

Postgres User Group

Brief Introduction to PostGIS

Presented by

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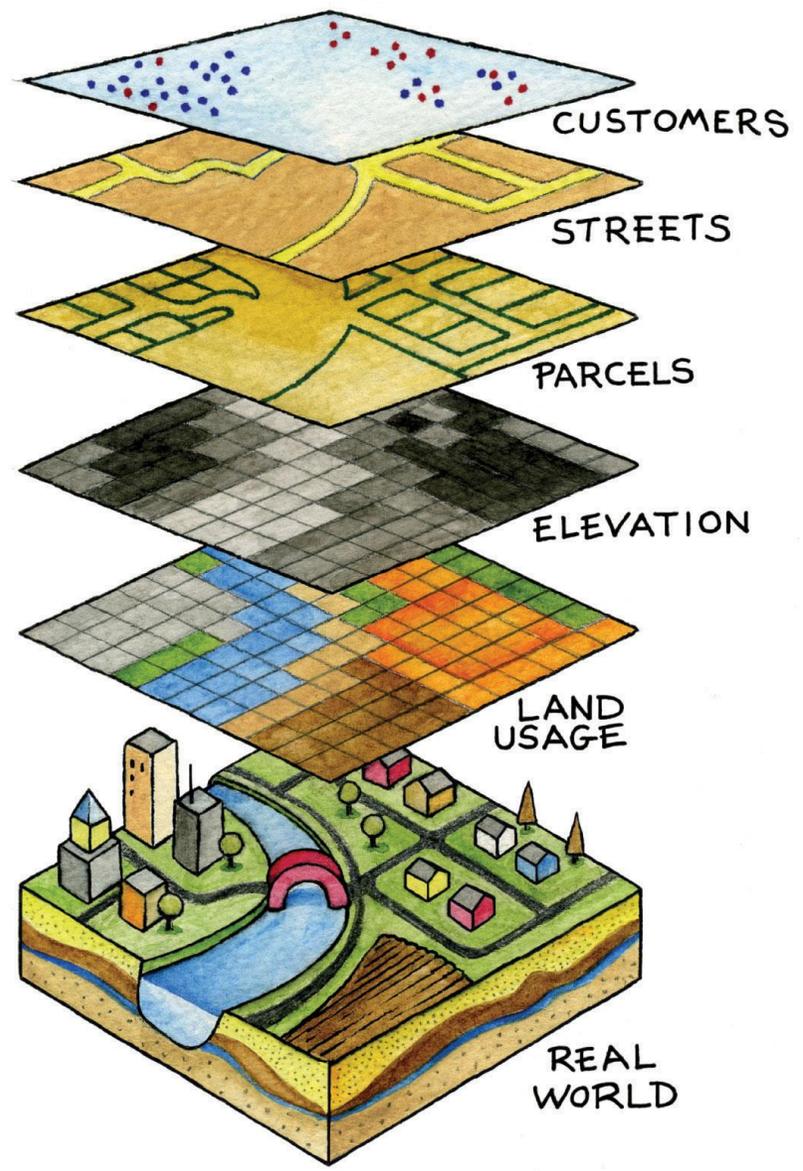
EOH

6 February 2018



PostgreSQL





What is PostGIS?

- Postgres Extension
- Adds ability to perform CRUD operations on **GIS** data
- Adds **spatial** functions
- Optimization capability



What is GIS?

- Geographic Information System
- Used to store, edit and analyze geographical data

