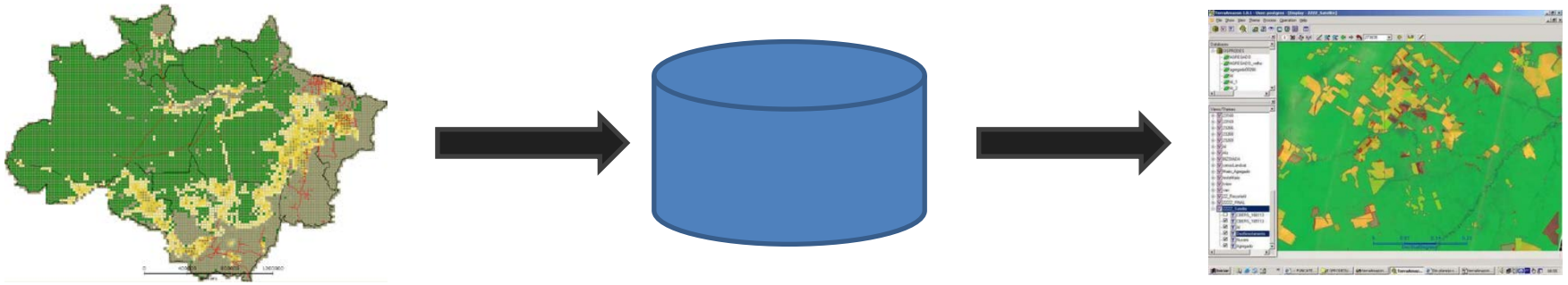
Spatial Databases: Lecture 6

Institute for Geoinformatics

Winter Semester 2014



Malumbo Chipofya: room 109

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Topic Overview

1. Prelude: Data and problem solving in science and applications
2. The Relational Database model
3. Interacting with relational databases
4. **Spatial Relational Database Management Systems**
5. Applications: Terraview and Terralib: Prof. Dr. Gilberto Camara
