



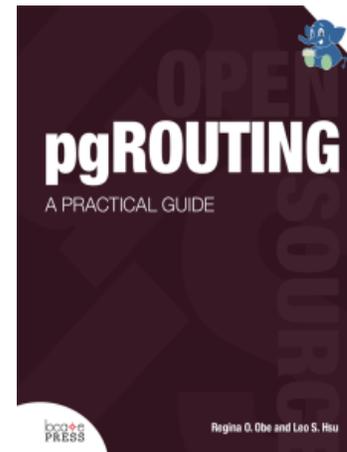
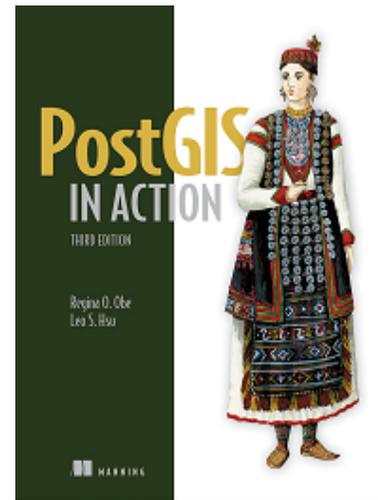
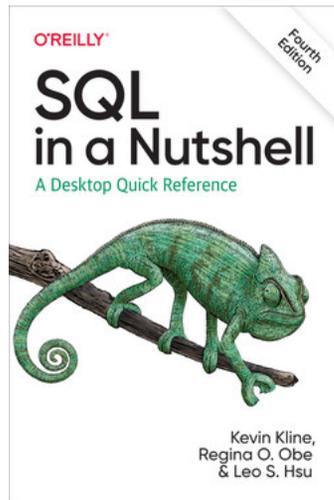
A TOUR OF THE POSTGIS EXTENDED FAMILY OF EXTENSIONS



REGINA OBE

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The Book of PostgreSQL ([No Starch Press](#))

In Progress

pgRouting (a practical guide) 2nd Ed ([Locate Press](#)) in Progress.