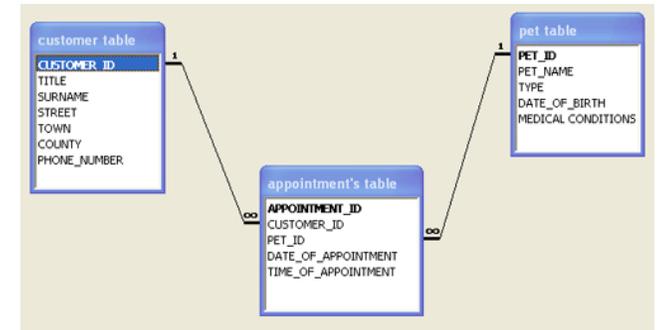
Evolution of GIS

- Flat – purely geographical data

```
Flat File - Notepad
File Edit Format Help
This is a sample Data File.
CustomerID      CompanyName      ContactName      ContactTitle
-----
ALFKI    Alfreds Futterkiste    Maria Anders    Sales Representative
ANATR    Ana Trujillo Emparedados y helados    Ana Trujillo    Owner
ANTON    Antonio Moreno Taqueria    Antonio Moreno    Owner
AROUT    Around the Horn Thomas Hardy    sales Representative
BERGS    Berglunds snabbkop    Christina Berglund    Order Administrator
BLAIS    Blauer See Delikatessen    Hanna Moos    Sales Representative
BLONP    Blondesds1 père et fils    Frédérique Citeaux    Marketing Manager
BOLID    Bólido comidas preparadas    Martin Sommer    Owner
BONAP    Bon app    Laurence Leblhan    Owner
BOTTM    Bottom-Dollar Markets    Elizabeth Lincoln    Accounting Manager
BSBEV    B's Beverages    Victoria Ashworth    Sales Representative
CACTU    cactus comidas para llevar    patricio simpson    Sales Agent
CENTC    Centro comercial Moctezuma    Francisco Chang    Marketing Manager
CHOPS    Chop-suey Chinese    Yang Wang    Owner
CONMI    Comercio Mifreio    Pedro Afonso    sales Associate
CONSH    consolidated Holdings    Elizabeth Brown    Sales Representative
DRACD    Drachenblut Delikatessen    Sven Ottlieb    Order Administrator
DUNON    Du monde entier    Janine Labrune    Owner
EASTC    Eastern Connection    Ann Devon    sales Agent
ERNSH    Ernst Handel    Roland Mendel    Sales Manager
FAMIA    Familia Arquibaldo    Arla Cruz    Marketing Assistant
FISSA    FISSA Fabrica Inter. salchichas S.A.    Diego Roel    Accounting Manager
```

- Semi-relational – geo data with attributes (shp, dbf, prj)

- Fully Relational – baked into relational [spatial] DB



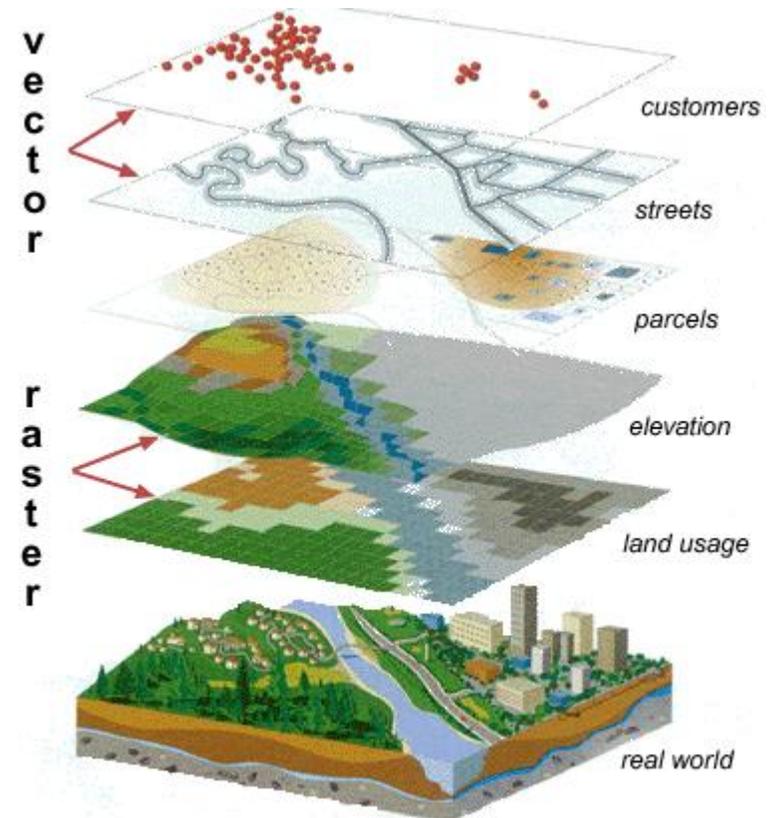
What is a Spatial Database?