6. A sample of Nosql Databases: brief introductions + example applications
   a. Array databases: SciDB
   b. Document databases: MongoDB
   c. Graph databases: Neo4J
7. Summary of all lectures given.

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Assignment 2: hints

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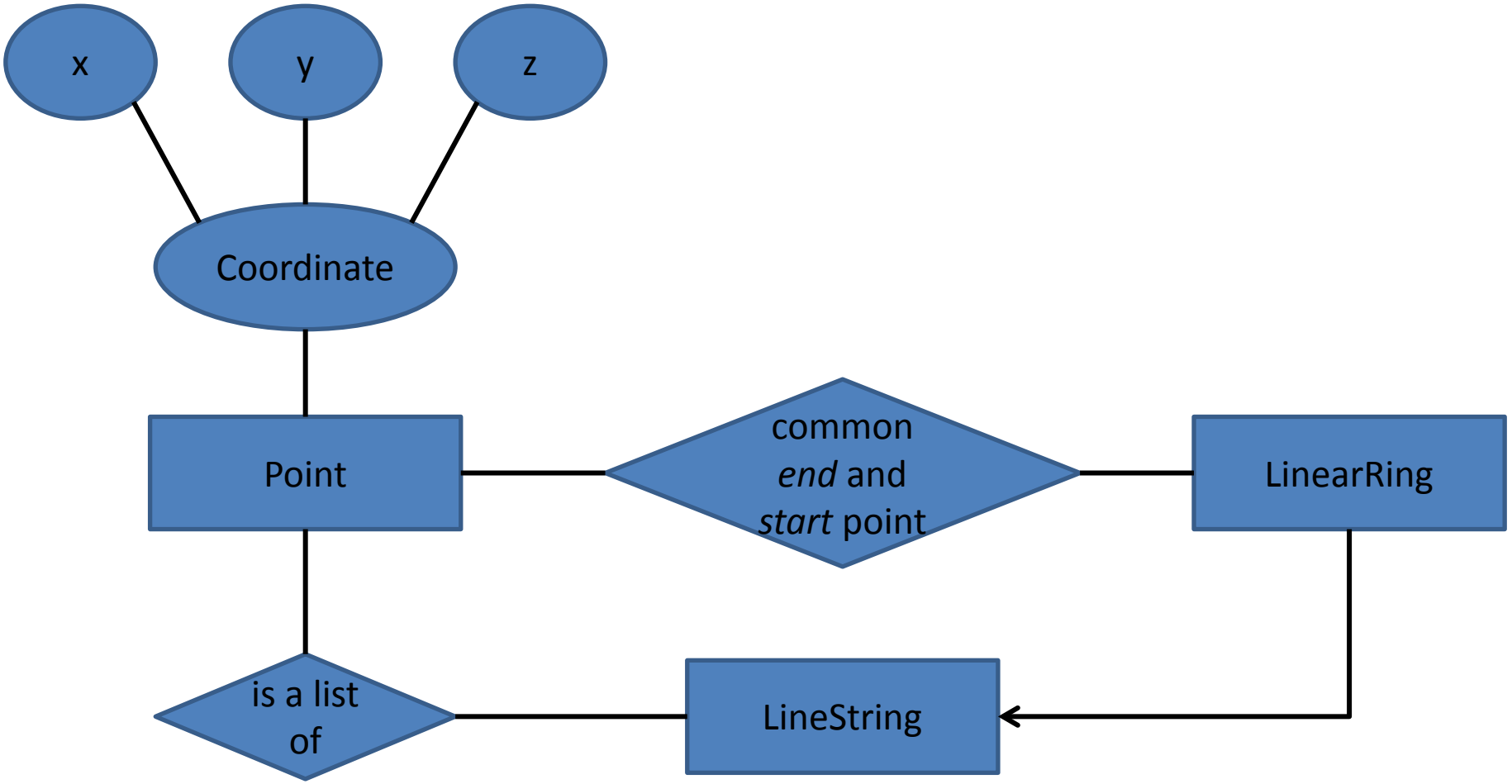
Creating of Geometry Storage in Postgresql



