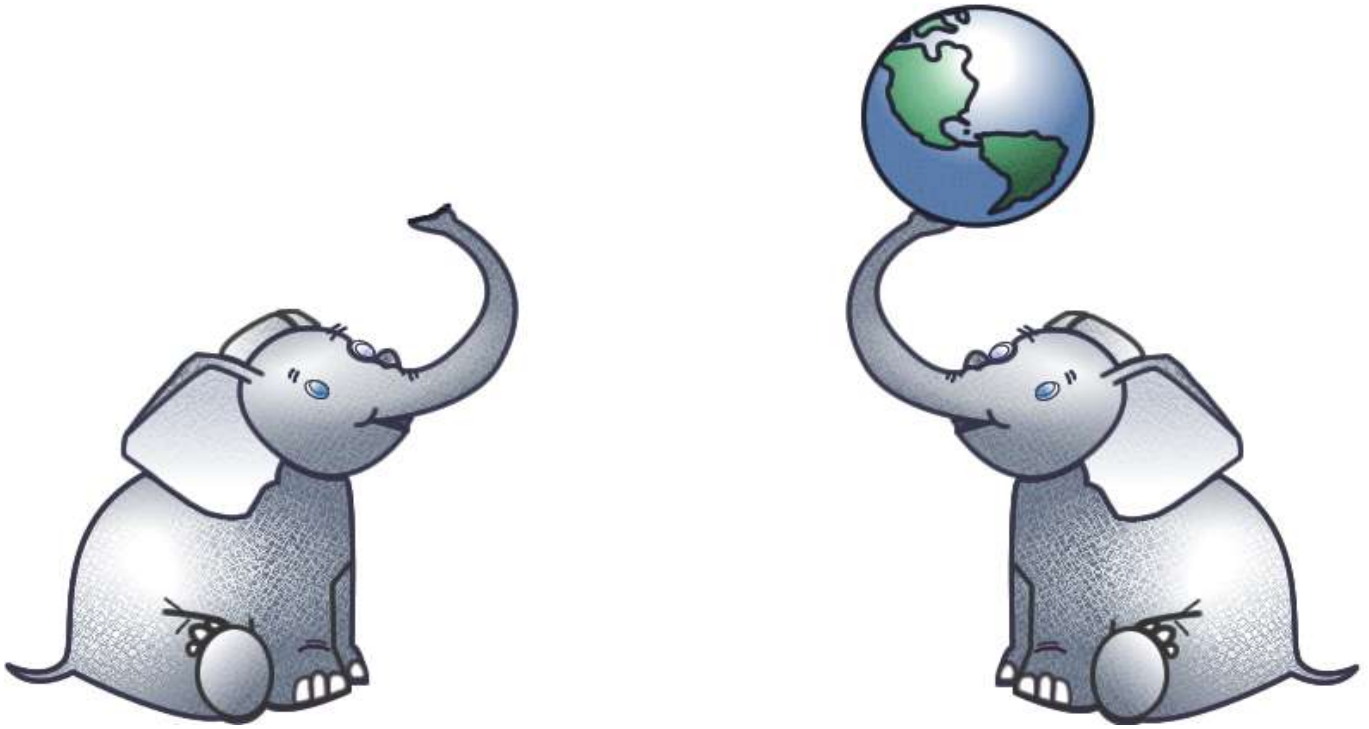
PostGIS: future developments



What is PostGIS

- GPL PostgreSQL extension for Geographic Objects
- Types
- Operators
- Functions
- Indexes
- Standard interfaces
- Extension API

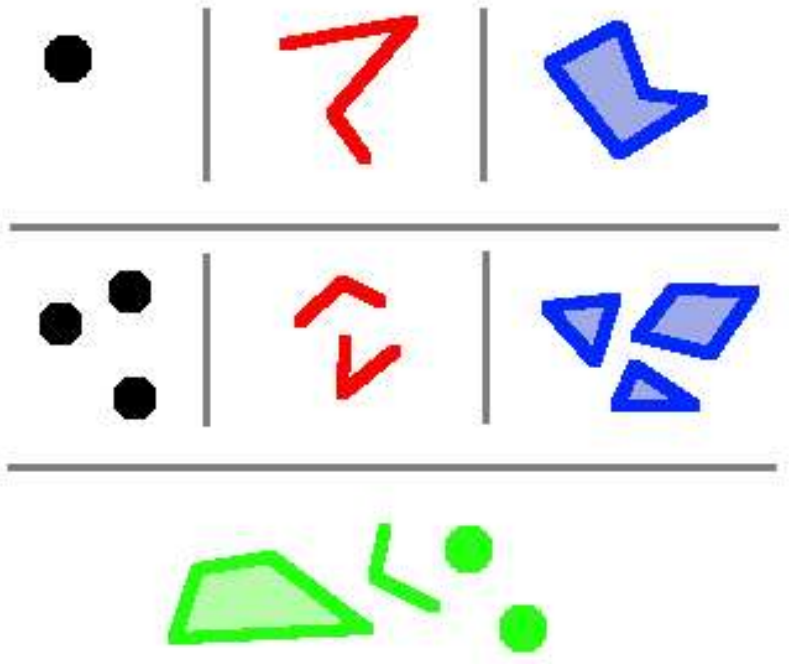
Current features

- OpenGIS “Simple Features for SQL” **certified**
- Spatial analysis and predicates (GEOS/JTS)
- Up to 4 dimensions coordinates (Shapefile-like)
- 2d spatial indexing (rtree/GiST)
- SRS reprojections (PROJ4)
- About 200 spatial functions
- Lossless Shapefile import / export