- Database that stores mappable (spatial) data
- Data that can be related to the geography of the real world
- Includes coordinates, topology



What is a Spatial Database? Cont.

- Stores spatial or GIS data
 - Columns that store vector
 - geometry, geography
- Rasters
- Perform simple and complex queries



Geometry vs Geography

- **Geometry**

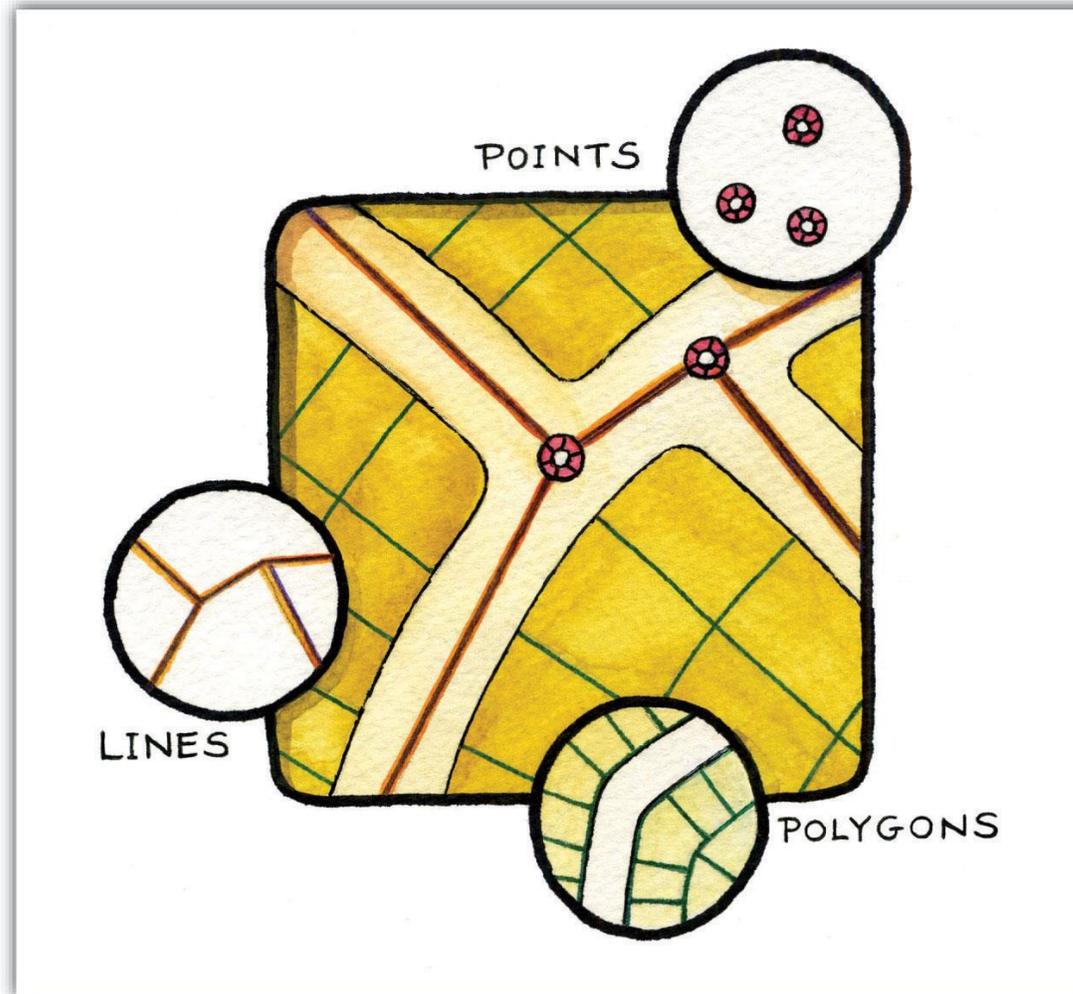
- Representation of round-earth on flat cartesian plane