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Creating of Geometry Storage in Postgresql

- **Create database**
- Create functions
  - make_world()
  - line_string_verbose()
  - get_vertices()
  - get_vertices_recurse()
  - line_string_insert()
- Create a view for LineStrings
- Create trigger
- Test in between

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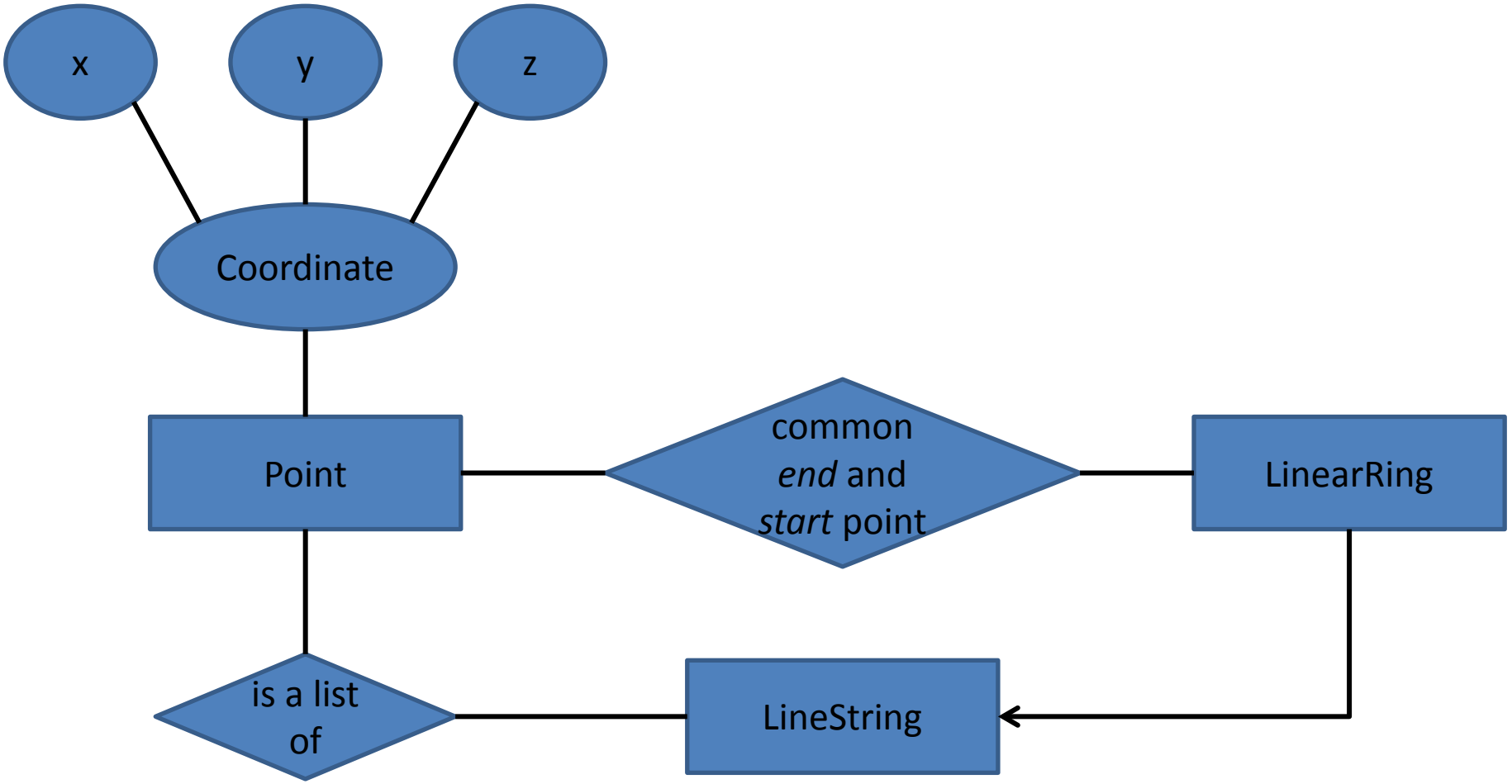
Creating of Geometry Storage in Postgresql



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Creating of Geometry Storage in Postgresql

- VIEWS

ID#	Skill	M.St	#Chd	#Yrs	M.€	Date	#sticks	Wgt.	Hrs
1	Medium	M	0	2	40	1.06	55	9	6
2	Low	S	0	1	30	7.05	34	5	5
3	High	S	2	3	45	1.06	54	9	6
4	High	M	3	4	50	3.11	61	12	8

- A view is a tailor made presentation of data in one or more tables or view (WHY VIEWS?)

#Yrs	M.€
2	40
1	30
3	45
4	50

#Yrs	Skill
2	Medium
1	Low
3	High
4	High

ID#	Date	#sticks	Wgt.	Hrs
1	1.06	55	9	6
2	7.05	34	5	5
3	1.06	54	9	6
4	3.11	61	12	8

ID#	#Yrs
1	2
2	1
3	2
4	4

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Creating of Geometry Storage in Postgresql

- TRIGGER: fire!

ID#	#Yrs
1	2
2	1
3	2
4	4

On insert or update, also update the other tables

#Yrs	M.€
2	40
1	30
3	45
4	50

#Yrs	Skill
2	Medium
	Low
	High
	High

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Creating of Geometry Storage in Postgresql

- TRIGGER: fire!

ID#	#Yrs
1	2
2	1
3	2
4	4

On insert or update, also update the other tables

#Yrs	M.€
2	40
1	30
3	45
4	50

#Yrs	Skill
2	Medium
	Low
	High
	High

ID#	Date	#sticks	Wgt.	Hrs
1	1.06	55	9	6
2	7.05	34	5	5
3	1.06	54	9	6
4	3.11	61	12	8

On insert or update, also update the other tables

Date	Total sticks
1.06	55
7.05	34
1.06	54
3.11	61

Here the function sum must be used to calculate the total

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Spatial Relational Databases