current features

OGC types

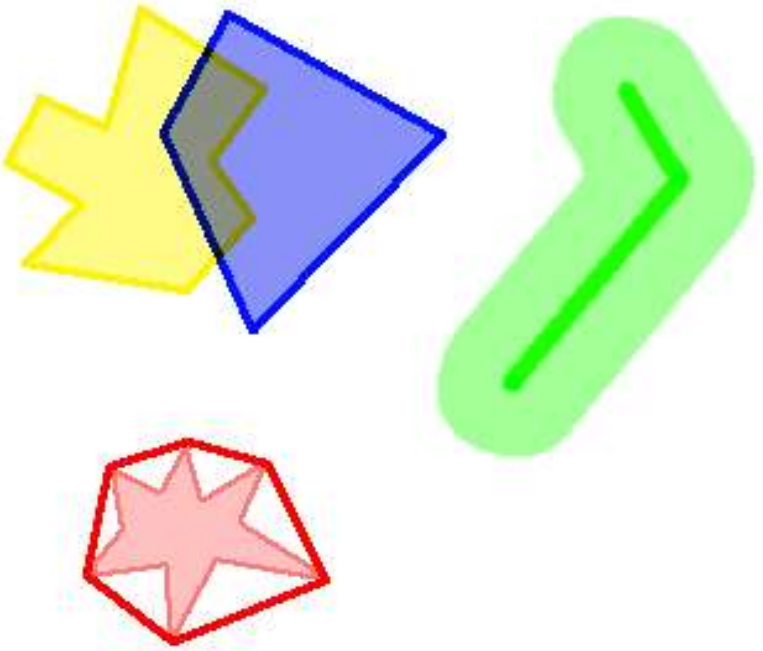
1. Points
2. Lines
3. Polygons
4. MultiPoints
5. MultiLines
6. MultiPolygons
7. Collections



current features

Spatial analysis

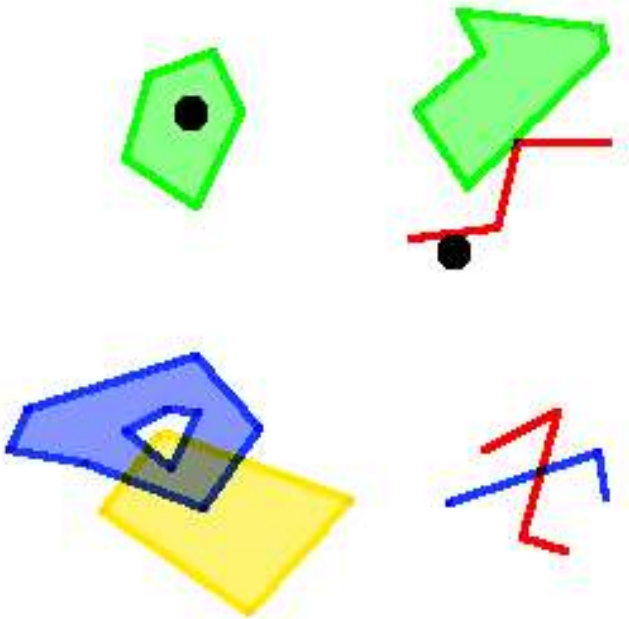
- Union
- Intersection
- Difference
- Symmetric difference
- Convex Hull
- Buffer



current features

Spatial predicates

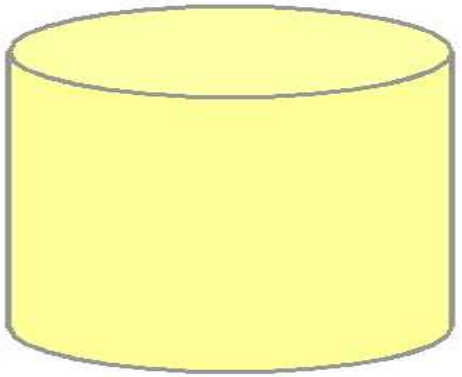
- Equals
- Disjoint
- Intersects
- Touches
- Crosses
- Within
- Contains
- Overlaps



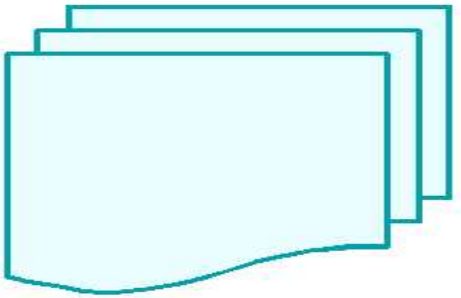
current features

Coordinate dimensions

- 2D (X, Y)
- 2.5D (X, Y, Z)
- Measured (X, Y, M)
- Measured 2.5D (X, Y, Z, M)



Lossless
Shapefile
import / export



Community

- MapServer
- GeoServer
- UDIG
- Qgis
- Jump
- OpenEV
- GRASS
- OGR
- GeoTypes
- GeoTools
- MezoGIS
- Thuban
- phpPgGis
- PrimaGIS
- OrbisCAD
- ...

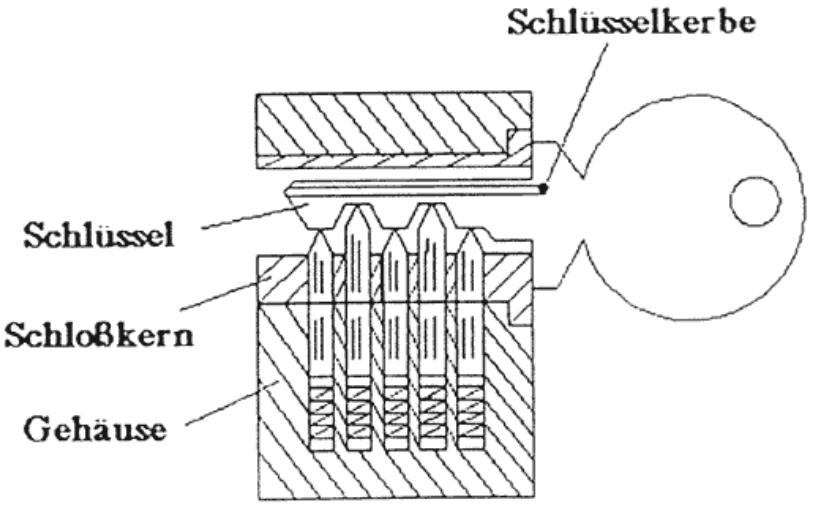
Ongoing and future developments

- Long transactions
- Topology
- Networks
- Rasters
- ISO SQL/MM

ongoing development

Long transactions

- Features locking
- Implemented in 1.1.3
- OGC standard (WFS)



long transactions

What for ?

