returns the amount of space (in bytes) the geometry 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_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. In prior versions this function was called ST_Mem_Size, old name deprecated though still available.

Ejemplos

```
--Return how much byte space Boston takes up  in our Mass data set
SELECT pg_size_pretty(SUM(ST_MemSize(the_geom))) as totgeomsum,
pg_size_pretty(SUM(CASE WHEN town = 'BOSTON' THEN ST_MemSize(the_geom) ELSE 0 END)) As  ↩
    bossum,
CAST(SUM(CASE WHEN town = 'BOSTON' THEN ST_MemSize(the_geom) ELSE 0 END)*1.00 /
                SUM(ST_MemSize(the_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( ↩
    the_geom)) As geomsize,
sum(ST_MemSize(the_geom))*1.00/pg_total_relation_size('public.neighborhoods')*100 As  ↩
    pergeom
FROM neighborhoods;
fulltable_size geomsize  pergeom
-----------------------------------------------
262144         96238         36.71188354492187500000
```

Ver también

8.15.10 ST_PointInsideCircle

ST_PointInsideCircle — Is the point geometry inside the circle defined by center_x, center_y, radius

Synopsis

boolean **ST_PointInsideCircle**(geometry a_point, float center_x, float center_y, float radius);

Descripción

The syntax for this functions is ST_PointInsideCircle(<geometry>,<circle_center_x>,<circle_center_y>,<radius>). Returns the true if the geometry is a point and is inside the circle. Returns false otherwise.

Note
This only works for points as the name suggests

Disponibilidad: 1.2

Changed: 2.2.0 In prior versions this used to be called ST_Point_Inside_Circle

Ejemplos

```
SELECT ST_PointInsideCircle(ST_Point(1,2), 0.5, 2, 3);
 st_pointinsidecircle
----------------------
 t
```

Ver también

ST_DWithin

8.16 Funciones Excepcionales

Estas funciones raramente se utilizan las funciones que sólo se deben utilizar si sus datos están dañados de alguna manera. Se utilizan para solucionar problemas de la corrupción y también arreglar cosas que en circunstancias normales, nunca sucedan.

8.16.1 PostGIS_AddBBox

PostGIS_AddBBox — Agregue el cuadro delimitador a la geometría.

Synopsis

geometry **PostGIS_AddBBox**(geometry geomA);

Descripción

Agregue el cuadro delimitador a la geometría. Esto haría que las consultas basadas en cuadros delimitadores se agilizaran, pero aumentarían el tamaño de la geometría.

Note
Los cuadros delimitadores se agregan automáticamente a las geometrías por lo que en general esto no es necesario a menos que el cuadro de delimitación generado de alguna manera se corrompe o se tiene una instalación antigua que carece de cuadros delimitadores. Entonces usted necesita eliminar el viejo y reagregar.

 This method supports Circular Strings and Curves

Ejemplos

```
UPDATE sometable
 SET the_geom =  PostGIS_AddBBox(the_geom)
 WHERE PostGIS_HasBBox(the_geom) = false;
```

Ver también

PostGIS_DropBBox, PostGIS_HasBBox

8.16.2 PostGIS_DropBBox

PostGIS_DropBBox — Elimina el caché de cuadro delimitador de la geometría.

Synopsis

geometry **PostGIS_DropBBox**(geometry geomA);

Descripción

Elimina el caché de cuadro delimitador de la geometría. Esto reduce el tamaño de la geometría, pero hace más lentas las consultas basadas en el cuadro delimitador. También se utiliza para eliminar un cuadro delimitador corrupto. Un signo tale-tell de un cuadro delimitador dañado en caché es cuando su ST_Intersects y otras consultas de relación dejan fuera las geometrías que legítimamente deben devolver true.

Note

Los cuadros delimitadores se agregan automáticamente a las geometrías y mejoran la velocidad de las consultas, por lo que en general esto no es necesario a menos que el cuadro delimitador generado de alguna manera se corrompa o tenga una instalación antigua que carezca de cuadros delimitadores. Entonces usted necesita eliminar el viejo y reagregar. Este tipo de corrupción se ha observado en la serie 8.3-8.3.6, por la cual las bboxes cacheadas no siempre se recalcularon cuando una geometría cambió y la actualización a una versión más reciente sin una recarga de volcado no corregirá las cajas ya corruptas. También uno puede corregir manualmente usando bajar y reagregar el Bbox o hace una recarga de la descarga.

 This method supports Circular Strings and Curves

Ejemplos

```
-- Este ejemplo elimina cuadros delimitadores donde el cuadro almacenado en caché no es  ↩
    correcto
                        -- Lo fuerza a ST_AsBinary antes de aplicar Box2D fuerza un nuevo  ↩
                            cálculo de la caja, y Box2D aplicado a la geometría de la tabla  ↩
                            siempre
                        -- Devuelve el cuadro delimitador almacenado en caché.
                        UPDATE sometable
 SET the_geom =  PostGIS_DropBBox(the_geom)
 WHERE Not (Box2D(ST_AsBinary(the_geom)) = Box2D(the_geom));

        UPDATE sometable
 SET the_geom =  PostGIS_AddBBox(the_geom)
 WHERE Not PostGIS_HasBBOX(the_geom);
```

Ver también

PostGIS_AddBBox, PostGIS_HasBBox, Box2D

8.16.3 PostGIS_HasBBox

PostGIS_HasBBox — Devuelve TRUE si el bbox de la geometría está almacenado en caché, FALSE de lo contrario.

Synopsis

boolean **PostGIS_HasBBox**(geometry geomA);

Descripción

Devuelve TRUE si el bbox de la geometría está almacenado en caché, FALSE de lo contrario. Utilice PostGIS_AddBBox y PostGIS_DropBBox para controlar el almacenamiento en caché.

 This method supports Circular Strings and Curves

Ejemplos

```
SELECT the_geom
FROM sometable WHERE PostGIS_HasBBox(the_geom) = false;
```

Ver también

PostGIS_AddBBox, PostGIS_DropBBox

Chapter 9

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 5.1

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)
||
'0000000000000040' -- scaleX (float64 2)
||
'0000000000000840' -- 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)
)::raster
),
-- Raster: 5 x 5 pixels, 3 bands, PT_8BUI pixel type, NODATA = 0
(2,  ('01000003009A9999999999A93F9A9999999999A9BF000000E02B274A' ||
'41000000077195641000000000000000000000000000000000 ↩
    FFFFFFFF050005000400FDFEFDFEFEFDFEFEFDF9FAFEF' ||
' ↩
    EFCF9FBFDFEFEFDFCFAFEFEFE04004E627AADD16076B4F9FE6370A9F5FE59637AB0E54F5861708704004656648 7A1506
    ')::raster);
```

9.1 Raster Support Data types

9.1.1 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 14.6

9.1.2 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

9.1.3 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)

9.1.4 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 9

9.1.5 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

9.1.6 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

9.1.7 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

9.2 Raster Management

9.2.1 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, boolean scale_x, boolean scale_y, boolean blocksize_x, boolean blocksize_y, boolean same_alignment, boolean regular_blocking, 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=fa
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 5.2.1 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 applys 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 5.2.1, ST_AddBand, ST_MakeEmptyRaster, DropRasterConstraints, ST_BandPixelType, ST_SRID

9.2.2 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 **DropRasterConstraints**(name rasttable, name rastcolumn, boolean srid, boolean scale_x, boolean scale_y, boolean blocksize_x, boolean blocksize_y, boolean same_alignment, boolean regular_blocking, boolean num_bands=true, boolean pixel_types=t
boolean nodata_values=true, boolean out_db=true , boolean extent=true);
boolean **DropRasterConstraints**(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=fa
boolean num_bands=true, boolean pixel_types=true, boolean nodata_values=true, boolean out_db=true , boolean extent=true);
boolean **DropRasterConstraints**(name rastschema, name rasttable, name rastcolumn, text[] constraints);

Description

Drops PostGIS raster constraints that refer to a raster table column that were added by AddRasterConstraints. Useful if you need to load more data or update your raster column data. You do not need to do this if you want to get rid of a raster table or a raster column.

To drop a raster table use the standard

```
DROP TABLE mytable
```

To drop just a raster column and leave the rest of the table, use standard SQL

```
ALTER TABLE mytable DROP COLUMN rast
```

the table will disappear from the `raster_columns` catalog if the column or table is dropped. However if only the constraints are dropped, the raster column will still be listed in the `raster_columns` catalog, but there will be no other information about it aside from the column name and table.

Availability: 2.0.0

Examples

```
SELECT DropRasterConstraints ('myrasters','rast');
----RESULT output ---
t

-- verify change in raster_columns --
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
------+---------+---------+-------------+-------------+-----------+-------------+--------------- ↩

    0 |         |         |             |             |           |             |
```

See Also

AddRasterConstraints

9.2.3 AddOverviewConstraints

AddOverviewConstraints — Tag a raster column as being an overview of another.

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 5.2.2, DropOverviewConstraints, ST_CreateOverview, AddRasterConstraints

9.2.4 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 5.2.2, AddOverviewConstraints, DropRasterConstraints

9.2.5 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

9.2.6 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

9.2.7 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

9.2.8 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 geneate 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

9.2.9 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

9.2.10 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 5.2.2

9.3 Raster Constructors

9.3.1 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);

Description

Returns a raster with a new band added in given position (index), of given type, of given initial value, and of given nodata value. If no index is specified, the band is added to the end. If no `fromband` is specified, band 1 is assumed. Pixel type is a string representation of one of the pixel types specified in ST_BandPixelType. If an existing index is specified all subsequent bands >= that index are incremented by 1. If an initial value greater than the max of the pixel type is specified, then the initial value is set to the highest value allowed by the pixel type.

For the variant that takes an array of addbandarg (Variant 1), a specific addbandarg's index value is relative to the raster at the time when the band described by that addbandarg is being added to the raster. See the Multiple New Bands example below.

For the variant that takes an array of rasters (Variant 5), if `torast` is NULL then the `fromband` band of each raster in the array is accumulated into a new raster.

For the variants that take `outdbfile` (Variants 6 and 7), the value must include the full path to the raster file. The file must also be accessible to the postgres server process.

Enhanced: 2.1.0 support for addbandarg added.

Enhanced: 2.1.0 support for new out-db bands added.

Examples: Single New Band

```
-- Add another band of type 8 bit unsigned integer with pixels initialized to 200
UPDATE dummy_rast
    SET rast = ST_AddBand(rast,'8BUI'::text,200)
WHERE rid = 1;
```

```
-- Create an empty raster 100x100 units, with upper left  right at 0, add 2 bands (band 1  ↩
    is 0/1 boolean bit switch, band2 allows values 0-15)
-- uses addbandargs
INSERT INTO dummy_rast(rid,rast)
    VALUES(10, ST_AddBand(ST_MakeEmptyRaster(100, 100, 0, 0, 1, -1, 0, 0, 0),
        ARRAY[
                ROW(1, '1BB'::text, 0, NULL),
                ROW(2, '4BUI'::text, 0, NULL)
                        ]::addbandarg[]
     )
    );

-- output meta data of raster bands to verify all is right --
```

```
SELECT  (bmd).*
FROM (SELECT ST_BandMetaData(rast,generate_series(1,2)) As bmd
    FROM dummy_rast WHERE rid = 10) AS foo;
 --result --
 pixeltype | nodatavalue | isoutdb | path
-----------+-------------+---------+------
 1BB       |             | f       |
 4BUI      |             | f       |


-- output meta data of raster -
SELECT  (rmd).width, (rmd).height, (rmd).numbands
FROM (SELECT ST_MetaData(rast) As rmd
    FROM dummy_rast WHERE rid = 10) AS foo;
-- result --
 upperleftx | upperlefty | width | height | scalex | scaley | skewx | skewy | srid |  ↩
     numbands
------------+------------+-------+--------+--------+--------+-------+-------+------+--------

          0 |          0 |   100 |    100 |      1 |     -1 |     0 |     0 |   0 |         ↩
              2
```

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

9.3.2 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 pixelsize 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.

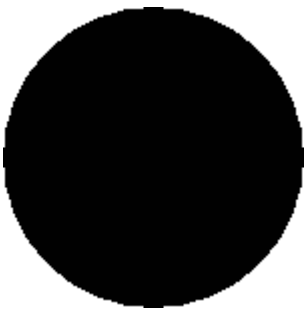
The optional `touched` parameter defaults to false and maps to the GDAL ALL_TOUCHED rasterization option, which determines if pixels touched by lines or polygons will be burned. Not just those on the line render path, or whose center point is within the polygon.

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

9.3.3 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.

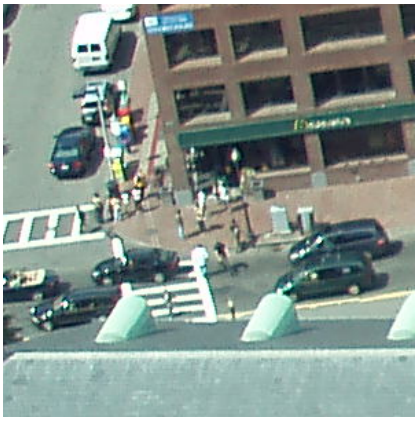
Warning
For the `nbands` as text variant of function, the default delimiter is `,` which means you can ask for `'1,2,3'` and if you wanted to use a different delimeter you would do `ST_Band(rast, '1@2@3', '@')`. For asking for multiple bands, we strongly suggest you use the array form of this function 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;
```

		
original (column rast)	*dupe_band*	*sing_band*

```
--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 9

9.3.4 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 |  ↩
                  0
      30.25 |         33 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
       38.5 |         33 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
      46.75 |         33 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
         22 |         22 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
      30.25 |         22 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
       38.5 |         22 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
      46.75 |         22 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
         22 |         11 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
      30.25 |         11 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
       38.5 |         11 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
      46.75 |         11 |     1 |      1 |   8.25 |    -11 |     0 |     0 | 4326 |  ↩
                  0
```

```
      22 |           0 |     1 |       1 |   8.25 |    -11 |     0 |     0 | 4326 | ↩
                  0
   30.25 |           0 |     1 |       1 |   8.25 |    -11 |     0 |     0 | 4326 | ↩
              0
    38.5 |           0 |     1 |       1 |   8.25 |    -11 |     0 |     0 | 4326 | ↩
               0
   46.75 |           0 |     1 |       1 |   8.25 |    -11 |     0 |     0 | 4326 | ↩
              0
```

See Also

ST_MakeEmptyRaster

9.3.5 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;
```

```
-- output --
 rid | upperleftx | upperlefty | width | height | scalex | scaley | skewx | skewy | srid |  ↩
     numbands
-----+------------+------------+-------+--------+--------+--------+-------+-------+------+--

   3 |     0.0005 |     0.0005 |   100 |    100 |      1 |      1 |     0 |     0 | ↩
        4326 |        0
   4 |     0.0005 |     0.0005 |   100 |    100 |      1 |      1 |     0 |     0 | ↩
        4326 |        0
```

See Also

ST_AddBand, ST_MetaData, ST_ScaleX, ST_ScaleY, ST_SetValue, ST_SkewX, , ST_SkewY

9.3.6 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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, '8 ↩
```

```
            BUI', 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, '8 ↩
            BUI', 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

9.3.7 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

9.3.8 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

9.4 Raster Accessors

9.4.1 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

9.4.2 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

9.4.3 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

9.4.4 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

9.4.5 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

9.4.6 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

9.4.7 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

9.4.8 ST_PixelWidth

ST_PixelWidth — Returns the pixel width in geometric units of the spatial reference system.

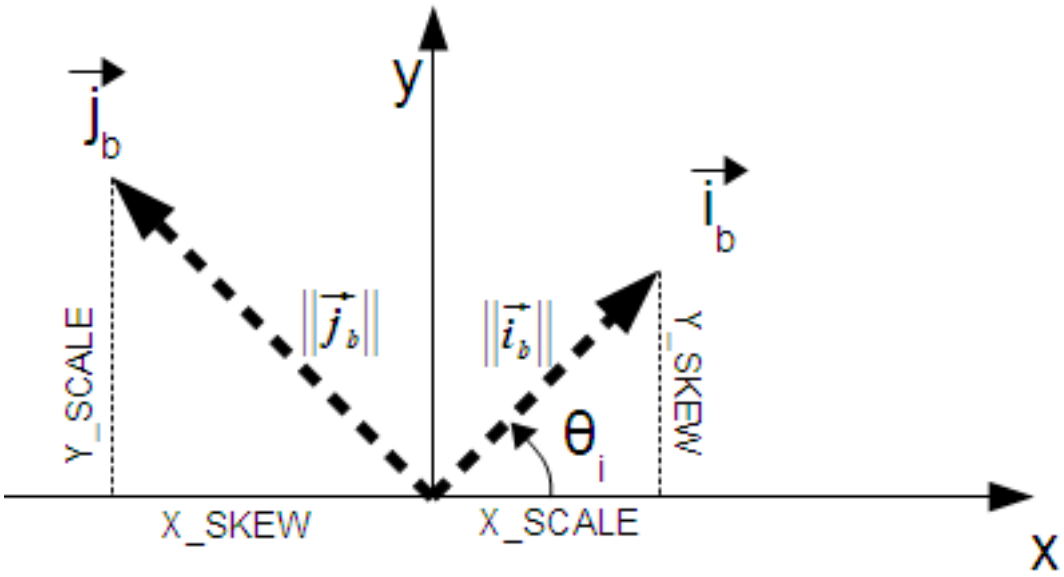
Synopsis

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

9.4.9 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

9.4.10 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

9.4.11 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

9.4.12 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

9.4.13 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 | y1coord |  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 y1coord,
        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 | y1coord |  y2coord  | pixely
-----+---------+-----------+--------
   1 |     0.5 |       107 |      3
   2 | 5793244 | 5793344.4 |  -0.05
```

See Also

ST_ScaleY, ST_RasterToWorldCoordX, ST_SetSkew, ST_SkewY

9.4.14 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

9.4.15 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

9.4.16 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

9.4.17 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 4.3.1, ST_SRID

9.4.18 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

9.4.19 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

9.4.20 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

9.4.21 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

9.4.22 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

9.4.23 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

9.4.24 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

9.5 Raster Band Accessors

9.5.1 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 ↩
           /regress/loader/Projected.tif      |            1  |    12345 |    1521807257 |
       3 | 8BUI      |             | t       | /home/pele/devel/geo/postgis-git/raster/test ↩
           /regress/loader/Projected.tif      |            3  |    12345 |    1521807257 |
       2 | 8BUI      |             | t       | /home/pele/devel/geo/postgis-git/raster/test ↩
           /regress/loader/Projected.tif      |            2  |    12345 |    1521807257 |
```

See Also

ST_MetaData, ST_BandPixelType

9.5.2 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

9.5.3 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

9.5.4 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

9.5.5 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
```

9.5.6 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
```

9.5.7 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 the value that represents no data for the 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

9.5.8 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

9.6 Raster Pixel Accessors and Setters

9.6.1 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 b1pgeom
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 |                                                                                b1pgeom
---+---+-------------------------------------------------------------------------------------
 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

9.6.2 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

9.6.3 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

9.6.4 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

9.6.5 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.

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

9.6.6 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.

Availability: 2.1.0

Changed: 2.1.1 Changed behavior of exclude_nodata_value.

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

9.6.7 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);
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.

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 579324
3.85,3427927.9 5793243.85,3427927.85 5793243.85,3427927.85 5793243.9,3427927.9  ↩
    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 5793243.8,3427
927.95 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  ↩
    5793243.7,3427927.85 5793243.7,
3427927.85 5793243.75,3427927.85 5793243.8,3427927.85 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;

                shadow
-------------------------------------------------------------------------------
 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

9.6.8 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

9.6.9 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=tru

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 * (distanceX|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,NULL},{1,1,1}}
```

```
-- 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
                ) AS rast
) AS foo

      st_neighborhood
---------------------------
 {{1,0,1},{1,1,1},{0,1,1}}
```

See Also

ST_NearestValue, ST_Min4ma, ST_Max4ma, ST_Sum4ma, ST_Mean4ma, ST_Range4ma, ST_Distinct4ma, ST_StdDev4ma

9.6.10 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

9.6.11 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.