Postgres/Postgis as an example

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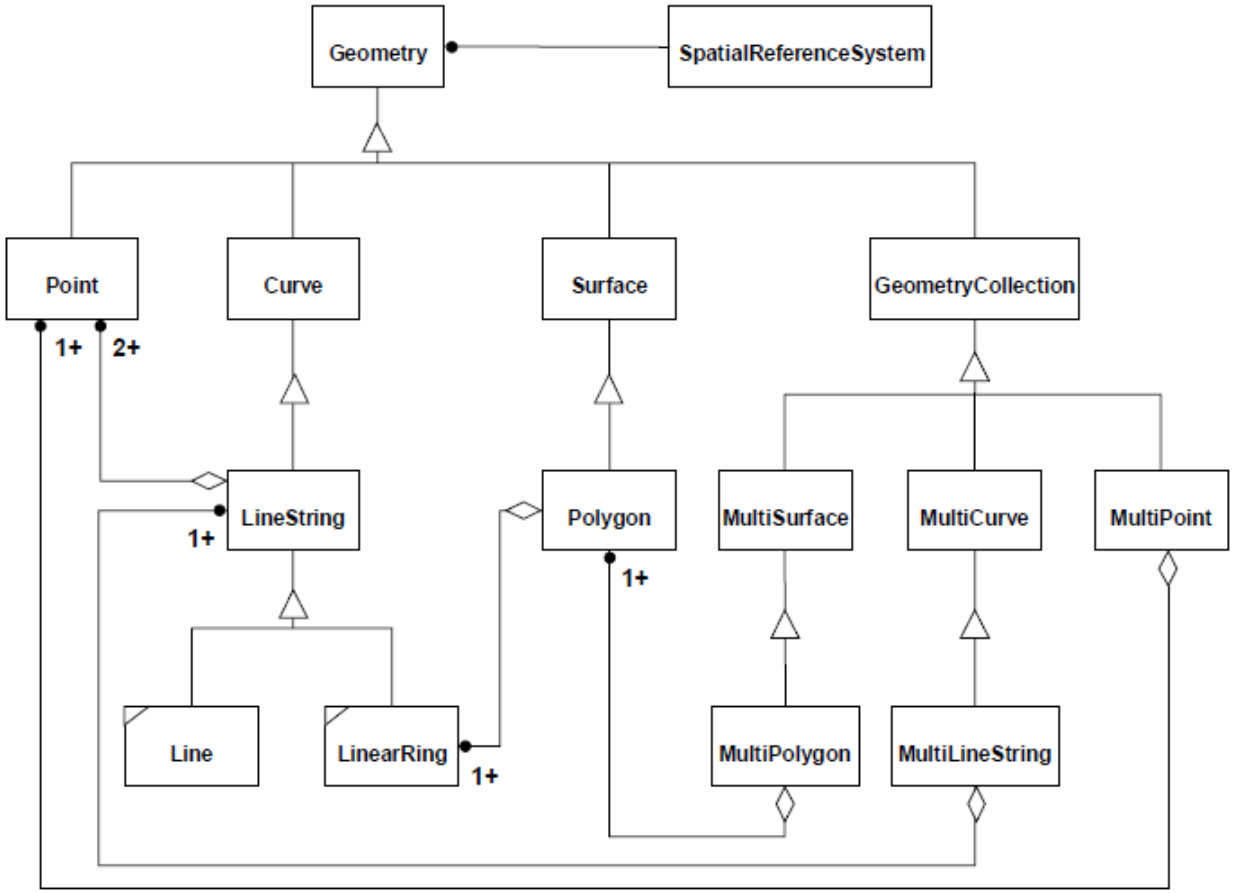
OGC Simple Features