- OGC Web Features Service
- Generic web-based architectures
- Data integrity
- Concurrent access

long transactions

How does it work

- Lock **any** database **row** (not only features)
- The lock is bound to an **authentication token**
- Add auth tokens to your session
- Do your things
- Unlock the row(s)

long transactions

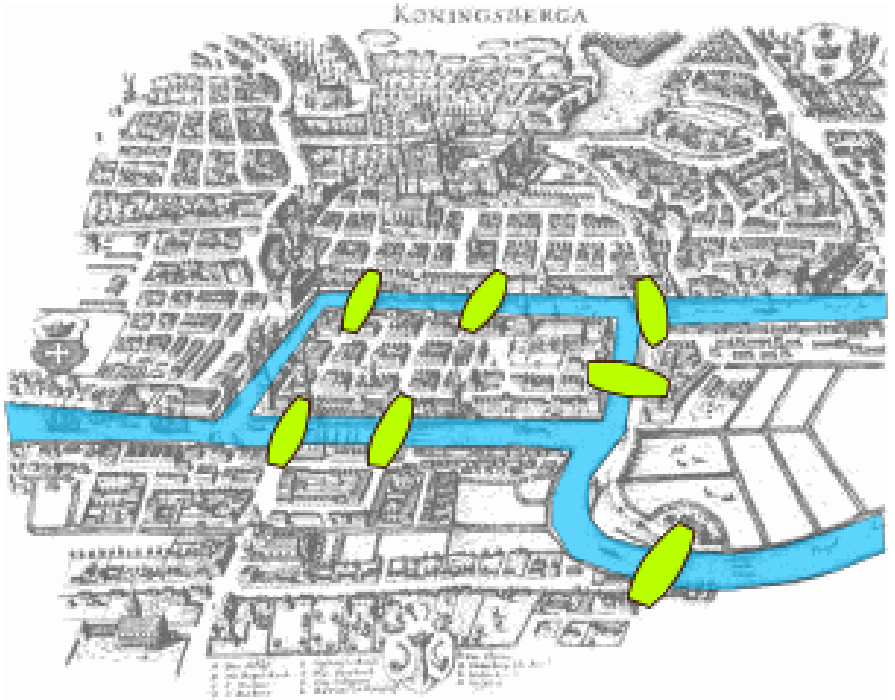
How does it work

- Locks are stored **inside** the DBMS
- Protection is implemented using **triggers**
- **No middleware** involved
- **Every** application is **prevented** from altering a locked row

ongoing development

Topology

- Normalized spatial data
- Drafted since 1.1.0
- ISO standard (SQL/MM)



topology

Why ?

- Topological integrity
- Reduced storage size
- Spatial analysis

why topology ?

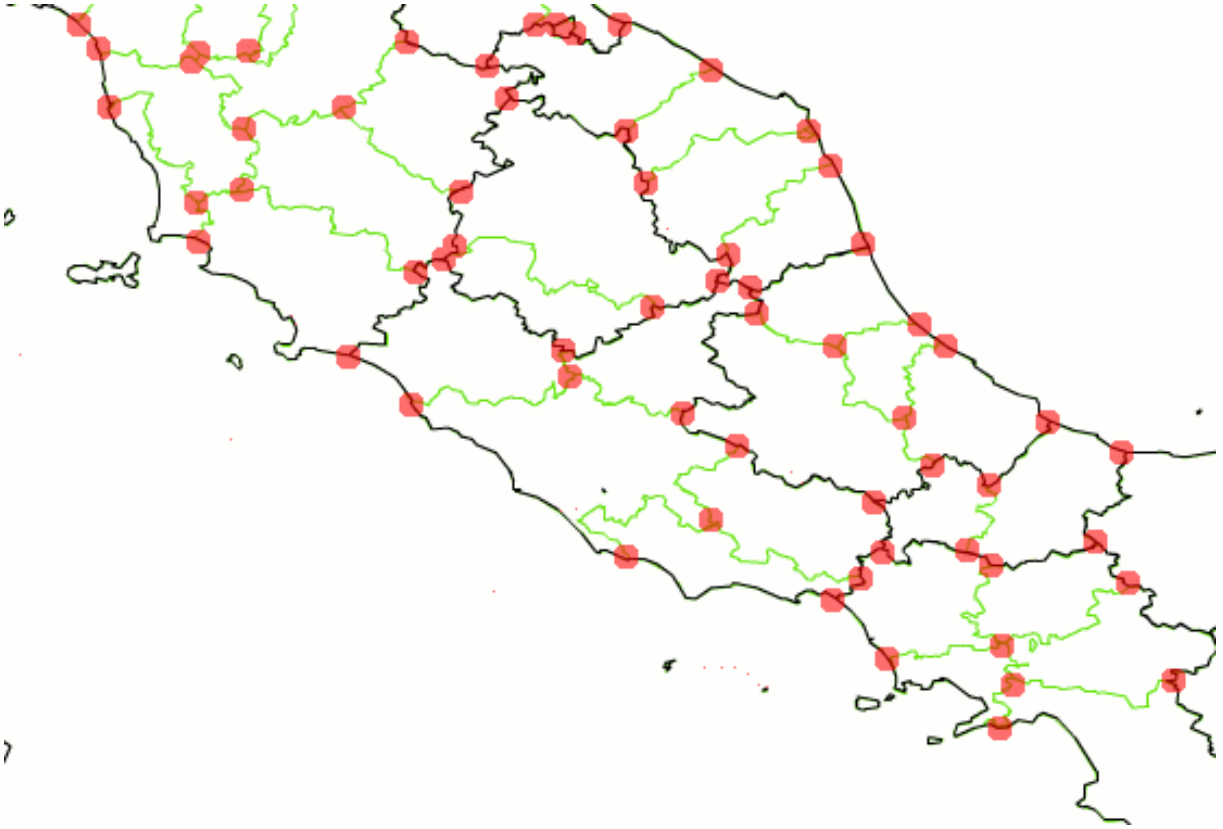
Topological integrity

- Every intersection is a node

why topology ?

Topological integrity

- Every intersection is a node



why topology ?

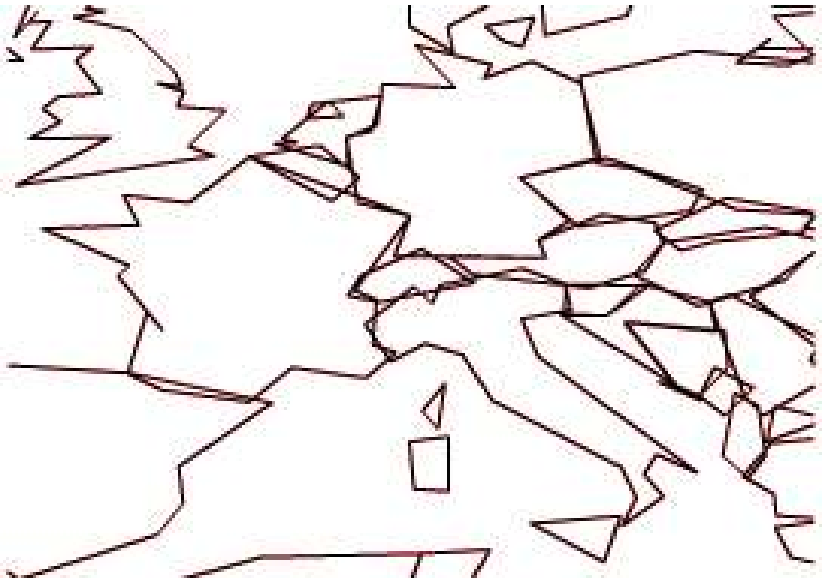
Topological integrity

- Edges are **shared** ...

why topology ?