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 with 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...

+ - + - + - +          + - + - + - +
| 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, 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, '8 ↩
            BUI', 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,NULL,NULL,NULL,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, '8 ↩
            BUI', 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, '8 ↩
            BUI', 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

9.6.12 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, '8 ↩
            BUI', 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

9.6.13 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
```

9.7 Raster Editors

9.7.1 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     |     upperlefty     | width | height | scalex | scaley | skewx | ↩
     skewy | srid | numbands
-----+--------------------+--------------------+-------+--------+--------+--------+-------+-------+-
   0 |                  0 |                  0 |     5 |      5 |      1 |     -1 |     0 | ↩
           0 |    0 |        0
   1 |                0.1 |                0.1 |     5 |      5 |     10 |    -10 |     0 | ↩
           0 |    0 |        0
   2 | 0.0999999999999996 | 0.0999999999999996 |     5 |      5 |     10 |    -10 |     0 | ↩
           0 |    0 |        0
   3 |                  1 |                  1 |     5 |      5 |     10 |    -10 | 0.001 | ↩
       0.001 |    0 |        0
```

See Also

ST_GeoReference, ST_ScaleX, ST_ScaleY, ST_UpperLeftX, ST_UpperLeftY

9.7.2 ST_SetRotation

ST_SetRotation — Set the rotation of the raster in radian.

Synopsis

float8 **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

9.7.3 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.

Examples

```
UPDATE dummy_rast
        SET rast = ST_SetScale(rast, 1.5)
WHERE rid = 2;

SELECT ST_ScaleX(rast) As pixx, ST_ScaleY(rast) As pixy, Box3D(rast) As newbox
FROM dummy_rast
WHERE rid = 2;

 pixx | pixy |                    newbox
------+------+-----------------------------------------------
  1.5 |  1.5 | BOX(3427927.75 5793244 0, 3427935.25 5793251.5 0)
```

```
UPDATE dummy_rast
        SET rast = ST_SetScale(rast, 1.5, 0.55)
WHERE rid = 2;

SELECT ST_ScaleX(rast) As pixx, ST_ScaleY(rast) As pixy, Box3D(rast) As newbox
FROM dummy_rast
WHERE rid = 2;

 pixx | pixy |                   newbox
------+------+-----------------------------------------------
  1.5 | 0.55 | BOX(3427927.75 5793244 0,3427935.25 5793247 0)
```

See Also

ST_ScaleX, ST_ScaleY, Box3D

9.7.4 ST_SetSkew

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.

Synopsis

raster **ST_SetSkew**(raster rast, float8 skewxy);
raster **ST_SetSkew**(raster rast, float8 skewx, float8 skewy);

Description

Sets the georeference X and Y skew (or rotation parameter). If only one is passed in, sets X and Y to the same value. Refer to World File for more details.

Examples

```
-- Example 1
UPDATE dummy_rast SET rast = ST_SetSkew(rast,1,2) 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 |     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

9.7.5 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 4.3.1, ST_SRID

9.7.6 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

9.7.7 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=NearestNeighbour, 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=NearestNeighbour, double precision maxerr=0.125, boolean usescale=true);
raster **ST_Resample**(raster rast, raster ref, boolean usescale, text algorithm=NearestNeighbour, 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 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.

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

9.7.8 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=NearestNeighbour, double precision maxerr=0.125);
raster **ST_Rescale**(raster rast, double precision scalex, double precision scaley, text algorithm=NearestNeighbour, 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

A maxerror percent of 0.125 is used if no `maxerr` is specified.

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

9.7.9 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=NearestNeighbour, double precision maxerr=0.125);
raster **ST_Reskew**(raster rast, double precision skewx, double precision skewy, text algorithm=NearestNeighbour, 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

9.7.10 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=NearestNeighbour, 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=NearestNeighbour, double precision maxerr=0.125);
raster **ST_SnapToGrid**(raster rast, double precision gridx, double precision gridy, double precision scalexy, text algorithm=NearestNeigh
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

9.7.11 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 |  ↩
             1
   2 |          0 |          0 |   500 |    100 |      1 |     -1 |     0 |     0 |    0 |  ↩
             1
   3 |          0 |          0 |   250 |    900 |      1 |     -1 |     0 |     0 |    0 |  ↩
             1
(3 rows)
```

See Also

ST_Resample, ST_Rescale, ST_Reskew, ST_SnapToGrid

9.7.12 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.

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
```

original mass state plane meters (mass_stm)

After transform to wgs 84 long lat (wgs_84)

After transform to wgs 84 long lat with bilinear algorithm instead of NN default (wgs_84_bilin)

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

9.8 Raster Band Editors

9.8.1 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

9.8.2 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

9.8.3 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

9.8.4 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

9.9 Raster Band Statistics and Analytics

9.9.1 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);
bigint **ST_Count**(text rastertable, text rastercolumn, integer nband=1, boolean exclude_nodata_value=true);
bigint **ST_Count**(text rastertable, text rastercolumn, 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

Availability: 2.0.0

Warning
The ST_Count(rastertable, rastercolumn, ...) variants are deprecated as of 2.2.0. Use ST_CountAgg instead.

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

9.9.2 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**(raster rast, integer nband, boolean exclude_nodata_value, double precision sample_percent);
bigint **ST_CountAgg**(raster rast, integer nband, boolean exclude_nodata_value);
bigint **ST_CountAgg**(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

9.9.3 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);
SETOF record **ST_Histogram**(text rastertable, text rastercolumn, integer nband, integer bins, boolean right);
SETOF record **ST_Histogram**(text rastertable, text rastercolumn, integer nband, boolean exclude_nodata_value, integer bins, boolean right);
SETOF record **ST_Histogram**(text rastertable, text rastercolumn, integer nband=1, boolean exclude_nodata_value=true, integer bins=autocomputed, double precision[] width=NULL, boolean right=false);
SETOF record **ST_Histogram**(text rastertable, text rastercolumn, integer nband=1, integer bins, double precision[] width=NULL, boolean right=false);

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]

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

9.9.4 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);
SETOF record **ST_Quantile**(text rastertable, text rastercolumn, integer nband=1, boolean exclude_nodata_value=true, double precision[] quantiles=NULL);
SETOF record **ST_Quantile**(text rastertable, text rastercolumn, integer nband, double precision[] quantiles);

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.

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

9.9.5 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);

summarystats **ST_SummaryStats**(text rastertable, text rastercolumn, boolean exclude_nodata_value);
summarystats **ST_SummaryStats**(text rastertable, text rastercolumn, integer nband=1, boolean exclude_nodata_value=true);

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

Availability: 2.0.0

Warning
The ST_SummaryStats(rastertable, rastercolumn, ...) variants are deprecated as of 2.2.0. Use ST_SummaryStatsAgg instead.

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(feat.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

9.9.6 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**(raster rast, integer nband, boolean exclude_nodata_value, double precision sample_percent);
summarystats **ST_SummaryStatsAgg**(raster rast, boolean exclude_nodata_value, double precision sample_percent);
summarystats **ST_SummaryStatsAgg**(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

9.9.7 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

SETOF record **ST_ValueCount**(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);
SETOF record **ST_ValueCount**(raster rast, integer nband, double precision[] searchvalues, double precision roundto=0, double precision OUT value, integer OUT count);
SETOF record **ST_ValueCount**(raster rast, double precision[] searchvalues, double precision roundto=0, double precision OUT value, integer OUT count);
bigint **ST_ValueCount**(raster rast, double precision searchvalue, double precision roundto=0);
bigint **ST_ValueCount**(raster rast, integer nband, boolean exclude_nodata_value, double precision searchvalue, double precision roundto=0);
bigint **ST_ValueCount**(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 coount 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

9.10 Raster Inputs

9.10.1 ST_RastFromWKB

ST_RastFromWKB — Return a raster value from a Well-Known Binary (WKB) raster.

Synopsis

raster **ST_RastFromWKB**(bytea wkb);

Description

Given a Well-Known Binary (WKB) raster, return a raster.

Availability: 2.5.0

Examples

```
SELECT (ST_Metadata(
        ST_RastFromWKB(
                '\001\000\000\000\000\000\000\000\000\000\000@ ↩
                    \000\000\000\000\000\000\010@ ↩
                    \000\000\000\000\000\000\340?\000\000\000\000\000\000\340?\000\000\000\000\000\0
                    bytea
        )
)).* AS metadata;

 upperleftx | upperlefty | width | height | scalex | scaley | skewx | skewy | srid |  ↩
    numbands
------------+------------+-------+--------+--------+--------+-------+-------+------+---------- ↩

        0.5 |        0.5 |    10 |     20 |      2 |      3 |     0 |     0 |   10 |  ↩
                  0
```

See Also

ST_MetaData, ST_RastFromHexWKB, ST_AsBinary/ST_AsWKB, ST_AsHexWKB

9.10.2 ST_RastFromHexWKB

ST_RastFromHexWKB — Return a raster value from a Hex representation of Well-Known Binary (WKB) raster.

Synopsis

raster **ST_RastFromHexWKB**(text wkb);

Description

Given a Well-Known Binary (WKB) raster in Hex representation, return a raster.

Availability: 2.5.0

Examples

```
SELECT (ST_Metadata(
        ST_RastFromHexWKB(
                '01000000000000000000000040000000000000084000000000000000 ↩
                    E03F000000000000E03F0000000000000000000000000000000000A0000000A001400'
        )
)).* AS metadata;

 upperleftx | upperlefty | width | height | scalex | scaley | skewx | skewy | srid |  ↩
    numbands
------------+------------+-------+--------+--------+--------+-------+-------+------+---------- ↩

        0.5 |        0.5 |    10 |     20 |      2 |      3 |     0 |     0 |   10 |  ↩
                  0
```

See Also

ST_MetaData, ST_RastFromWKB, ST_AsBinary/ST_AsWKB, ST_AsHexWKB

9.11 Raster Outputs

9.11.1 ST_AsBinary/ST_AsWKB

ST_AsBinary/ST_AsWKB — Return the Well-Known Binary (WKB) representation of the raster.

Synopsis

bytea **ST_AsBinary**(raster rast, boolean outasin=FALSE);
bytea **ST_AsWKB**(raster rast, boolean outasin=FALSE);

Description

Returns the Binary representation of the raster. If `outasin` is TRUE, out-db bands are treated as in-db. Refer to raster/doc/RFC2-WellKnownBinaryFormat located in the PostGIS source folder for details of the representation.

This is useful in binary cursors to pull data out of the database without converting it to a string representation.

Note
By default, WKB output contains the external file path for out-db bands. If the client does not have access to the raster file underlying an out-db band, set `outasin` to TRUE.

Enhanced: 2.1.0 Addition of `outasin`

Enhanced: 2.5.0 Addition of `ST_AsWKB`

Examples

```
SELECT ST_AsBinary(rast) As rastbin FROM dummy_rast WHERE rid=1;

                                          rastbin
--------------------------------------------------------------------------------
\001\000\000\000\000\000\000\000\000\000\000@\000\000\000\000\000\000\010@ ↩
    \000\000\000\000\000\000\340?\000\000\000\000\000\000\340?\000\000\000\000\000\000\000\000\00
```

See Also

ST_RastFromWKB, ST_AsHexWKB

9.11.2 ST_AsHexWKB

ST_AsHexWKB — Return the Well-Known Binary (WKB) in Hex representation of the raster.

Synopsis

bytea **ST_AsHexWKB**(raster rast, boolean outasin=FALSE);

Description

Returns the Binary representation in Hex representation of the raster. If `outasin` is TRUE, out-db bands are treated as in-db. Refer to raster/doc/RFC2-WellKnownBinaryFormat located in the PostGIS source folder for details of the representation.

Note
By default, Hex WKB output contains the external file path for out-db bands. If the client does not have access to the raster file underlying an out-db band, set `outasin` to TRUE.

Availability: 2.5.0

Examples

```
SELECT ST_AsHexWKB(rast) As rastbin FROM dummy_rast WHERE rid=1;

                                                                st_ashexwkb
------------------------------------------------------------------------------------------------------------------------

 01000000000000000000000040000000000000084000000000000000 ↩
    E03F000000000000E03F000000000000000000000000000000000A0000000A001400
```

See Also

ST_RastFromHexWKB, ST_AsBinary/ST_AsWKB

9.11.3 ST_AsGDALRaster

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.

Synopsis

bytea **ST_AsGDALRaster**(raster rast, text format, text[] options=NULL, integer srid=sameassource);

Description

Returns the raster tile in the designated format. Arguments are itemized below:

- `format` format to output. This is dependent on the drivers compiled in your libgdal library. Generally available are 'JPEG', 'GTIff', 'PNG'. Use ST_GDALDrivers to get a list of formats supported by your library.
- `options` text array of GDAL options. Valid options are dependent on the format. Refer to GDAL Raster format options for more details.
- `srs` The proj4text or srtext (from spatial_ref_sys) to embed in the image

Availability: 2.0.0 - requires GDAL >= 1.6.0.

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'lll 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(loid, '/tmp/dummy.jpg')
   FROM tmp_out;

SELECT lo_unlink(loid)
  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 5.3, ST_GDALDrivers, ST_SRID

9.11.4 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 5.3, ST_GDALDrivers, ST_AsGDALRaster, ST_AsPNG, ST_AsTIFF

9.11.5 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 then 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 5.3

9.11.6 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

9.12 Raster Processing

9.12.1 Map Algebra

9.12.1.1 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_BandPixelTyp 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
```

Full raster tile before clipping

After Clipping

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_Clip(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

9.12.1.2 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

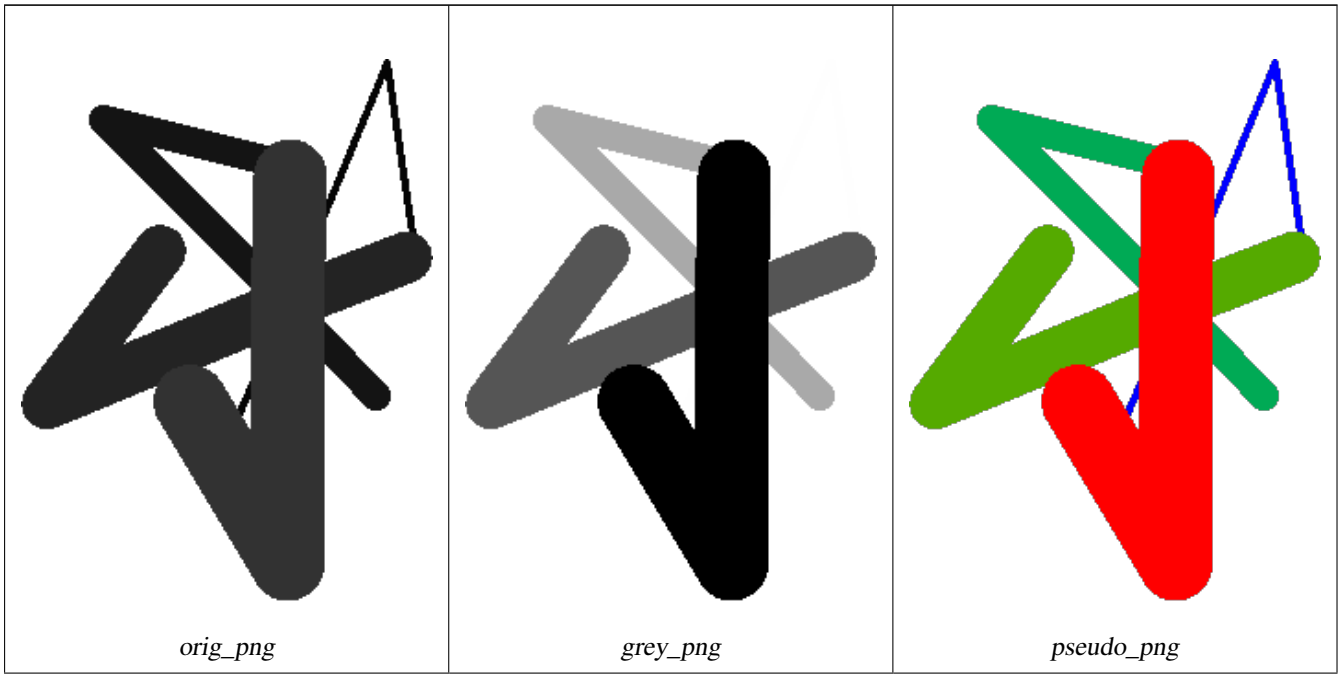
```
-- setup test raster table --
DROP TABLE IF EXISTS funky_shapes;
CREATE TABLE funky_shapes(rast raster);

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;
```

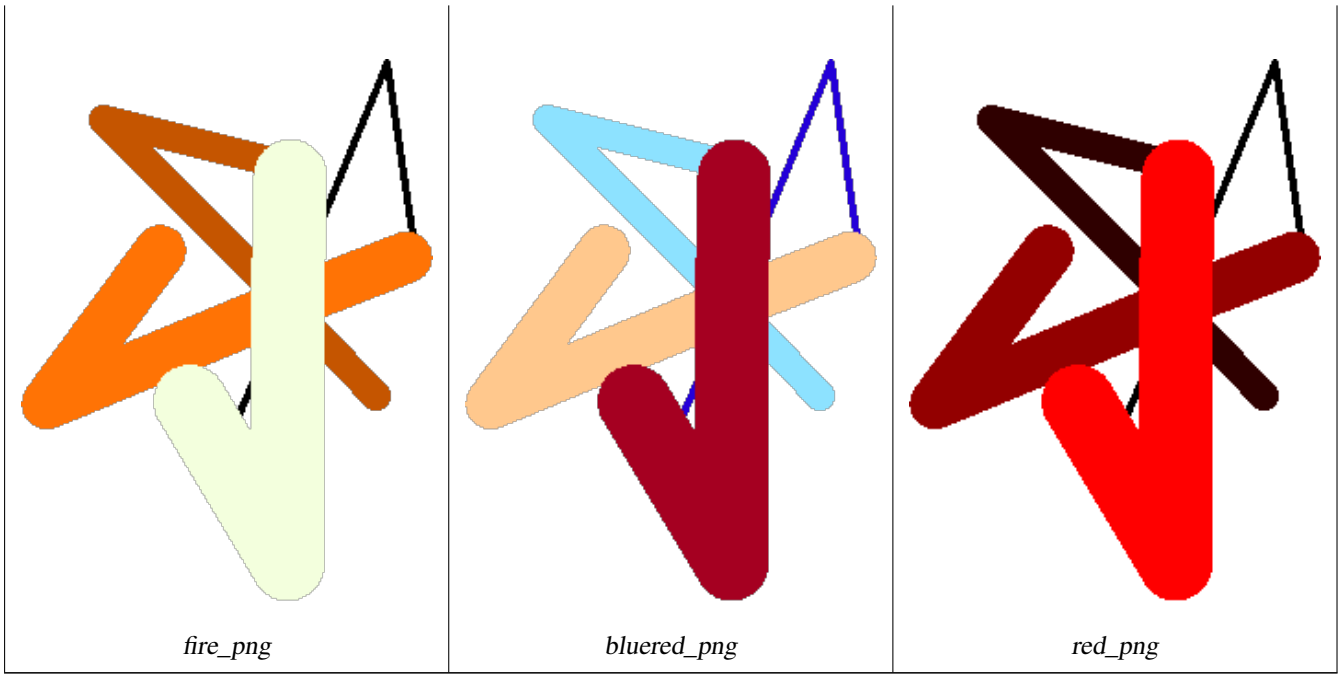
```
n_orig | ngrey | npseudo | nfire | nbluered | nred
--------+-------+---------+-------+----------+------
      1 |     1 |       4 |     4 |        4 |    3
```

