Neo4j
Spatial

GIS for the rest of us

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#neo4j
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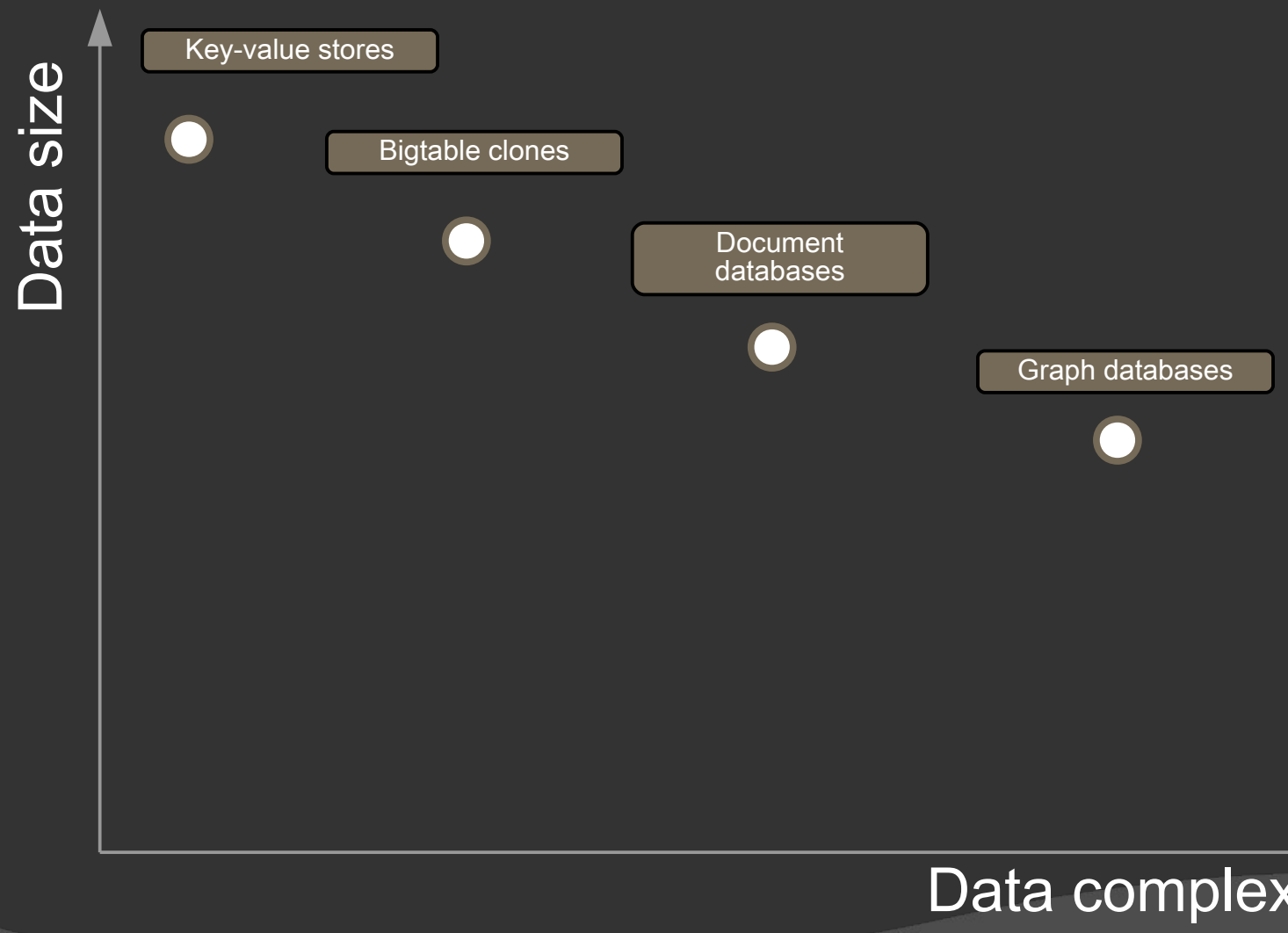
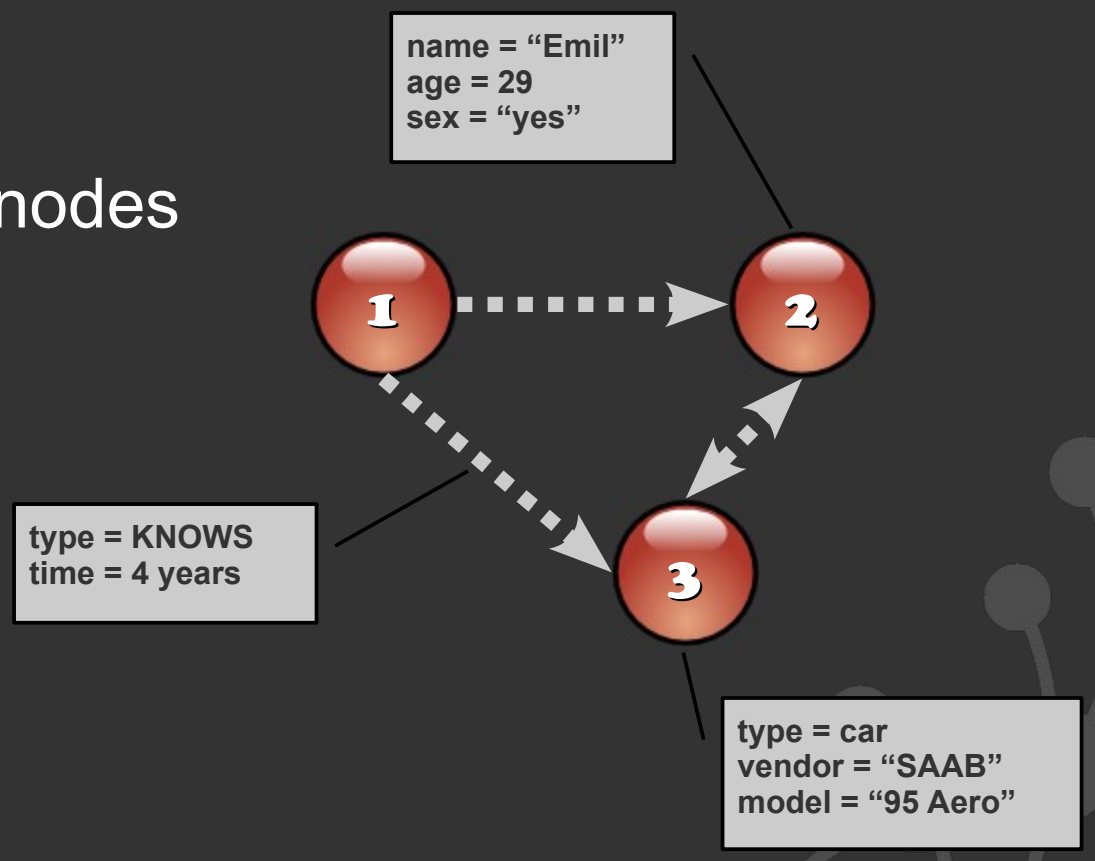
NOSQL data models



