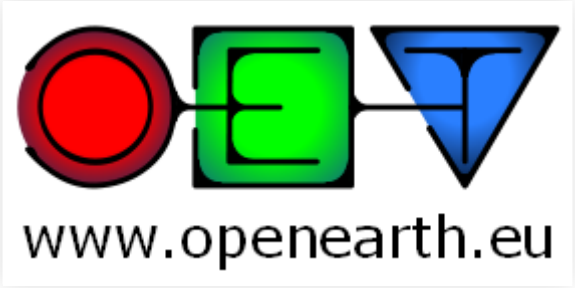
OpenGIS Services

@ Delft Software Days 2014

Fedor Baart

fedor.baart@deltares.nl



Agenda

09:00 - 09:15	Introduction, Fedor Baart
09:15 - 10:30	PostGIS and Qgis, Frank Keppel
10:30 - 11:00	☕
11:00 - 12:30	Gridded data, Giorgio Santinelli
12:30 - 14:00	🍴
14:00 - 15:30	Visualizing with KML, Kees den Heijer
15:30 - 16:00	☕
16:00 - 17:30	Services, Fedor Baart
17:30 - 18:30	🍸

History

Open Source GIS

1980 Lagrid @ Westervelt

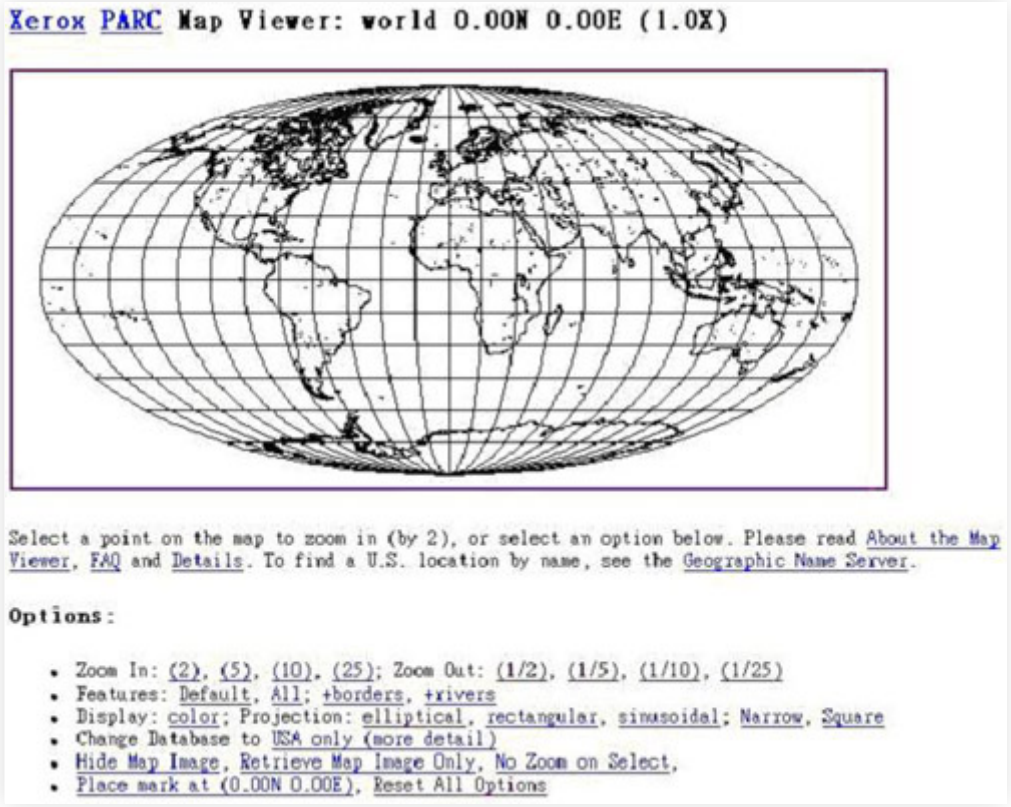
1983 Proj4 @ Evenden

1983 GRASS GIS @ CERL

1994 www

1994 Open Geospatial Consortium

First map

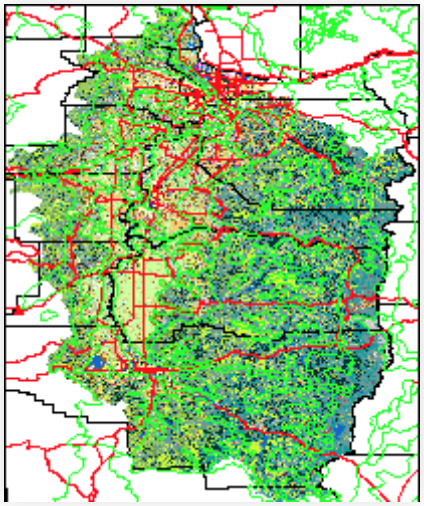


1993 @ Xerox

Mapserver

1994 @ NASA/ForNet (open source since 1999)