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;
```



orig_png | *grey_png* | *pseudo_png*



fire_png | *bluered_png* | *red_png*

See Also

ST_AsPNG, ST_AsRaster ST_MapAlgebra (callback function version), ST_Grayscale ST_NumBands, ST_Reclass, ST_SetBandNoDat ST_Union

9.12.1.3 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

9.12.1.4 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 geomin);
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_DumpAsPolygon) 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_Intersect 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

9.12.1.5 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=INTERSECTIO
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**(nband integer, regprocedure callbackfunc, float8[] mask, boolean weighted, text pixeltype=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 hte 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 `extentype` 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*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*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, '16 ↩
            BUI', 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, 1, 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, '16 ↩
            BUI', 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',
                '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, '16 ↩
            BUI', 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
```

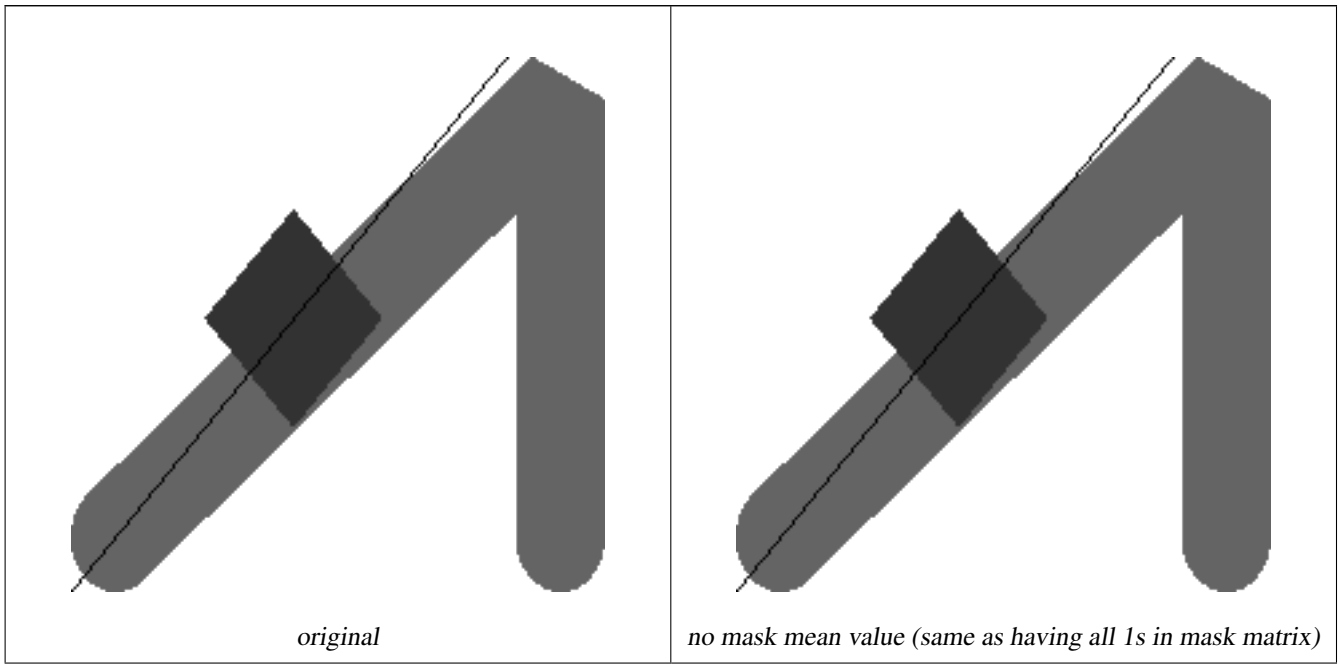
Examples: Variant 4

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
```

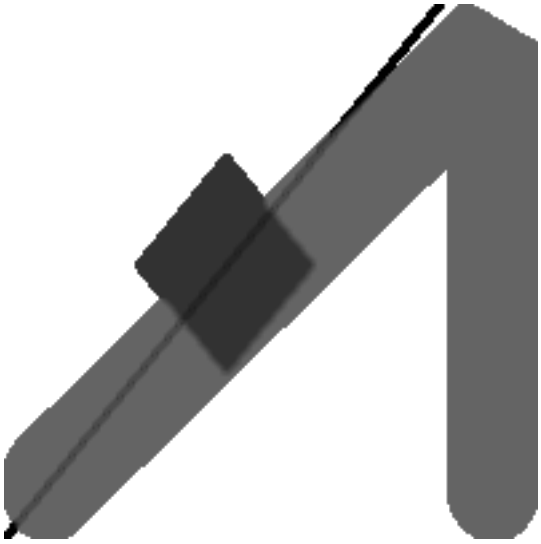
Examples: Using Masks

```
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;
```

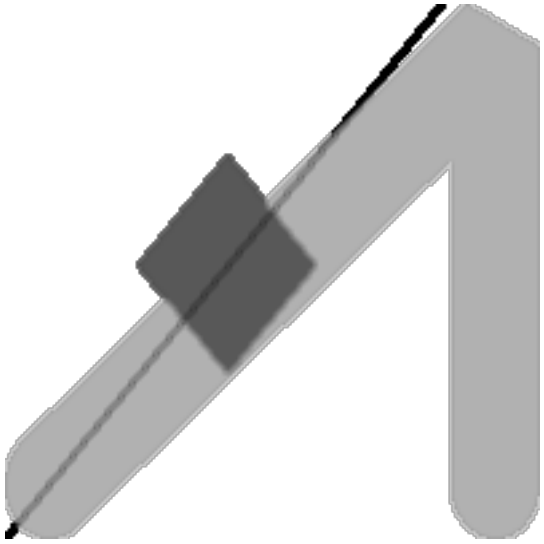


original

no mask mean value (same as having all 1s in mask matrix)



mask only consider neighbors, exclude center



mask weighted only consider neighbors, exclude center multi other pixel values by 2

See Also

rastbandarg, ST_Union, ST_MapAlgebra (expression version)

9.12.1.6 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, 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)

9.12.1.7 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

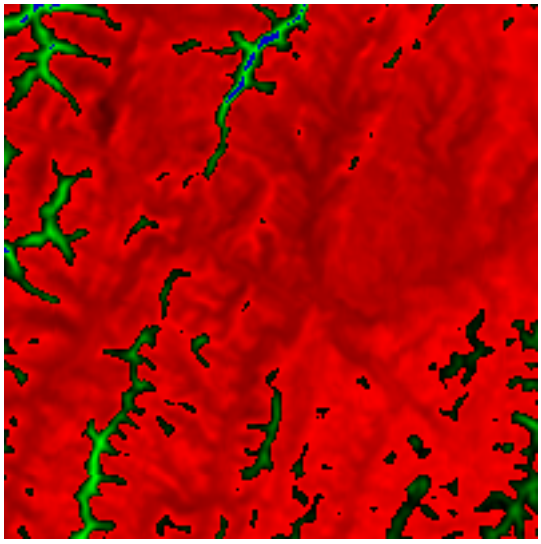
Examples

Create a new 1 band raster from our original that is a function of modulo 2 of the original raster band.

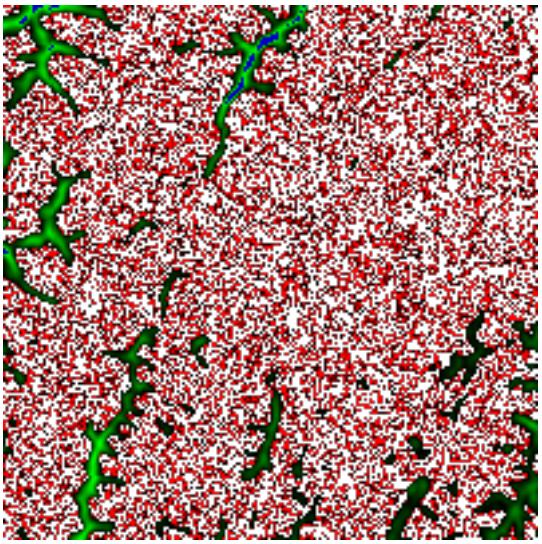
```
ALTER TABLE dummy_rast ADD COLUMN map_rast raster;
UPDATE dummy_rast SET map_rast = ST_MapAlgebraExpr(rast,NULL,'mod([rast]::numeric,2)')  ↩
    WHERE rid = 2;

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
```



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.

```
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

9.12.1.8 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=INTERSEC
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

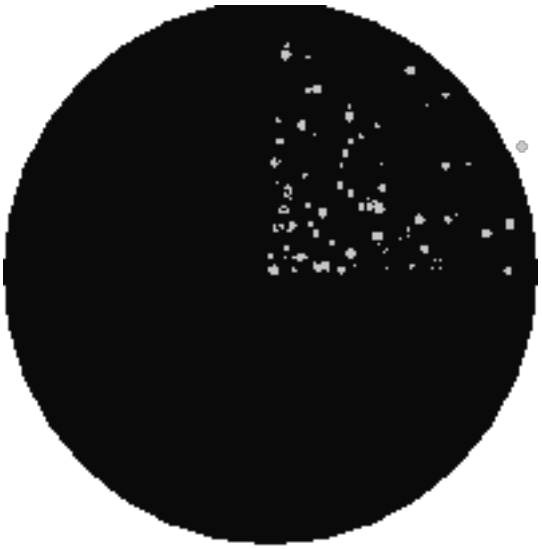
Example: 2 Band Intersection and Union

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

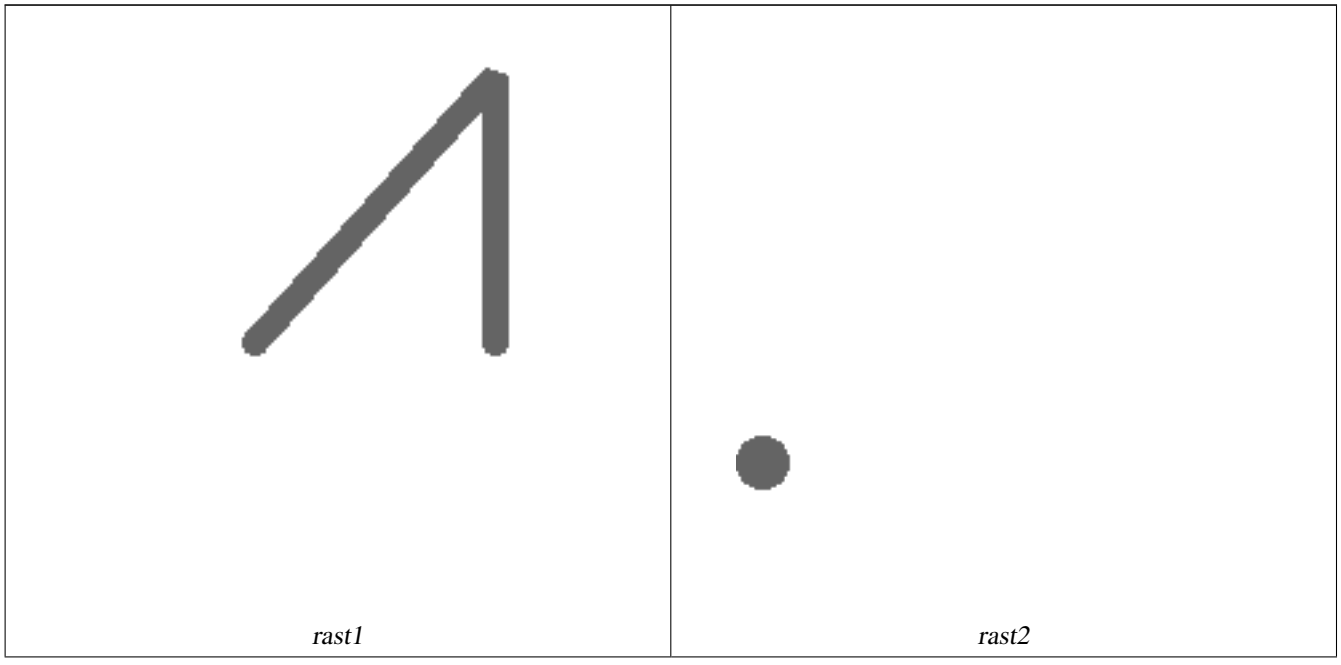


map algebra union

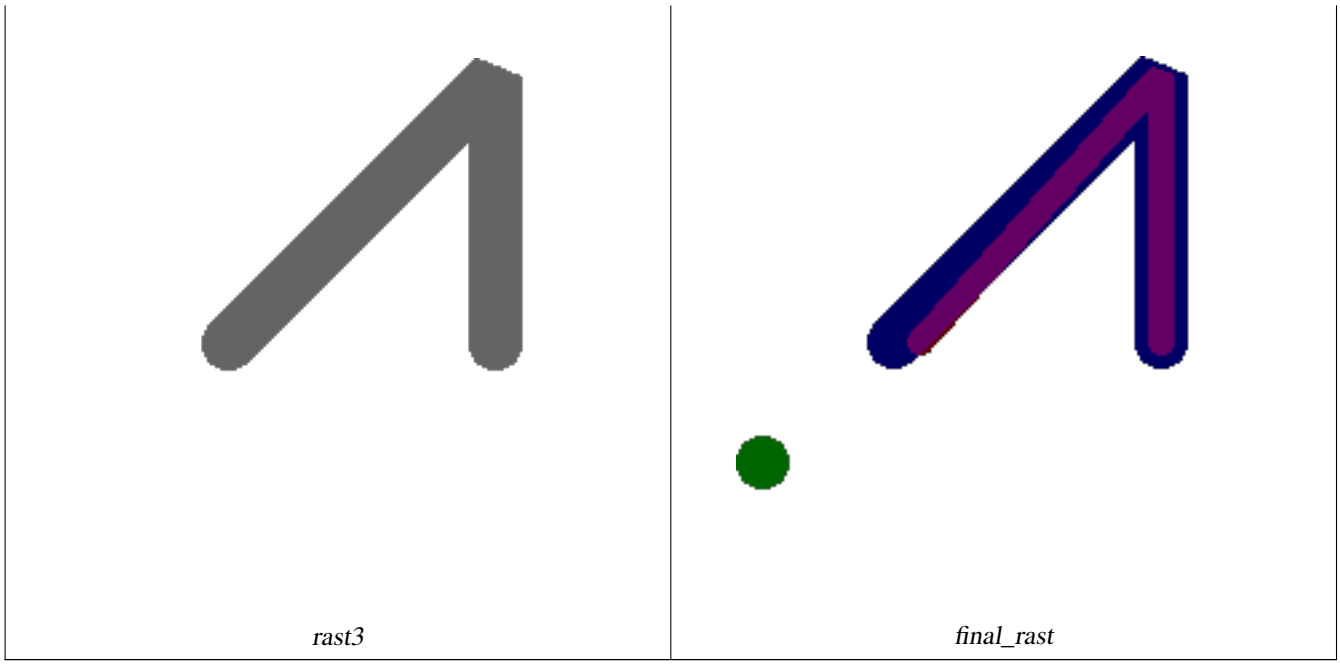
Example: Overlaying rasters on a canvas as separate bands

```
-- 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;
```



rast1 *rast2*



rast3 | *final_rast*

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 aerials.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(the_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

9.12.1.9 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 prodived. 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 regprodedure 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.

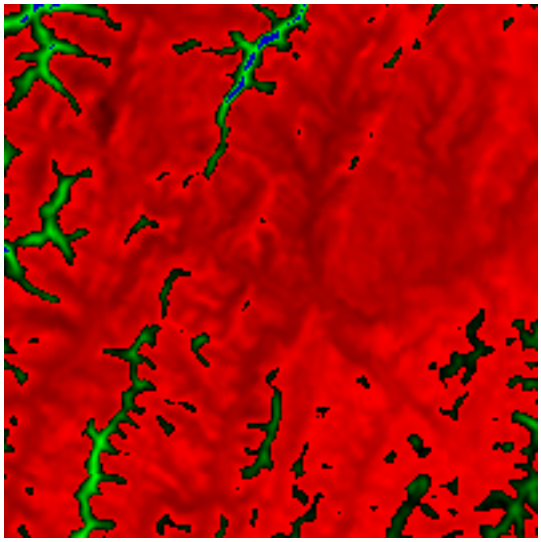
```
ALTER TABLE dummy_rast ADD COLUMN map_rast raster;
CREATE FUNCTION mod_fct(pixel float, pos integer[], variadic args text[])
RETURNS float
AS $$
BEGIN
    RETURN pixel::integer % 2;
END;
$$
```

```
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
```