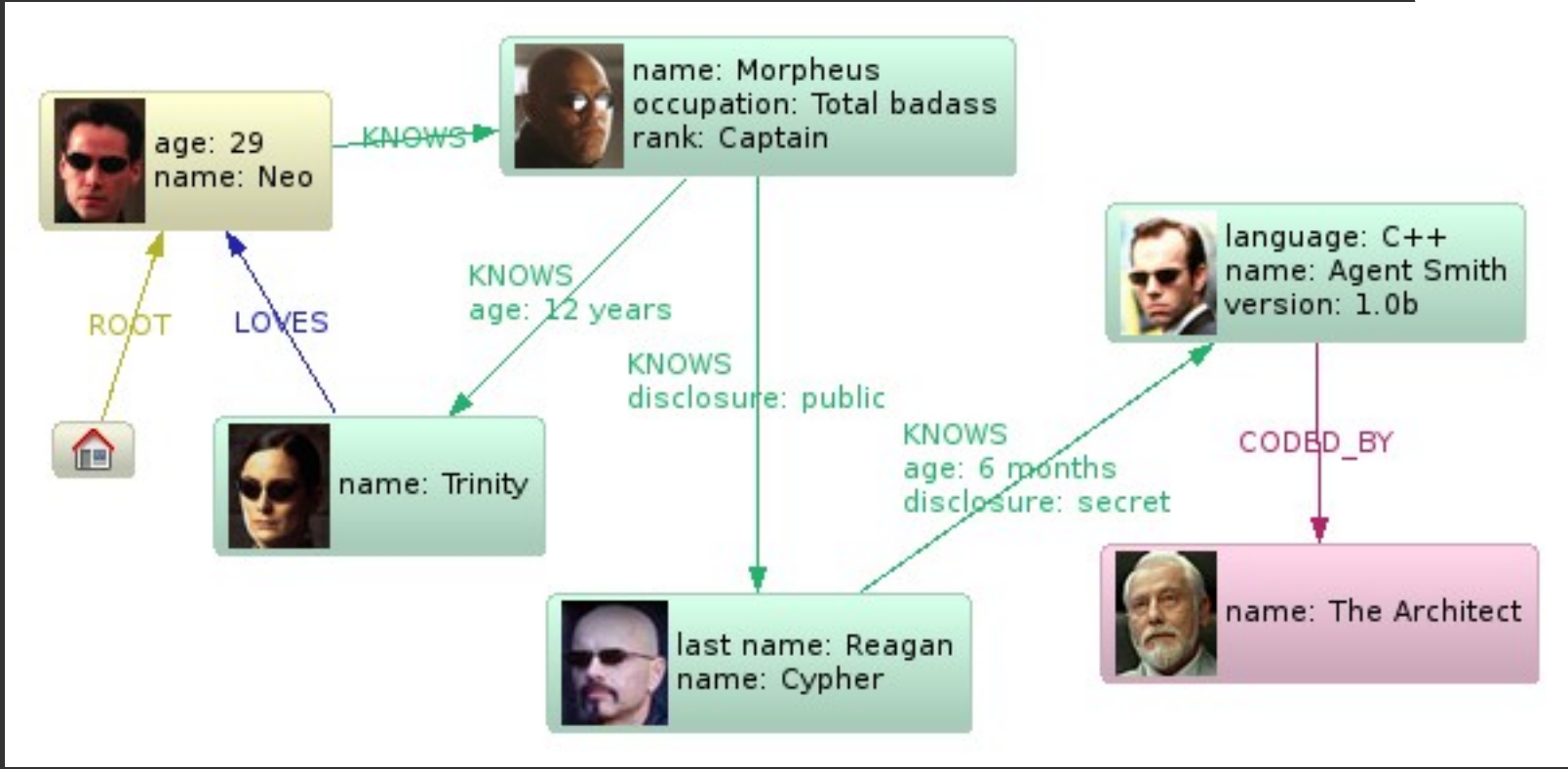
The Neo4j model: Property Graph

Core abstractions:

- Nodes
- Relationships between nodes
- Properties on both



Neo4j – Nodes, Relationships, Prope



- Nodes have different properties
  - Matrix characters: People vs. Programs
- Build structure as you go
  - Who loves Neo?

Building a node space

```
GraphDatabaseService graphDb = ... // Get factory


// Create Thomas 'Neo' Anderson
Node mrAnderson = graphDb.createNode();
mrAnderson.setProperty( "name", "Thomas Anderson" );
mrAnderson.setProperty( "age", 29 );

// Create Morpheus
Node morpheus = graphDb.createNode();
morpheus.setProperty( "name", "Morpheus" );
morpheus.setProperty( "rank", "Captain" );
morpheus.setProperty( "occupation", "Total bad ass" );

// Create a relationship representing that they know each other
mrAnderson.createRelationshipTo( morpheus, RelTypes.KNOWS );
// ...create Trinity, Cypher, Agent Smith, Architect similarly
```

Building a node space

```
GraphDatabaseService graphDb = ... // Get factory
Transaction tx = graphdb.beginTx();

// Create Thomas 'Neo' Anderson
Node mrAnderson = graphDb.createNode();
mrAnderson.setProperty( "name", "Thomas Anderson" );
mrAnderson.setProperty( "age", 29 );

// Create Morpheus
Node morpheus = graphDb.createNode();
morpheus.setProperty( "name", "Morpheus" );
morpheus.setProperty( "rank", "Captain" );
morpheus.setProperty( "occupation", "Total bad ass" );

// Create a relationship representing that they know each other
mrAnderson.createRelationshipTo( morpheus, RelTypes.KNOWS );
// ...create Trinity, Cypher, Agent Smith, Architect similarly
tx.commit();
```

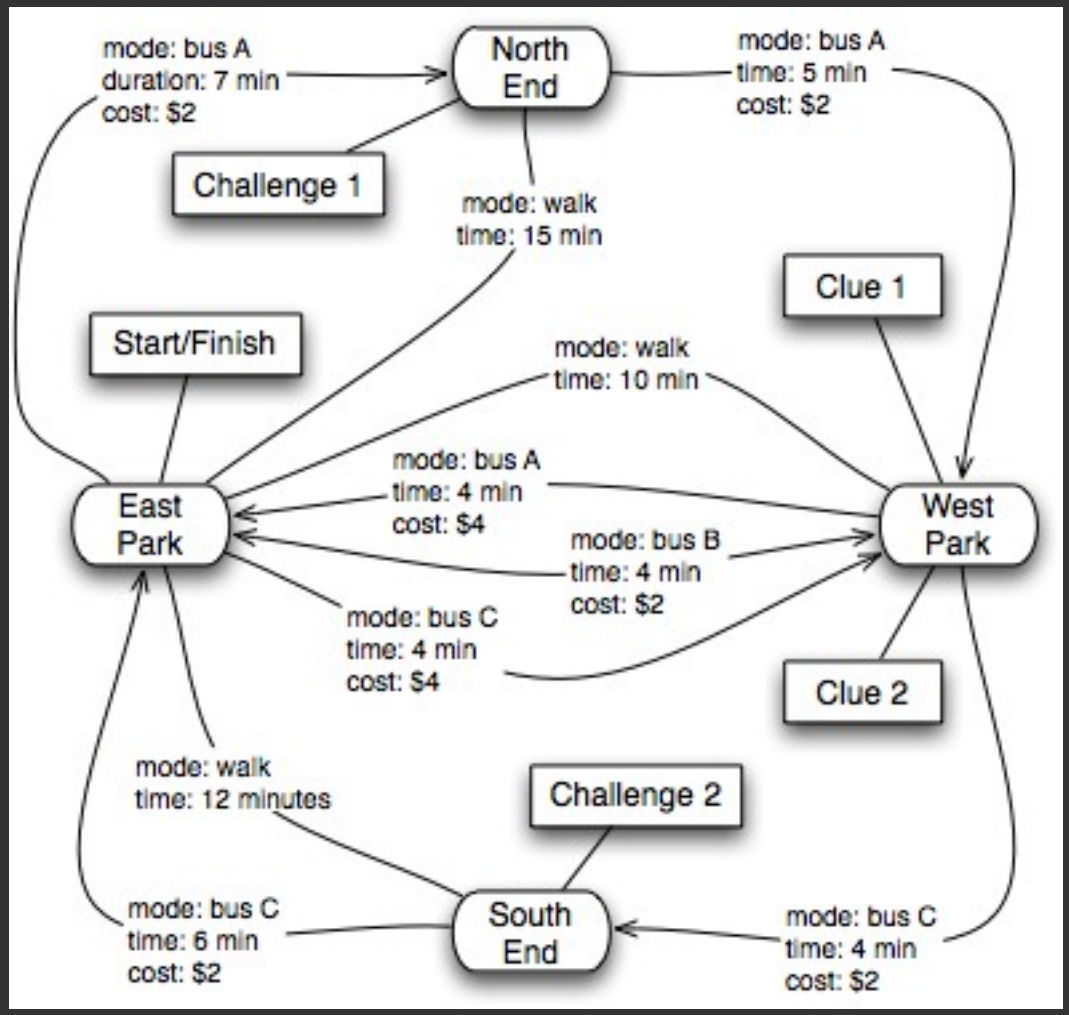
Code (2): Traversing a node space

```
// Instantiate a traverser that returns Mr Anderson's friends
Traverser friendsTraverser = mrAnderson.traverse(
    Traverser.Order.BREADTH_FIRST,
    StopEvaluator.END_OF_GRAPH,
    ReturnableEvaluator.ALL_BUT_START_NODE,
    RelTypes.KNOWS,
    Direction.OUTGOING );

// Traverse the node space and print out the result
System.out.println( "Mr Anderson's friends:" );
for ( Node friend : friendsTraverser )
{
    System.out.printf( "At depth %d => %s%n",
        friendsTraverser.currentPosition().getDepth(),
        friend.getProperty( "name" ) );
}
```