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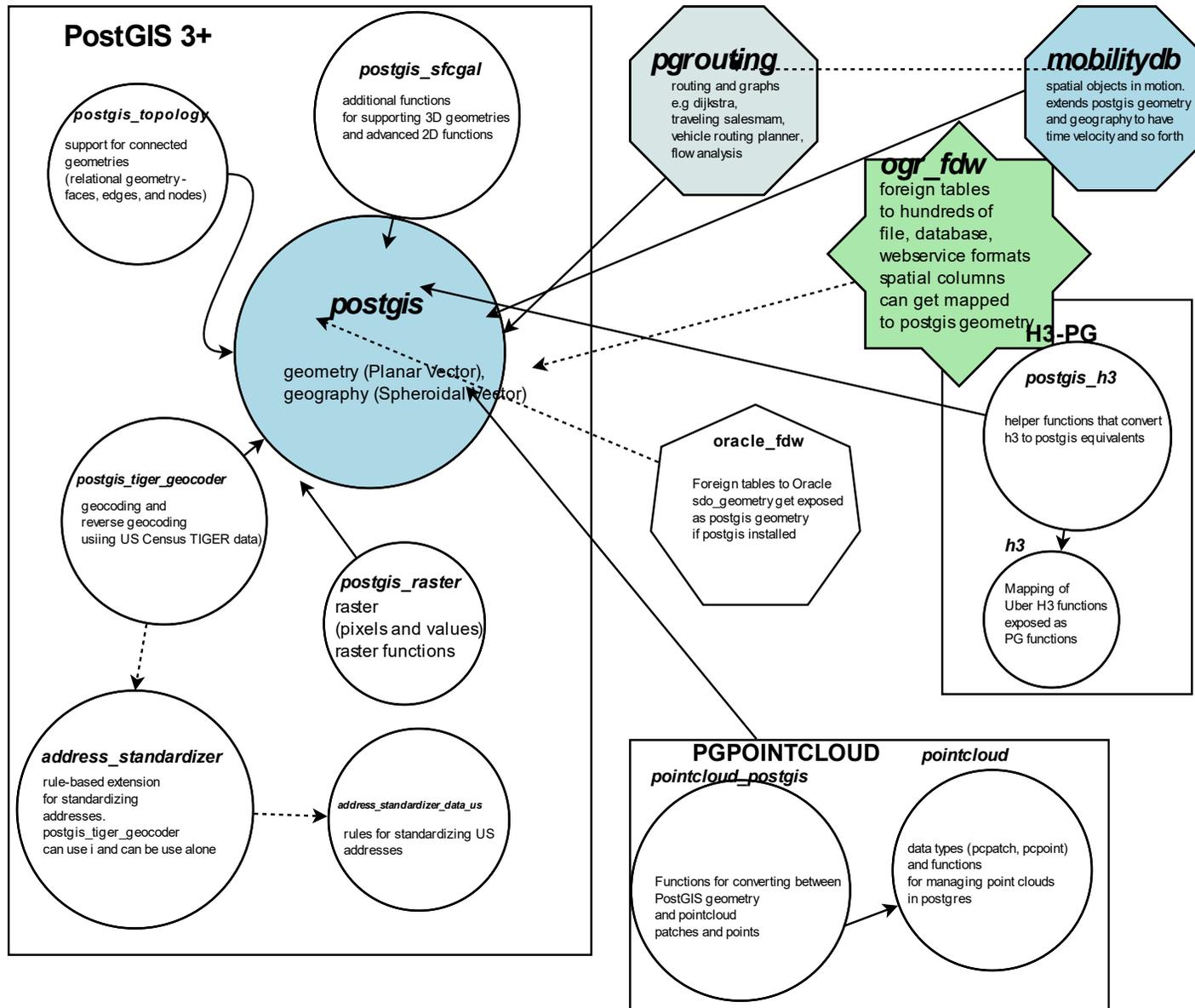


POSTGIS SOLVES SPATIAL PROBLEMS

PostGIS helps you analyze, manage, mold, and visualize space.

POSTGIS RELATED EXTENSIONS

CREATE EXTENSION ...;



POSTGIS MODELS SPACE IN MANY WAYS

Flat, Round, Matrix, Declarative

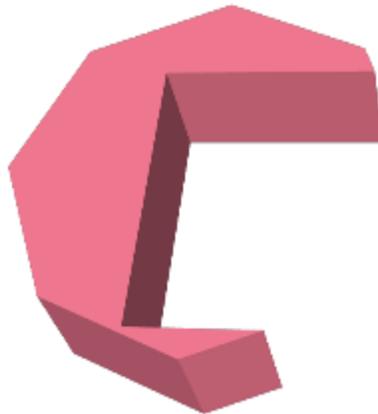
POSTGIS **GEOMETRY** TYPE (FLAT)

extension: postgis

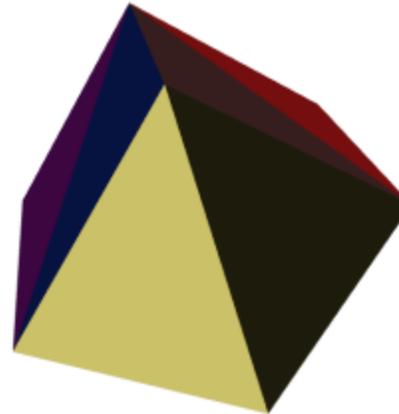
The flat space model. Space is a cartesian grid. Supports drawing of linestrings, polygons, 3D polygons, points, 3d points, collections of polygons, points, linestrings, Polyhedral Surfaces, and TINS



Basic geometric types



Polyhedral Surface



Triangulated Irregular Network (TIN)

POSTGIS **GEOGRAPHY** TYPE (ROUND)

extension: postgis

Model of space as spheroid. Takes into consideration the earth or any given planet whose spatial reference is defined in *spatial_ref_sys* table.