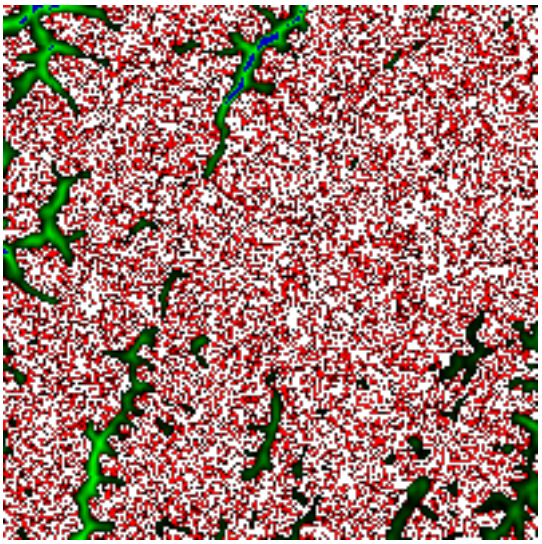
Create a new 1 band raster of pixel-type 2BUI from our original that is reclassified and set the nodata value to a passed parameter to the user function (0).

```
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

9.12.1.10 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 prodived. 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 regprodedure 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

9.12.1.11 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 onerastngbuserfunc, 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.

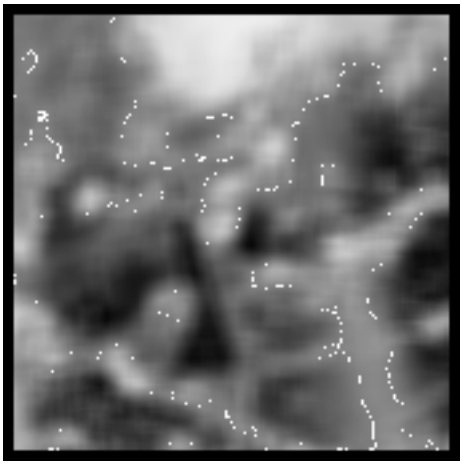
Availability: 2.0.0

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

9.12.1.12 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

9.12.1.13 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

9.12.2 Built-in Map Algebra Callback Functions

9.12.2.1 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

9.12.2.2 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

9.12.2.3 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

9.12.2.4 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

9.12.2.5 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

9.12.2.6 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

9.12.2.7 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

9.12.2.8 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

9.12.2.9 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

9.12.3 DEM (Elevation)

9.12.3.1 ST_Aspect

ST_Aspect — Returns the aspect (in degrees by default) of an elevation raster band. Useful for analyzing terrain.

Synopsis

raster **ST_Aspect**(raster rast, integer band=1, text pixeltype=32BF, text units=DEGREES, boolean interpolate_nodata=FALSE);
raster **ST_Aspect**(raster rast, integer band, raster customextent, text pixeltype=32BF, text units=DEGREES, boolean interpolate_nodata=FALSE);

Description

Returns the aspect (in degrees by default) of an elevation raster band. Utilizes map algebra and applies the aspect equation to neighboring pixels.

`units` indicates the units of the aspect. Possible values are: RADIANS, DEGREES (default).

When `units` = RADIANS, values are between 0 and 2 * pi radians measured clockwise from North.

When `units` = DEGREES, values are between 0 and 360 degrees measured clockwise from North.

If slope of pixel is zero, aspect of pixel is -1.

> **Note**
> For more information about Slope, Aspect and Hillshade, please refer to ESRI - How hillshade works and ERDAS Field Guide - Aspect Images.

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, 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_Aspect(rast, 1, '32BF'))
FROM foo




-------------------------------------------------------------------------------------------------------------

----------------------------------
 (1,"{{315,341.565063476562,0,18.4349479675293,45},{288.434936523438,315,0,45,71.5650482177734},{270

2227,180,161.565048217773,135}}")
(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_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

9.12.3.2 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

9.12.3.3 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

9.12.3.4 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},{21.568

{26.5650520324707,36.8698959350586,0,36.8698959350586,26.5650520324707},{21.5681285858154,35.2643890

5681285858154,26.5650520324707,21.5681285858154,10.0249881744385}}")
(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

9.12.3.5 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

9.12.3.6 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

9.12.4 Raster to Geometry

9.12.4.1 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

9.12.4.2 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 convhull,
        ST_AsText(ST_Envelope(rast)) As env
FROM dummy_rast WHERE rid=1;

                        convhull                         |                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

9.12.4.3 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.

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

9.12.4.4 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

9.12.4.5 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, '8BUI', 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 mhull_1,
        ST_AsText(ST_MinConvexHull(rast, 2)) AS mhull_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

9.12.4.6 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

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

9.13 Raster Operators

9.13.1 &&

&& — 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
```

9.13.2 &<

&< — 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
```

9.13.3 &>

&> — 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
```

9.13.4 =

= — 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

~=

9.13.5 @

@ — 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

~

9.13.6 ~=

~= — 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, =

9.13.7 ~

~ — 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

@

9.14 Raster and Raster Band Spatial Relationships

9.14.1 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

9.14.2 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

9.14.3 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

9.14.4 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

9.14.5 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

9.14.6 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

9.14.7 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

9.14.8 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

9.14.9 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 Aggegrate 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 5.1, ST_NotSameAlignmentReason, ST_MakeEmptyRaster

9.14.10 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_notsamealignmentreason
------------------+------------------------------------------------
 f                | The rasters have different scales on the X axis
(1 row)
```

See Also

Section 5.1, ST_SameAlignment

9.14.11 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

9.14.12 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

9.14.13 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

9.15 Raster Tips

9.15.1 Out-DB Rasters

9.15.1.1 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'
```

9.15.1.2 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

9.15.1.2.1 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
```

9.15.1.2.2 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)
...
```

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 10

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?*

   Starting with PostGIS 2.0 PostGIS Raster is fully integrated, so it will be compiled when you compile PostGIS.Las instrucciones para instalarlo y ejecutarlo desde Windows están disponibles en Cómo instalar y configurar PostGIS Ráster en WindowsSi esta en windows, puede compilarlo usted mismo, o utilizar el precompiladobinario de windows PostGIS Raster. Si esta en MAc OSX Leopard or Snow Leopard, hay binarios disponibles en binarios PostgreSQL/GIS Kyng Chaos Mac OSX. For other platforms, install PostGIS from your software repository. For more details about compiling from source, please refer to Installing PostGIS Raster from source

4. *Me aparece el error de que no pudo cargar la librería "C:/Program Files/PostgreSQL/8.4/lib/rtpostgis.dll": No se encontró el módulo indicado, o no se pudo cargar la librería en Linux al intentar ejecutar rtpostgis.sql.*

   rtpostgis.so/dll está construido bajo la dependencia de libgdal.so/dll. Asegúrese de tener, en Windows, el fichero libgdal-1.dll en la carpeta "bin" de su instalación de PostgreSQL. En Linux, libgdal debe estar en el "path" o la carpeta "bin". Pueden aparecer también diferentes errores si no tenemos PostGIS instalado en nuestra base de datos. Asegúrese primero de instalar PostGIS en su base de datos antes de instalar el soporte para ráster.

5. *¿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 5.1.1 for more details.

6. *¿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
   ```

7. *¿Puedo exportar mis datos ráster en PostGIS a otros formatos ráster?*

   SíGDAL 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 cáusula 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

8. *¿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.La última versión estable de FWTools para Windows está compilada con el soporte para ráster.

9. *¿Qué herramientas puedo usar para ver datos ráster de PostGIS?*

   You can use MapServer compiled with GDAL 1.7+ and PostGIS Raster driver support 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.

10. *¿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='cooltable' 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='cooltable' 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
```

11. *¿Qué funciones puedo utilizar actualmente con mis datos ráster?*

    Consulte la relación en Chapter 9. Hay más, pero es un trabajo en marcha todavía.Consulte PostGIS Raster roadmap page para detalles acerca de qué esperar en el futuro.

12. *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);
```

13. *¿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-capa 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.

14. *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 a establecido una codificación cliente explicita diferente de su codificación de base de datos, entonces al cargar archivos ráster grandes (por encima de 30 MB de tamaño), puede ejecutar un `los bytes son demasiado largo 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 asegúrese de que la codificación de cliente es el mismo 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

15. *Estoy recibiendo error `ERROR: RASTER_fromGDALRaster: No se pudo abrir bytea con GDAL. Comprue 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 11

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 proporciona una buena sinopsis y una visión general de lo que es la topología, cómo se utiliza, y varias herramientas FOSS4G que lo apoyan en 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 nesesita 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 Topology se compila por defecto comenzando con PostGIS 2.0, y puede ser deshabilitado especificando --without-topology configure la opción en tiempo de compilación como se describe en Chapter 2

11.1 Tipos en Topology

11.1.1 getfaceedges_returntype

getfaceedges_returntype — Un tipo compuesto que consiste en un número de secuencia y un número de borde. Éste es el tipo de retorno para `ST_GetFaceEdges`

Descripción

Un tipo compuesto que consiste en un número de secuencia y un número de borde. Éste es el tipo de retorno para `ST_GetFaceEdges`

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.

11.1.2 TopoGeometry

TopoGeometry — Un tipo compuesto que representa una geometría definida topológicamente.

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 númerico autogenerado 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

11.1.3 validatetopology_returntype

validatetopology_returntype — Un tipo compuesto que consta de un mensaje de error y un id1 e id2 para identificar la ubicación del error. Este es el tipo de retorno para `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 validacion 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

11.2 Dominios de Topology

11.2.1 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 cualqueir TopoGeometry jerarquica 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

11.2.2 TopoElementArray

TopoElementArray — Una 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

11.3 Topología y Gestión de TopoGeometría

11.3.1 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 TopologyLaye. 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 TopoGeometrías 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 TopoGeometry

Los `feature_types` válidos son: POINT, LINE, POLYGON, COLLECTION

Disponibilidad: 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

CreateTopology, CreateTopoGeom

11.3.2 DropTopology

DropTopology — Usar con precaución: Permite eliminar un esquema de topología y elimina su referencia de la talbla topology.topology y referencias a las tablas en ese esquema desde la tabla geometry_columns

Synopsis

integer **DropTopology**(varchar topology_schema_name);

Descripción

Permite elimiar 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.

Disponibilidad: 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

11.3.3 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.

Disponibilidad: 1.?

Ejemplos

```
SELECT topology.DropTopoGeometryColumn('ma_topo', 'parcel_topo', 'topo');
```

Ver también

AddTopoGeometryColumn

11.3.4 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

11.3.5 TopologySummary

TopologySummary — Toma el nombre de una topología y provee un resumen del total de los tipos de objetos en la topología.

Synopsis

text **TopologySummary**(varchar topology_schema_name);

Descripción

Toma el nombre de una topología y provee un resumen del total de los 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

11.3.6 ValidateTopology

ValidateTopology — Devuelve un conjunto de objetos validatetopology_returntype que detallan problemas con la topología.

Synopsis

setof validatetopology_returntype **ValidateTopology**(varchar topology_schema_name);

Descripción

Devuelve un conjunto de objetos validatetopology_returntype que detallan problemas con la topología. La lista de posibles errores y lo que representan los identificadores devueltos se muestra a continuación:

Error	id1	id2
Borde curza nodo	edge_id	node_id
borde inválido	edge_id	null
borde no simple	edge_id	null
borde cruza borde	edge_id	edge_id
No coincide la geometría del nodo inicial de la arista	edge_id	node_id
No coincide la geometría del nodo final de la arista	edge_id	node_id
Cara sin bordes	face_id	null
cara no tiene anillos	face_id	null
cara superpone cara	face_id	face_id
cara dentro de cara	face_id interior	face_id exterior

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.

Ejemplos

```
SELECT * FROM  topology.ValidateTopology('ma_topo');
      error        | id1 | id2
-------------------+-----+-----
face without edges |   0 |
```

Ver también

validatetopology_returntype, Topology_Load_Tiger

11.4 Constructores de Topología

11.4.1 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 epecifica.

Disponibilidad: 1.?

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 4.3.1, ST_InitTopoGeo, Topology_Load_Tiger

11.4.2 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_bakup');
```

Ver también

Section 4.3.1, CreateTopology

11.4.3 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.

Disponibilidad: 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

11.4.4 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

11.4.5 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 toponame, geometry apoint, float8 tolerance);

Descripción

Agrega un punto a una topología existente y devuelve su identificador. El punto dado se acoplará a los nodos o aristas existentes dentro de la tolerancia dada. Un borde existente se puede dividir por el punto de ajuste.

Disponibilidad: 2.0.0

Ver también

TopoGeo_AddLineString, TopoGeo_AddPolygon, AddNode, CreateTopology

11.4.6 TopoGeo_AddLineString

TopoGeo_AddLineString — Agrega un cadena de linea a una topología existente utilizando una tolerancia y posiblemente dividiendo bordes/caras existentes. Devuelve identificadores de borde.

Synopsis

SETOF integer **TopoGeo_AddLineString**(varchar toponame, geometry aline, float8 tolerance);

Descripción

Agrega una cadena de linea a una topología existente y devuelve un conjunto de identificadores de bordes que lo forman. La línea dada se ajustará a los nodos o bordes existentes dentro de la tolerancia dada. Los bordes y las caras existentes pueden dividirse por la línea.

Disponibilidad: 2.0.0

Ver también

TopoGeo_AddPoint, TopoGeo_AddPolygon, AddEdge, CreateTopology

11.4.7 TopoGeo_AddPolygon

TopoGeo_AddPolygon — Agrega un polígono a una topología existente utilizando una tolerancia y posiblemente dividiendo bordes/caras existentes.

Synopsis

integer **TopoGeo_AddPolygon**(varchar atopology, geometry apoly, float8 atolerance);

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 acoplará a los nodos o bordes existentes dentro de la tolerancia dada. Los bordes y caras existentes pueden dividirse por el límite del nuevo polígono.

Disponibilidad: 2.0.0

Ver también

TopoGeo_AddPoint, TopoGeo_AddLineString, AddFace, CreateTopology

11.5 Editores de Topología

11.5.1 ST_AddIsoNode

ST_AddIsoNode — Agrega un nodo aislado a una cara de una topología y devuelve el identificardor 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 geometía 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.

Disponibilidad: 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

11.5.2 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 inicion y final de la `alinestring` entonces una excepción es lanzada.

Disponibilidad: 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

11.5.3 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.

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

11.5.4 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

11.5.5 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

11.5.6 ST_RemEdgeModFace

ST_RemEdgeModFace — Elimina un borde y, si el borde eliminado separa dos caras, elimina una de ellas y modifca 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

11.5.7 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.

Si algún argumento es null, el borde dado no existe en la tabla `edge` del esquema de topología, el `acurve` no es un `LINESTRING`, el `anode` y `anothernode` no son el inicio y los extremos de `acurve` o la modificación cambiaría la topología subyacente, entonces se produce un error.

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

11.5.8 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.

Disponibilidad: 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

11.5.9 ST_ModEdgeHeal

ST_ModEdgeHeal — Curar dos bordes eliminando el nodo que los conecta, modificando el primer borde y eliminando el segundo borde. Devuelve el identificador del nodo eliminado.

Synopsis

int **ST_ModEdgeHeal**(varchar atopology, integer anedge, integer anotheredge);

Descripción

Curar dos bordes eliminando el nodo que los conecta, modificando el primer borde y eliminando el segundo borde. Devuelve el identificador del nodo eliminado. Actualiza todos los bordes unidos existentes y relaciones 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

11.5.10 ST_NewEdgeHeal

ST_NewEdgeHeal — Cura dos aristas al eliminar el nodo que los conecta, elimina ambos bordes y los reemplaza por un borde cuya dirección es la misma que la del primer borde proporcionado.

Synopsis

int **ST_NewEdgeHeal**(varchar atopology, integer anedge, integer anotheredge);

Descripción

Cura dos aristas al eliminar el nodo que los conecta, elimina ambos bordes y los reemplaza por un borde cuya dirección es la misma que la del primer borde proporcionado. Devuelve el identificador del nuevo borde que reemplaza a los curados. Actualiza todos los bordes unidos existentes y relaciones 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

11.5.11 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 anedge, 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.

Si algún argumento es nulo, el `apoint` no es un punto, el nodo existente no está aislado (es un punto inicial o final de un borde existente), la nueva ubicación del nodo cruza un borde existente (incluso en los puntos finales) entonces se lanza una excepción.

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: 1.?

 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

11.5.12 ST_NewEdgesSplit

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.

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.

Disponibilidad: 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

11.5.13 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.

Disponibilidad: 1.?

 This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detelles 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

11.5.14 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.

Disponibilidad: 1.?

 This method implements the SQL/MM specification. SQL-MM: Topo-Geo y Topo-Net 3: Detelles 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

11.6 Accesores de Topología

11.6.1 GetEdgeByPoint

GetEdgeByPoint — Encontrar el identificador de borde de un borde que intersecta un punto dado

Synopsis

integer **GetEdgeByPoint**(varchar atopology, geometry apoint, float8 tol);

Recuperar el identificador de un borde que intersecta un punto

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 el punto no intersecta un borde, devuelte 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.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

Ejemplos

Estos ejemplos utilizan los bordes que hemos creado en AddEdge

```
SELECT topology.GetEdgeByPoint('ma_topo',geom, 1) As with1mtol, topology.GetEdgeByPoint(' ↩
    ma_topo',geom,0) As withnotol
FROM ST_GeomFromEWKT('SRID=26986;POINT(227622.6 893843)') As geom;
 with1mtol | 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

11.6.2 GetFaceByPoint

GetFaceByPoint — Encuentra el identificador de cara de una cara intersecta un punto determinado

Synopsis

integer **GetFaceByPoint**(varchar atopology, geometry apoint, float8 tol);

Descripción

Recuperar el identificador de una cara que intersecta un punto.

La función devuelve un entero (identificador de cara) dada una topología, un POINT y una tolerancia. Si la tolerancia = 0 entonces el punto tiene que intersectar la cara.

Si el punto no intersecta una cara, devuelve 0 (cero).

Si se usa tolerancia > 0 y hay más de una cara cerca del punto, entonces se lanza una excepción.

Note
Si la tolerancia = 0, la función utiliza ST_Intersects de otra manera utiliza ST_DWithin.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

Ejemplos

Estos ejemplos utilizan los bordes de cara que hemos creado en AddFace

```
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

AddFace, GetNodeByPoint, GetEdgeByPoint

11.6.3 GetNodeByPoint

GetNodeByPoint — Buscar el identificador de un nodo en una locación de punto

Synopsis

integer **GetNodeByPoint**(varchar atopology, geometry point, float8 tol);

Recuperar el identificador de un nodo en una locación de punto

La función devuelve un entero (identificador de nodo) dado una topología, un punto y una tolerancia. Si la tolerancia = 0 significa exactamente la intersección, de lo contrario, recupere el nodo de un intervalo.

Si no hay un nodo en el punto, devuelve 0 (cero).

Si la tolerancia usada > 0 y cerca del punto hay más de un nodo lanzar una excepción.

Note
Si la tolerancia = 0, se utiliza la función ST_Intersects de lo contrario se utilizará ST_DWithin.

Disponibilidad: 2.0.0 - requiere GEOS >= 3.3.0.

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

11.6.4 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.

Disponibilidad: 1.?

Ejemplos

```
SELECT topology.GetTopologyID('ma_topo') As topo_id;
 topo_id
---------
       1
```

Ver también

CreateTopology, DropTopology, GetTopologyName, GetTopologySRID

11.6.5 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

11.6.6 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.

Disponibilidad: 1.?

Ejemplos

```
SELECT topology.GetTopologyName(1) As topo_name;
 topo_name
-----------
 ma_topo
```

Ver también

CreateTopology, DropTopology, GetTopologyID, GetTopologySRID

11.6.7 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

11.6.8 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.

Disponibilidad: 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

11.6.9 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 atopology, 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

11.6.10 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

GetRingEdges, ST_Azimuth

11.7 Procesamiento de Topología

11.7.1 Polygonize

Polygonize — Buscar y registrar todas las caras definidas por aristas de topología

Synopsis

text **Polygonize**(varchar toponame);

Descripción

Registra todas las caras que se pueden construir a partir de primitivas de arista 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

11.7.2 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

11.7.3 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.

Disponibilidad: 2.0.0 requiere GEOS >= 3.3.0.

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 4.3.1

11.7.4 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 4.3.1

11.7.5 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 geomA, float 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

11.8 Constructores de Geometría Topográfica

11.8.1 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 topogeometry para la capa denotada por layer_id y lo registra en la tabla de relaciones del esquema `toponame`.

tg_type es un entero: 1:[multi]point (punctal), 2:[multi]line (lineal), 3:[multi]poly (areal), 4:collection. layer_id es el identificador de capa en 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.