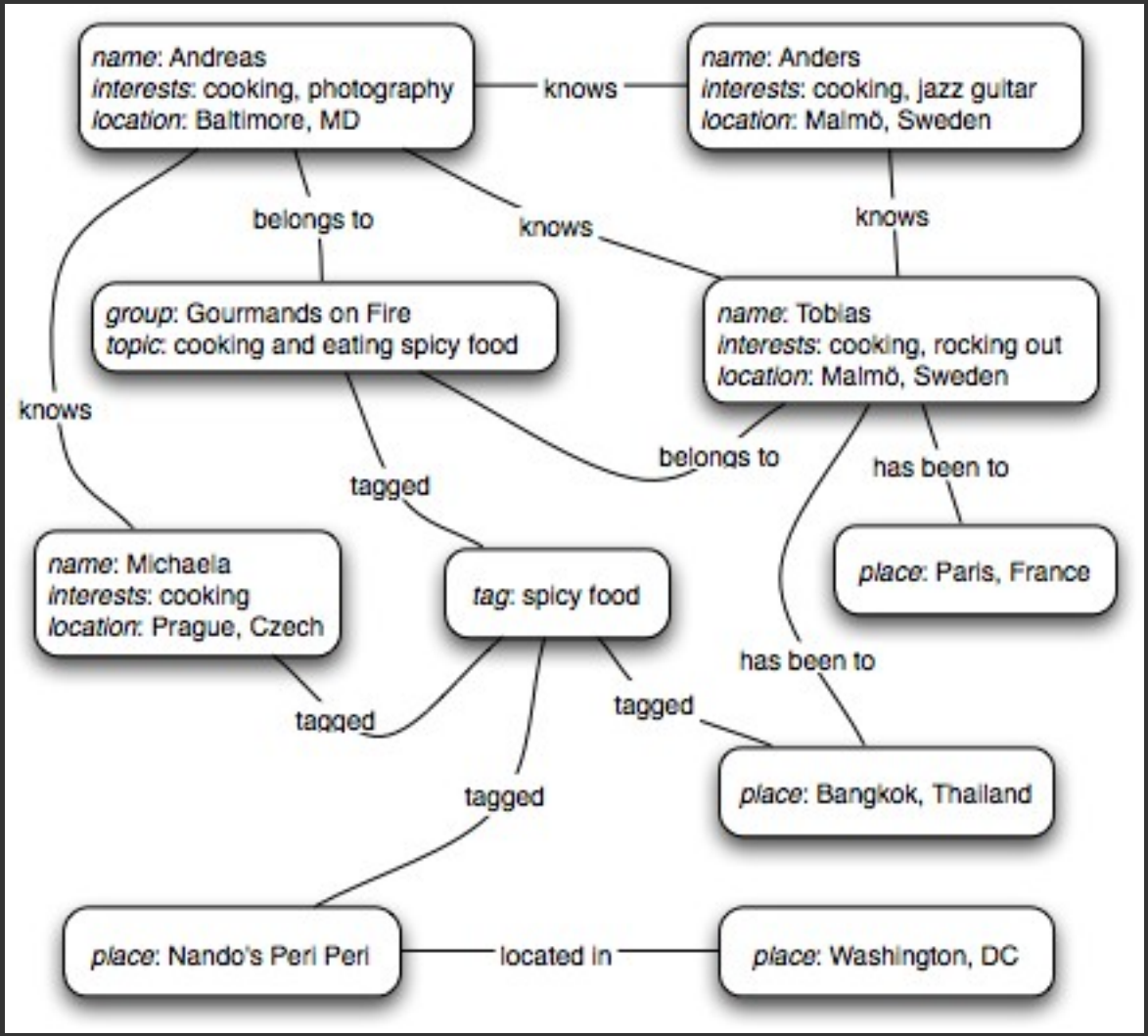
Ruby

```
gem install neo4j

require "rubygems"
require 'neo4j'

class Person
  include Neo4j::NodeMixin
  property :name, :age, :occupation
  index :name
  has_n :friends
end

Neo4j::Transactoin.run do
  neo = Person.new :name=>'Neo', :age=>29
  morpheus = Person.new :name=>'Morpheus', :occupation=>'badass'
  neo.friends << morpheus
end

neo.friends.each {|p|...}
```

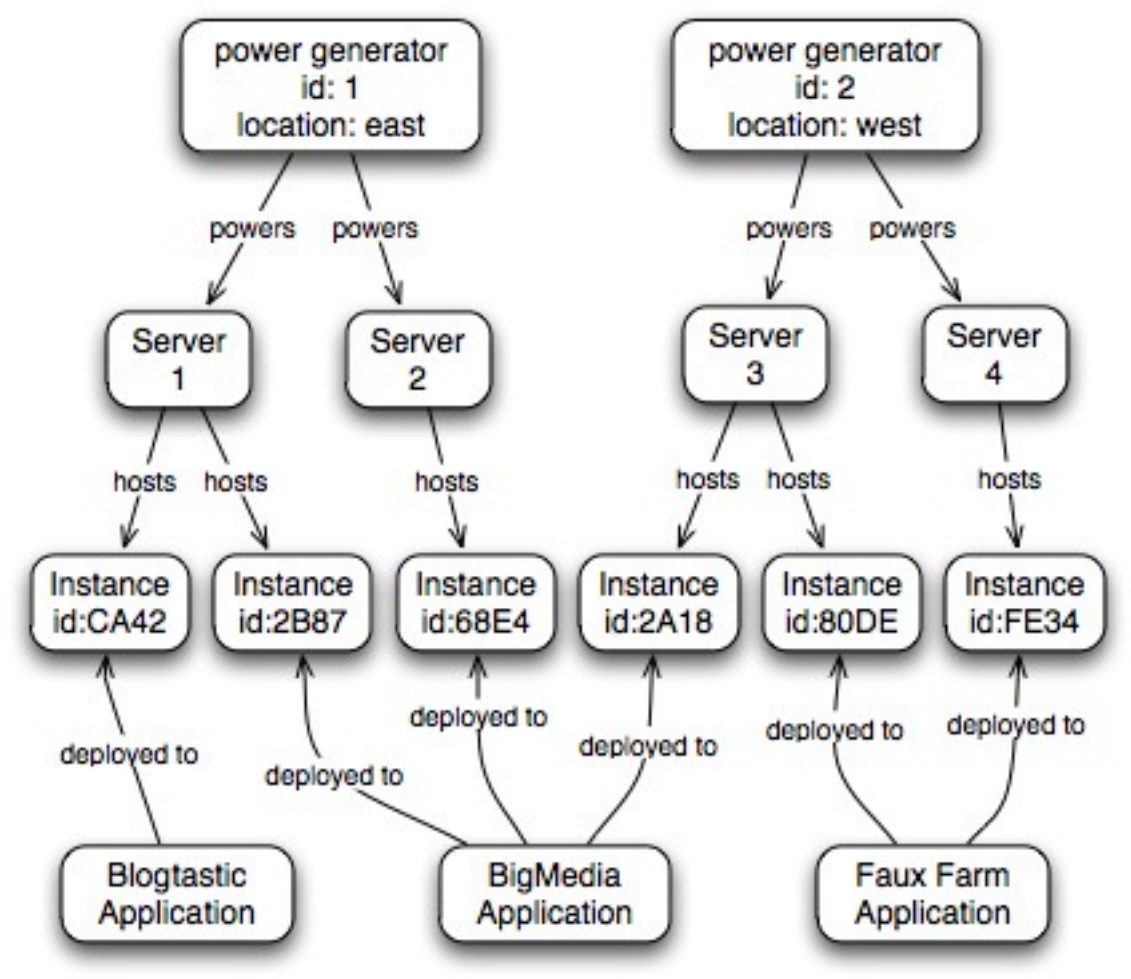
Routing


mode: bus A
duration: 7 min
cost: $2
North End
mode: bus A
time: 5 min
cost: $2
Challenge 1
mode: walk
time: 15 min
Clue 1
Start/Finish
mode: walk
time: 10 min
mode: bus A
time: 4 min
cost: $4
East Park
West Park
mode: bus B
time: 4 min
cost: $2
mode: bus C
time: 4 min
cost: $4
Clue 2
mode: walk
time: 12 minutes
Challenge 2
mode: bus C
time: 6 min
cost: $2
South End
mode: bus C
time: 4 min
cost: $2