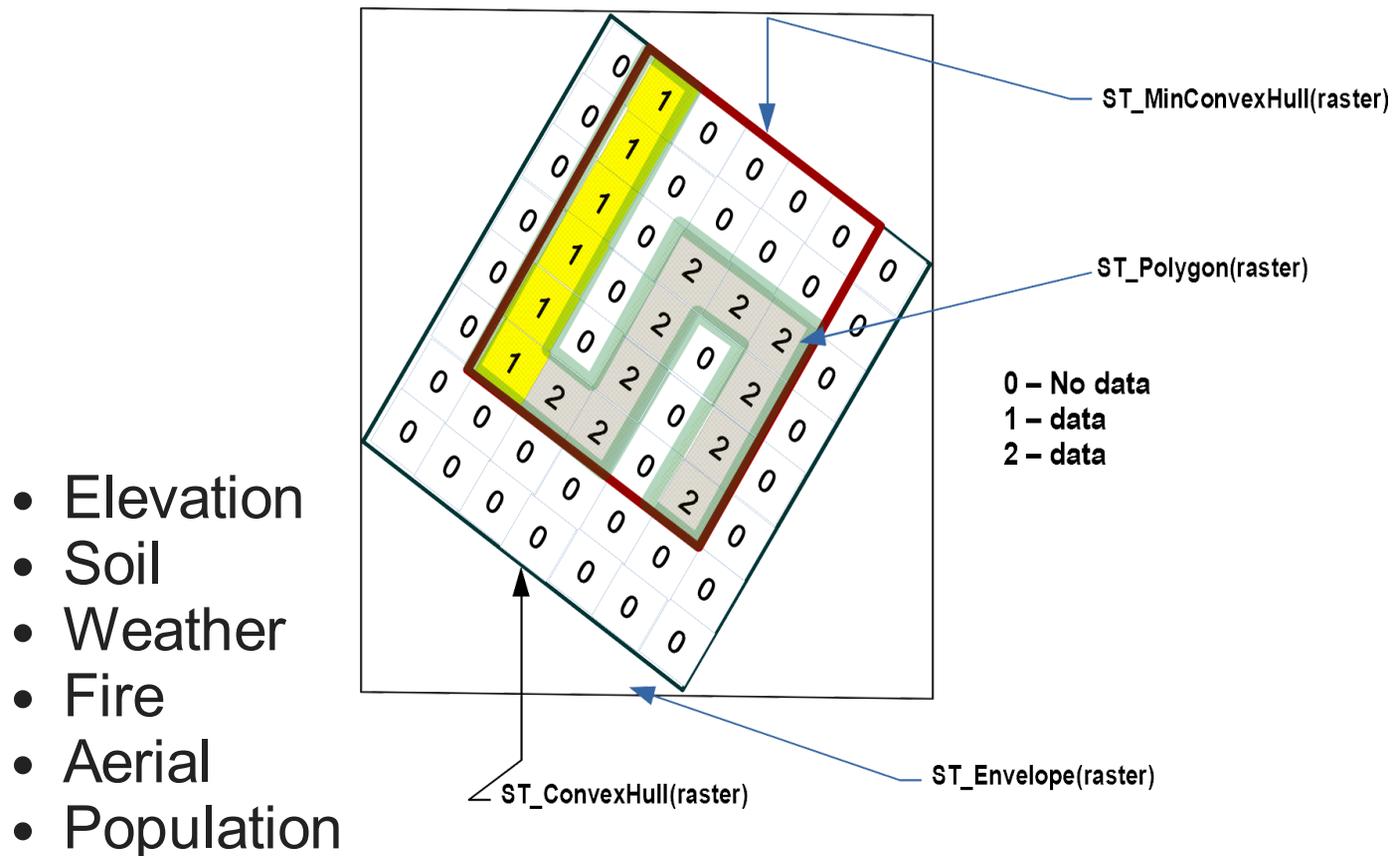
GEODETTIC (GEOGRAPHY) 4326 (WGS 84 LON LAT) IN GEOGRAPHY