First process

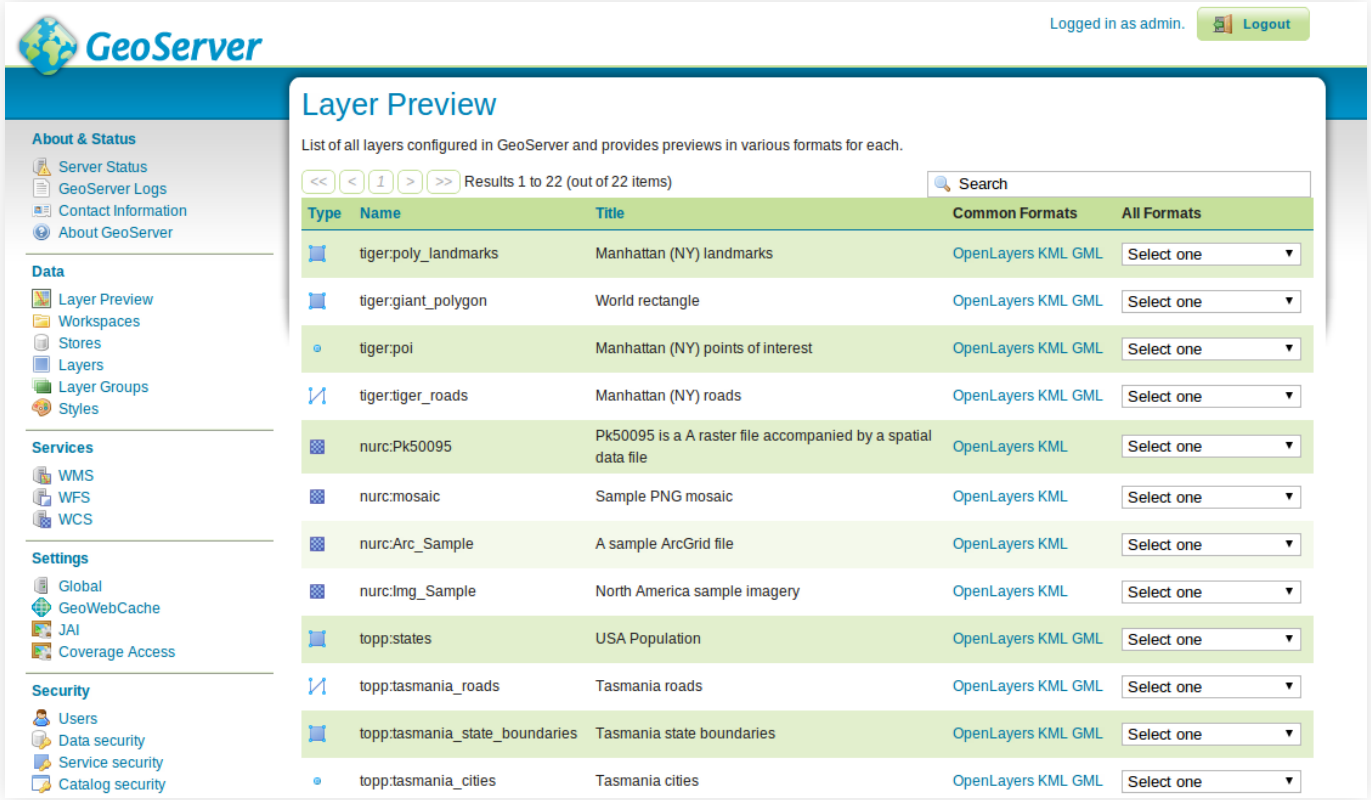


1995 @ Berkeley

Location based services: routing