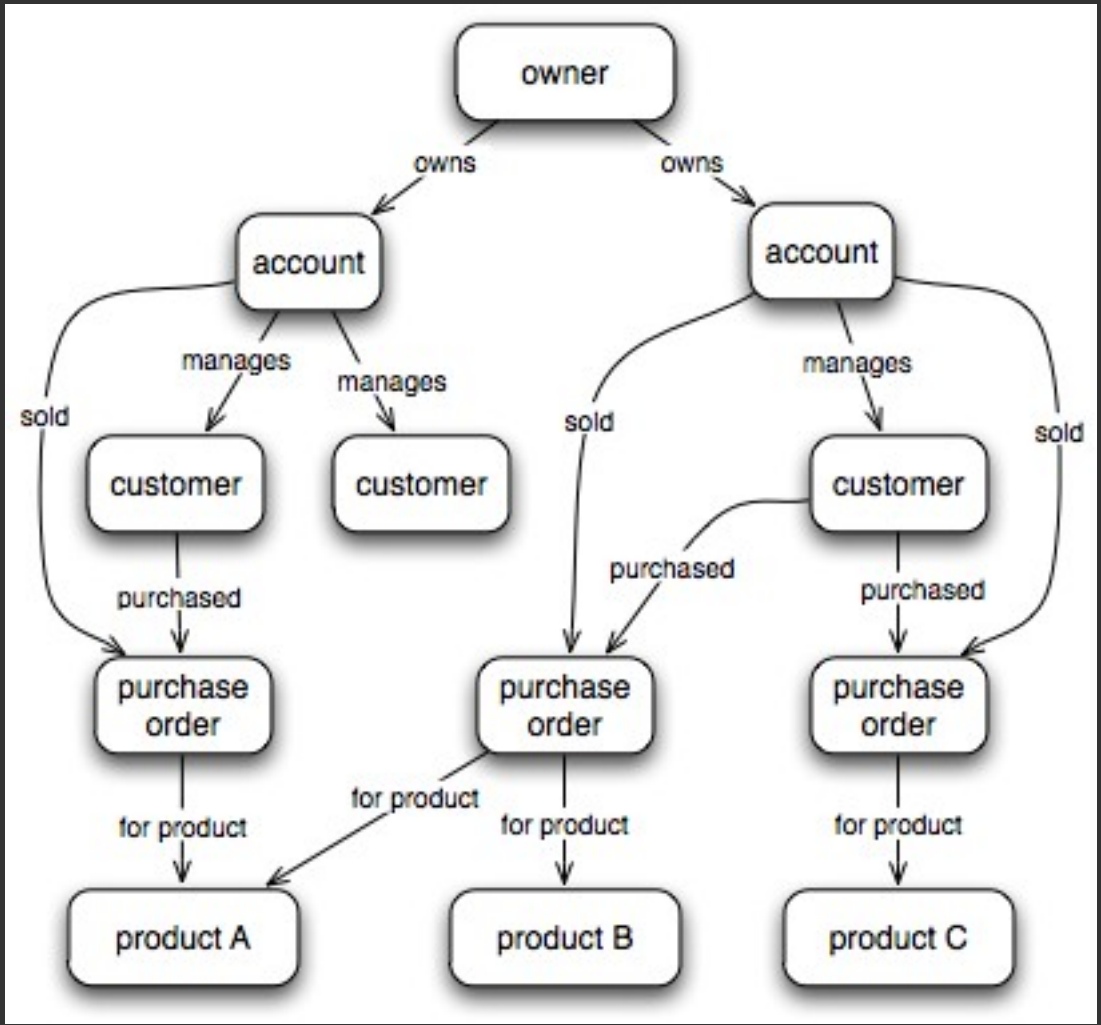
Social graphs



Impact, Dependency Analysis



Master Data Management



Why Spatial?

- Complex data
  - Multiple indexing (domain, Spatial, temporal)
- Location entering many domains
- GIS going mainstream, topologies explode
- No good systems out there
- Proprietary stacks rule (ESRI, Oracle)
- Open Government Data
- Shapefiles suck.

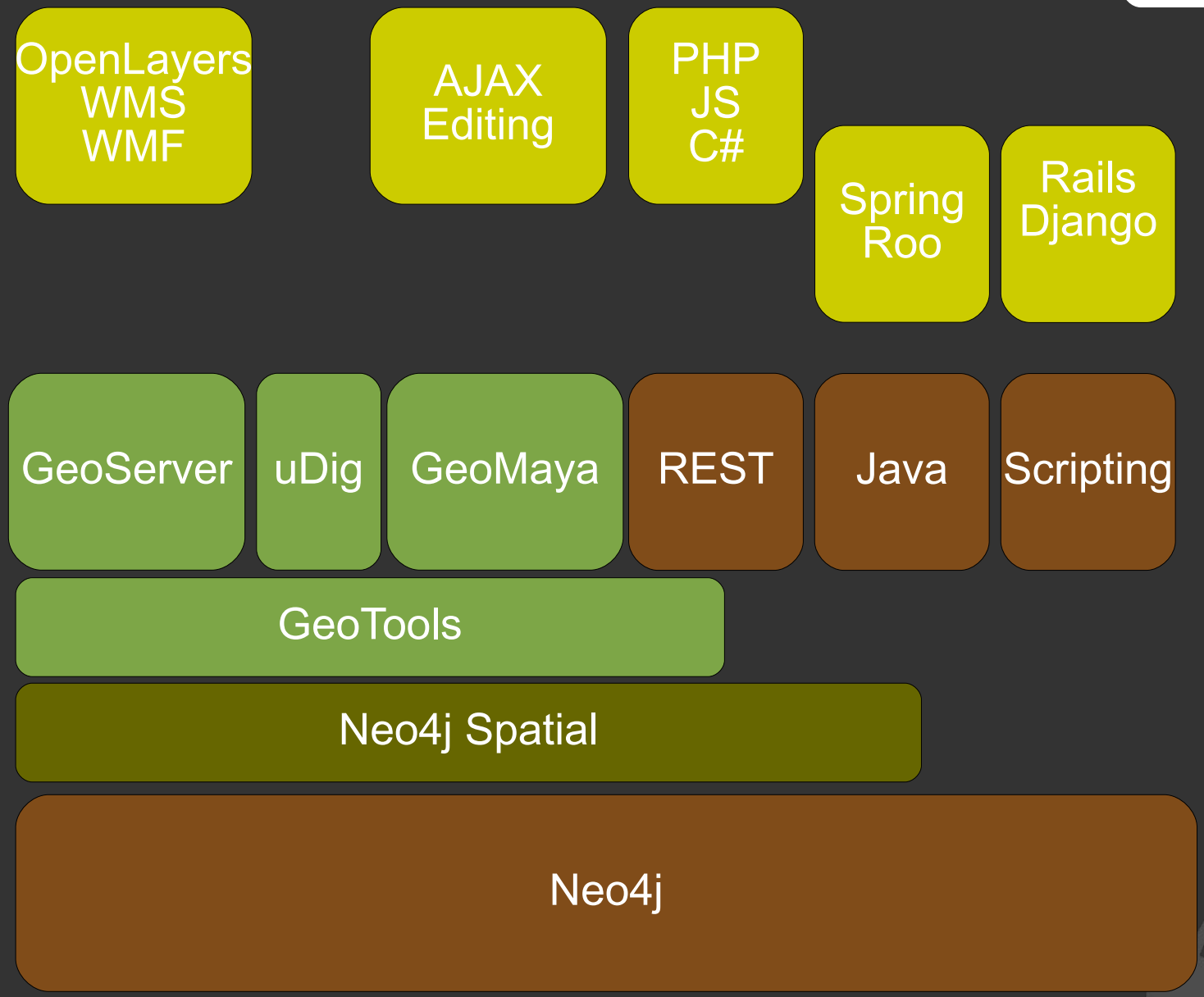
Persistence backends in GIS

- Shapefiles
- PostGIS
- MySQL
- Oracle Spatial
- ESRI
- GeoCouch
- Cassandra (?)
- Neo4j Spatial

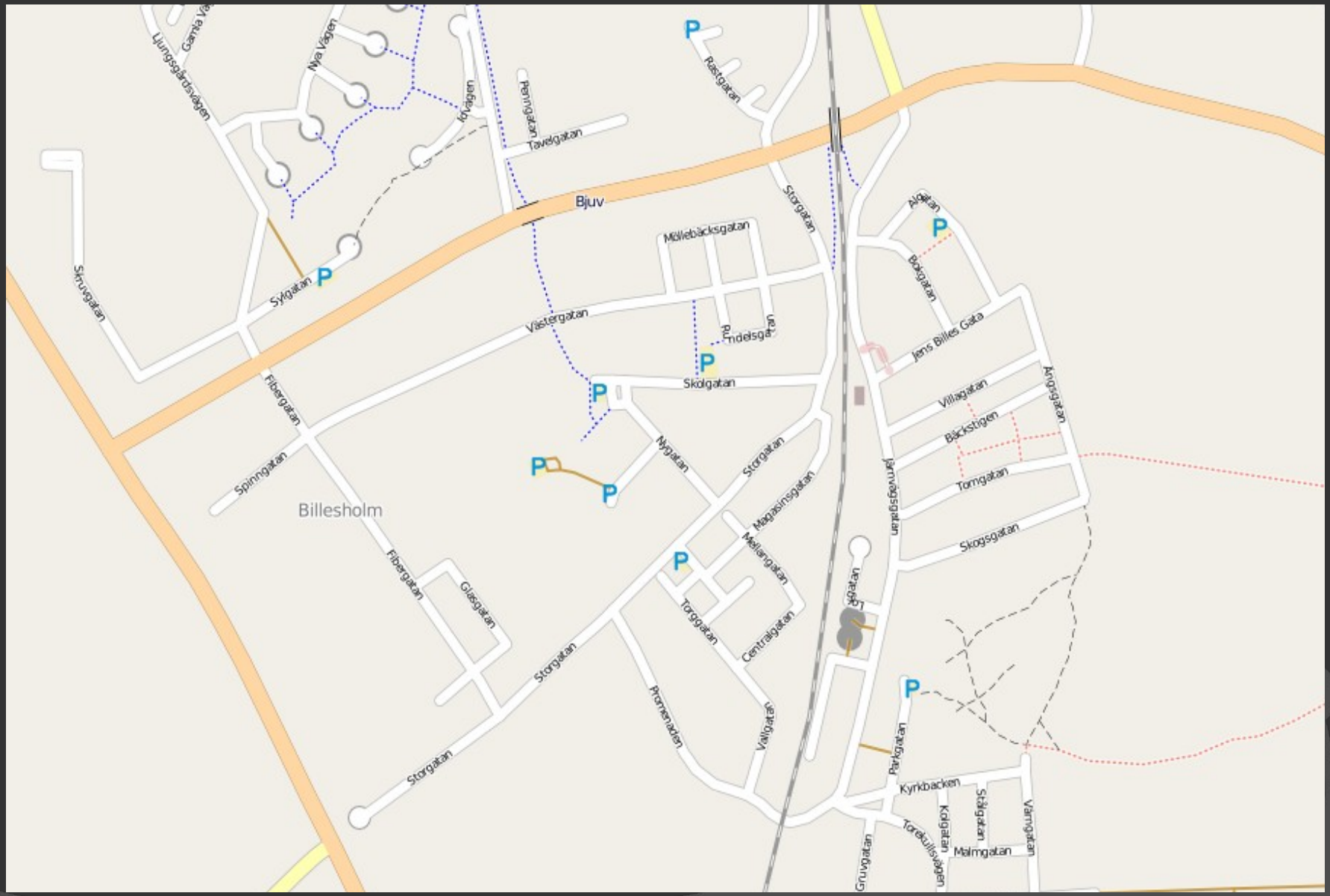
Current challenges in Spatial

- Domain and Spatial interconnections
- Unstructured domain data
- Routing
- Topology handling
- No good OSS full GIS stack