Disponibilidad: 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');

-- addtopgeometrycolumn --
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 un error
-- contar la cara si el 50% de ella cae
-- dentro de lo que creemos que es nuestro límite blockgroup
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 nuestro topogeometry de nuevo
-- a una geometría denomalizada alineada con nuestras caras y aristas
-- pacemos el topo a una geometría
-- Lo realmente genial es que mis nuevas geometrías
-- ahora están alineadas con mis líneas centrales de calle Tiger
UPDATE boston.blockgroups SET new_geom = topo::geometry;
```

Ver también

AddTopoGeometryColumn, toTopoGeom ST_CreateTopoGeo, ST_GetFaceGeometry, TopoElementArray, TopoElementArray_Agg

11.8.2 toTopoGeom

toTopoGeom — Convierte una Geometry simple en una topo geometry

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 `topogeom`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

11.8.3 TopoElementArray_Agg

TopoElementArray_Agg — Devuelve un `topoelementarray` para un conjunto de element_id, arrays 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

11.9 Editores TopoGeometry

11.9.1 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

11.9.2 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

11.9.3 TopoGeom_remElement

TopoGeom_remElement — Elimina un elemento de la definición de un 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

11.9.4 toTopoGeom

toTopoGeom — Agrega una forma geométrica a una geometría topo existente

Descripción

Consulte toTopoGeom

11.10 Descriptores de Geometría Topográfica

11.10.1 GetTopoGeomElementArray

GetTopoGeomElementArray — Devuelve un `topoelementarray` (una matriz de topoelements) que contiene los elementos topológicos y el tipo de los TopoGeometry dados (elementos primitivos)

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.

Disponibilidad: 1.?

Ejemplos

Ver también

GetTopoGeomElements, TopoElementArray

11.10.2 GetTopoGeomElements

GetTopoGeomElements — Devuelve un conjunto de objetos `topoelement` que contienen el element_id topológico, element_type del TopoGeometry dado (elementos primitivos)

Synopsis

setof topoelement **GetTopoGeomElements**(varchar toponame, integer layer_id, integer tg_id);

setof topoelement **GetTopoGeomElements**(topogeometry tg);

Descripción

Devuelve un conjunto de element_id, element_type (topoelements) para un objeto topogeometry dado en el esquema `toponame`.

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

11.11 Salidas de Geometría Topográfica

11.11.1 AsGML

AsGML — Devuelve una representación GML de una geometría topográfica.

Synopsis

text **AsGML**(topogeometry tg);
text **AsGML**(topogeometry tg, text nsprefix_in);
text **AsGML**(topogeometry tg, regclass visitedTable);
text **AsGML**(topogeometry tg, regclass visitedTable, text nsprefix);
text **AsGML**(topogeometry tg, text nsprefix_in, integer precision, integer options);
text **AsGML**(topogeometry tg, text nsprefix_in, integer precision, integer options, regclass visitedTable);
text **AsGML**(topogeometry tg, text nsprefix_in, integer precision, integer options, regclass visitedTable, text idprefix);
text **AsGML**(topogeometry tg, text nsprefix_in, integer precision, integer options, regclass visitedTable, text idprefix, int gmlversion);

Descripción

Devuelve la representación GML de un topogeometry en formato de versión GML3. Si no se especifica ningún `nsprefix_in` entonces se utiliza `gml`. Pase una cadena vacía a nsprefix 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

11.11.2 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_parcels 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]]
 ]}
```

11.12 Relaciones espaciales de topología

11.12.1 Equals

Equals — Devuelve true si dos topogeometries están compuestas de las mismas primitivas topologicas.

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

11.12.2 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

Chapter 12

Normalizador de Direcciones

This is a fork of the PAGC standardizer (original code for this portion was PAGC PostgreSQL Address Standardizer).

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_standardize`

El código para esta extensión se puede encontrar en PostGIS `extensions/address_standardizer` y es actualmente autocontenido.

Para instrucciones de instalación, consulte: Section 2.7.

12.1 Cómo funciona el analizador

El analizador trabaja de derecha a izquierda localizando primero los macro elementos para el codigo postal, estado/provincia, ciudad y a continuación los micro elementos para determinar si se esta tratando con un número de casa y calle o una interterseccion 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 Assumed to be US or CA based on: postcode as US or Canada state/province as US or Canada else US

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.

12.2 Tipos de Address Standardizer

12.2.1 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

A composite type that consists of elements of an address. This is the return type for standardize_address function. Some descriptions for elements are borrowed from PAGC Postal Attributes.

Los números de token indican el número de referencia de salidarules table

 This method needs address_standardizer extension.

construyendo is text (token number `0`): Refers to building number or name. Unparsed building identifiers and types. Generally blank for most addresses.

house_num is a text (token number `1`): This is the street number on a street. Example *75* in `75 State Street`.

predir is text (token number `2`): STREET NAME PRE-DIRECTIONAL such as North, South, East, West etc.

qual is text (token number `3`): STREET NAME PRE-MODIFIER Example *OLD* in `3715 OLD HIGHWAY 99`.

pretype is text (token number `4`): STREET PREFIX TYPE

nombre is text (token number `5`): STREET NAME

suftype is text (token number `6`): STREET POST TYPE e.g. St, Ave, Cir. A street type following the root street name. Example *STREET* in `75 State Street`.

sufdir is text (token number `7`): STREET POST-DIRECTIONAL A directional modifier that follows the street name.. Example *WEST* in `3715 TENTH AVENUE WEST`.

ruralroute is text (token number `8`): RURAL ROUTE . Example *7* in `RR 7`.

extra Es texto: Información adicional como el número de piso.

ciudad is text (token number `10`): Example Boston.

estado is text (token number `11`): Example `MASSACHUSETTS`

país is text (token number `12`): Example `USA`

código postal is text POSTAL CODE (ZIP CODE) (token number `13`): Example `02109`

box is text POSTAL BOX NUMBER (token number `14 and 15`): Example `02109`

unidad is text Apartment number or Suite Number (token number `17`): Example *3B* in `APT 3B`.

12.3 Address Standardizer Tables

12.3.1 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*.

BUILDT (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 typess. 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.pagcgeo.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.pagcgeo.org/docs/html/pagc-12.html#--r-typ--.

HOUSE is a text (token number `1`): This is the street number on a street. Example *75* in `75 State Street`.

predir is text (token number `2`): STREET NAME PRE-DIRECTIONAL such as North, South, East, West etc.

qual is text (token number `3`): STREET NAME PRE-MODIFIER Example *OLD* in `3715 OLD HIGHWAY 99`.

pretype is text (token number `4`): STREET PREFIX TYPE

street is text (token number `5`): STREET NAME

suftype is text (token number `6`): STREET POST TYPE e.g. St, Ave, Cir. A street type following the root street name. Example *STREET* in `75 State Street`.

sufdir is text (token number 7): STREET POST-DIRECTIONAL A directional modifier that follows the street name.. Example *WEST* in 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.

12.3.2 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.

12.3.3 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? - identifer 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.

12.4 Funciones de Address Standardizer

12.4.1 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

12.4.2 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

Chapter 13

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 ejectuados tal cual.

13.1 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.

13.1.1 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

13.1.2 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 stae 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

13.1.3 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

13.1.4 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 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('226 Hanover Street, Boston, MA',1) As g;
 rating |         wktlonlat          | 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 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('31 - 37 Stewart Street, Boston, MA 02116',1) As g;
 rating |         wktlonlat         | 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    |  ↩
                  new_address                | rating
-------+--------------------------------------------+-----------+----------+-----------------------

     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

13.1.5 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

13.1.6 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

13.1.7 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` whic 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 >

13.1.8 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

13.1.9 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 4.4.2 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

13.1.10 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 4.4.2 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-envars.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 2.8.1, Loader_Generate_Nation_Script

13.1.11 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 4.4.2 to load in the data.

It uses the following control tables `tiger.loader_platform`, `tiger.loader_variables`, and `tiger.loader_lookupt` 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

13.1.12 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

13.1.13 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_look` 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_lo` 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 addess 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

Output select fields. Use Pprint_Addy 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, Walaford, KS 99912323               | Wizard of Oz  |
```

Ver también

Geocode, Pprint_Addy

13.1.14 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_look 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_lo 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 addess 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

13.1.15 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

13.1.16 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                     |    lon    |   lat    | ↵
                                         int_addr1                 |     cross1      |    ↵
                         cross2
-----------------------------------------------------+-----------+----------+----------------------

 529 Main Street, Boston MA, 02129                   | -71.07181 | 42.38359 | 527 Main St,  ↵
    Boston, MA 02129              | Medford St       |
 77 Massachusetts Avenue, Cambridge, MA 02139        | -71.09428 | 42.35988 | 77  ↵
    Massachusetts Ave, Cambridge, MA 02139 | Vassar St       |
 26 Capen Street, Medford, MA                        | -71.12377 | 42.41101 | 9 Edison Ave, ↵
     Medford, MA 02155            | Capen St         | Tesla Ave
 124 Mount Auburn St, Cambridge, Massachusetts 02138 | -71.12304 | 42.37328 | 3 University  ↵
    Rd, Cambridge, MA 02138       | Mount Auburn St |
 950 Main Street, Worcester, MA 01610                | -71.82368 | 42.24956 | 3 Maywood St, ↵
     Worcester, MA 01603          | Main St          | Maywood Pl
```

Ver también

Pprint_Addy, Missing_Indexes_Generate_Script

13.1.17 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 11 and Section 2.4.1. 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

13.1.18 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 14

PostGIS Special Functions Index

14.1 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 - an aggregate function that returns the box3D bounding box that bounds rows of geometries.
- ST_Accum - Aggregate. Constructs an array of geometries.
- ST_AsGeobuf - Return a Geobuf representation of a set of rows.
- ST_AsMVT - Return a Mapbox Vector Tile representation of a set of rows.
- ST_ClusterIntersecting - Aggregate. Returns an array with the connected components of a set of geometries
- ST_ClusterWithin - Aggregate. Returns an array of GeometryCollections, where each GeometryCollection represents a set of geometries separated by no more than the specified distance.
- ST_Collect - Return a specified ST_Geometry value from a collection of other geometries.
- ST_Extent - an aggregate function that returns the bounding box that bounds rows of geometries.
- ST_MakeLine - Crea una cadena de línea desde geometrías de punto, multipunto o de línea.
- ST_MemUnion - Same as ST_Union, only memory-friendly (uses less memory and more processor time).
- ST_Polygonize - Aggregate. Creates a GeometryCollection containing possible polygons formed from the constituent 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 - Returns a geometry that represents the point set union of the Geometries.
- TopoElementArray_Agg - Devuelve un topoelementarray para un conjunto de element_id, arrays de tipo (topoelements)

14.2 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_numer(), lead(), lag(). All these require an SQL OVER() clause.

- ST_ClusterDBSCAN - Windowing function that returns integer id for the cluster each input geometry is in based on 2D implementation of Density-based spatial clustering of applications with noise (DBSCAN) algorithm.
- ST_ClusterKMeans - Windowing function that returns integer id for the cluster each input geometry is in.

14.3 PostGIS SQL-MM Compliant Functions

The functions given below are PostGIS functions that conform to the SQL/MM 3 standard

Note
SQL-MM defines the default SRID of all geometry constructors as 0. PostGIS uses a default SRID of -1.

- ST_3DDWithin - For 3d (z) geometry type Returns true if two geometries 3d distance is within number of units. This method implements the SQL/MM specification. SQL-MM ?
- ST_3DDistance - For geometry type Returns the 3-dimensional cartesian minimum distance (based on spatial ref) between two geometries in projected units. This method implements the SQL/MM specification. SQL-MM ?
- ST_3DIntersects - Returns TRUE if the Geometries "spatially intersect" in 3d - only for points, linestrings, polygons, polyhedral surface (area). With SFCGAL backend enabled also supports TINS This method implements the SQL/MM specification. SQL-MM 3: ?
- 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 identificardor 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 the surface if it is a Polygon or MultiPolygon. For geometry, a 2D Cartesian area is determined with units specified by the SRID. For geography, area is determined on a curved surface with units in square meters. This method implements the SQL/MM specification. SQL-MM 3: 8.1.2, 9.5.3
- ST_AsBinary - Return the 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_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 3: 5.1.14
- ST_Buffer - (T) Returns a geometry covering all points within a given distance from the input geometry. This method implements the SQL/MM specification. SQL-MM 3: 5.1.17
- 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 - Returns true 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. This method implements the SQL/MM specification. SQL-MM 3: 5.1.31
- ST_ConvexHull - The convex hull of a geometry represents the minimum convex geometry that encloses all geometries within the set. This method implements the SQL/MM specification. SQL-MM 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 - Returns TRUE if the supplied 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 CIRCULARSTRING/CURVEPOLYGON to a LINESTRING/POLYGON This method implements the SQL/MM specification. SQL-MM 3: 7.1.7
- ST_Difference - Devuelve una geometría que representa esa parte de la geometría A que no se intersecta con la geometría B. This method implements the SQL/MM specification. SQL-MM 3: 5.1.20
- ST_Dimension - La dimensión inherente del objeto Geometry, la cual debe ser menor o igual a la dimensión de coordenadas. This method implements the SQL/MM specification. SQL-MM 3: 5.1.2
- ST_Disjoint - Returns TRUE if the Geometries do not "spatially intersect" - if they do not share any space together. This method implements the SQL/MM specification. SQL-MM 3: 5.1.26
- ST_Distance - For geometry type returns the 2D Cartesian distance between two geometries in projected units (based on spatial reference system). For geography type defaults to return minimum geodesic distance between two geographies in meters. This method implements the SQL/MM specification. SQL-MM 3: 5.1.23
- ST_EndPoint - Devuelve el último punto de una geometría LINESTRING o CIRCULARLINESTRING como un POINT. 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: 5.1.15
- ST_Equals - Returns true if the given geometries represent the same geometry. Directionality is ignored. This method implements the SQL/MM specification. SQL-MM 3: 5.1.24
- ST_ExteriorRing - Devuelve una linestring representando el anillo exterior de una geometria tipo POLYGON. Devuelve NULL si la geometria no es un poligono. No funcionará con MULTIPOLYGON This method implements the SQL/MM specification. SQL-MM 3: 8.2.3, 8.3.3
- ST_GMLToSQL - Devuelve un valor especifico 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 especifico 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 especifico 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 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. 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 aface. 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 - Devuelve la cadena de texto del anillo interior N del poligono. Devuelve NULL si la geometría no es un polígono o el indice N dado esta fuera de rango. This method implements the SQL/MM specification. SQL-MM 3: 8.2.6, 8.3.5
- ST_Intersection - (T) Returns a geometry that represents the shared portion of geomA and geomB. This method implements the SQL/MM specification. SQL-MM 3: 5.1.18
- ST_Intersects - Returns TRUE if the Geometries/Geography "spatially intersect in 2D" - (share any portion of space) and FALSE if they don't (they are Disjoint). For geography -- tolerance is 0.00001 meters (so any points that close are considered to intersect) 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 LINESTRINGson 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 - Devuelve True si la Geometría es una colección vacía, polígono vacio, punto vacío etc. This method implements the SQL/MM specification. SQL-MM 3: 5.1.7
- ST_IsRing - Devuelve TRUE si esta LINESTRING es simple y cerrada. 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 - Devuelve true si la ST_Geometry esta bien formada. This method implements the SQL/MM specification. SQL-MM 3: 5.1.9
- ST_Length - Returns the 2D length of the geometry if it is a LineString or MultiLineString. geometry are in units of spatial reference and geography are in meters (default spheroid) 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_M - Devuelve la coordenada M del punto, o NULL si no seta disponible. La entrada debe ser un punto. 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 - Curar dos bordes eliminando el nodo que los conecta, modificando el primer borde y eliminando el segundo borde. 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 al eliminar el nodo que los conecta, elimina ambos bordes y los reemplaza por un borde cuya dirección es la misma que la del primer borde proporcionado. 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 - Si la geometría es una GEOMETRYCOLLECTION (o MULTI*) devuelve el numero de geometrías, para geometrias simples devuelve 1, si no devuelve NULL. 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 3: ?
- 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 - Returns true if the given geometries represent the same geometry and points are in the same directional order. This method implements the SQL/MM specification. SQL-MM 3: 5.1.43
- ST_Overlaps - Returns TRUE if the Geometries share space, are of 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 la 1 geometría de base n-ésima (cara) si la geometría es un POLYHEDRALSURFACE, POLYHEDRALSURFACEM. De lo contrario, devuelve NULL. This method implements the SQL/MM specification. SQL-MM 3: ?
- ST_Perimeter - Return the length measurement of the boundary of an ST_Surface or ST_MultiSurface geometry or geography. (Polygon, MultiPolygon). geometry measurement is in units of spatial reference and geography is in meters. This method implements the SQL/MM specification. SQL-MM 3: 8.1.3, 9.5.4
- ST_Point - Devuelve un ST_Point con el valor de coordenadas dado. Es un alias de ST_MakePoint del OGC. 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 punto enésimo en la primera cadena de línea o cadena de linea circular en la geometría. Los valores negativos se contabilizan hacia atrás desde el final de la cadena de línea. Devuelve NULL si no hay cadena de línea en la geometría. This method implements the SQL/MM specification. SQL-MM 3: 7.2.5, 7.3.5
- ST_PointOnSurface - Returns a POINT guaranteed to lie on the surface. This method implements the SQL/MM specification. SQL-MM 3: 8.1.5, 9.5.6. According to the specs, ST_PointOnSurface works for surface geometries (POLYGONs, MULTIPOLYGONS, CURVED POLYGONS). So PostGIS seems to be extending what the spec allows here. Most databases Oracle,DB II, ESRI SDE seem to only support this function for surfaces. SQL Server 2008 like PostGIS supports for all common geometries.
- ST_Polygon - Devuelve un polygon construido desde un linestring especifico y un 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 - Returns true if this Geometry is spatially related to anotherGeometry, by testing for intersections between the Interior, Boundary and Exterior of the two geometries as specified by the values in the intersectionMatrixPattern. If no intersectionMatrixPattern is passed in, then returns the maximum intersectionMatrixPattern that relates the 2 geometries. 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 modifca 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: Detelles 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: Detelles de Rutina: X+1.3.3
- ST_SRID - Devuelve el identificador de referencia espacial para el ST_Geometry como se define en la tabla spatial_ref_sys. This method implements the SQL/MM specification. SQL-MM 3: 5.1.5
- ST_StartPoint - Devuelve el primer punto de una geometría LINESTRING como un POINT. This method implements the SQL/MM specification. SQL-MM 3: 7.1.3
- ST_SymDifference - Returns a geometry that represents the portions of A and B that do not intersect. It is called a symmetric difference because ST_SymDifference(A,B) = ST_SymDifference(B,A). This method implements the SQL/MM specification. SQL-MM 3: 5.1.21
- ST_Touches - Returns TRUE if the 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 - Devuelve una nueva geometría con sus coordenadas transformadas a una referencia espacial diferente. This method implements the SQL/MM specification. SQL-MM 3: 5.1.6
- ST_Union - Returns a geometry that represents the point set union of the Geometries. This method implements the SQL/MM specification. SQL-MM 3: 5.1.19 the z-index (elevation) when polygons are involved.
- ST_WKBToSQL - Devuelve un valor especifico 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 especifico 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 - Returns true if the geometry A is completely inside geometry B This method implements the SQL/MM specification. SQL-MM 3: 5.1.30
- ST_X - Devuelve la coordenada X del punto, o NULL si no está disponible. La entrada debe ser un punto. This method implements the SQL/MM specification. SQL-MM 3: 6.1.3
- ST_Y - Devuelve la coordenada Y del punto, o NULL si no está disponible. La entrada debe ser un punto. This method implements the SQL/MM specification. SQL-MM 3: 6.1.4
- ST_Z - Devuelve la coordenada Z del punto, o NULL si no está disponible. La entrada debe ser un punto. This method implements the SQL/MM specification.