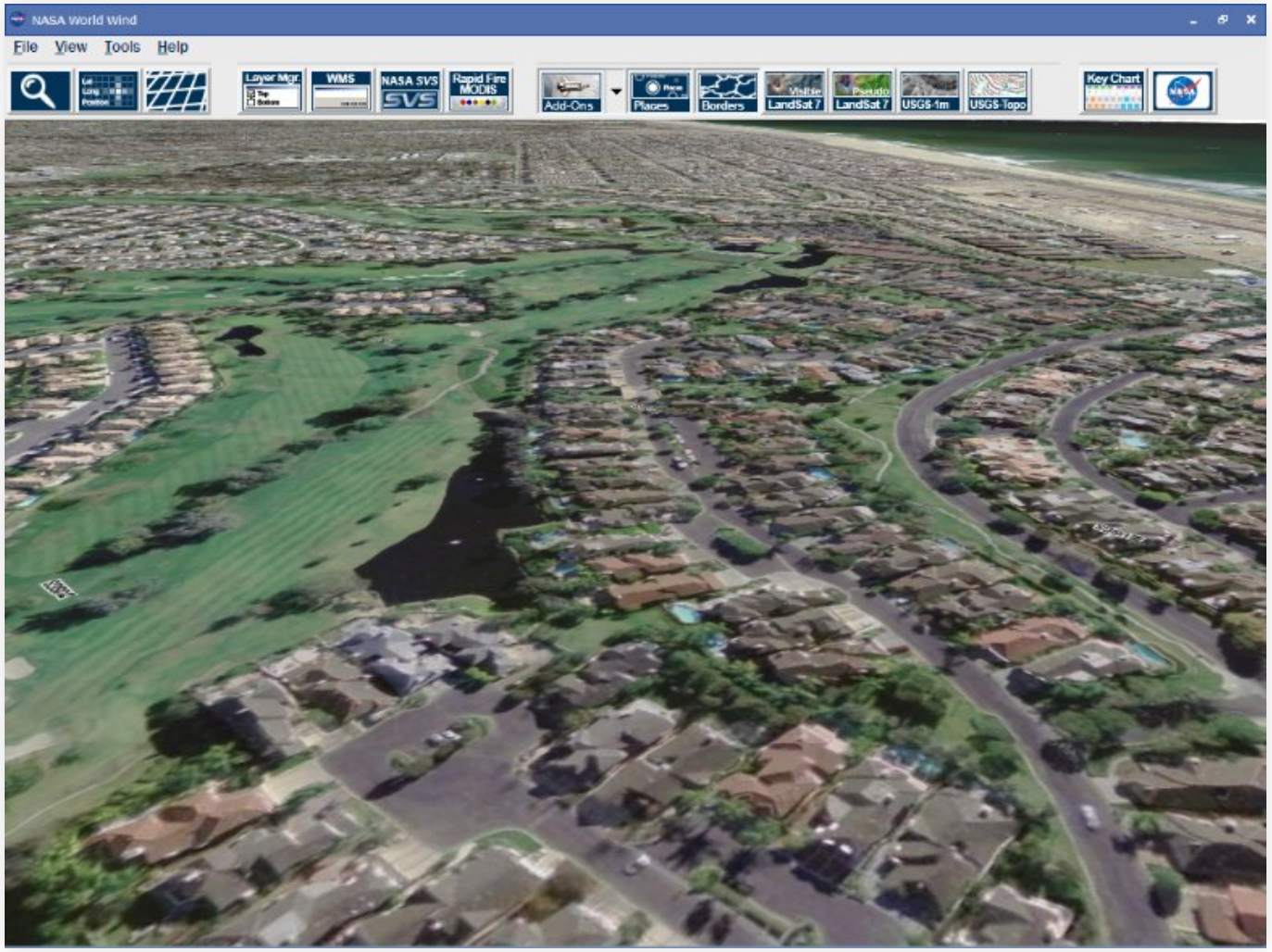
1996 @ Mapquest & Multimap

Spatial querying