- **Geography**

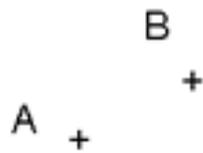
- Representation of round earth (spherical surface)



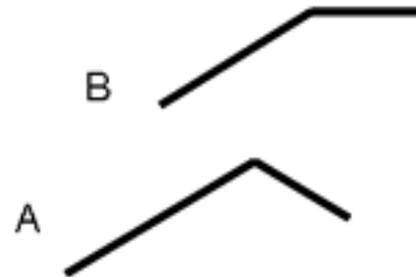
Spatial Data Types - Geometrical



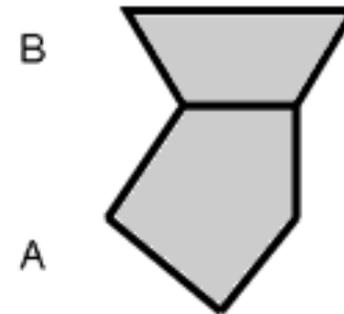
Spatial Data Types – Geometrical Representation



(x, y) coordinates
 A (2, 4)
 B (3, 5)



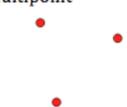
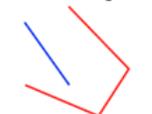
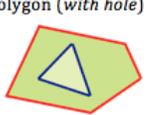
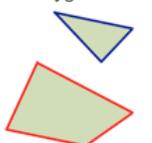
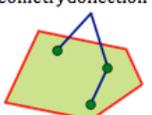
(x, y) coordinates
 A (1,3) (3,5) (6,4)
 B (2,6) (4,7) (7,7)



(x, y) coordinates
 A (1,3) (3,1) (4,3) (4,5) (2,5) (1,3)
 B (2,5) (4,5) (5,6) (1,6) (2,5)