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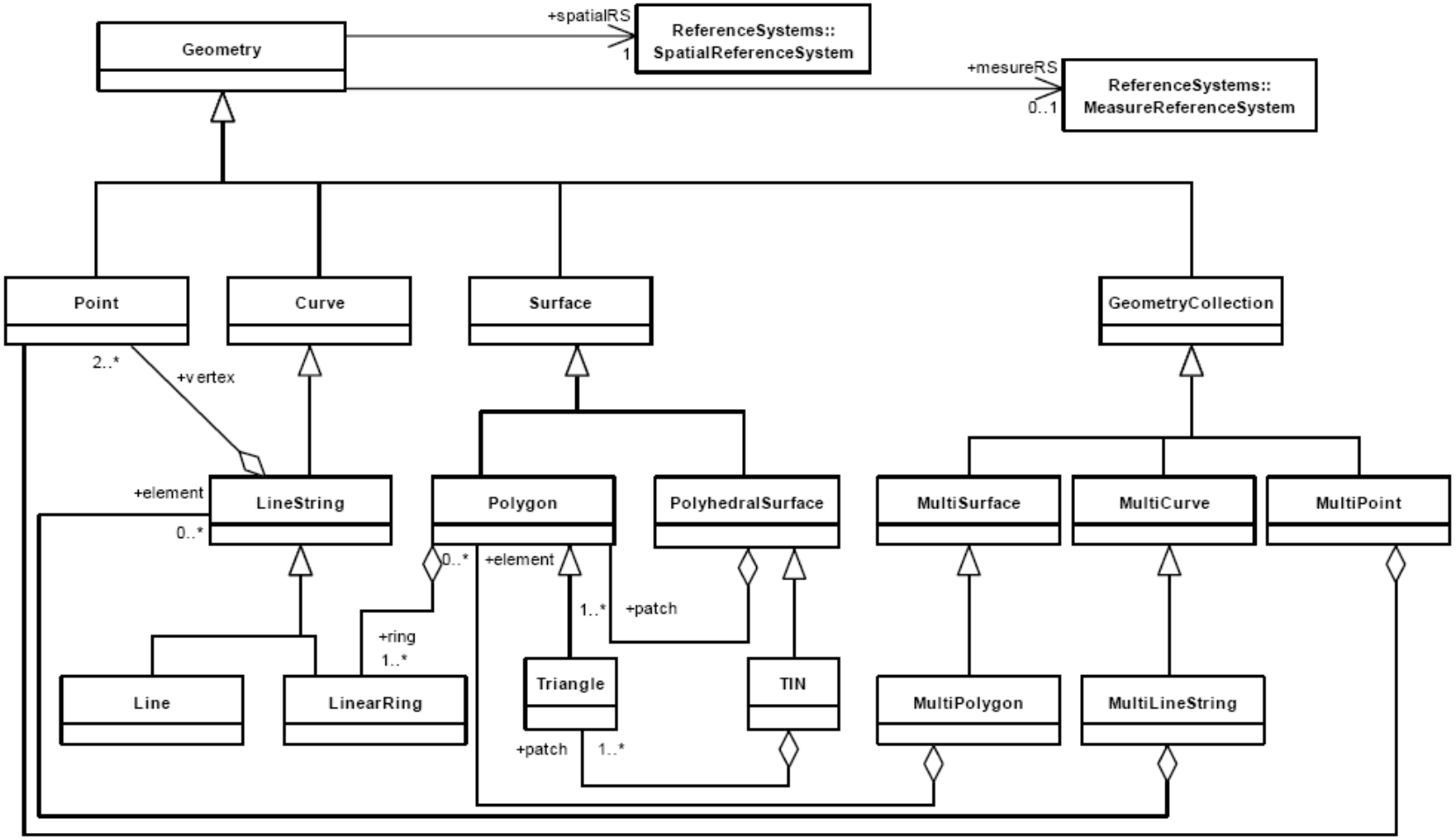
OGC *less* Simple Features