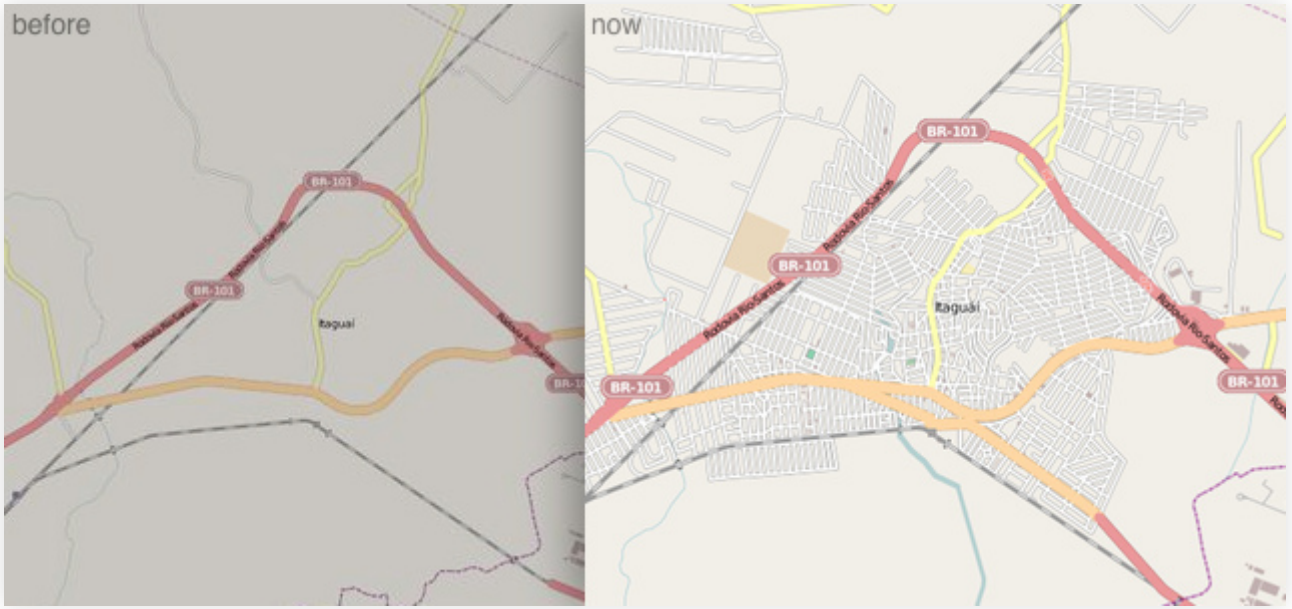
2000 @ Geoserver

NASA World Wind



2003 @ NASA

OpenStreetMap