The Neo4j Spatial stack



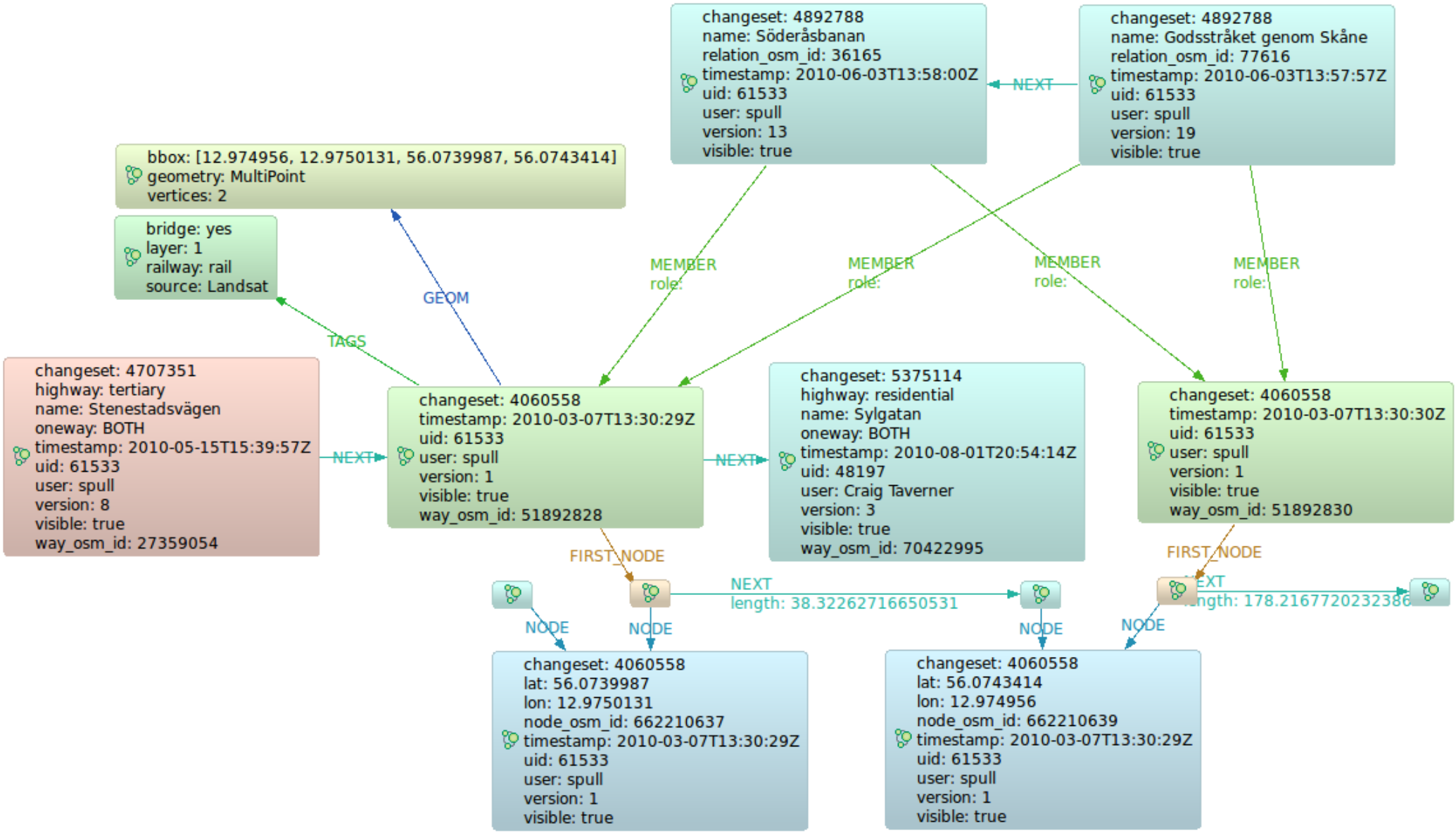
OpenStreetMap



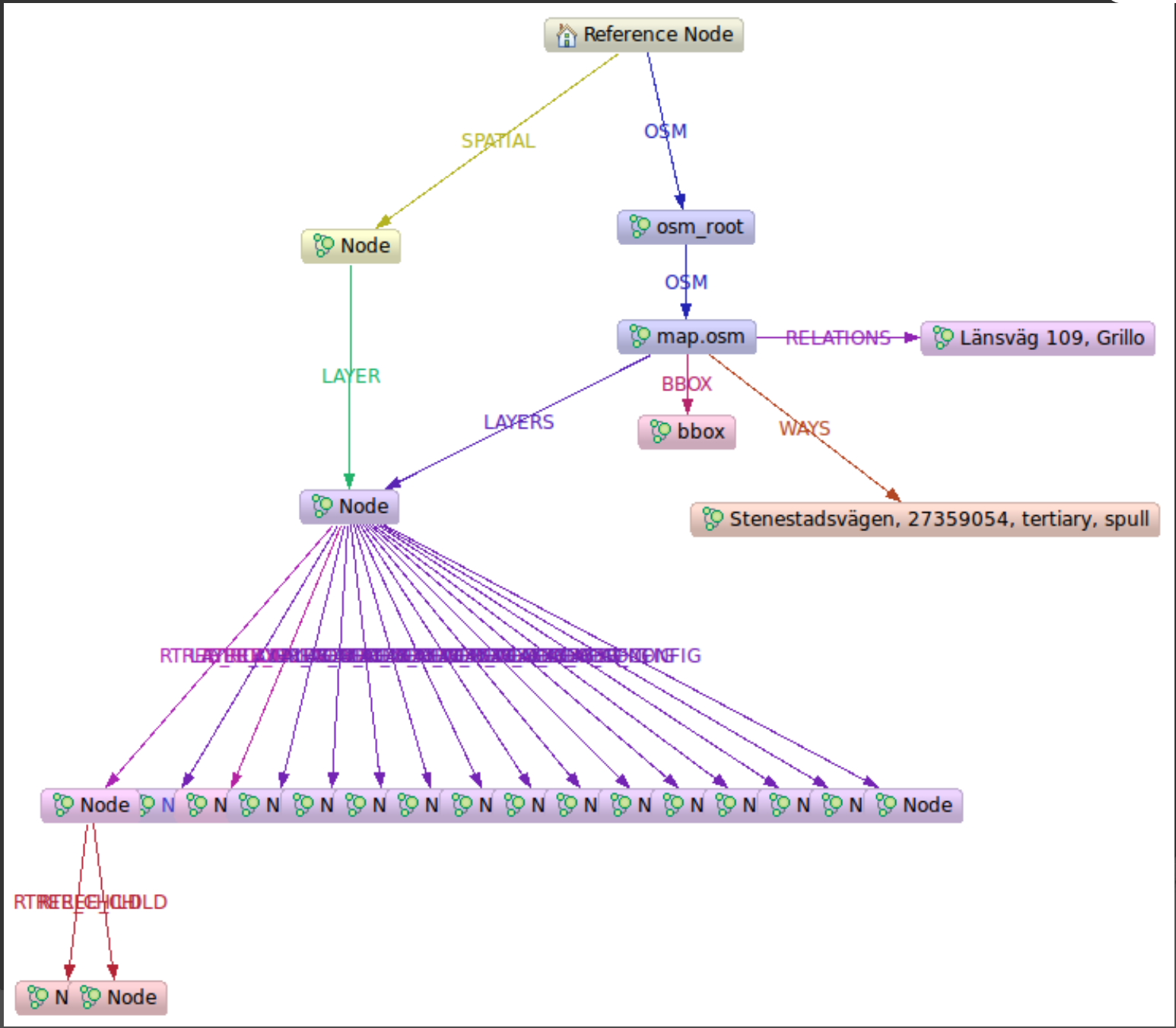
The OpenStreetMap dataset

- Wiki for Spatial info
- Freely available data
- Very unstructured, free tagging
  - Points, Ways, Relations, Tags, Changesets
- Changes can be pushed back
  - Used for other purposes
- Great coverage in interesting places (towns, disasters etc)