Topological integrity

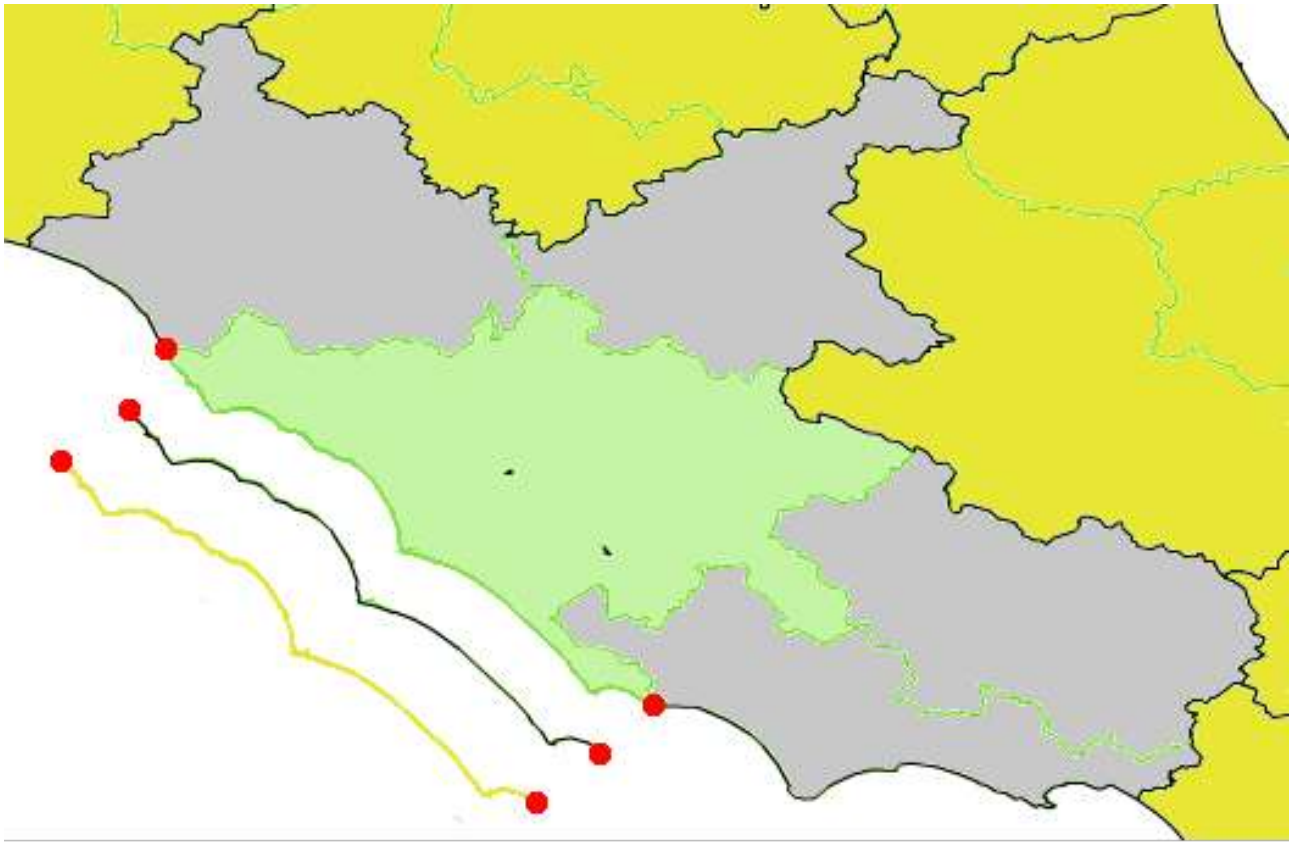
- ... not **separate** entities.



why topology ?

Reduced storage size

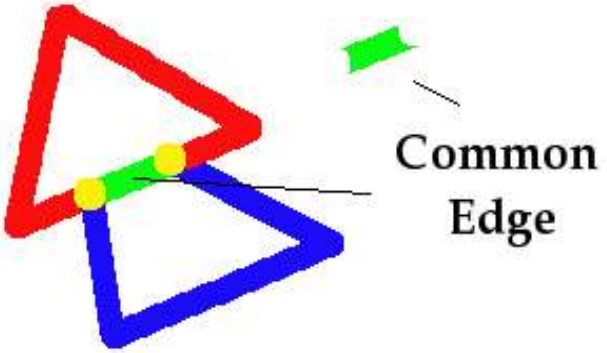
- Every edge is stored only **once**



why topology ?

Spatial analysis

- Spatial relationships are part of the model
- Predicates and overlays using standard SQL
- Do they touch ? YES ! (no starvation)



