Brief Introduction to PostGIS

Presented by

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6 February 2018
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

• 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)  A (1,3) (3,5) (6,4)  A (1,3) (3,1) (4,3) (4,5) (2,5) (1,3)
B (3, 5)  B (2,6) (4,7) (7,7)  B (2,5) (4,5) (5,6) (1,6) (2,5)
### Spatial Data Types – Geometrical Representation

<table>
<thead>
<tr>
<th>Geometry Type</th>
<th>WKT representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point</td>
<td>POINT(7)</td>
</tr>
<tr>
<td>Multipoint</td>
<td>MULTIPONT(7, 4, 3, 8, 6)</td>
</tr>
<tr>
<td>LineString</td>
<td>LINESTRING(2, 3, 5, 5, 4)</td>
</tr>
<tr>
<td>MultiLineString</td>
<td>MULTILINESTRING((4, 9, 4, 3, 4, 5, 8, 5, 4, 2, 1), 4)</td>
</tr>
<tr>
<td>Polygon</td>
<td>POLYGON((1, 2, 3, 5, 6, 7, 8, 3, 6, 7, 2))</td>
</tr>
<tr>
<td>Polygon [with hole]</td>
<td>POLYGON((1, 2, 3, 6, 1, 9, 3, 8, 5, 3, 6, 1, 2), (3, 3, 6, 6, 3, 3))</td>
</tr>
<tr>
<td>MultiPolygon</td>
<td>MULTIPOLYGON(((1, 2, 6, 1, 9, 3, 6, 3, 2), (4, 6, 7, 6, 9, 8, 4)))</td>
</tr>
<tr>
<td>GeometryCollection</td>
<td>GEOMETRYCOLLECTION(POINT(4, 5), POINT(7, 4), POINT(5, 2), LINESTRING(4, 5, 6, 7, 4, 6, 2), POLYGON((1, 2, 6, 1, 9, 3, 8, 5, 3, 6, 7, 2)))</td>
</tr>
</tbody>
</table>
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`
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

- \( \text{ST\_Area}(\text{ST\_Union(\text{the\_geom}))} \) FROM province WHERE road\_nr = 'N3';

- \( \text{ST\_GeomFromText}('\text{POINT(-72.1235 42.3521'),'4326}') \)

- \( \text{ST\_Distance}(\text{ST\_GeomFromText('\text{POINT(-72.1235 42.3521'),'4326}')},\text{ST\_GeomFromText('\text{LINESTRING(-72.1260 42.45, -72.123 42.1546)，4326}')}) \); st\_distance ORDER DESCENDING

- \( \text{ST\_Within} \)
Applications

• TIGER Topologically Integrated Geographic Encoding & Referencing
Thank you

Questions?