OpenStreetMap

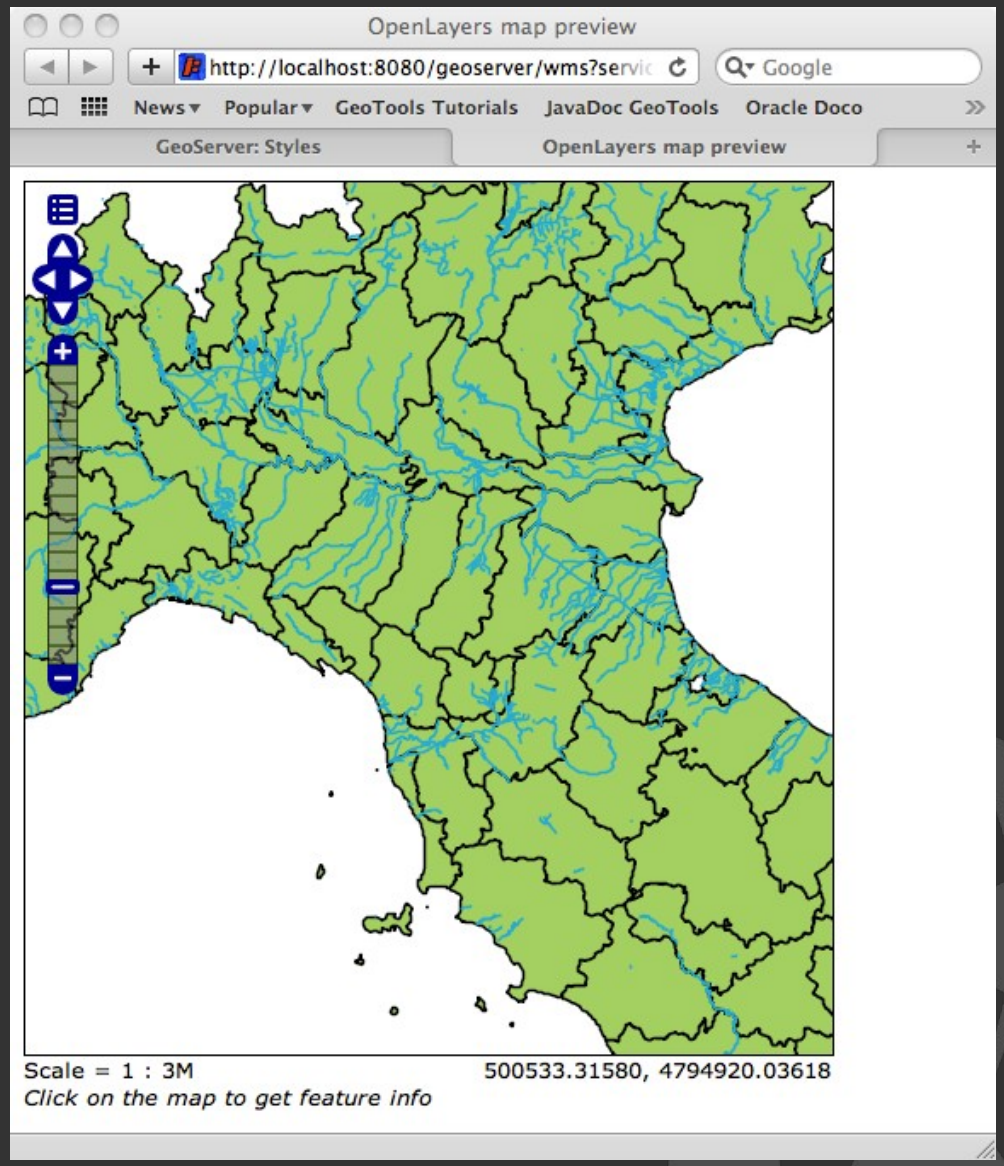


OpenStreetMap

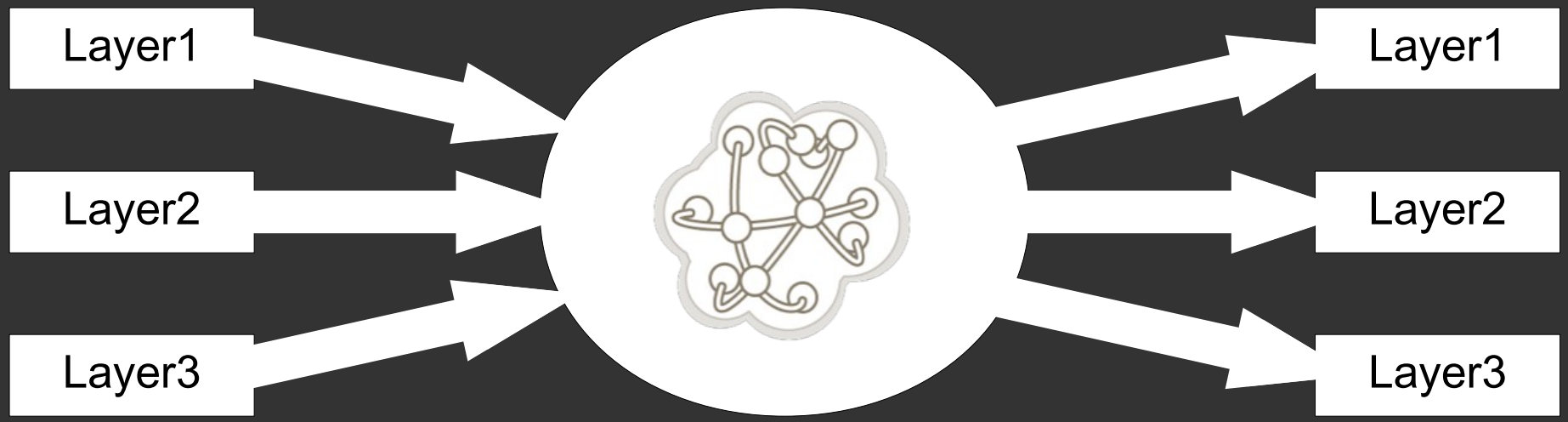


GSoC 2010

- Davide Savazzi
- Geotools & GeoServer
- Routing
- uDig

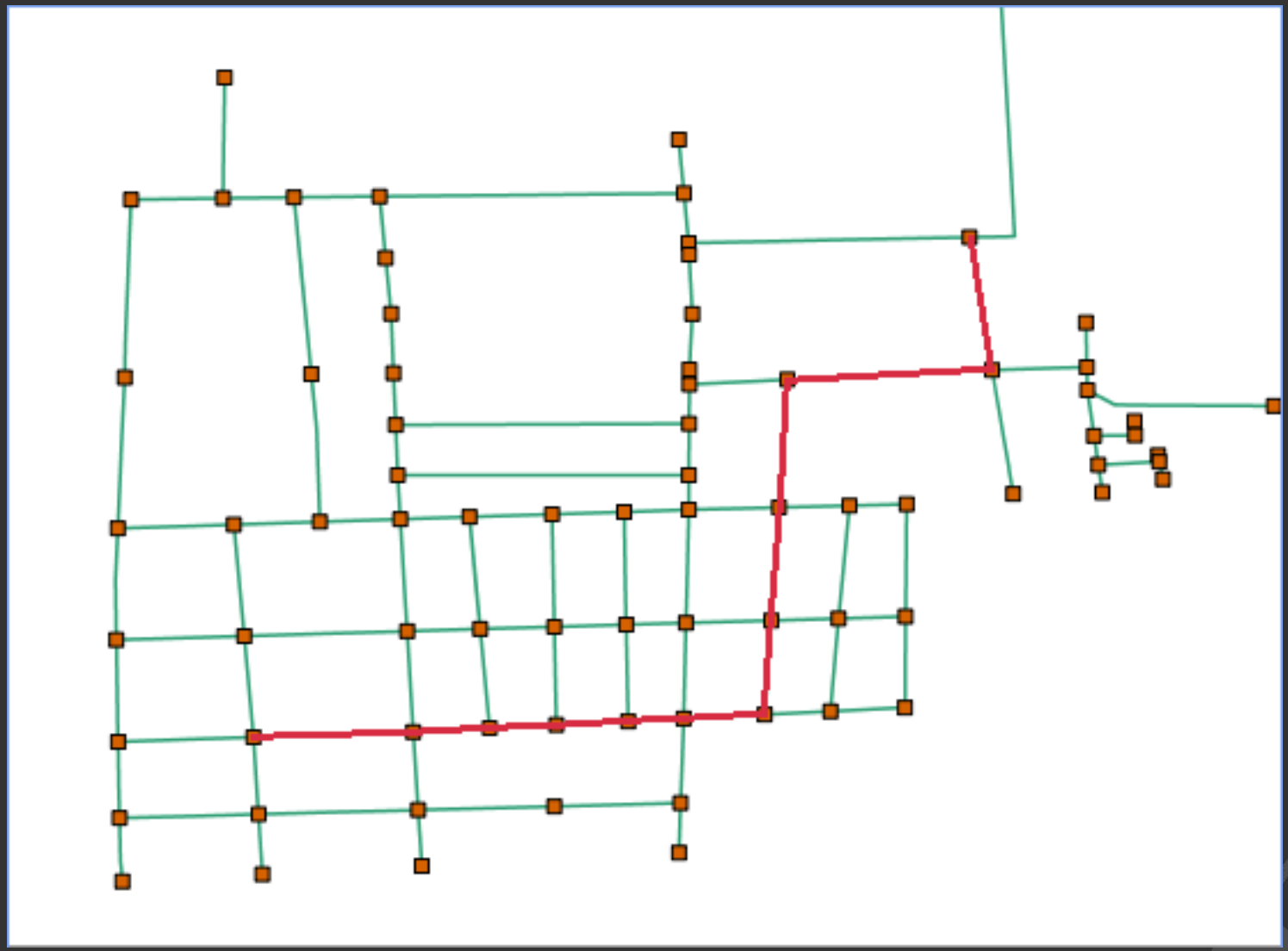


Connecting and Splitting



- Why have layers at all?
  - Simpler renderers
  - Historical
  - Data sources

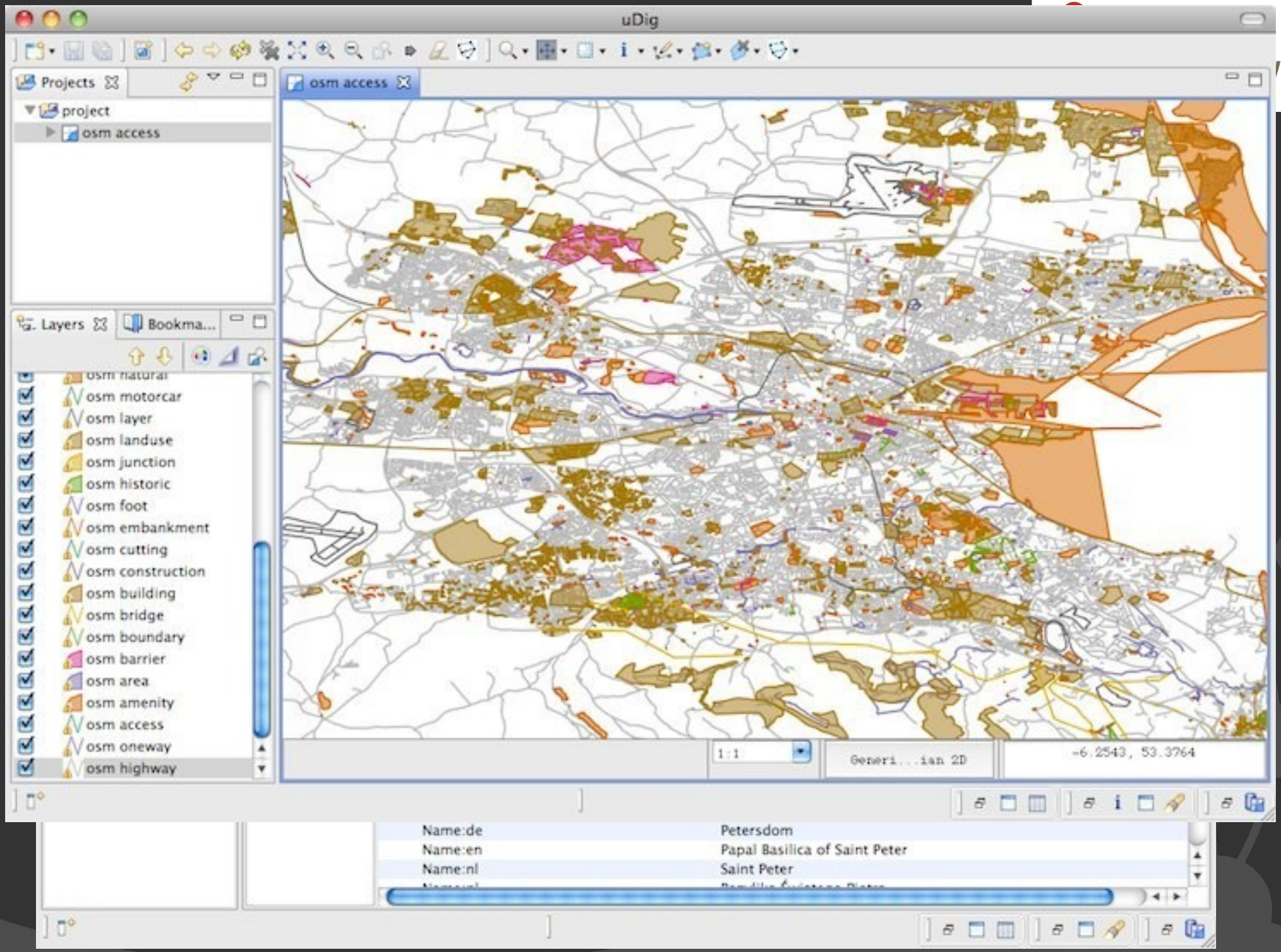
GSoC 2010 - Routing



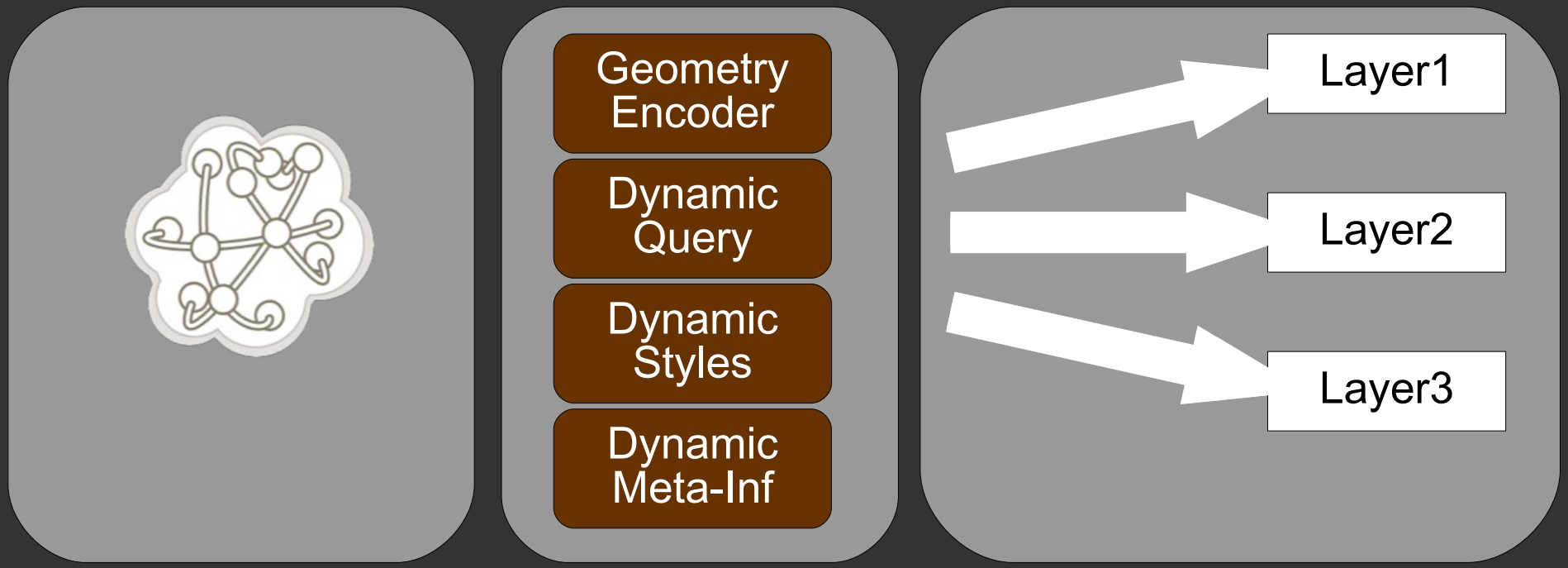
Connecting and Splitting

- Routing

- OSM Dynamic Layers


uDig
Projects
project
osm access
Layers
Bookma...
osm motorcar
osm layer
osm landuse
osm junction
osm historic
osm foot
osm embankment
osm cutting
osm construction
osm building
osm bridge
osm boundary
osm barrier
osm area
osm amenity
osm access
osm oneway
osm highway
1:1
Generi...ian 2D
-6.2543, 53.3764
Name:de
Petersdom
Name:en
Papal Basilica of Saint Peter
Name:nl
Saint Peter