topology

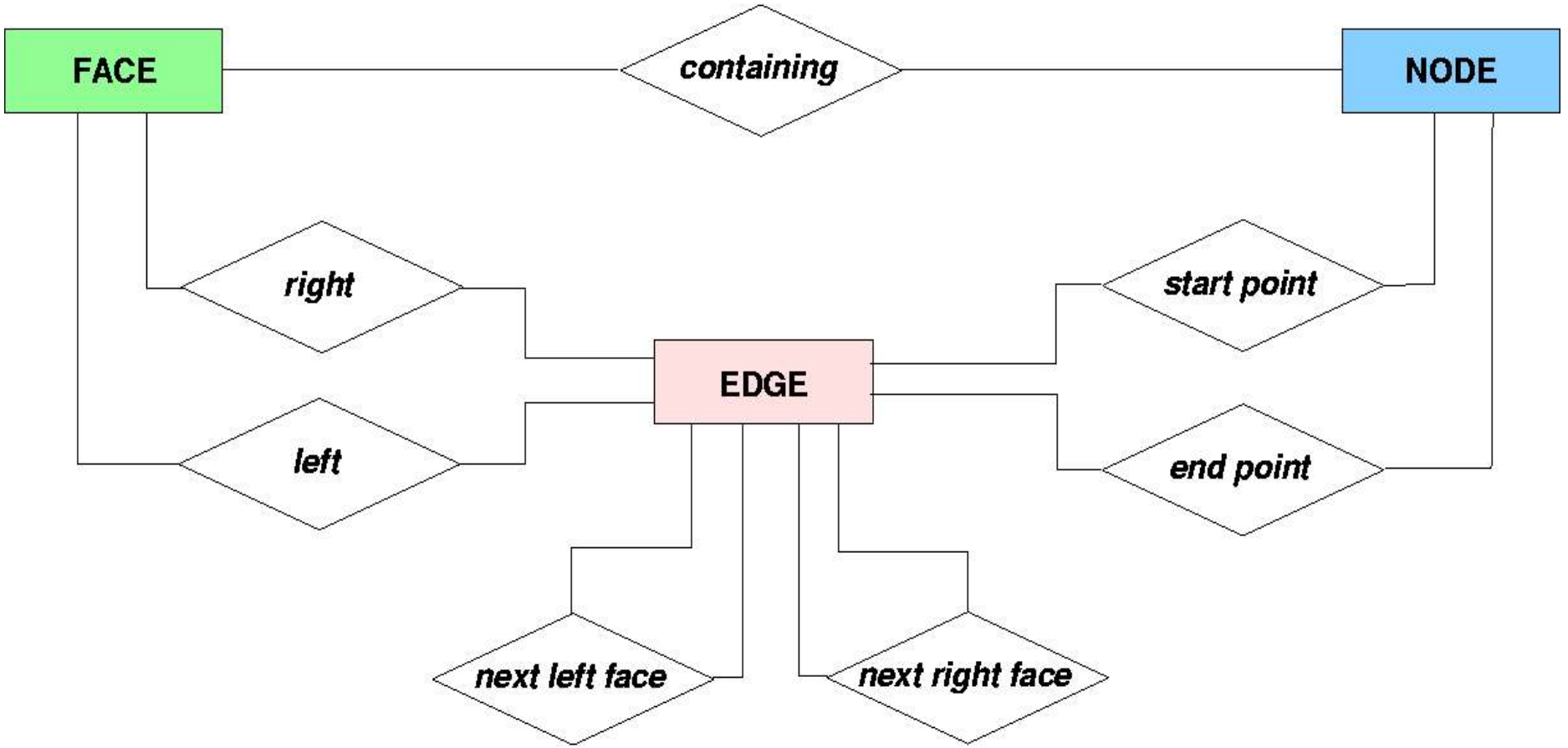
What do we have

- Draft included in PostGIS 1.1.0
- Conceptual schema
- Physical schema (ISO SQL/MM)
- Functions (ISO SQL/MM)