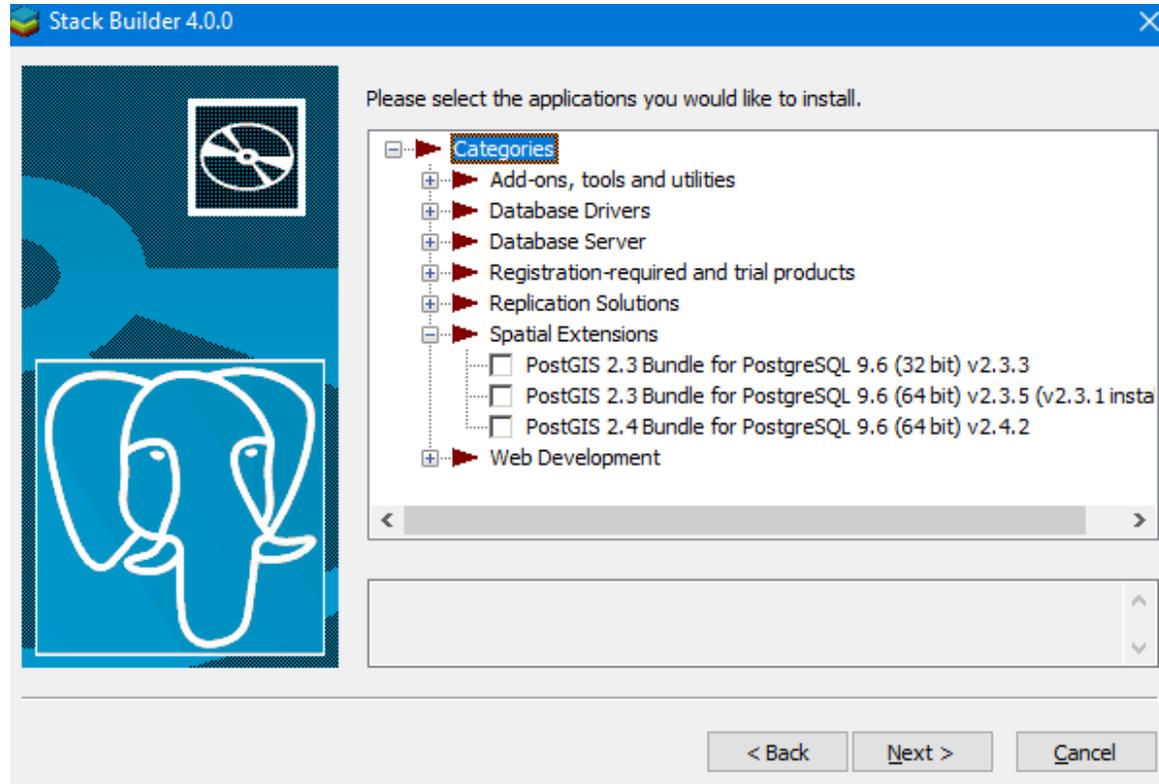


Spatial Data Types – Geometrical Representation

Geometry Type	WKT representation
Point 	<code>POINT(3 7)</code>
Multipoint 	<code>MULTIPOINT(3 7, 4 2, 8 6)</code>
LineString 	<code>LINESTRING(1 2, 3 6, 9 4)</code>
MultiLineString 	<code>MULTILINESTRING((1 8, 4 4), (4 9, 8 5, 6 2, 1 4))</code>
Polygon 	<code>POLYGON((1 2, 6 1, 9 3, 8 5, 3 6, 1 2))</code>
Polygon (with hole) 	<code>POLYGON((1 2, 6 1, 9 3, 8 5, 3 6, 1 2), (3 3, 5 5, 6 2, 3 3))</code>
MultiPolygon 	<code>MULTIPOLYGON(((1 2, 6 1, 9 3, 3 6, 1 2)), ((4 9, 7 6, 9 8, 4 9)))</code>
GeometryCollection 	<code>GEOMETRYCOLLECTION(POINT(4 5), POINT(7 4), POINT(6 2), LINESTRING(4 5, 6 7, 7 4, 6 2), POLYGON((1 2, 6 1, 9 3, 8 5, 3 6, 1 2)))</code>