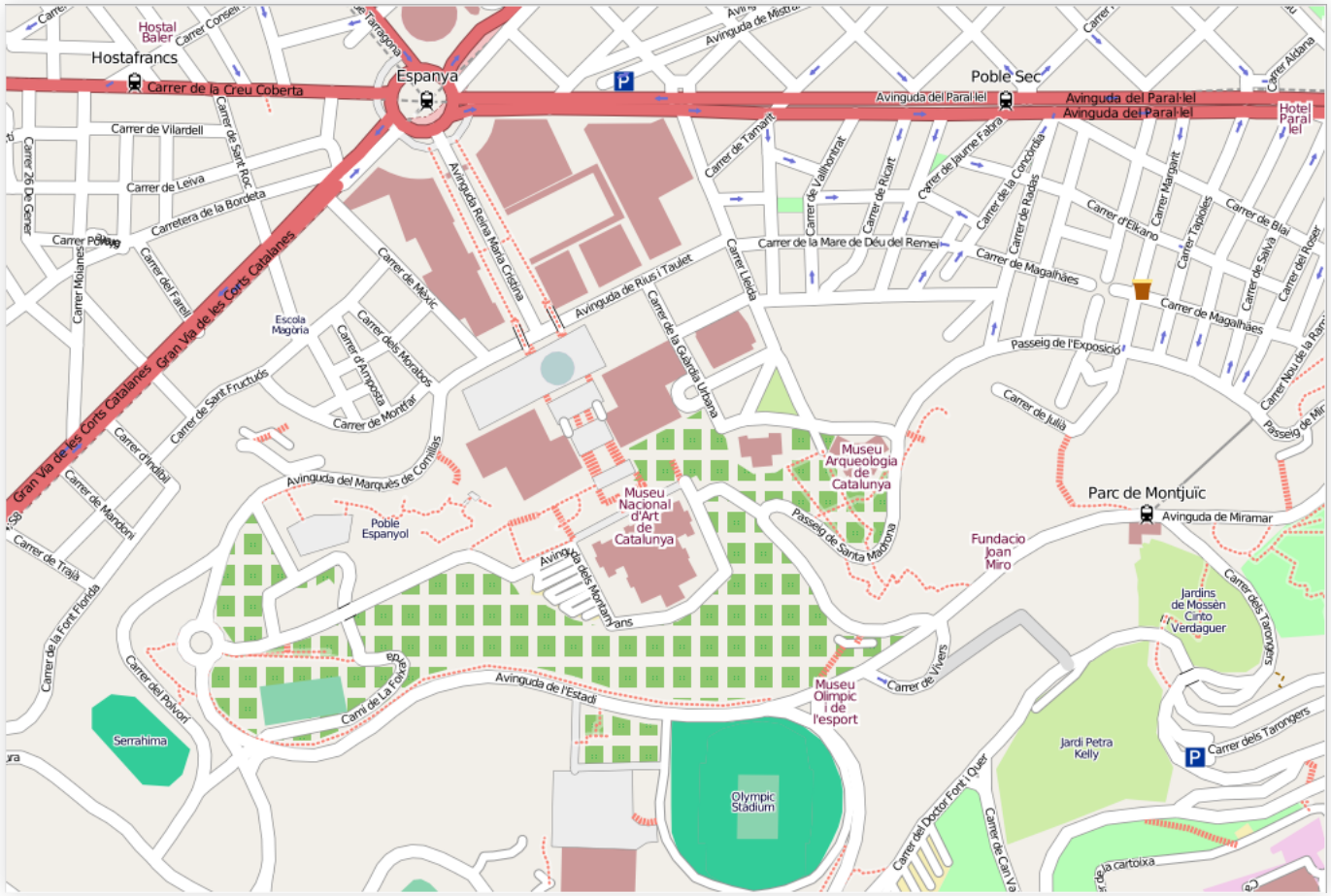


2004 @ Steve Coast

OpenStreetMap

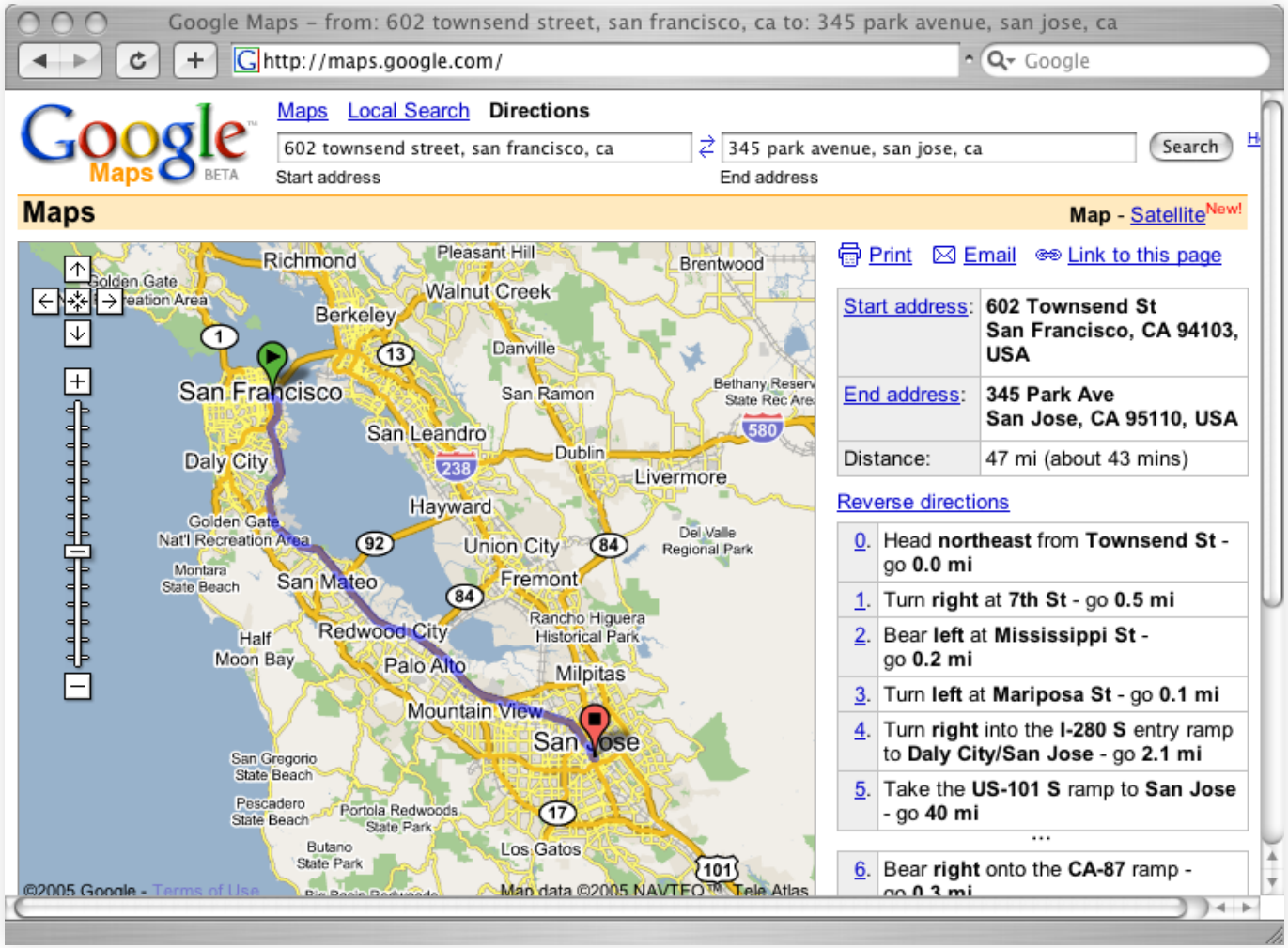
