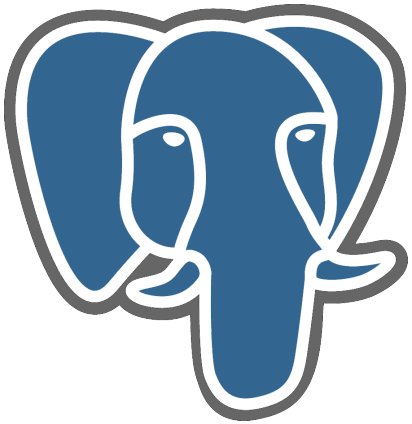
Sirius

Integrating Map Data with PostGIS



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- What is PostGIS?
  - A collection of SQL types, operators and functions to “spatially enable” PostgreSQL
  - Also includes a spatial R-Tree indexing scheme
    - Implemented using GiST
  - This allows us to extend PostgreSQL to ask questions like:
    - How many features lie within 100m?
    - What is the total length of a given road?
    - What is the total area of water in my city?

How can we use PostGIS?

- PostGIS can primarily be used in two different ways
  - GIS object data store
    - ESRI Shapefiles
    - OS MasterMap
  - Spatial object processing
    - Calculate binary predicates such as Crosses(), Touches(), and Intersects()
    - Calculate the geometric results of Intersection() and Union()

PostGIS dependencies

- PostGIS makes use of two popular existing libraries
  - PROJ.4
    - Provides co-ordinate system and on-the-fly reprojection support
  - GEOS
    - Provides spatial predicates and geometric processing functions
- But all functions can be accessed using SQL

- Installation
  - Very easy with RHEL 5
    - http://yum.pgsqlrpms.org/
  - This installs the libraries required
    - All that remains is to load the new functions into the database
  - PostGIS provides 2 files:
    - lwpostgis.sql
      - Main operators and types (ST prefixed)
    - spatial_ref_sys.sql
      - A list of international spatial reference systems

Creating a spatial database

- Creating a spatial database
  - PostGIS requires PL/PGSQL

```
postgres@cleopatra:~$ createdb postgis
CREATE DATABASE
postgres@cleopatra:~$ createlang plpgsql postgis
postgres@cleopatra:~$ psql -d postgis /usr/share/postgresql/lwpostgis.sql
postgres@cleopatra:~$ psql -d postgis /usr/share/postgresql/spatial_ref_sys.sql
```

- Check that everything is working

```
postgis=# SELECT postgis_full_version();
                                postgis_full_version
-------------------------------------------------------------------------------
 POSTGIS="1.3.2" GEOS="3.0.0-CAPI-1.4.1" PROJ="Rel. 4.6.0, 21 Dec 2007" USE_STATS
(1 row)
```

- Now we can start adding geometries

PostGIS Geometries

- PostGIS supports OGC-compliant geometries
  - From the Open Geospatial Consortium
    - http://www.opengeospatial.org/
    - Geometries are defined as part of the “OpenGIS Simple Features Implementation Specification for SQL”
    - The specification can be downloaded for free
  - PostGIS has been officially certified as OGC SFS 1.1 compliant

Basic Geometry Types

- Basic OGC geometry types
  - POINT
  - POLYGON
  - LINESTRING
- Geometry array types
  - MULTIPOINT
  - MULTIPOLYGON
  - MULTILINESTRING
  - GEOMETRYCOLLECTION

- Basic geometry examples

```
postgis=# SELECT ST_AsText(ST_GeomFromText('POINT(4 51)'));
  st_astext
-------------
 POINT(4 51)
(1 row)

postgis=# SELECT ST_AsText(ST_GeomFromText('LINESTRING(0 0, 1 1, 2 2, 3 3)'));
          st_astext
----------------------------
 LINESTRING(0 0,1 1,2 2,3 3)
(1 row)

postgis=# SELECT ST_AsText(ST_GeomFromText('POLYGON((0 0, 0 1, 1 1, 1 0, 0 0))'));
           st_astext
-------------------------------
 POLYGON((0 0,0 1,1 1,1 0,0 0))
(1 row)

postgis=# SELECT ST_AsText(ST_GeomFromText('POLYGON((0 0, 0 1, 1 1, 1 0, 0 -1))'));
ERROR:  geometry contains non-closed rings
CONTEXT:  SQL function "st_geomfromtext" statement 1

postgis=# SELECT ST_AsText(ST_GeomFromText('LINESTRING(0,0 1,1 2,2 3,3)'));
ERROR:  parse error - invalid geometry
CONTEXT:  SQL function "st_geomfromtext" statement 1
```

More complex queries

- These examples use the free datasets from http://mappinghacks.com
- Imported into PostGIS from ESRI Shapefiles
  - World Borders
    - Country outlines stored as 2D POLYGONs
  - Cities
    - POINTs representing major cities throughout the world

- Example 1
  - Given a table of countries, find the names of all of the countries that border Chad

```
postgis=# SELECT t1.cntry_name FROM world_borders t1, world_borders t2 WHERE
ST_Touches(t1.the_geom, t2.the_geom) AND t2.cntry_name = 'Chad';
        cntry_name
---------------------------
 Libya
 Niger
 Sudan
 Cameroon
 Central African Republic
 Nigeria
(6 rows)
```

- Example 2
  - Given a table of cities and a table of countries, find the total number of cities within each country and return the list in alphabetical order

```
postgis=# SELECT world_borders.cntry_name, COUNT(world_borders.cntry_name)
 FROM cities, world_borders WHERE ST_Within(cities.the_geom, world_borders.the_geom)
 GROUP BY world_borders.cntry_name
 ORDER BY world_borders.cntry_name;

 cntry_name  | count
-------------+-------
 Afghanistan |     3
 Albania     |     1
 Algeria     |     5
 Angola      |     3
 Argentina   |     9
 Armenia     |     1
 Australia   |    14
 Austria     |     5
 Azerbaijan  |     1
 Bangladesh  |     3

... etc ...
```

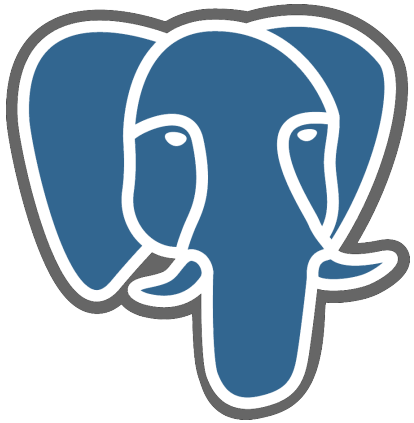
Tools that can use PostGIS

- There are many GIS tools that can access data within PostGIS
  - Open source
    - JUMP
    - QGIS
    - GeoServer
    - MapServer
  - Some proprietary support also exists
    - CadCorp SIS
    - Safe Software FME
    - ESRI

Tools that can use PostGIS

- Similarly any applications that can connect to PostgreSQL can access spatial data
  - Java, PHP, Perl etc.
- This allows data to loaded into online mapping applications such as Google Maps
- Wrapper classes are available for most languages

- Demonstration & Questions



- For more information:
  - http://postgis.refractions.net
- Or specific enquiries:
  - http://www.siriusit.co.uk