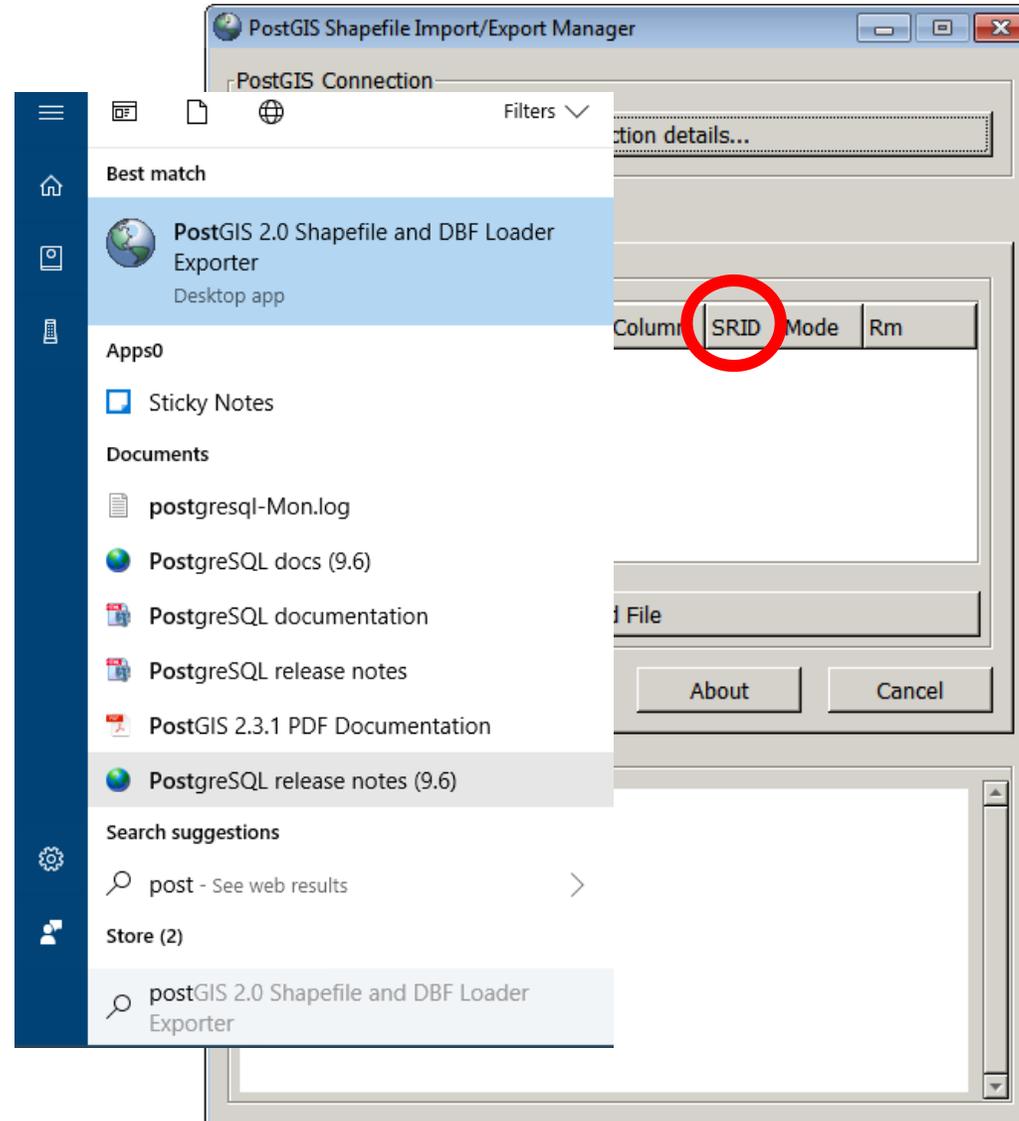
Installing PostGIS



Setting up PostGIS

- `CREATE EXTENSION postgis;`
- `SELECT postgis_full_version();`

Loading the Data



What is the SRID?

- Spatial Reference Identifier
- **select * from spatial_ref_sys**

Output pane

Data Output	Explain	Messages	History	
srid integer	auth_name character varying(256)	auth_srid integer	srtext character varying(2048)	proj4text character varying(2048)
2139	4322 EPSG	4322	GEOGCS["WGS 72", DATUM["WGS 1972", SPHEROID["WGS 72", 6378135, 298.26, AUTHORITY["EPSG", "7043"]], TOWGS84[0, 0, 4.5, 0, 0, 0.554, 0.2263], AUTHO	+proj=longlat +ellps=WGS72 +towgs84=0,0,4.5,0,0,0.554,0.2263 +no defs
2140	4324 EPSG	4324	GEOGCS["WGS 72BE", DATUM["WGS 1972 Transit Broadcast Ephemeris", SPHEROID["WGS 72", 6378135, 298.26, AUTHORITY["EPSG", "7043"]], TOWGS84[0	+proj=longlat +ellps=WGS72 +towgs84=0,0,1.9,0,0,0.814,-0.38 +no defs
2141	4326 EPSG	4326	GEOGCS["WGS 84", DATUM["WGS 1984", SPHEROID["WGS 84", 6378137, 298.257223563, AUTHORITY["EPSG", "7030"]], AUTHORITY["EPSG", "6326"]], PRIMEM	+proj=longlat +datum=WGS84 +no defs
2142	4328 EPSG	4328	GEOCCS["WGS 84 (geocentric)", DATUM["WGS 1984", SPHEROID["WGS 84", 6378137, 298.257223563, AUTHORITY["EPSG", "7030"]], AUTHORITY["EPSG", "6	+proj=geocent +datum=WGS84 +units=m +no defs
2143	4330 EPSG	4330	GEOCCS["ITRF88 (geocentric)", DATUM["International Terrestrial Reference Frame 1988", SPHEROID["GRS 1980", 6378137, 298.257222101, AUTHO	+proj=geocent +ellps=GRS80 +units=m +no defs
2144	4331 EPSG	4331	GEOCCS["ITRF89 (geocentric)", DATUM["International Terrestrial Reference Frame 1989", SPHEROID["GRS 1980", 6378137, 298.257222101, AUTHO	+proj=geocent +ellps=GRS80 +units=m +no defs