14.4 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 the surface if it is a Polygon or MultiPolygon. For geometry, a 2D Cartesian area is determined with units specified by the SRID. For geography, area is determined on a curved surface with units in square meters.
- ST_AsBinary - Return the 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 the geometry as a GeoJSON element.
- ST_AsKML - Return the geometry as a KML element. Several variants. Default version=2, default maxdecimaldigits=15
- ST_AsSVG - Returns a Geometry in SVG path data given a geometry or geography object.
- ST_AsText - Return the Well-Known Text (WKT) representation of the geometry/geography without SRID metadata.
- ST_Azimuth - Returns the north-based azimuth as the angle in radians measured clockwise from the vertical on pointA to pointB.
- ST_Buffer - (T) Returns a geometry covering all points within a given distance from the input geometry.
- ST_Centroid - Returns the geometric center of a geometry.
- ST_CoveredBy - Returns 1 (TRUE) if no point in Geometry/Geography A is outside Geometry/Geography B
- ST_Covers - Returns 1 (TRUE) if no point in Geometry B is outside Geometry A
- ST_DWithin - Returns true if the geometries are within the specified distance of one another. For geometry units are in those of spatial reference and for geography units are in meters and measurement is defaulted to use_spheroid=true (measure around spheroid), for faster check, use_spheroid=false to measure along sphere.
- ST_Distance - For geometry type returns the 2D Cartesian distance between two geometries in projected units (based on spatial reference system). For geography type defaults to return minimum geodesic distance between two geographies in meters.
- ST_GeogFromText - Devuelve un valor especifico "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 especifico "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 - (T) Returns a geometry that represents the shared portion of geomA and geomB.

- ST_Intersects - Returns TRUE if the Geometries/Geography "spatially intersect in 2D" - (share any portion of space) and FALSE if they don't (they are Disjoint). For geography -- tolerance is 0.00001 meters (so any points that close are considered to intersect)
- ST_Length - Returns the 2D length of the geometry if it is a LineString or MultiLineString. geometry are in units of spatial reference and geography are in meters (default spheroid)
- ST_Perimeter - Return the length measurement of the boundary of an ST_Surface or ST_MultiSurface geometry or geography. (Polygon, MultiPolygon). geometry measurement is in units of spatial reference and geography is in meters.
- ST_Project - Returns a POINT projected from a start point using a distance in meters and bearing (azimuth) in radians.
- 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.

14.5 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_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.
- 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 prodived. 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 prodived. 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.
- 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_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_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.

- 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.

14.6 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.
- ST_Dump - Returns a set of geometry_dump (geom,path) rows, that make up a geometry g1.
- ST_DumpPoints - Returns a set of geometry_dump (geom,path) rows of all points that make up a geometry.
- ST_DumpRings - Returns a set of geometry_dump rows, representing the exterior and interior rings of a polygon.

14.7 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 maximum extents of the geometry.
- Box3D - Returns a BOX3D representing the maximum extents of the geometry.
- Box3D - Returns the box 3d representation of the enclosing box of the raster.
- ST_3DExtent - an aggregate function that returns the box3D bounding box that bounds rows of geometries.
- ST_3DMakeBox - Crea una BOX3D definida por las geometrías puntuales 3D.
- ST_AsMVTGeom - Transform a geometry into the coordinate space of a Mapbox Vector 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 - Returns the portion of a geometry falling within a rectangle.
- ST_EstimatedExtent - Return the 'estimated' extent of the given spatial table. The estimated is taken from the geometry column's statistics. The current schema will be used if not specified.
- ST_Expand - Returns bounding box expanded in all directions from the bounding box of the input geometry. Uses double-precision
- ST_Extent - an aggregate function that returns the bounding box that bounds rows of geometries.
- ST_MakeBox2D - Crea una BOX2D definida por los puntos de la geometría dada.
- ST_XMax - Devuelve la X máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_XMin - Devuelve la X mínima de un cuadro delimitador 2d o 3d o una geometría.
- ST_YMax - Devuelve la Y máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_YMin - Devuelve la Y mínima de un cuadro delimitador 2d o 3d o una geometría.
- ST_ZMax - Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_ZMin - Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.
- ~(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).
- @(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).

14.8 PostGIS Functions that support 3D

The functions given below are PostGIS functions that do not throw away the Z-Index.

- AddGeometryColumn - Añade una columna de geometrías a una tabla de atributos existente. Por defecto utiliza el modificador de tipo en vez de restricciones. Si se cambia a falso use_typmode se utilizará el metido antiguo basado en restricciones
- Box3D - Returns a BOX3D representing the maximum extents of the geometry.
- DropGeometryColumn - Suprime una columna de geometrías de una tabla espacial.
- GeometryType - Devuelve el tipo de geometría como una cadena de texto. Ej: 'LINESTRING', 'POLYGON', 'MULTIPOINT', etc.

- ST_3DArea - Computes area of 3D surface geometries. Will return 0 for solids.
- ST_3DClosestPoint - Returns the 3-dimensional point on g1 that is closest to g2. This is the first point of the 3D shortest line.
- ST_3DDFullyWithin - Returns true if all of the 3D geometries are within the specified distance of one another.
- ST_3DDWithin - For 3d (z) geometry type Returns true if two geometries 3d distance is within number of units.
- ST_3DDifference - Perform 3D difference
- ST_3DDistance - For geometry type Returns the 3-dimensional cartesian minimum distance (based on spatial ref) between two geometries in projected units.
- ST_3DExtent - an aggregate function that returns the box3D bounding box that bounds rows of geometries.
- ST_3DIntersection - Perform 3D intersection
- ST_3DIntersects - Returns TRUE if the Geometries "spatially intersect" in 3d - only for points, linestrings, polygons, polyhedral surface (area). With SFCGAL backend enabled also supports TINS
- ST_3DLength - Returns the 3-dimensional or 2-dimensional length of the geometry if it is a linestring or multi-linestring.
- ST_3DLongestLine - Returns the 3-dimensional longest line between two geometries
- ST_3DMaxDistance - For geometry type Returns the 3-dimensional cartesian maximum distance (based on spatial ref) between two geometries in projected units.
- ST_3DPerimeter - Returns the 3-dimensional perimeter of the geometry, if it is a polygon or multi-polygon.
- ST_3DShortestLine - Returns the 3-dimensional shortest line between two geometries
- ST_3DUnion - Perform 3D union
- ST_Accum - Aggregate. Constructs an array of geometries.
- ST_AddMeasure - Devuelve una geometría derivada con elementos de medida interpolados linealmente entre los puntos inicial y final.
- ST_AddPoint - Añade un punto a una cadena de línea.
- ST_Affine - Aplicar una transformación de afinidad 3D a una geometría.
- ST_ApproximateMedialAxis - Compute the approximate medial axis of an areal geometry.
- ST_AsBinary - Return the Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- ST_AsEWKB - Return the Well-Known Binary (WKB) 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 the 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. Several variants. Default version=2, default maxdecimaldigits=15
- 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 - Devuelve true si los puntos de aproximación más cercanos de las trayectorias están dentro de la distancia especificada.

- ST_ClosestPointOfApproach - Devuelve la medida de los puntos interpolados a lo largo de dos lineas cercanas.
- ST_Collect - Return a specified ST_Geometry value from a collection of other geometries.
- ST_ConvexHull - The convex hull of a geometry represents the minimum convex geometry that encloses all geometries within the set.
- ST_CoordDim - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
- ST_CurveToLine - Converts a CIRCULARSTRING/CURVEPOLYGON to a LINESTRING/POLYGON
- ST_DelaunayTriangles - Return a Delaunay triangulation around the given input points.
- ST_Difference - Devuelve una geometría que representa esa parte de la geometría A que no se intersecta con la geometría B.
- ST_DistanceCPA - Devuelve la distancia entre puntos cercanos de aproximación a dos trayectorias.
- ST_Dump - Returns a set of geometry_dump (geom,path) rows, that make up a geometry g1.
- ST_DumpPoints - Returns a set of geometry_dump (geom,path) rows of all points that make up a geometry.
- ST_DumpRings - Returns a set of geometry_dump rows, representing the exterior and interior rings of a polygon.
- ST_EndPoint - Devuelve el último punto de una geometría LINESTRING o CIRCULARLINESTRING como un POINT.
- ST_ExteriorRing - Devuelve una linestring representando el anillo exterior de una geometria tipo POLYGON. Devuelve NULL si la geometria no es un poligono. No funcionará con MULTIPOLYGON
- ST_Extrude - Extrude a surface to a related volume
- ST_FlipCoordinates - Returns a version of the given geometry with X and Y axis flipped. Useful for people who have built latitude/longitude features and need to fix them.
- 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 especifico 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 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.
- ST_GeometryType - Devuelve el tipo de geometría del valor de ST_Geometry.
- ST_HasArc - Returns true if a geometry or geometry collection contains a circular string
- ST_InteriorRingN - Devuelve la cadena de texto del anillo interior N del poligono. Devuelve NULL si la geometría no es un polígono o el indice N dado esta fuera de rango.
- ST_InterpolatePoint - Devuelve el valor de la dimensión medida de una geometría en el punto cerrado al punto proporcionado.
- ST_IsClosed - Devuelve TRUE si los puntos de inicio y final de una LINESTRINGson coincidentes. Para superficies poliedricas si son cerradas (volumetricas).
- ST_IsCollection - Devuelve TRUE si el argumento es una colección (MULTI*, GEOMETRYCOLLECTION, ...)
- 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 - Devuelve true si la geometría es una trayectoria válida.
- ST_Length_Spheroid - Calculates the 2D or 3D length/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.
- ST_LineFromMultiPoint - Crea una LineString desde una geometría MultiPoint.
- ST_LineInterpolatePoint - Devuelve un punto interpolado a lo largo de una línea. El segundo argumento es un float8 entre 0 y 1 que representa la fracción de la longitud total de la cadena de linea el punto tiene que ser localizado.
- ST_LineInterpolatePoints - Returns one or more points interpolated along a line.
- ST_LineSubstring - Devuelve una cadena de linea que es una subcadena de la entrada uno que comienza y termina en las fracciones 2D dadas de la longitud total. Los argumentos segundo y tercero son valores float8 entre 0 y 1.
- ST_LineToCurve - Converts a LINESTRING/POLYGON to a CIRCULARSTRING, CURVEPOLYGON
- ST_LocateBetweenElevations - Devuelve un valor de geometría (colección) derivada con elementos que intersectan el rango de cotas especificado de forma inclusiva. Solamente 3D, 4D LINESTRINGS y MULTILINESTRINGS son soportados.
- ST_M - Devuelve la coordenada M del punto, o NULL si no seta disponible. La entrada debe ser un punto.
- ST_MakeLine - Crea una cadena de línea desde geometrías de punto, multipunto o de línea.
- ST_MakePoint - Creates a 2D, 3DZ or 4D point geometry.
- ST_MakePolygon - Crea un polígono formado por el contorno dado. Las geometrías de entrada deben ser LINESTRINGS cerradas.
- 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 - Returns the amount of space (in bytes) the geometry takes.
- ST_MemUnion - Same as ST_Union, only memory-friendly (uses less memory and more processor time).
- ST_NDims - Devuelve la dimension de las coordenadas de la geometría como un entero "small int". Los valores son: 2,3 o 4.
- ST_NPoints - Devuelve el numero de puntos (vértices) en la geometría.
- ST_NRings - Si la geometria es un polígono o un multi-polígono devuelve el numero de anillos.
- ST_Node - Node a set of linestrings.
- ST_NumGeometries - Si la geometría es una GEOMETRYCOLLECTION (o MULTI*) devuelve el numero de geometrías, para geometrias simples devuelve 1, si no devuelve NULL.
- 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 la 1 geometría de base n-ésima (cara) si la geometría es un POLYHEDRALSURFACE, POLYHEDRALSURFACEM. De lo contrario, devuelve NULL.
- ST_PointFromWKB - Crea una geometría desde un WKB con el SRID dado.
- ST_PointN - Devuelve el punto enésimo en la primera cadena de línea o cadena de linea circular en la geometría. Los valores negativos se contabilizan hacia atrás desde el final de la cadena de línea. Devuelve NULL si no hay cadena de línea en la geometría.
- ST_PointOnSurface - Returns a POINT guaranteed to lie on the surface.
- ST_Points - Devuelve un MultiPoint que contiene todas las coordenadas de una geometría.
- ST_Polygon - Devuelve un polygon construido desde un linestring especifico y un SRID.
- ST_RemovePoint - Eliminar el punto de una cadena de líneas.
- ST_RemoveRepeatedPoints - Returns a version of the given geometry with duplicated points removed.
- ST_Reverse - Devuelve la geometría con el orden de vértice invertido.
- ST_Rotate - Gira una geometría rotRadians en sentido contrario a las manecillas del reloj sobre un origen.
- ST_RotateX - Gira una geometría rotRadians sobre el eje X.
- ST_RotateY - Gira una geometría rotRadians sobre el eje Y.
- ST_RotateZ - Gira una geometría rotRadians sobre el eje Z.
- ST_Scale - Escalar una geometría por factores dados.
- ST_SetPoint - Reemplace el punto de una cadena de línea con un punto dado.
- ST_Shift_Longitude - Toggle geometry coordinates between -180..180 and 0..360 ranges.
- ST_SnapToGrid - Ajusta todos los puntos de la geometría de entrada a una cuadrícula regular.
- ST_StartPoint - Devuelve el primer punto de una geometría LINESTRING como un POINT.
- 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 - Returns a geometry that represents the portions of A and B that do not intersect. It is called a symmetric difference because ST_SymDifference(A,B) = ST_SymDifference(B,A).
- ST_Tesselate - Perform surface Tesselation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS

- ST_TransScale - Traslada una geometría por factores y offsets dados.
- ST_Translate - Trasladar una geometría por desplazamientos dados.
- ST_UnaryUnion - Like ST_Union, but working at the geometry component level.
- 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 - Devuelve la coordenada X del punto, o NULL si no está disponible. La entrada debe ser un punto.
- ST_XMax - Devuelve la X máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_XMin - Devuelve la X mínima de un cuadro delimitador 2d o 3d o una geometría.
- ST_Y - Devuelve la coordenada Y del punto, o NULL si no está disponible. La entrada debe ser un punto.
- ST_YMax - Devuelve la Y máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_YMin - Devuelve la Y mínima de un cuadro delimitador 2d o 3d o una geometría.
- ST_Z - Devuelve la coordenada Z del punto, o NULL si no está disponible. La entrada debe ser un punto.
- ST_ZMax - Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_ZMin - Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_Zmflag - Devuelve el indicador ZM (dimensión semántica) de las geometrías como un small int. los valores son: 0=2d, 1=3dm, 2=3dz, 3=4d.
- 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 - Actualiza el SRID de todos los objetos espaciales de una columna de geometría, GEOMETRY_COLUMNS metadatos y srid. Si se cumple con las limitaciones, las restricciones se actualizarán con una nueva restricción srid. Si el viejo se impuso por tipo de definición, se cambiará la definición de tipo.
- 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_version - Returns the version of SFCGAL in use

14.9 PostGIS Curved Geometry Support Functions

The functions given below are PostGIS functions that can use CIRCULARSTRING, CURVEPOLYGON, and other curved geometry types

- AddGeometryColumn - Añade una columna de geometrías a una tabla de atributos existente. Por defecto utiliza el modificador de tipo en vez de restricciones. Si se cambia a falso use_typmode se utilizará el metido antiguo basado en restricciones
- Box2D - Returns a BOX2D representing the maximum extents of the geometry.
- Box3D - Returns a BOX3D representing the maximum extents of the geometry.
- DropGeometryColumn - Suprime una columna de geometrías de una tabla espacial.

- GeometryType - Devuelve el tipo de geometría como una cadena de texto. Ej: 'LINESTRING', 'POLYGON', 'MULTIPOINT', etc.
- PostGIS_AddBBox - Agregue el cuadro delimitador a la geometría.
- PostGIS_DropBBox - Elimina el caché de cuadro delimitador de la geometría.
- PostGIS_HasBBox - Devuelve TRUE si el bbox de la geometría está almacenado en caché, FALSE de lo contrario.
- ST_3DExtent - an aggregate function that returns the box3D bounding box that bounds rows of geometries.
- ST_Accum - Aggregate. Constructs an array of geometries.
- ST_Affine - Aplicar una transformación de afinidad 3D a una geometría.
- ST_AsBinary - Return the Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- ST_AsEWKB - Return the Well-Known Binary (WKB) 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_Collect - Return a specified ST_Geometry value from a collection of other geometries.
- ST_CoordDim - Devuelve la dimensión de las coordenadas del valor de ST_Geometry.
- ST_CurveToLine - Converts a CIRCULARSTRING/CURVEPOLYGON to a LINESTRING/POLYGON
- ST_Distance - For geometry type returns the 2D Cartesian distance between two geometries in projected units (based on spatial reference system). For geography type defaults to return minimum geodesic distance between two geographies in meters.
- ST_Dump - Returns a set of geometry_dump (geom,path) rows, that make up a geometry g1.
- ST_DumpPoints - Returns a set of geometry_dump (geom,path) rows of all points that make up a geometry.
- ST_EndPoint - Devuelve el último punto de una geometría LINESTRING o CIRCULARLINESTRING como un POINT.
- ST_EstimatedExtent - Return the 'estimated' extent of the given spatial table. The estimated is taken from the geometry column's statistics. The current schema will be used if not specified.
- ST_FlipCoordinates - Returns a version of the given geometry with X and Y axis flipped. Useful for people who have built latitude/longitude features and need to fix them.
- 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 especifico 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 especifico 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 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.
- = - 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 - Returns true if a geometry or geometry collection contains a circular string
- ST_IsClosed - Devuelve TRUE si los puntos de inicio y final de una LINESTRINGson coincidentes. Para superficies poliedricas si son cerradas (volumetricas).
- ST_IsCollection - Devuelve TRUE si el argumento es una colección (MULTI*, GEOMETRYCOLLECTION, ...)
- ST_IsEmpty - Devuelve True si la Geometría es una colección vacía, polígono vacio, punto vacío etc.
- ST_LineToCurve - Converts a LINESTRING/POLYGON to a CIRCULARSTRING, CURVEPOLYGON
- ST_MemSize - Returns the amount of space (in bytes) the geometry takes.
- ST_NPoints - Devuelve el numero de puntos (vértices) en la geometría.
- ST_NRings - Si la geometria es un polígono o un multi-polígono devuelve el numero de anillos.
- ST_PointFromWKB - Crea una geometría desde un WKB con el SRID dado.
- ST_PointN - Devuelve el punto enésimo en la primera cadena de línea o cadena de linea circular en la geometría. Los valores negativos se contabilizan hacia atrás desde el final de la cadena de línea. Devuelve NULL si no hay cadena de línea en la geometría.
- ST_Points - Devuelve un MultiPoint que contiene todas las coordenadas de una geometría.
- ST_Rotate - Gira una geometría rotRadians en sentido contrario a las manecillas del reloj sobre un origen.
- ST_RotateZ - Gira una geometría rotRadians sobre el eje Z.
- ST_SRID - Devuelve el identificador de referencia espacial para el ST_Geometry como se define en la tabla spatial_ref_sys.
- ST_Scale - Escalar una geometría por factores dados.
- ST_SetSRID - Establezca el SRID en una geometría en un valor entero determinado.
- ST_StartPoint - Devuelve el primer punto de una geometría LINESTRING como un POINT.
- 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 - Traslada una geometría por factores y offsets dados.
- ST_Transform - Devuelve una nueva geometría con sus coordenadas transformadas a una referencia espacial diferente.
- ST_Translate - Trasladar una geometría por desplazamientos dados.