topology

Conceptual model

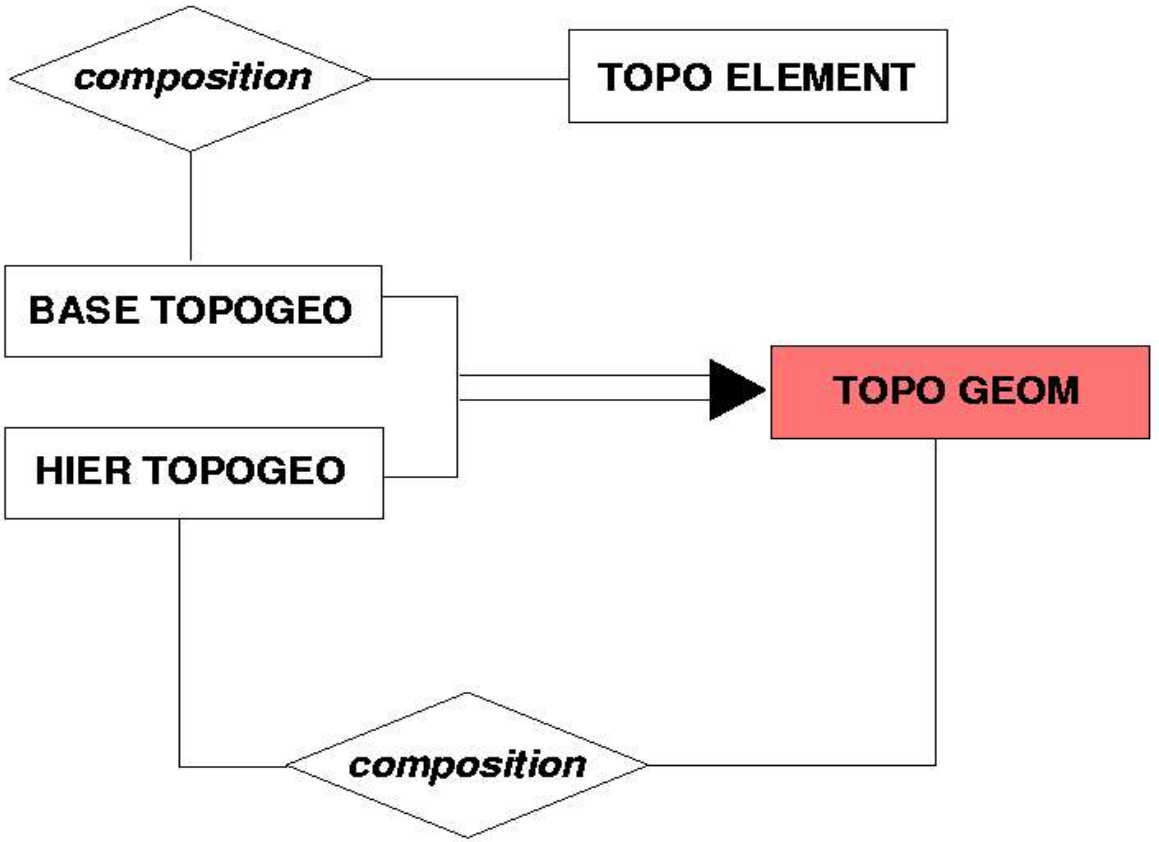
- Faces, Edges and Nodes



topology

Conceptual model

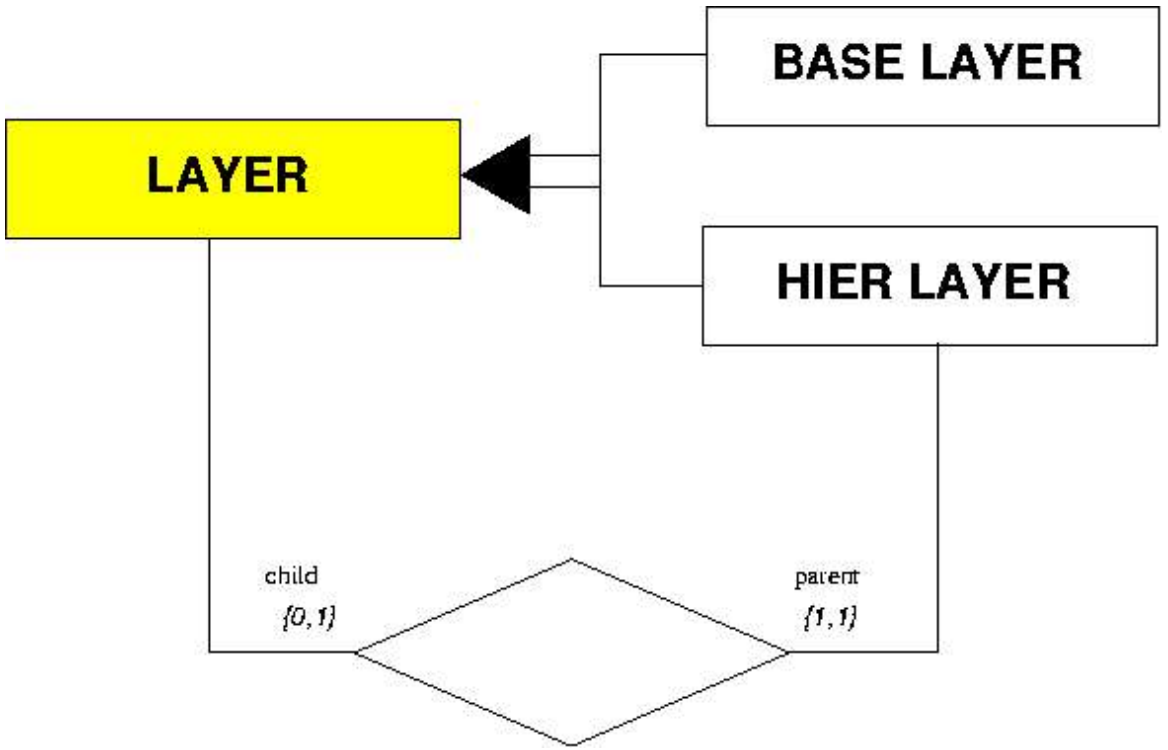
- Topo-geometries



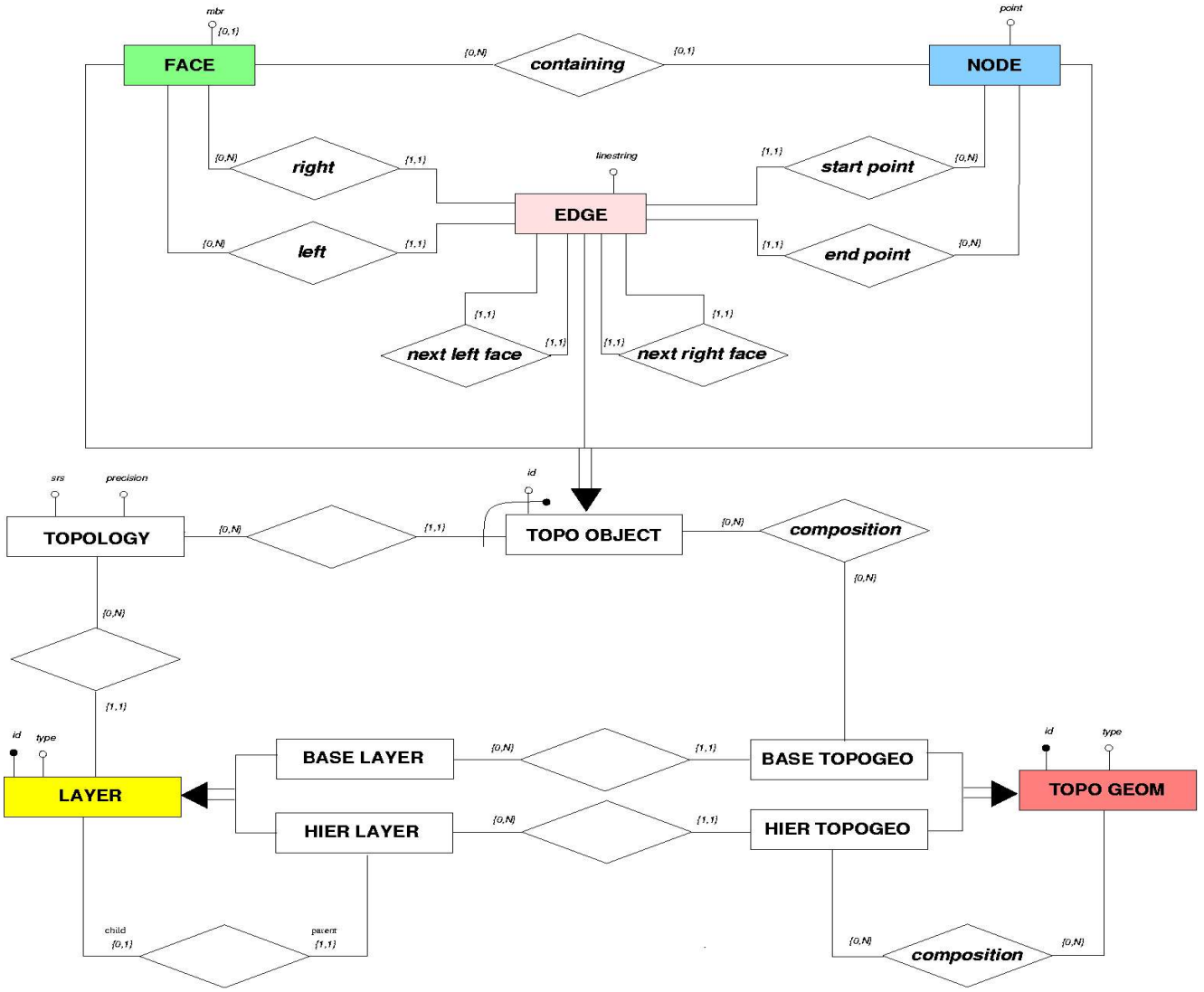
topology

Conceptual model

- Layers



topology
Conceptual model



topology

Physical model

- PostgreSQL 7.3 or up required
- All routines, types and other management objects are stored in the "topology" schema
- Topologies are stored in schemas
- TopoGeometry type
- Layers metadata

topology

Metadata tables

- topology.topology
- topology.layer

Topology schema

- <name>.edge
- <name>.face
- <name>.node
- <name>.relation (TopoGeometry comp.)