Indexing the data

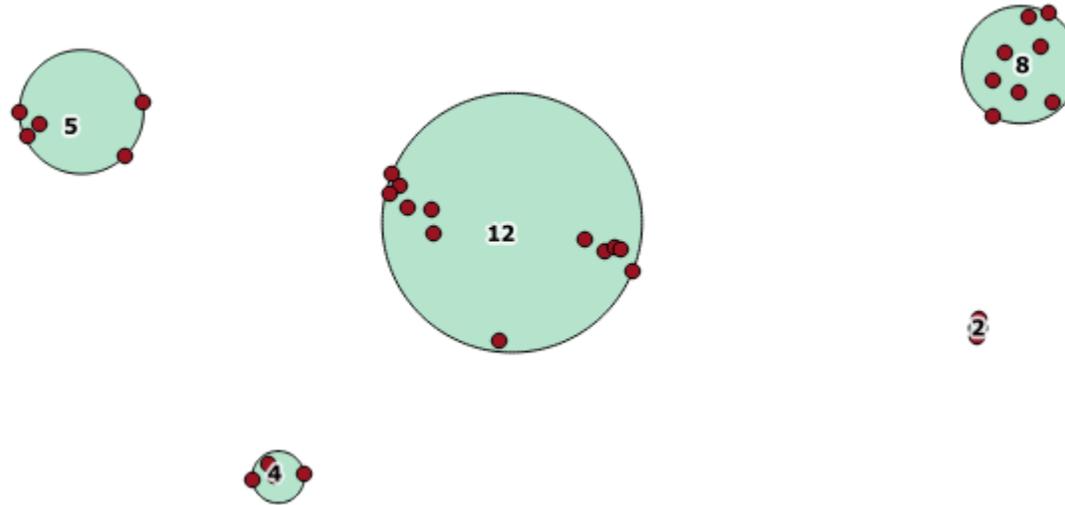
- For spatial indexes - use a GiST index.
- Stores bounding box of the geometry as the index

```
CREATE INDEX idx_road_geom ON road USING gist(the_geom);
```



Clustering

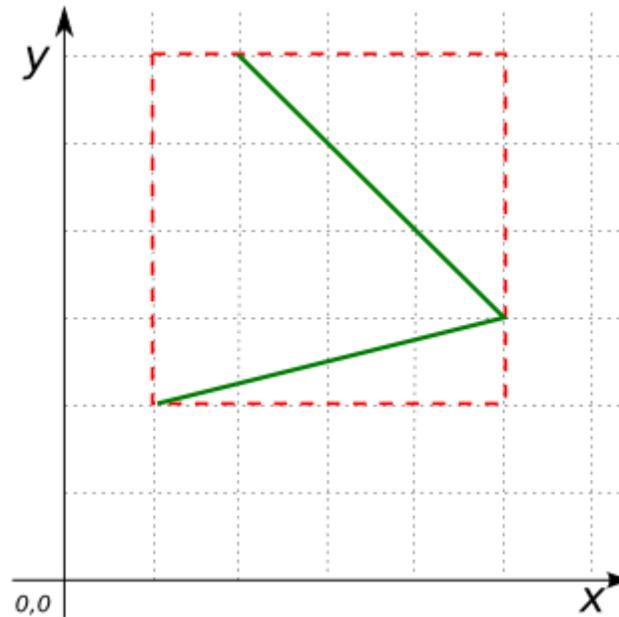
- Physically reorders all the data rows



CLUSTER road USING geometry_index_name

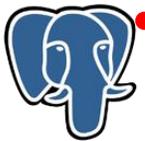
Querying the Data

```
SELECT ST_Extent(the_geom) FROM road WHERE road_nr = 'N3';
```



Querying the Data

- **ST_Area**(ST_Union(the_geom)) FROM province WHERE road_nr = 'N3';
- **ST_GeomFromText**('POINT(-72.1235 42.3521)',4326)
- **ST_Distance**(ST_GeomFromText('POINT(-72.1235 42.3521)',4326),ST_GeomFromText('LINESTRING(-72.1260 42.45, -72.123 42.1546)', 4326));st_distance **ORDER DESCENDING**



- **ST_Within**

Applications

- TIGER Topologically Integrated Geographic Encoding & Referencing



Thank you

Questions?



PostgreSQL