- ST_XMax - Devuelve la X máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_XMin - Devuelve la X mínima de un cuadro delimitador 2d o 3d o una geometría.
- ST_YMax - Devuelve la Y máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_YMin - Devuelve la Y mínima de un cuadro delimitador 2d o 3d o una geometría.
- ST_ZMax - Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_ZMin - Devuelve la Z máxima de un cuadro delimitador 2d o 3d o una geometría.
- ST_Zmflag - Devuelve el indicador ZM (dimensión semántica) de las geometrías como un small int. los valores son: 0=2d, 1=3dm, 2=3dz, 3=4d.
- UpdateGeometrySRID - Actualiza el SRID de todos los objetos espaciales de una columna de geometría, GEOMETRY_COLUMNS metadatos y srid. Si se cumple con las limitaciones, las restricciones se actualizarán con una nueva restricción srid. Si el viejo se impuso por tipo de definición, se cambiará la definición de tipo.
- ~(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.

14.10 PostGIS Polyhedral Surface Support Functions

The functions given below are PostGIS functions that can use POLYHEDRALSURFACE, POLYHEDRALSURFACEM geometries

- Box2D - Returns a BOX2D representing the maximum extents of the geometry.
- Box3D - Returns a BOX3D representing the maximum extents of the geometry.

- GeometryType - Devuelve el tipo de geometría como una cadena de texto. Ej: 'LINESTRING', 'POLYGON', 'MULTIPOINT', etc.
- ST_3DArea - Computes area of 3D surface geometries. Will return 0 for solids.
- ST_3DClosestPoint - Returns the 3-dimensional point on g1 that is closest to g2. This is the first point of the 3D shortest line.
- ST_3DDFullyWithin - Returns true if all of the 3D geometries are within the specified distance of one another.
- ST_3DDWithin - For 3d (z) geometry type Returns true if two geometries 3d distance is within number of units.
- ST_3DDifference - Perform 3D difference
- ST_3DDistance - For geometry type Returns the 3-dimensional cartesian minimum distance (based on spatial ref) between two geometries in projected units.
- ST_3DExtent - an aggregate function that returns the box3D bounding box that bounds rows of geometries.
- ST_3DIntersection - Perform 3D intersection
- ST_3DIntersects - Returns TRUE if the Geometries "spatially intersect" in 3d - only for points, linestrings, polygons, polyhedral surface (area). With SFCGAL backend enabled also supports TINS
- ST_3DLongestLine - Returns the 3-dimensional longest line between two geometries
- ST_3DMaxDistance - For geometry type Returns the 3-dimensional cartesian maximum distance (based on spatial ref) between two geometries in projected units.
- ST_3DShortestLine - Returns the 3-dimensional shortest line between two geometries
- ST_3DUnion - Perform 3D union
- ST_Accum - Aggregate. Constructs an array of geometries.
- ST_Affine - Aplicar una transformación de afinidad 3D a una geometría.
- ST_ApproximateMedialAxis - Compute the approximate medial axis of an areal geometry.
- ST_Area - Returns the area of the surface if it is a Polygon or MultiPolygon. For geometry, a 2D Cartesian area is determined with units specified by the SRID. For geography, area is determined on a curved surface with units in square meters.
- ST_AsBinary - Return the Well-Known Binary (WKB) representation of the geometry/geography without SRID meta data.
- ST_AsEWKB - Return the Well-Known Binary (WKB) 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 - La dimensión inherente del objeto Geometry, la cual debe ser menor o igual a la dimensión de coordenadas.
- ST_Dump - Returns a set of geometry_dump (geom,path) rows, that make up a geometry g1.
- ST_DumpPoints - Returns a set of geometry_dump (geom,path) rows of all points that make up a geometry.
- ST_Expand - Returns bounding box expanded in all directions from the bounding box of the input geometry. Uses double-precision
- ST_Extent - an aggregate function that returns the bounding box that bounds rows of geometries.
- ST_Extrude - Extrude a surface to a related volume
- ST_FlipCoordinates - Returns a version of the given geometry with X and Y axis flipped. Useful for people who have built latitude/longitude features and need to fix them.

- 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 especifico 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 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.
- 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 LINESTRINGson 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 - Returns the amount of space (in bytes) the geometry takes.
- ST_NPoints - Devuelve el numero de puntos (vértices) en la geometría.
- ST_NumGeometries - Si la geometría es una GEOMETRYCOLLECTION (o MULTI*) devuelve el numero de geometrías, para geometrias simples devuelve 1, si no devuelve NULL.
- ST_NumPatches - Devuelve el número de caras en una superficie poliédrica. Devolverá nulo para geometrías no poliédricas.
- ST_PatchN - Devuelve la 1 geometría de base n-ésima (cara) si la geometría es un POLYHEDRALSURFACE, POLYHEDRALSURFACEM. De lo contrario, devuelve NULL.
- ST_RemoveRepeatedPoints - Returns a version of the given geometry with duplicated points removed.
- ST_Reverse - Devuelve la geometría con el orden de vértice invertido.
- ST_Rotate - Gira una geometría rotRadians en sentido contrario a las manecillas del reloj sobre un origen.
- ST_RotateX - Gira una geometría rotRadians sobre el eje X.
- ST_RotateY - Gira una geometría rotRadians sobre el eje Y.

- ST_RotateZ - Gira una geometría rotRadians sobre el eje Z.
- ST_Scale - Escalar una geometría por factores dados.
- ST_ShiftLongitude - Toggle geometry coordinates between -180..180 and 0..360 ranges.
- 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_Tesselate - Perform surface Tesselation of a polygon or polyhedralsurface and returns as a TIN or collection of TINS
- ST_Transform - Devuelve una nueva geometría con sus coordenadas transformadas a una referencia espacial diferente.
- 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 (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.
- postgis_sfcgal_version - Returns the version of SFCGAL in use

14.11 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	✓		✓	✓		✓	✓
Find_SRID							
GeometryType	✓		✓	✓		✓	✓
ST_3DArea							
ST_3DClosestPoint	✓		✓			✓	
ST_3DDFullyWithi	✓		✓			✓	
ST_3DDWithin	✓		✓		✓	✓	
ST_3DDifference							
ST_3DDistance	✓						
ST_3DExtent	✓		✓	✓		✓	✓
ST_3DIntersection							
ST_3DIntersects	✓						

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_3DLength	✓		✓				
ST_3DLongestLine	✓		✓			✓	
ST_3DMakeBox	✓						
ST_3DMaxDistance	✓		✓			✓	
ST_3DPerimeter	✓		✓				
ST_3DShortestLine	✓		✓			✓	
ST_3DUnion							
ST_Accum	✓		✓	✓		✓	✓
ST_AddMeasure	✓		✓				
ST_AddPoint	✓		✓				
ST_Affine	✓		✓	✓		✓	✓
ST_Angle	✓						
ST_ApproximateM Axis							
ST_Area	✓	✓					
ST_AsBinary	✓	✓	✓	✓	✓	✓	✓
ST_AsEWKB	✓		✓	✓		✓	✓
ST_AsEWKT	✓	✓	✓	✓		✓	✓
ST_AsEncodedPoly	✓						
ST_AsGML	✓	✓	✓			✓	✓
ST_AsGeoJSON	✓	✓	✓				
ST_AsGeobuf							
ST_AsHEXEWKB	✓		✓	✓			
ST_AsKML	✓	✓	✓				
ST_AsLatLonText	✓						
ST_AsMVT							
ST_AsMVTGeom	✓						
ST_AsSVG	✓	✓					
ST_AsTWKB	✓						
ST_AsText	✓	✓		✓	✓		
ST_AsX3D	✓		✓			✓	✓
ST_Azimuth	✓	✓					
ST_BdMPolyFromT	✓						
ST_BdPolyFromTe	✓						

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_Boundary	✓		✓		✓		✓
ST_BoundingDiago	✓		✓				
ST_Box2dFromGe h	☑						
ST_Buffer	✓	😁			✓		
ST_BuildArea	✓						
ST_CPAWithin	✓		✓				
ST_Centroid	✓	✓			✓		
ST_ChaikinSmooth	✓						
ST_ClipByBox2D	✓						
ST_ClosestPoint	✓						
ST_ClosestPointOf roach	✓		✓				
ST_ClusterDBSCA	✓						
ST_ClusterIntersect	✓						
ST_ClusterKMeans	✓						
ST_ClusterWithin	✓						
ST_Collect	✓		✓	✓			
ST_CollectionExtra	✓						
ST_CollectionHom ize	✓						
ST_ConcaveHull	✓						
ST_Contains	✓				✓		
ST_ContainsProper	✓						
ST_ConvexHull	✓		✓		✓		
ST_CoordDim	✓		✓	✓	✓	✓	✓
ST_CoveredBy	✓	✓					
ST_Covers	✓	✓					
ST_Crosses	✓				✓		
ST_CurveToLine	✓		✓	✓	✓		
ST_DFullyWithin	✓						
ST_DWithin	✓	✓					
ST_DelaunayTriang	✓		✓				✓
ST_Difference	✓		✓		✓		
ST_Dimension	✓				✓	✓	✓
ST_Disjoint	✓				✓		

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_Distance	✓	✓		✓			
ST_DistanceCPA	✓		✓				
ST_DistanceSphere	✓						
ST_DistanceSpheroid	✓						
ST_Dump	✓		✓	✓		✓	✓
ST_DumpPoints	✓		✓	✓		✓	✓
ST_DumpRings	✓		✓				
ST_EndPoint	✓		✓	✓	✓		
ST_Envelope	✓				✓		
ST_Equals	✓				✓		
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_Force3DM	✓			✓			
ST_Force3DZ	✓		✓	✓		✓	
ST_Force4D	✓		✓	✓			
ST_ForceCollection	✓		✓	✓		✓	
ST_FrechetDistance	✓						
ST_GMLToSQL	✓				✓		
ST_GeneratePoints	✓						
ST_GeoHash	✓			✓			

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_GeogFromText		✓					
ST_GeogFromWKB		✓		✓			
ST_GeographyFromText		✓					
ST_GeomCollFrom	✓				✓		
ST_GeomFromEWI	✓		✓	✓		✓	✓
ST_GeomFromEWI	✓		✓	✓		✓	✓
ST_GeomFromGM	✓		✓			✓	✓
ST_GeomFromGeo	✓						
ST_GeomFromGeo	✓		✓				
ST_GeomFromKM	✓		✓				
ST_GeomFromTWI	✓						
ST_GeomFromText	✓			✓	✓		
ST_GeomFromWK	✓			✓	✓		
ST_GeometricMedi	✓		✓				
ST_GeometryFrom	✓				✓		
ST_GeometryN	✓		✓	✓	✓	✓	✓
ST_GeometryType	✓		✓		✓	✓	
|>>	✓						
<<|	✓						
~	✓						
@	✓						
=	✓	✓		✓		✓	
<<	✓						
|&>	✓						
&<|	✓			✓		✓	
&<	✓						
&>	✓						
>>	✓						
~=	✓					✓	
ST_HasArc	✓		✓	✓			
ST_HausdorffDistan	✓						
ST_InteriorRingN	✓		✓		✓		
ST_InterpolatePoint	✓		✓				

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_Intersection	✓	☺			✓		
ST_Intersects	✓	✓			✓		
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_IsValidTrajector	✓		✓				
ST_Length	✓	✓			✓		
ST_Length2D	✓						
ST_Length2D_Sphe	✓ l						
ST_LengthSpheroid	✓		✓				
ST_LineCrossingDi	✓ ion						
ST_LineFromEncoc	✓ olyline						
ST_LineFromMulti	✓ t		✓				
ST_LineFromText	✓				✓		
ST_LineFromWKB	✓				✓		
ST_LineInterpolatel	✓ t		✓				
ST_LineInterpolatel	✓ ts		✓				
ST_LineLocatePoin	✓						
ST_LineMerge	✓						
ST_LineSubstring	✓		✓				
ST_LineToCurve	✓		✓	✓			
ST_LinestringFrom	✓ B				✓		
ST_LocateAlong	✓						

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_LocateBetween	✓						
ST_LocateBetweenElevations	✓		✓				
ST_LongestLine	✓						
ST_M	✓		✓		✓		
ST_MLineFromText	✓				✓		
ST_MPointFromText	✓				✓		
ST_MPolyFromText	✓				✓		
ST_MakeBox2D	✓						
ST_MakeEnvelope	✓						
ST_MakeLine	✓		✓				
ST_MakePoint	✓		✓				
ST_MakePointM	✓						
ST_MakePolygon	✓		✓				
ST_MakeSolid							
ST_MakeValid	✓		✓				
ST_MaxDistance	✓						
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_NumInteriorRing	✓						
ST_NumInteriorRings	✓				✓		
ST_NumPatches	✓		✓		✓	✓	

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_NumPoints	✓				✓		
ST_OffsetCurve	✓						
ST_OrderingEquals	✓				✓		
ST_Orientation							
ST_OrientedEnvelo	✓						
ST_Overlaps	✓				✓		
ST_PatchN	✓		✓		✓	✓	
ST_Perimeter	✓	✓			✓		
ST_Perimeter2D	✓						
ST_Point	✓				✓		
ST_PointFromGeoHash							
ST_PointFromText	✓				✓		
ST_PointFromWKE	✓		✓	✓	✓		
ST_PointN	✓		✓	✓	✓		
ST_PointOnSurface	✓		✓		✓		
ST_PointInsideCirc	✓						
ST_Points	✓		✓	✓			
ST_Polygon	✓		✓		✓		
ST_PolygonFromTe	✓				✓		
ST_Polygonize	✓						
ST_Project		✓					
ST_QuantizeCoordi	✓ s						
ST_Relate	✓				✓		
ST_RelateMatch							
ST_RemovePoint	✓		✓				
ST_RemoveRepeate	✓ ints		✓			✓	
ST_Reverse	✓		✓			✓	
ST_Rotate	✓		✓	✓		✓	✓
ST_RotateX	✓		✓			✓	✓
ST_RotateY	✓		✓			✓	✓
ST_RotateZ	✓		✓	✓		✓	✓
ST_SRID	✓			✓	✓		
ST_Scale	✓		✓	✓		✓	✓
ST_Segmentize	✓	✓					

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_SetEffectiveAre	✓						
ST_SetPoint	✓		✓				
ST_SetSRID	✓			✓			
ST_SharedPaths	✓						
ST_ShiftLongitude	✓		✓			✓	✓
ST_ShortestLine	✓						
ST_Simplify	✓						
ST_SimplifyPreserv	✓ pology						
ST_SimplifyVW	✓						
ST_Snap	✓						
ST_SnapToGrid	✓		✓				
ST_Split	✓						
ST_StartPoint	✓		✓	✓	✓		
ST_StraightSkeleto							
ST_Subdivide	✓						
ST_Summary	✓	✓		✓		✓	✓
ST_SwapOrdinates	✓		✓	✓		✓	✓
ST_SymDifference	✓		✓		✓		
ST_Tesselate							
ST_Touches	✓				✓		
ST_TransScale	✓		✓	✓			
ST_Transform	✓			✓	✓	✓	
ST_Translate	✓		✓	✓			
ST_UnaryUnion	✓		✓				
ST_Union	✓				✓		
ST_Volume							
ST_VoronoiLines	✓						
ST_VoronoiPolygor	✓						
ST_WKBToSQL	✓				✓		
ST_WKTToSQL	✓				✓		
ST_Within	✓				✓		
ST_WrapX	✓		✓				
ST_X	✓		✓		✓		

Function	geom	geog	2.5D	Curves	SQL MM	PS	T
ST_XMax	☑		✓	✓			
ST_XMin	☑		✓	✓			
ST_Y	✓		✓		✓		
ST_YMax	☑		✓	✓			
ST_YMin	☑		✓	✓			
ST_Z	✓		✓		✓		
ST_ZMax	☑		✓	✓			
ST_ZMin	☑		✓	✓			
ST_Zmflag	✓		✓	✓			
~(box2df,box2df)	☑			✓		✓	
~(box2df,geometry)	✓			✓		✓	
~(geometry,box2df)	✓			✓		✓	
<#>	✓						
<<#>>	✓						
<<->>	✓						
|=|	✓						
<->	✓	✓					
&&	✓	✓		✓		✓	
&&&	✓		✓	✓		✓	✓
@(box2df,box2df)	☑			✓		✓	
@(box2df,geometry	✓			✓		✓	
@(geometry,box2df	✓			✓		✓	
&&(box2df,box2df)	☑			✓		✓	
&&(box2df,geomet	✓			✓		✓	
&&(geometry,box2	✓			✓		✓	
&&&(geometry,gid	✓		✓	✓		✓	✓
&&&(gidx,geometr	✓		✓	✓		✓	✓
&&&(gidx,gidx)			✓	✓		✓	✓
postgis.backend							
postgis.enable_outdb_rasters							
postgis.gdal_datapath							
postgis.gdal_enabled_drivers							
postgis_sfcgal_version							

14.12 New, Enhanced or changed PostGIS Functions

14.12.1 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 Upgrades installed postgis packaged extensions (e.g. postgis_sfcgal, postgis_topology, postgis_sfcgal) to latest installed version. Reports full postgis version and build configuration infos after.
- ST_Angle - Availability: 2.5.0 Returns the angle between 3 points, or between 2 vectors (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_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 one or more points interpolated along a line.
- 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. Return a Mapbox Vector Tile 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. (T) Returns a geometry covering all points within a given distance from the input 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 MultiPoint.
- ST_Intersects - Enhanced: 2.5.0 Supports GEOMETRYCOLLECTION. Returns TRUE if the Geometries/Geography "spatially intersect in 2D" - (share any portion of space) and FALSE if they don't (they are Disjoint). For geography -- tolerance is 0.00001 meters (so any points that close are considered to intersect)

- ST_OffsetCurve - Enhanced: 2.5 - added support for GEOMETRYCOLLECTION and MULTILINESTRING Return an offset line at a given distance and side from an input line. Useful for computing parallel lines about a center line
- ST_Subdivide - Enhanced: 2.5.0 reuses existing points on polygon split, vertex count is lowered from 8 to 5. Returns a set of geometry where no geometry in the set has more than the specified number of vertices.

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

14.12.2 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 Return a Mapbox Vector Tile representation of a set of rows.
- ST_AsMVTGeom - Availability: 2.4.0 Transform a geometry into the coordinate space of a Mapbox Vector Tile.
- ST_Centroid - Availability: 2.4.0 support for geography was introduced. Returns the geometric center of a geometry.
- ST_FrechetDistance - Availability: 2.4.0 - requires GEOS >= 3.7.0 Returns the Fréchet distance between two geometries. This is a measure of similarity between curves that takes into account the location and ordering of the points along the curves. Units are in the units of the spatial reference system of the 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).
- Pagc_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_strnum_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 Returns 1 (TRUE) if no point in Geometry B is outside Geometry A
- ST_CurveToLine - Enhanced: 2.4.0 added support for max-deviation and max-angle tolerance, and for symmetric output. Converts a CIRCULARSTRING/CURVEPOLYGON to a LINESTRING/POLYGON
- ST_Project - Enhanced: 2.4.0 Allow negative distance and non-normalized azimuth. Returns a POINT projected from a start point using a distance in meters and bearing (azimuth) in radians.