2004 @ Steve Coast

Styling



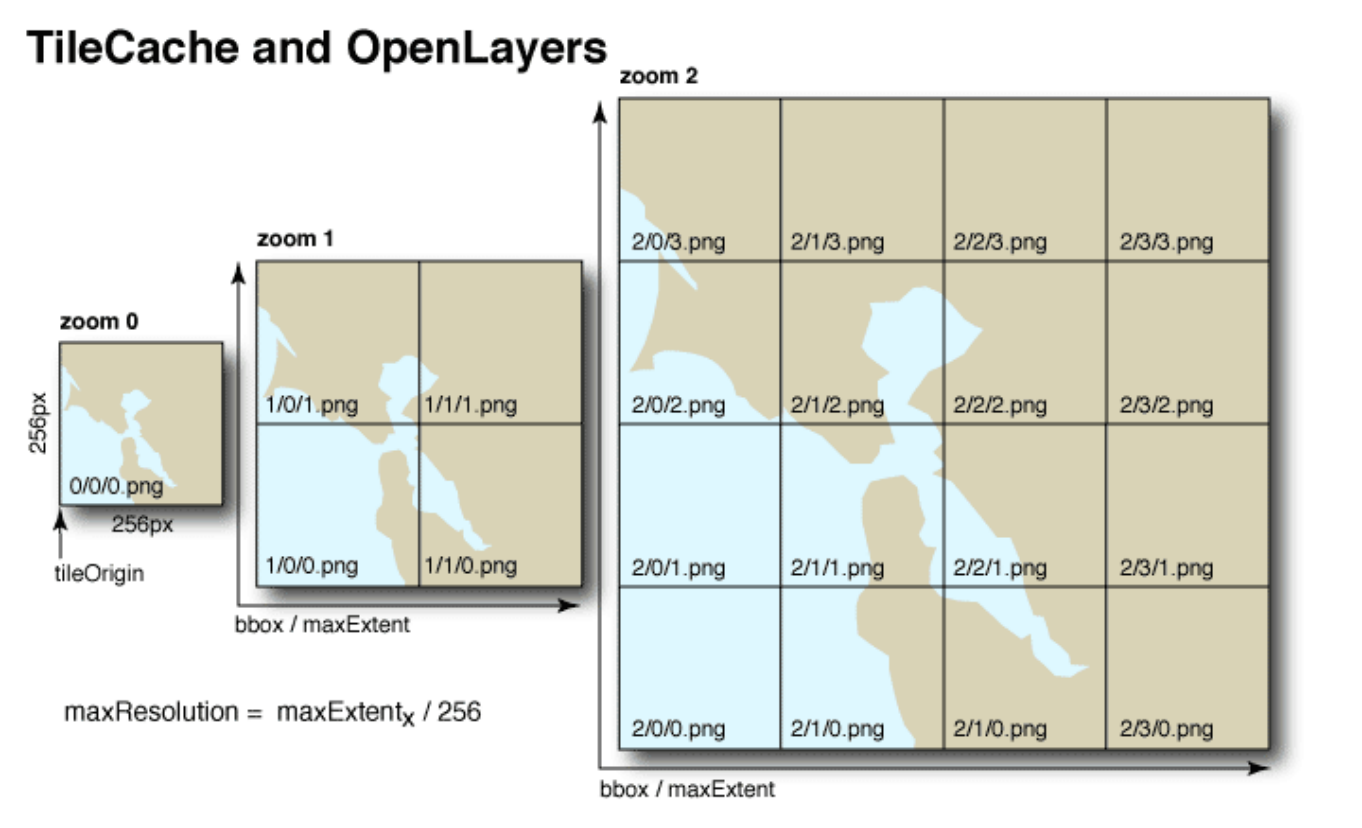
2005 @ Mapnik