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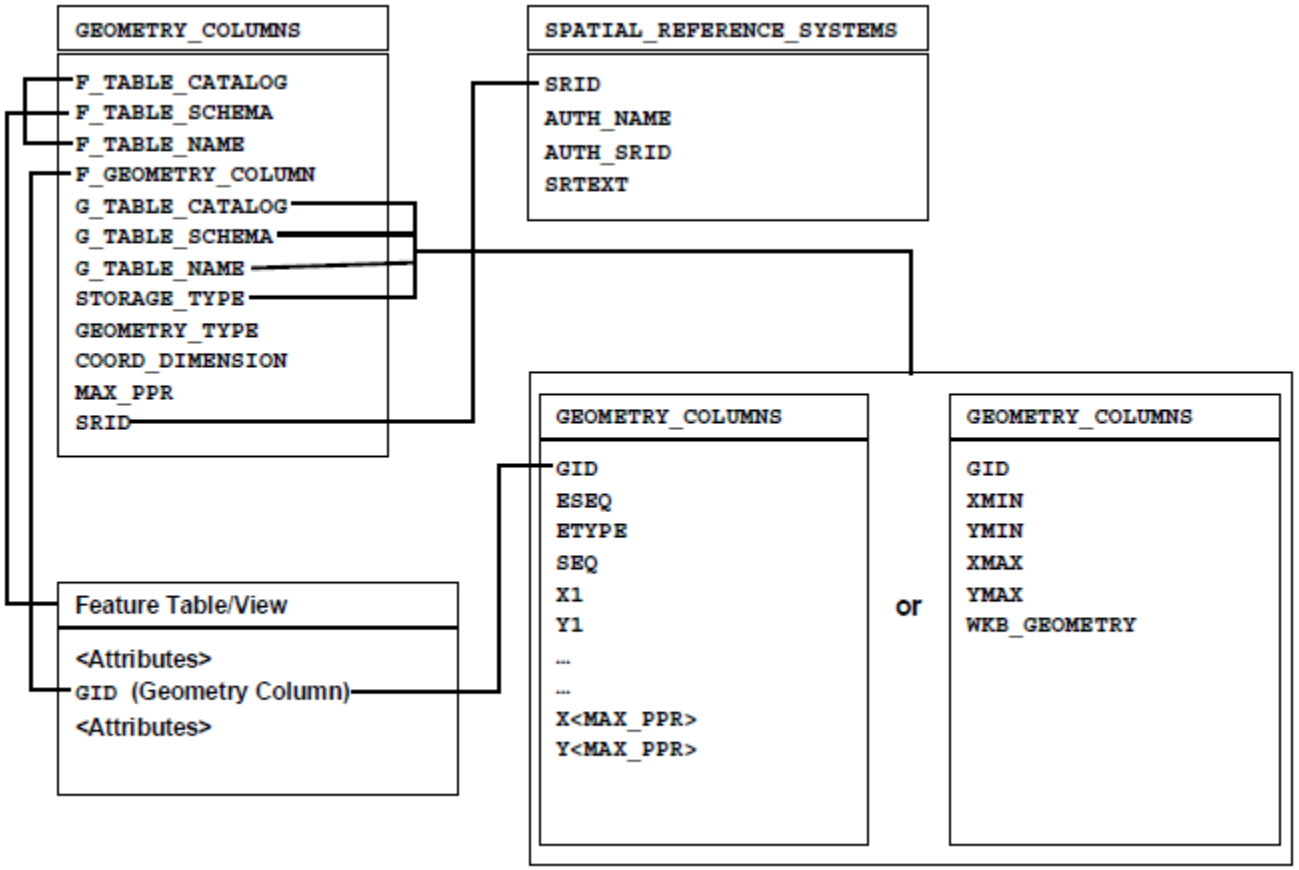
Database Structure



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Creating Geometry Columns

- Start PSQL and login to “mygeoms” database
  - If logged in to the default database postgres, type “\c mygeoms” to change databases
- Install the postgis extension in mygeoms
- In postgis geometries are types so the can be referenced in DDL statements as directly
  - CREATE TABLE test (ID int4 , test_label varchar(25), geom geometry(LINESTRING,4326));

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Creating Geometry Columns

- Add a new table called pgGeomCols with attributes
  i. gcid: serial
  ii. label: varchar(80)
- Check the columns you have in your table
  – \d pgGeomCols

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Creating Geometry Columns

- Add a new Geometry columns called poi and poi_neighborhood as follows
  - SELECT AddGeometryColumn ('pgGeomCols', 'poi', 4326, 'POINT',2);
  - SELECT AddGeometryColumn ('pgGeomCols', 'poi_neighborhood', 4326, ‘Polygon',2);
- Now check the columns in your table again
  - \d pgGeomCols

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Creating Geometry Columns

- Geometries are stored in the table geometry_columns
  - SELECT f_geometry_column As cols, type, srid, coord_dimension As dims FROM geometry_columns WHERE f_table_name = 'pgGeomCols‘;