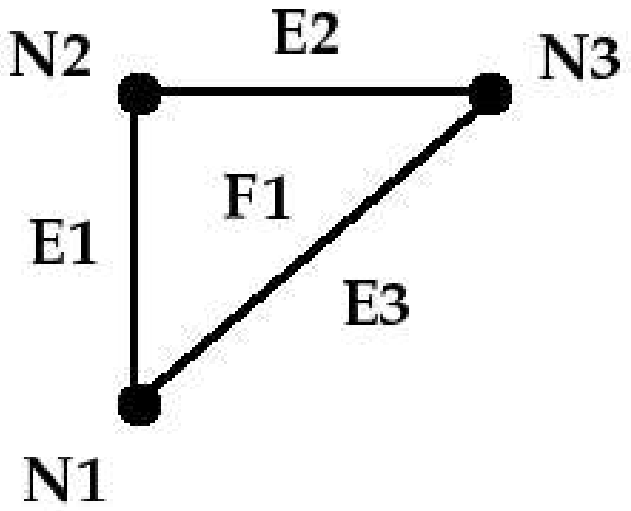
topology

Functions

- Create/destroy topologies
- Edit topologies
- Validate topologies
- Define layers (simple and hierarchical)
- Define TopoGeometries (simple and hierarchical)
- Cast TopoGeometries to Geometries

Example: loading a topology

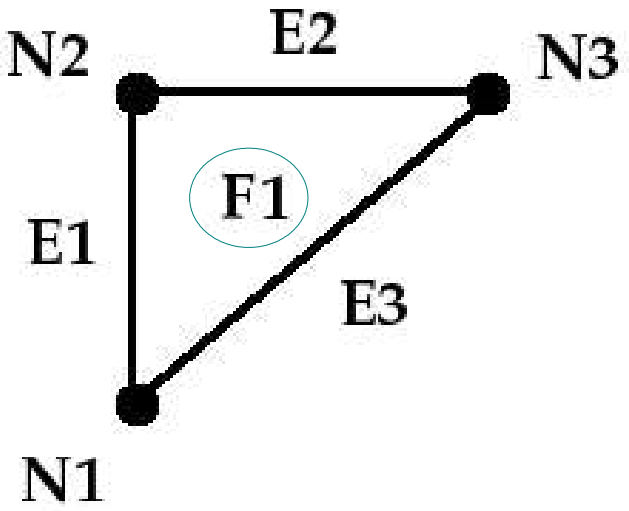
```
SELECT topology.CreateTopology('mytopo');
```



topology

Example: loading a topology

INSERT INTO mytopo.face(face_id) VALUES(1); -- **F1**



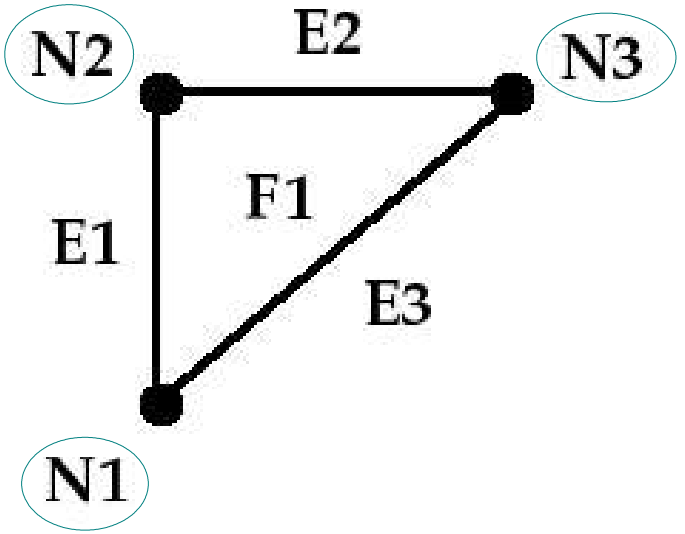
topology

Example: loading a topology

INSERT INTO mytopo.node VALUES(1, 'POINT(0 0)', NULL); -- **N1**

INSERT INTO mytopo.node VALUES(2, 'POINT(0 30)', NULL); -- **N2**

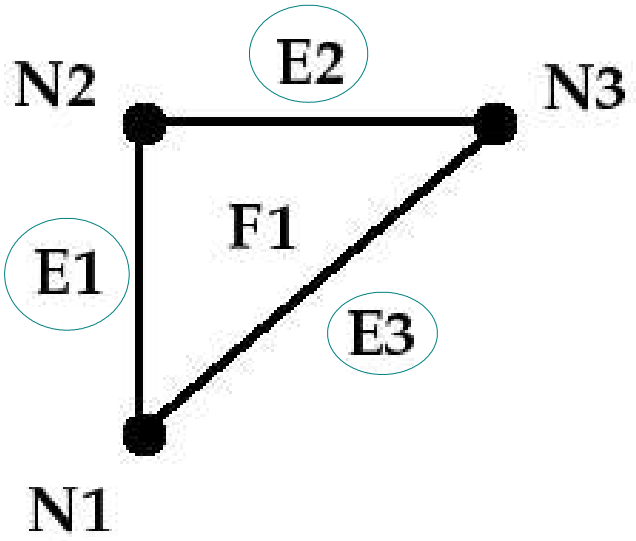
INSERT INTO mytopo.node VALUES(3, 'POINT(30 30)', NULL); -- **N3**



topology

Example: loading a topology

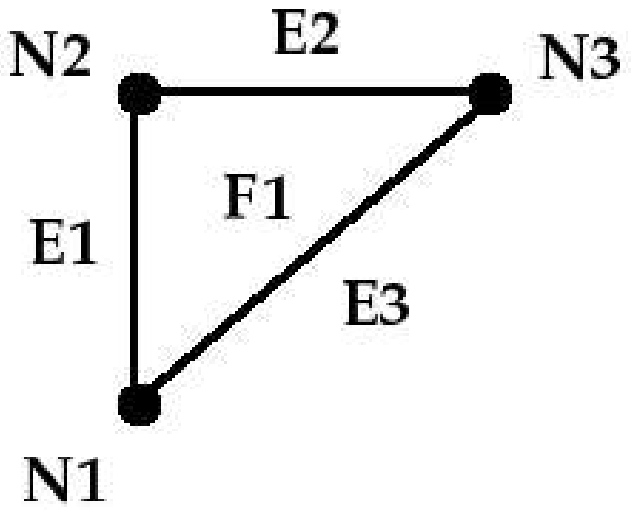
```
INSERT INTO mytopo.edge
  VALUES(1, 1, 2, -3, 2, 0, 1, 'LINESTRING(0 0, 0 30)'); -- E1

INSERT INTO mytopo.edge
  VALUES(2, 2, 3, -1, 3, 0, 1, 'LINESTRING(0 30, 30 30)'); -- E2

INSERT INTO mytopo.edge
  VALUES(3, 3, 1, -2, 1, 0, 1, 'LINESTRING(30 30, 0 0)'); -- E3
```