POSTGIS RASTER TYPE (MATRIX)

extension: postgis_raster

Model of space as a flat numeric matrix (with cells (called pixels) that have values (on) or don't have values (off))



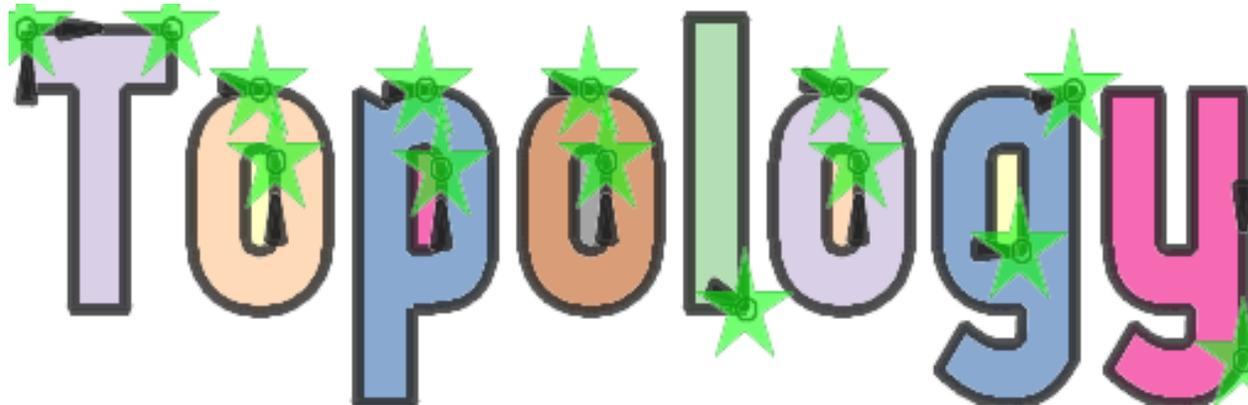
POSTGIS **TOPOGEOMETRY** TYPE (DECLARATIVE)

extension: postgis_topology

Defined in SQL/MM Topology-Geometry specs. [Spatialite](#) has it too. Topology partitions space into **edges**, **nodes**, and **faces**. Then it says this thing called **topogeometry** is space composed of these **edges**, **nodes**, **faces** and other topogeometries (which are again just a bunch of edges, nodes, and faces). If two topogeometries have the same set of (edges, nodes, faces) then they are the same.

```
(1,1,2,3) -> topology_id, layer_id, id, type
```

```
SELECT topo::geometry AS geom, (topo).*  
FROM some_topo_table;
```



POSTGIS PACKAGED COMMAND-LINE TOOLS

These are part of PostGIS, but often shipped by packagers in a separate package from PostGIS extensions.

- **shp2pgsql** - Loads data from ESRI Shapefile format
- **pgsql2shp** - Exports data from PostGIS format to ESRI shapefile format (for other formats use **ogr2ogr** (part of GDAL suite of tools) or **ogr_fdw**)
- **raster2pgsql** - Loads data into postgis raster from hundreds of different raster formats (thru the power of GDAL)
- **pgtopo_export** - New in PostGIS 3.3 export topologies
- **pgtopo_import** - Import topologies (New in PostGIS 3.3.0)

NEED TO GEOCODE US DATA?

extension: postgis_tiger_geocoder

Geocoding and Reverse Geocoding using US Census Tiger data.