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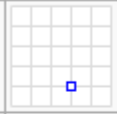
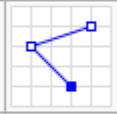
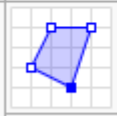
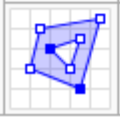
Creating Geometries

- A geometry column can be of any geometry type.
  - SELECT AddGeometryColumn ('pgGeomCols', 'poi_full_neighborhood', 4326, ‘Geometry',2);

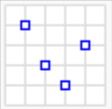
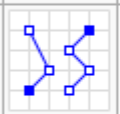
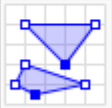
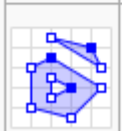
Referring to Geometries

- Well Known Text format

Geometry primitives (2D)

Type	Examples	
Point		POINT (30 10)
LineString		LINESTRING (30 10, 10 30, 40 40)
Polygon		POLYGON ((30 10, 40 40, 20 40, 10 20, 30 10))
		POLYGON ((35 10, 45 45, 15 40, 10 20, 35 10), (20 30, 35 35, 30 20, 20 30))

Multipart geometries (2D)

Type	Examples	
MultiPoint		MULTIPOINT ((10 40), (40 30), (20 20), (30 10))
		MULTIPOINT (10 40, 40 30, 20 20, 30 10)
MultiLineString		MULTILINESTRING ((10 10, 20 20, 10 40), (40 40, 30 30, 40 20, 30 10))
MultiPolygon		MULTIPOLYGON (((30 20, 45 40, 10 40, 30 20)), ((15 5, 40 10, 10 20, 5 10, 15 5)))
		MULTIPOLYGON (((40 40, 20 45, 45 30, 40 40)), ((20 35, 10 30, 10 10, 30 5, 45 20, 20 35), (30 20, 20 15, 20 25, 30 20)))

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Referring to Geometries

```
INSERT INTO pgGeomCols (label, poi, poi_neighborhood,
poi_full_neighborhood)
VALUES ('Point1', 'POINT(0.5 0.5)‘, 'POLYGON((0 0, 1 0, 1 1, 0 1,
0 0)) ', 'GEOMETRYCOLLECTION(POINT(0 0), POLYGON((0 0, 1
0, 1 1, 0 1, 0 0)))'),
('Point2', 'POINT(2 0)‘, 'POLYGON((0 0, 3 0, 3 3, 0 3, 0 0)) ',
'GEOMETRYCOLLECTION(POINT(2 0), POLYGON((0 0, 1 0, 1 1, 0
1, 0 0)))'),
('PolygonWithHole', 'POINT(0.5 1)‘, 'POLYGON((0 0, 10 0, 10
10, 0 10, 0 0),(1 1, 1 2, 2 2, 2 1, 1 1))',
'GEOMETRYCOLLECTION(POINT(0.5 1), POLYGON((0 0, 10 0, 10
10, 0 10, 0 0),(1 1, 1 2, 2 2, 2 1, 1 1)), LINESTRING(0 0, 1 1, 2 1,
2 2))');
SELECT label, poi_full_neighborhood FROM pgGeomCols;
SELECT label, ST_AsText(poi_full_neighborhood) FROM
pgGeomCols;
```

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PostGIS functions

http://postgis.net/docs/reference.html

- PostgreSQL PostGIS Geometry/Geography/Box Types
- Management Functions
- Geometry Constructors
- Geometry Accessors
- Geometry Editors
- Geometry Outputs
- Operators
- Spatial Relationships and Measurements
- SFCGAL Functions
- Geometry Processing
- Linear Referencing
- Long Transactions Support
- Miscellaneous Functions
- Exceptional Functions

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References

- http://postgis.net/docs/
- http://www.postgresql.org/docs/9.3/static/index.html
- http://workshops.boundlessgeo.com/postgis-intro/index.html
- http://www.opengeospatial.org/standards/sfa (OGC SFS - Common architecture)
- http://www.opengeospatial.org/standards/sfs (OGC SFS - SQL option)

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That’s all for today

Thank you!

Questions?

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