Example: validating a topology

SELECT * FROM topology.ValidateTopology ('mytopo');

```
 error | id1 | id2
-------+-----+-----
(0 rows)
```



Example: defining a TopoGeometry

```
CREATE TABLE land_parcels (feature_name VARCHAR);

-- Returns TG_LAYER_ID
SELECT AddTopoGeometryColumn('mytopo', 'public',
    'land_parcels', 'feature', 'POLYGON');

INSERT INTO features.land_parcels
  VALUES ('P1', -- Feature name
      topology.CreateTopoGeom(
        'mytopo', -- Topology name
        3, -- Topology geometry type (polygon/multipolygon)
        1, -- TG_LAYER_ID for this topology (from topology.layer)
        '{{1,3}}') -- face_id:1
   );
```

topology

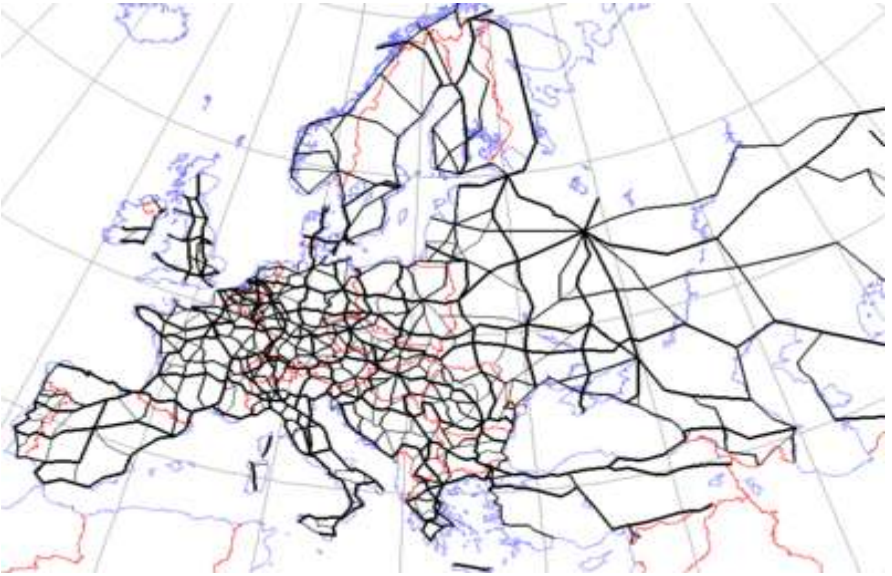
Missing features

- ISO SQL/MM topology editing functions are incomplete (can still use standard SQL)
- TIGER/Line loader dumper (possible at this stage)
- Geometry => TopoGeometry
- Interface cleanups

future developments

Network

- Shortest path
- Cartoweb
- ISO standard (SQL/MM)



network

Why ?

- Communication networks modeling
- Standardized interface
- Common algorithms

network

What would it be ?

- A schema and a set of functions
- Like Topology model
- Nodes, Links (vs. edges), **No** faces

network

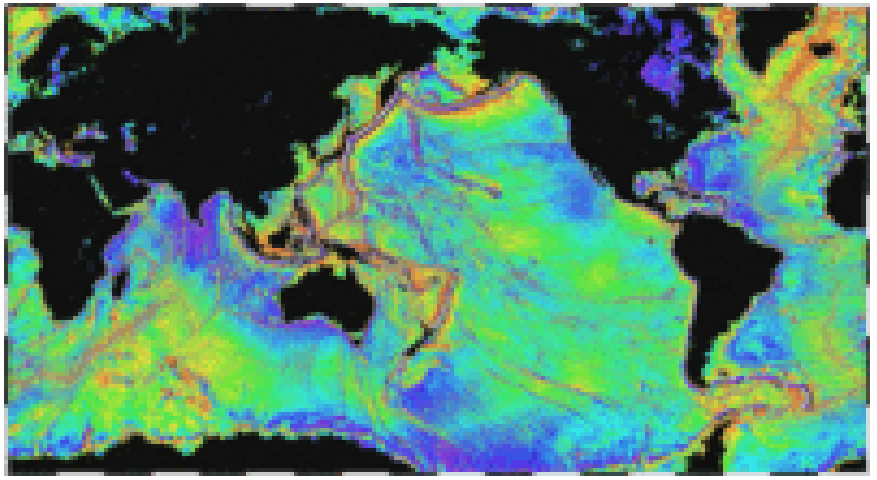
Current status

- Unimplemented :)

future developments

Rasters

- DBMS vs. filesystem
- Imagery or analysis ?
- Standards ?
- Use cases ?



rasters

Why ?

- Unified access
- Relational model (metadata)
- SQL interface
- Transactional integrity
- Raster cells analysis

rasters

Why not ?

- File formats already indexed
- Easier disaster recovery
- Don't use DBMS as filesystems :)
- Rasters on disk and metadata in DBMS
- I/O overhead (blobs?)

Possible data models

- Blocks (values are blocks)
  - existing implementations (ie. GEORASTER)
- Wrapped-blob (values are file handlers)
  - reduced I/O overhead
  - no need to define yet another file format
- Fully relational (values are single pixels)
  - quick & easy
  - scalability & performance limits

rasters

What do we have

- The CHIP type (could become a BLOCK type)
- PgCHIP gdal driver
- An implementation of the “fully relational” model
- A community pushing for it :)

future developments

ISO SQL/MM

- Signatures
- New types
- (Topology)
- (Networks)

ISO SQL/MM

Types

- Instantiable subtypes
- CircularString
- CompoundCurve
- CurvePolygon
- MultiCurve
- Surface
- MultiSurface

That's all, folks !

Questions ?