Companion **extension:** address_standardizer

Loading the data

```
SELECT ST_AsText(g.geomout), pprint_addy(g.addy)
FROM geocode('1600 Pennsylvania Avenue NW, Washington, DC 20500', 1) AS g;
```

st_astext	pprint_addy
POINT(-77.03511478601034 38.89867093615472)	1600 Pennsylvania Ave NW, Washington, DC 20500

```
SELECT pprint_addy(rg.addy[1])
FROM reverse_geocode(ST_Point(-77.03511, 38.89867)) AS rg;
```

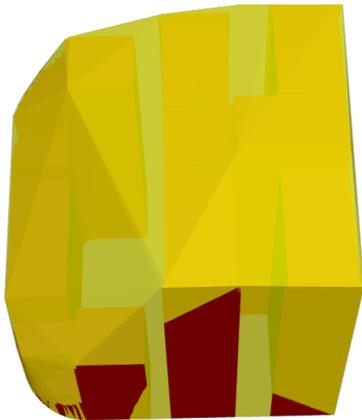
pprint_addy
692 E Executive Ave NW, Washington, DC 20006

POSTGIS + CGAL

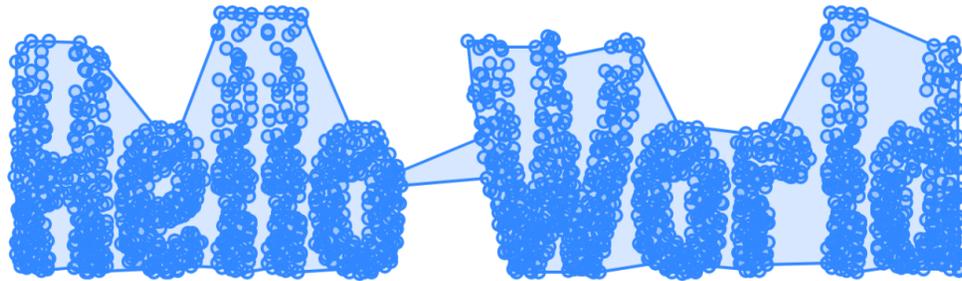
extension: postgis_sfcgal

Power of CGAL in PostGIS via the **SFCGAL** library. Used for advanced 3-D and 2-D processing.

- Many functions specifically targeted for Polyhedral surfaces and TINs
- **New in PostGIS 3.3.0**



ST_3DConvexHull



ST_OptimalAlphaShape ST_AlphaShape

INSTALLING

```
CREATE SCHEMA postgis;
ALTER DATABASE gisdb set search_path=public,postgis;
set search_path=public,postgis;
-- included with postgis
CREATE EXTENSION postgis SCHEMA postgis; --only vector in 3.0
CREATE EXTENSION postgis_raster SCHEMA postgis; -- raster separate in 3.0
CREATE EXTENSION postgis_topology;
CREATE EXTENSION fuzzystrmatch; -- needed by geocoder
CREATE EXTENSION postgis_tiger_geocoder;
CREATE EXTENSION postgis_sfcgal SCHEMA postgis;
CREATE EXTENSION address_standardizer;
CREATE EXTENSION address_standardizer_data_us; -- lex and rules
```

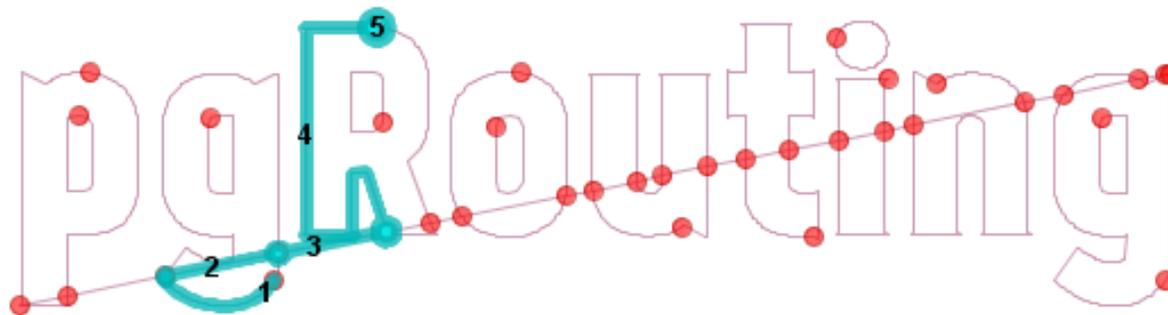
PGROUTING

extension: pgrouting



Uses graph algorithms: **edges** have **costs**, **nodes** connect edges.