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 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. Node a set of linestrings.

14.12.3 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 4.6.2.

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_MinimumClearance - Availability: 2.3.0 - requires GEOS >= 3.6.0 Returns the minimum clearance of a geometry, a measure of a geometry's robustness.
- ST_MinimumClearanceLine - Availability: 2.3.0 - requires GEOS >= 3.6.0 Returns the two-point LineString spanning a geometry's minimum clearance.
- ST_VoronoiLines - Availability: 2.3.0 - requires GEOS >= 3.5.0. Returns the boundaries between the cells of the Voronoi diagram constructed from the vertices of a geometry.
- ST_VoronoiPolygons - Availability: 2.3.0 - requires GEOS >= 3.5.0. Returns the cells of the Voronoi diagram constructed from the vertices of a geometry.
- ~(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 bonding 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 bonding 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_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.

14.12.4 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 Chapter 12 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_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_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_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_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.
- |=| - 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_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.

14.12.5 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 used to be 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 used to be called ST_Length_Spheroid and used to have a ST_3DLength_Spheroid alias
- ST_MemSize - Changed: 2.2.0 name changed to ST_MemSize to follow naming convention. In prior versions this function was called ST_Mem_Size, old name deprecated though still available.
- ST_PointInsideCircle - Changed: 2.2.0 In prior versions this used to be 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.

14.12.6 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 11 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 9 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 13.1 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 Aggegrate 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_DumpPoints - Enhanced: 2.1.0 Faster speed. Reimplemented as native-C.
- ST_MakeValid - Enhanced: 2.1.0 added support for GEOMETRYCOLLECTION and MULTIPOINT.

14.12.7 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(geo 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.

14.12.8 PostGIS Functions new, behavior changed, or enhanced in 2.0

The functions given below are PostGIS functions that were added, enhanced, or have Section 14.12.9 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 11 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 9 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 13.1 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_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_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 prodived. 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 prodived. 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_OffsetCurve - Availability: 2.0 - requires GEOS >= 3.2, improved with GEOS >= 3.3 Return an offset line at a given distance and side from an input line. Useful for computing parallel lines about a center line
- 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_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_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_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.

- 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_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. Default is no prefix
- ST_Azimuth - Enhanced: 2.0.0 support for geography was introduced.
- ST_MakeValid - Enhanced: 2.0.1, speed improvements requires GEOS-3.3.4
- ST_Relate - Enhanced: 2.0.0 - added support for specifying boundary node rule (requires GEOS >= 3.0).

14.12.9 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_drive 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_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('POI 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.
- ST_AsGML - Changed: 2.0.0 use default named args
- ST_AsGeoJSON - Changed: 2.0.0 support default args and named args.
- ST_AsKML - Changed: 2.0.0 - uses default args and supports 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

14.12.10 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.

- ST_AsBinary - Availability: 1.5.0 geography support was introduced. Return the 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 the 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. - requires GEOS >= 3.2 to take advantage of advanced geometry functionality. (T) Returns a geometry covering all points within a given distance from the input geometry.
- ST_Covers - Availability: 1.5 - support for geography was introduced. Returns 1 (TRUE) if no point in Geometry B is outside Geometry A
- ST_DWithin - Availability: 1.5.0 support for geography was introduced Returns true if the geometries are within the specified distance of one another. For geometry units are in those of spatial reference and for geography units are in meters and measurement is defaulted to use_spheroid=true (measure around spheroid), for faster check, use_spheroid=false to measure along sphere.
- 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 For geometry type returns the 2D Cartesian distance between two geometries in projected units (based on spatial reference system). For geography type defaults to return minimum geodesic distance between two geographies in meters.
- 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. 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.
- 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 given a particular spheroid. PostGIS versions prior to 1.5 only support points.
- ~= - 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. (T) Returns a geometry that represents the shared portion of geomA and geomB.
- ST_Intersects - Availability: 1.5 support for geography was introduced. Returns TRUE if the Geometries/Geography "spatially intersect in 2D" - (share any portion of space) and FALSE if they don't (they are Disjoint). For geography -- tolerance is 0.00001 meters (so any points that close are considered to intersect)
- ST_Length - Availability: 1.5.0 geography support was introduced in 1.5. Returns the 2D length of the geometry if it is a LineString or MultiLineString. geometry are in units of spatial reference and geography are in meters (default spheroid)
- && - Availability: 1.5.0 support for geography was introduced. Returns TRUE if A's 2D bounding box intersects B's 2D bounding box.

14.12.11 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 a Geometry in SVG path data given a geometry or geography object. 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#PathDat
- ST_Collect - Return a specified ST_Geometry value from a collection of other geometries. Availability: 1.4.0 - ST_Collect(geomarray) was introduced. ST_Collect was enhanced to handle more geometries faster.
- ST_Union - Returns a geometry that represents the point set union of the Geometries. Availability: 1.4.0 - ST_Union was enhanced. ST_Union(geomarray) was introduced and also faster aggregate collection in PostgreSQL. If you are using GEOS 3.1.0+ ST_Union will use the faster Cascaded Union algorithm described in http://blog.cleverelephant.ca/2009/01/must-faster-unions-in-postgis-14.html

14.12.12 PostGIS Functions new in 1.3

The functions given below are PostGIS functions that were introduced in the 1.3 release.

Chapter 15

Informar de problemas

15.1 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.

15.2 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:

   svn checkout http://svn.osgeo.org/postgis/trunk/

   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 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.1.1 New Features

#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.1.2 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.2 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.2.1 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.2.2 Mejoras

#3946, Compile support for PgSQL 11 (Paul Ramsey)

#3992, Use PKG_PROG_PKG_CONFIG macro from pkg.m4 to detect pkg-config (Bas Couwenberg)

#4044, Upgrade support for PgSQL 11 (Regina Obe)

A.3 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.3.1 Mejoras

#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.4 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.4.1 Mejoras

#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.5 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.5.1 Mejoras

#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.6 Versión 2.2.0

Fecha de versión: 2014-09-10

A.6.1 New Features

#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, ainomieli)

#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.6.2 Mejoras

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 pagc_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.6.3 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.7 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.7.1 Mejoras

#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 pgsql2shp

#3701, Escape double quotes issue in pgsql2shp

#3704, ST_AsX3D crashes on empty geometry

#3730, Change ST_Clip from Error to Notice when ST_Clip can't compute a band

A.8 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.8.1 Mejoras

#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.9 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.9.1 Mejoras

#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.10 Versión 2.2.0

Fecha de versión: 2014-09-10

This is a new feature release, with new functions, improved performance, all relevant bug fixes from PostGIS 2.2.3,and other goodies.

A.10.1 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.10.2 New Features

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 PgSQL 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.10.3 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.10.4 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.11 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.11.1 New Features

#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 ptarray_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.12 Versión 2.2.0

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.12.1 New Features

#2232, avoid accumulated error in SVG rounding

#3321, Fix performance regression in topology loading

#3329, Fix robustness regression in TopoGeo_addPoint

#3349, Fix installation path of postgis_topology scripts

#3351, set endnodes isolation on ST_RemoveIsoEdge (and lwt_RemIsoEdge)

#3355, geography ST_Segmentize has geometry bbox

#3359, Fix toTopoGeom loss of low-id primitives from TopoGeometry definition

#3360, _raster_constraint_info_scale invalid input syntax

#3375, crash in repeated point removal for 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.13 Versión 2.2.0

Fecha de versión: 2014-09-10

This is a new feature release, with new functions, improved performance, and other goodies.

A.13.1 New Features

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 PgSQL 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.13.2 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.14 Versión 2.1.4

Fecha de versión: 2014-09-10

This is a critical bug fix release.

A.14.1 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

Corregir caída en ST_Union(raster)

A.15 Versión 2.1.4

Fecha de versión: 2014-09-10

This is a critical bug fix release.

A.15.1 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.16 Versión 2.1.4

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.16.1 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.16.2 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.17 Release 2.1.5

Release date: 2014-12-18

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.17.1 Mejoras

#2933, Speedup construction of large multi-geometry objects

A.17.2 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.18 Versión 2.1.4

Fecha de versión: 2014-09-10

Esta es una versión de corrección de errores y la mejora del rendimiento.

A.18.1 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.18.2 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.19 Release 2.1.3

Release date: 2014/05/13

This is a bug fix and security release.

A.19.1 Important changes

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.19.2 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.20 Release 2.1.2

Release date: 2014/03/31

This is a bug fix release, addressing issues that have been filed since the 2.1.1 release.

A.20.1 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.20.2 Mejoras

#2494, avoid memcopy in GiST index (hayamiz)

#2560, soft upgrade: avoid drop/recreate of aggregates that hadn't changed

A.21 Release 2.1.1

Release date: 2013/11/06

This is a bug fix release, addressing issues that have been filed since the 2.1.0 release.

A.21.1 Important Changes

#2514, Change raster license from GPL v3+ to v2+, allowing distribution of PostGIS Extension as GPLv2.

A.21.2 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.21.3 Mejoras

#2478, support for tiger 2013

#2463, support for exact length calculations on arc geometries

A.22 Release 2.1.0

Release date: 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.22.1 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('LINESTRI 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 existance 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_Raster2WorldC 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.22.2 New Features

- 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 throught postgis.backend var) Functions available both throught 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_Tesselate, ST_3DArea, ST_Extrude, ST_ForceLHR ST_Orientation, ST_Minkowski, ST_StraightSkeleton postgis_sfcgal_version New function available in PostGIS: ST_ForceSFS (Olivier Courtin and Hugo Mercier / Oslandia)

A.22.3 Mejoras

For detail of new functions and function improvements, please refer to Section 14.12.6.

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.22.4 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.22.5 Known Issues

#2111, Raster bands can only reference the first 256 bands of out-db rasters

A.23 Release 2.0.5

Release date: 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.23.1 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.23.2 Important Changes

##2514, Change raster license from GPL v3+ to v2+, allowing distribution of PostGIS Extension as GPLv2.

A.24 Release 2.0.4

Release date: 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.24.1 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.24.2 Mejoras

#2269, Avoid uselessly detoasting full geometries on ANALYZE

A.24.3 Known Issues

#2111, Raster bands can only reference the first 256 bands of out-db rasters

A.25 Release 2.0.3

Release date: 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.25.1 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.25.2 Mejoras

#2141, More verbose output when constraints fail to be added to a raster column

Speedup ST_ChangeEdgeGeom

A.26 Release 2.0.2

Release date: 2012/12/03

This is a bug fix release, addressing issues that have been filed since the 2.0.1 release.

A.26.1 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.26.2 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.27 Release 2.0.1

Release date: 2012/06/22

This is a bug fix release, addressing issues that have been filed since the 2.0.0 release.

A.27.1 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.27.2 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.28 Release 2.0.0

Release date: 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 2.10.2 for details on upgrading. Refer to Section 14.12.8 for more details and changed/new functions.

A.28.1 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.28.2 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 rom column definition

#1081, #1082, #1084, #1088 - Mangement 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.28.3 New Features

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.28.4 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.28.5 Corrección de errores

#1335 ST_AddPoint returns incorrect result on Linux (Even Rouault)

A.28.6 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.29 Release 1.5.4

Release date: 2012/05/07

This is a bug fix release, addressing issues that have been filed since the 1.5.3 release.

A.29.1 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.30 Release 1.5.3

Release date: 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.30.1 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 (Sando 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.31 Release 1.5.2

Release date: 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.31.1 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 Aven)

#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.32 Release 1.5.1

Release date: 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.32.1 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 PgSQL release (Paul Ramsey)

A.33 Release 1.5.0

Release date: 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.33.1 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.33.2 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.33.3 New Features

Section 14.12.10

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.33.4 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.33.5 Bug fixes

http://trac.osgeo.org/postgis/query?status=closed&milestone=PostGIS+1.5.0&order=priority

A.34 Release 1.4.0

Release date: 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.34.1 API Stability

As of the 1.4 release series, the public API of PostGIS will not change during minor releases.

A.34.2 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.34.3 New Features

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.34.4 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.34.5 Bug fixes

http://trac.osgeo.org/postgis/query?status=closed&milestone=PostGIS+1.4.0&order=priority

A.35 Release 1.3.6

Release date: 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.36 Release 1.3.5

Release date: 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.37 Release 1.3.4

Release date: 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.38 Release 1.3.3

Release date: 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.39 Release 1.3.2

Release date: 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.40 Release 1.3.1

Release date: 2007/08/13

This release fixes some oversights in the previous release around version numbering, documentation, and tagging.

A.41 Release 1.3.0

Release date: 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.41.1 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.41.2 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.41.3 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.42 Release 1.2.1

Release date: 2007/01/11

This release provides bug fixes in PostgreSQL 8.2 support and some small performance enhancements.

A.42.1 Changes

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.43 Release 1.2.0

Release date: 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.43.1 Changes

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.44 Release 1.1.6

Release date: 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.44.1 Upgrading

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.44.2 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.44.3 Other changes

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.45 Release 1.1.5

Release date: 2006/10/13

This is an bugfix release, including a critical segfault on win32. Upgrade is *encouraged*.

A.45.1 Upgrading

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.45.2 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.45.3 New Features

Added -S option for non-multi geometries to shp2pgsql

A.46 Release 1.1.4

Release date: 2006/09/27

This is an bugfix release including some improvements in the Java interface. Upgrade is *encouraged*.

A.46.1 Upgrading

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.46.2 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 pgsql2shp run concurrency.

A.46.3 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.47 Release 1.1.3

Release date: 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.47.1 Upgrading

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.47.2 Bug fixes / correctness

BUGFIX in distance(poly,poly) giving wrong results.

BUGFIX in pgsql2shp 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.47.3 New functionalities

NEW Long Transactions support.

NEW DumpRings() function.

NEW AsHEXEWKB(geom, XDR|NDR) function.

A.47.4 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.47.5 Other changes

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 pgsql2shp to more libs then required.

Initial support for PostgreSQL 8.2.

A.48 Release 1.1.2

Release date: 2006/03/30

This is an bugfix release including some new functions and portability enhancements. Upgrade is *encouraged*.

A.48.1 Upgrading

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.48.2 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.48.3 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 pgsql >= 8.0.0

A.48.4 Other changes

More portable ./configure script

Changed ./run_test script to have more sane default behaviour

A.49 Release 1.1.1

Release date: 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.49.1 Upgrading

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.49.2 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.49.3 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.50 Release 1.1.0

Release date: 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.50.1 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.50.2 Upgrading

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.50.3 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.50.4 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.50.5 Function semantic changes

SnapToGrid doesn't discard higher dimensions

Changed Z() function to return NULL if requested dimension is not available

A.50.6 Performance improvements

Much faster transform() function, caching proj4 objects

Removed automatic call to fix_geometry_columns() in AddGeometryColumns() and update_geometry_stats()

A.50.7 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.50.8 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.50.9 Other changes

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.51 Release 1.0.6

Release date: 2005/12/06

Contains a few bug fixes and improvements.

A.51.1 Upgrading

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.51.2 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.51.3 Improvements

Initial support for postgresql 8.2

Added missing SRID mismatch checks in GEOS ops

A.52 Release 1.0.5

Release date: 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.52.1 Upgrading

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.52.2 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.52.3 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.52.4 Other changes

Schema aware postgis_proc_upgrade.pl, support for pgsql 7.2+

New "Reporting Bugs" chapter in manual

A.53 Release 1.0.4

Release date: 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.53.1 Upgrading

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.53.2 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.53.3 Improvements

Documentation improvements

More robust selectivity estimator

Minor speedup in distance()

Minor cleanups

GiST indexing cleanup

Looser syntax acceptance in box3d parser

A.54 Release 1.0.3

Release date: 2005/08/08

Contains some bug fixes - *including a severe one affecting correctness of stored geometries* - and a few improvements.

A.54.1 Upgrading

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.54.2 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.54.3 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.55 Release 1.0.2

Release date: 2005/07/04

Contains a few bug fixes and improvements.

A.55.1 Upgrading

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.55.2 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.55.3 Improvements

New index creation capabilities in loader (-I switch)

Initial support for postgresql 8.1dev

A.56 Release 1.0.1

Release date: 2005/05/24

Contains a few bug fixes and some improvements.

A.56.1 Upgrading

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.56.2 Library changes

BUGFIX in 3d computation of length_spheroid()

BUGFIX in join selectivity estimator

A.56.3 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 pgsql2shp

NEW support for custom createdb options in postgis_restore.pl

BUGFIX in pgsql2shp attribute names unicity enforcement

BUGFIX in Paris projections definitions

postgis_restore.pl cleanups

A.57 Release 1.0.0

Release date: 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.57.1 Upgrading

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.57.2 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.57.3 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.58 Release 1.0.0RC6

Release date: 2005/03/30

Sixth release candidate for 1.0.0. Contains a few bug fixes and cleanups.

A.58.1 Upgrading

You need a dump/reload to upgrade from precedent releases. See the upgrading chapter for more informations.

A.58.2 Library changes

BUGFIX in multi()

early return [when noop] from multi()

A.58.3 Scripts changes

dropped {x,y}{min,max}(box2d) functions

A.58.4 Other changes

BUGFIX in postgis_restore.pl scrip

BUGFIX in dumper's 64bit support

A.59 Release 1.0.0RC5

Release date: 2005/03/25

Fifth release candidate for 1.0.0. Contains a few bug fixes and a improvements.

A.59.1 Upgrading

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.59.2 Library changes

BUGFIX (segfaulting) in box3d computation (yes, another!).

BUGFIX (segfaulting) in estimated_extent().

A.59.3 Other changes

Small build scripts and utilities refinements.

Additional performance tips documented.

A.60 Release 1.0.0RC4

Release date: 2005/03/18

Fourth release candidate for 1.0.0. Contains bug fixes and a few improvements.

A.60.1 Upgrading

You need a dump/reload to upgrade from precedent releases. See the upgrading chapter for more informations.

A.60.2 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.60.3 Scripts changes

NEW distance_sphere() function.

Changed get_proj4_from_srid implementation to use PL/PGSQL instead of SQL.

A.60.4 Other changes

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.61 Release 1.0.0RC3

Release date: 2005/02/24

Third release candidate for 1.0.0. Contains many bug fixes and improvements.

A.61.1 Upgrading

You need a dump/reload to upgrade from precedent releases. See the upgrading chapter for more informations.

A.61.2 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 palloced one.

A.61.3 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.61.4 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.61.5 Other changes

new performance tips chapter in manual

documentation updates: pgsql72 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.62 Release 1.0.0RC2

Release date: 2005/01/26

Second release candidate for 1.0.0 containing bug fixes and a few improvements.

A.62.1 Upgrading

You need a dump/reload to upgrade from precedent releases. See the upgrading chapter for more informations.

A.62.2 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.62.3 Scripts changes

More correct STABLE, IMMUTABLE, STRICT uses in lwpostgis.sql

stricter OGC WKB/WKT constructors

A.62.4 Other changes

Faster and more robust loader (both i18n and not)

Initial autoconf script

A.63 Release 1.0.0RC1

Release date: 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.63.1 Upgrading

You need a dump/reload to upgrade from precedent releases. See the upgrading chapter for more informations.

A.63.2 Changes

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.