Neo4j dynamic layers

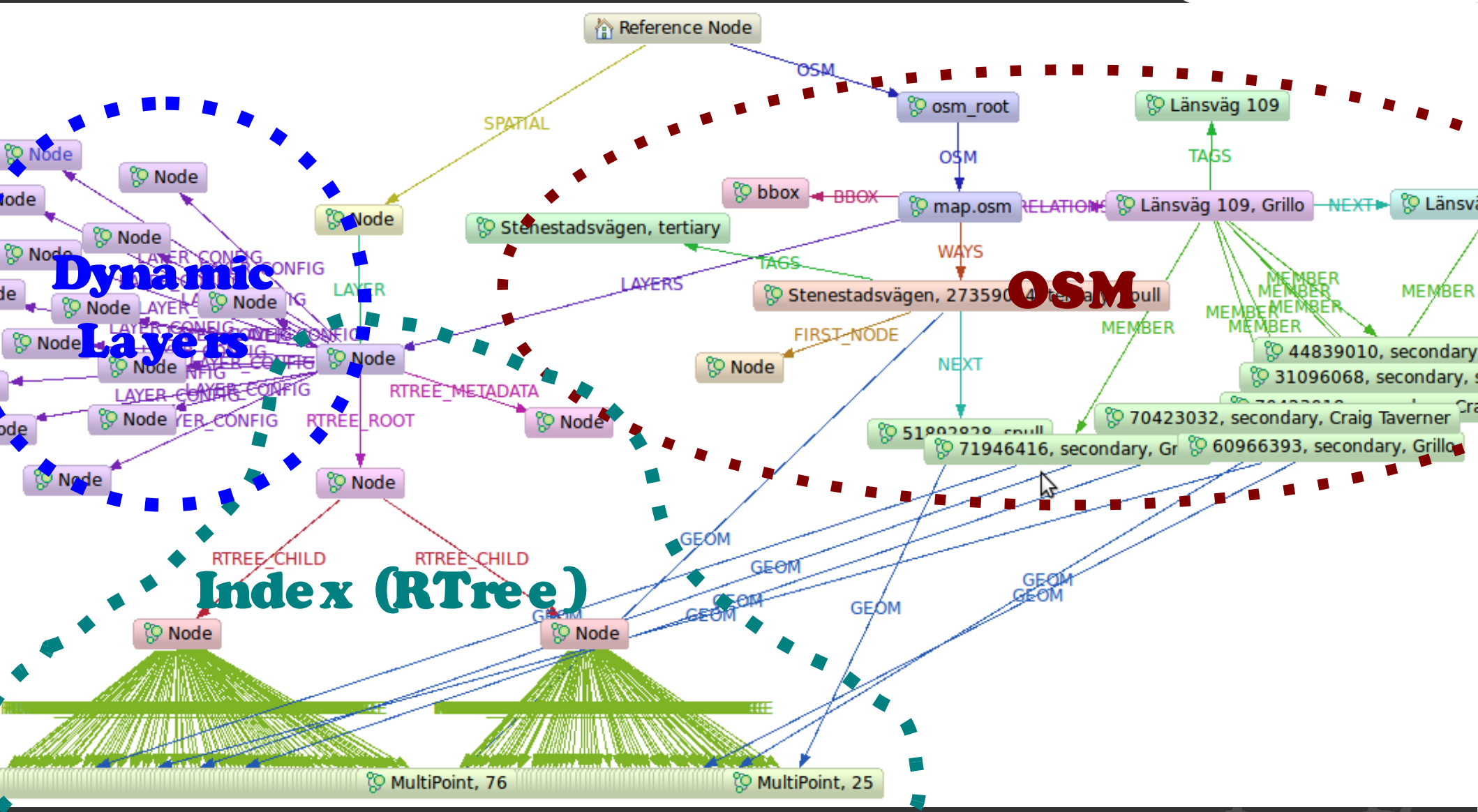


Connected domain data

Neo4j Spatial

GIS and Spatial stacks

OpenStreetMap



Dynamic Layers

Projects

project

highway-footway

Layers | Bookmarks

- highway-secondary
- highway-tertiary
- highway-residential
- highway-cycleway
- highway-footway
- highway-track
- highway-path
- highway-unclassified
- highway
- railway
- amenity-parking

highway-footway

Tavelgatan
Sylgatan
Mölleb□cksgatan
V□stergatan
Rundelsgatan
Nygatan
Fibergatan
Glasgatan
Tv□rgatan
Promenaden
Vallgatan
Bokgatan
□ngsgatan
J□rnv□gsgatan
Skogsgatan
Parkgatan
Malmgatan
Schaktsv□gen

1:8,91 | WGS84(DD) | 12.9708, 56.0497

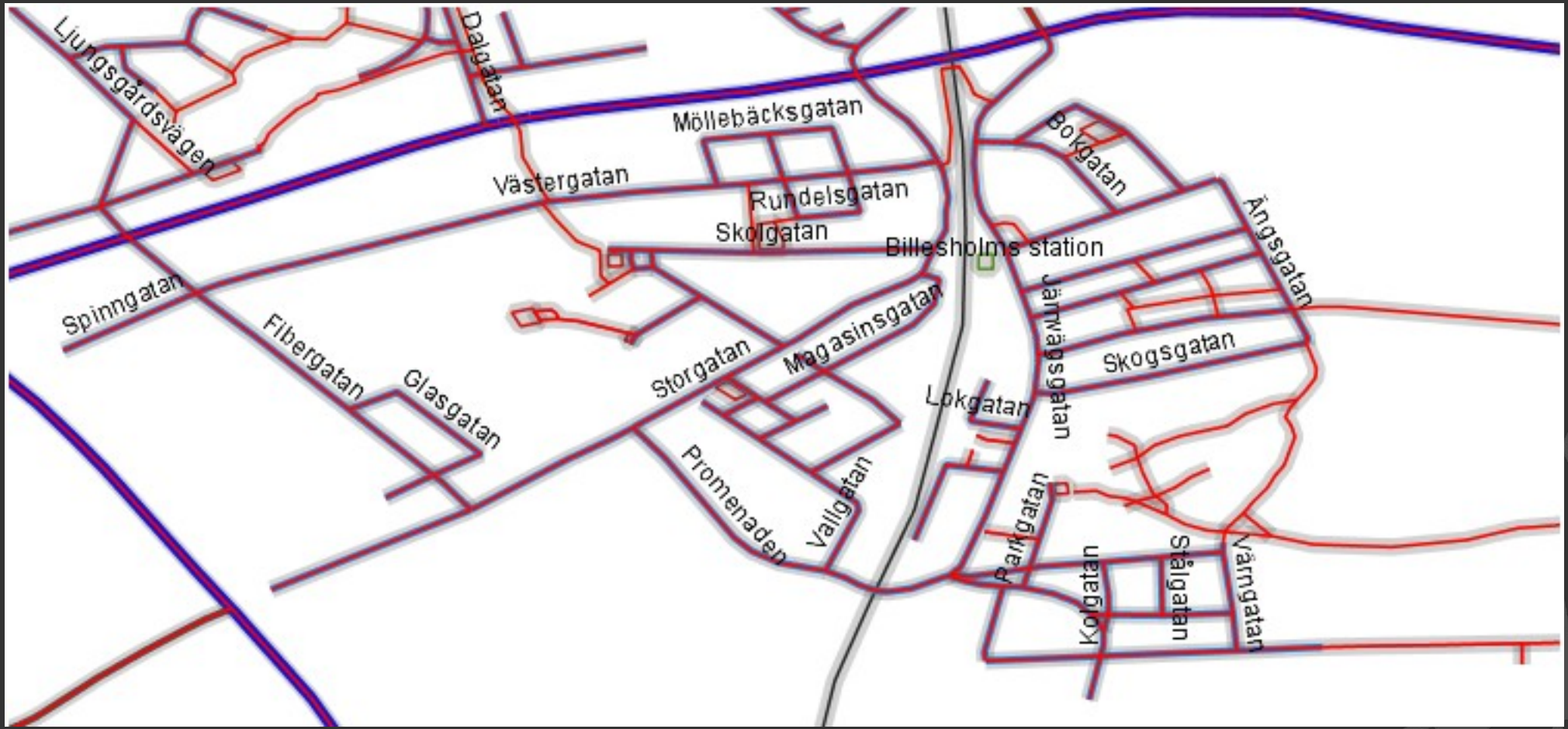
Catalog | Web | Search | Table | Error Log

Any | search | A

Features Selected: 1

FID	name	amenity	area	bicycle	highway	railway
highway-residential.40	Skolgatan				residential	
highway-residential.41	Nygatan				residential	
highway-residential.42	⋄ngsgatan				residential	
highway-residential.43	J⋄rnv⋄gsgatan				residential	
highway-residential.44	Magasinsgatan				residential	
highway-residential.45	Villagatan				residential	
highway-residential.46	Centralgatan				residential	

Dynamic Layers



Dynamic Layers

Future

- Complex spatial mapping and analytics made easy
- Editing
  - Fine Grained Geotools Feature Editing
  - OSM Editor
- OSM
  - Caching sub-graphs (desktop & mobile)
  - More Dynamic Layers & Shapefile export
- Topology
  - Persist all topological results in graph
- Benchmarking & Performance
  - Improved indexing
  - Composite index

API References

- Wiki, Code, API references
  - http://wiki.neo4j.org/content/Neo4j_Spatial
  - http://github.com/neo4j/neo4j-spatial
  - http://components.neo4j.org/neo4j-spatial
  - Mailing list: neo4j@lists.neo4j.org
  - http://neo4j.org/community/list/

Questions?

Image credit: lost again! Sorry :(


neo technology
value in relationships