- Find shortest path consider costs (road network, one way, toll price etc).
- Maximum service area
- Decision trees - compute most favorable path given where you are in the tree.



MOBILITYDB

extension: mobilitydb



Analysis and managing spatial movement in a compact way.

Follows the [OGC Moving Features spec](#). Extends postgis geometry and geography types with time elements. Raw data often comes in General Transit Feed Specification (GTFS) format and GPX (that stuff from your GPS device). Extends postgis geometry and geography types to form temporal spatial types: tgeompoint, tgeogpoint, and many others.

- Store massive amounts of movement data in a compact way.
- Do short and fast computations on travel.
- [What's the average speed a cat travels when on the hunt for prey.](#)
- Integration with QGIS for viewing movement data.

PGPOINTCLOUD

extension: pointcloud, postgis_pointcloud **data types** pcpatch, pcpoint

Load data in using another open source tool [PDAL: Point Data Abstraction Library](#)

What are point clouds? a bag of fat points collected by satellites, drones, planes, 3d scanners, and used to develop other forms of data: spatial data formats (particularly 3D models).



FOREIGN DATA WRAPPERS

Foreign data wrappers allow you to query data not in your database as if it is a table in your database.

- [oracle_fdw](#): Oracle sdo_geometry -> postgis::geometry
- [ogr_fdw](#): spatial anything -> postgis::geometry

OGR_FDW (MEGA FOREIGN DATA WRAPPER)

extension: ogr_fdw

Links external (sometimes spatial) data in PostGIS/PostgreSQL format. **It is an abstraction:** this data over there is a table in my database.



- If you have spatial data it can link it.
- If you have non-spatial data, it can link it.
- If you have no clue what this random file someone gave you is, it can probably link it.

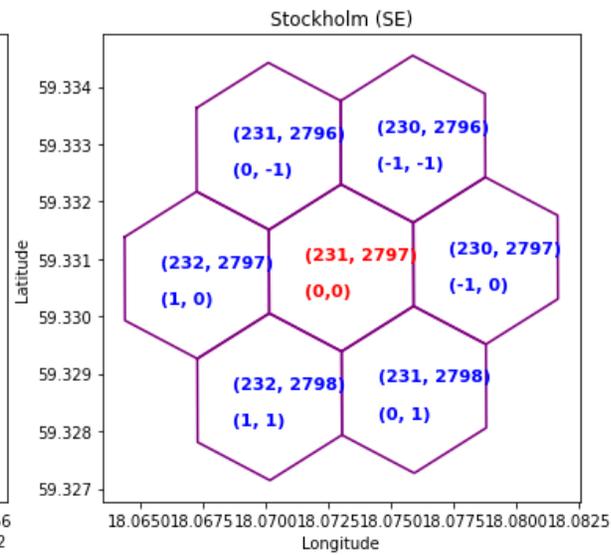
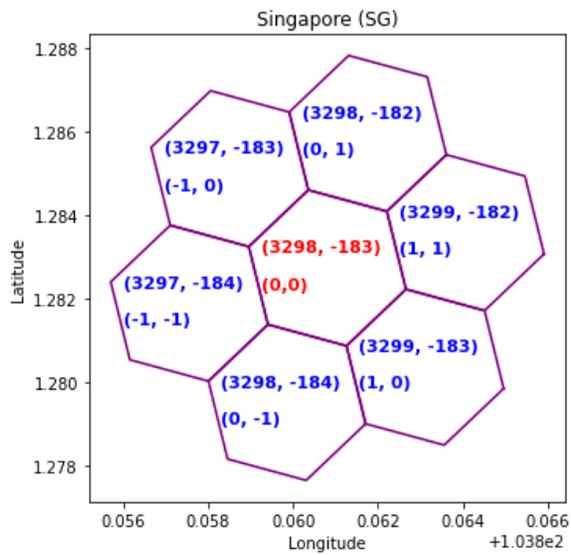
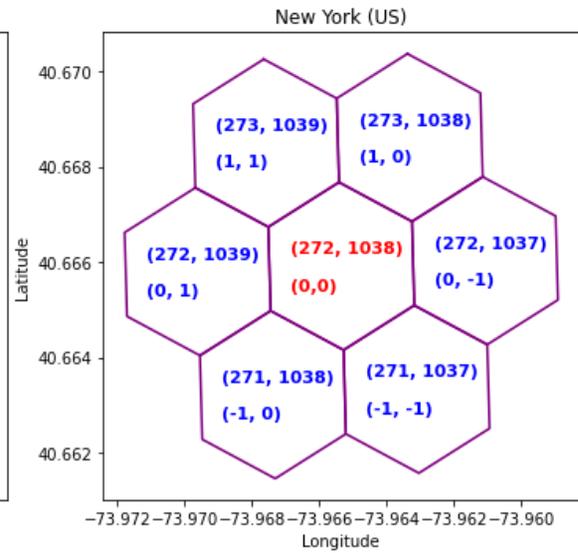
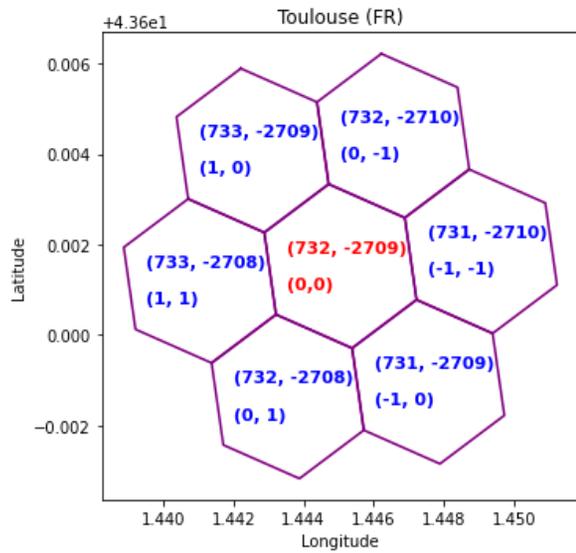
H3 HIERARCHICAL GEOSPATIAL INDEXING SYSTEM

extensions: `h3-pg`

`h3`, `h3_postgis`

Exposes [Uber's Hexagonal tiling scheme](#) as a PostgreSQL SQL API.

Also adds a new type called `h3index`.



LIVE DEMO

https://postgis.us/presentations/postgisday_2022.sql

- postgis
- postgis_tiger_geocoder
- h3, h3_postgis
- postgis_sfcgal
- postgis_topology
- postgis_raster
- ogr_fdw
- mobilitydb
- pgrouting
- pointcloud, pointcloud_postgis

POSTGIS 3.3.1 LATEST STABLE

Works with PostgreSQL 11-15. Available in a package near you.

Can't enable in database with `CREATE EXTENSION` unless have binaries

- **Available from packagers:** (apt.postgresql.org, yum.postgresql.org, Windows Stackbuilder, bsd ports, homebrew) postgis packaged extensions, pointcloud/pointcloud_postgis, pgrouting, ogr_fdw, oracle_fdw

Many available via pgxn

- **Support via Database As a Service (DBaaS):** postgis extensions (except sometimes not postgis_sfcgal), pgrouting (a lot of the time, but popular ask when not), oracle_fdw (sometimes), ogr_fdw (rarely)
- **Need to compile yourself or use provided container setups:** - mobilitydb, h3, h3_postgis (available via pgxn also)

FIN

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