Google Maps



2005 @ Google

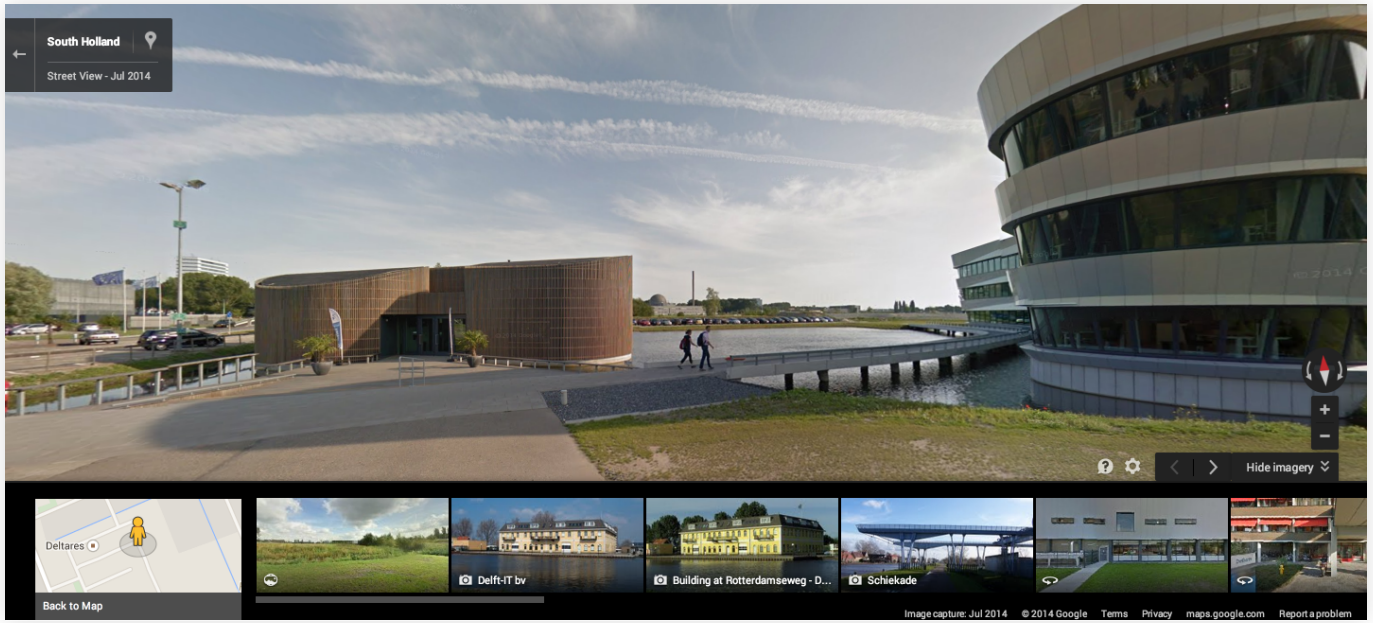
Tilecache



src: renderfast.com

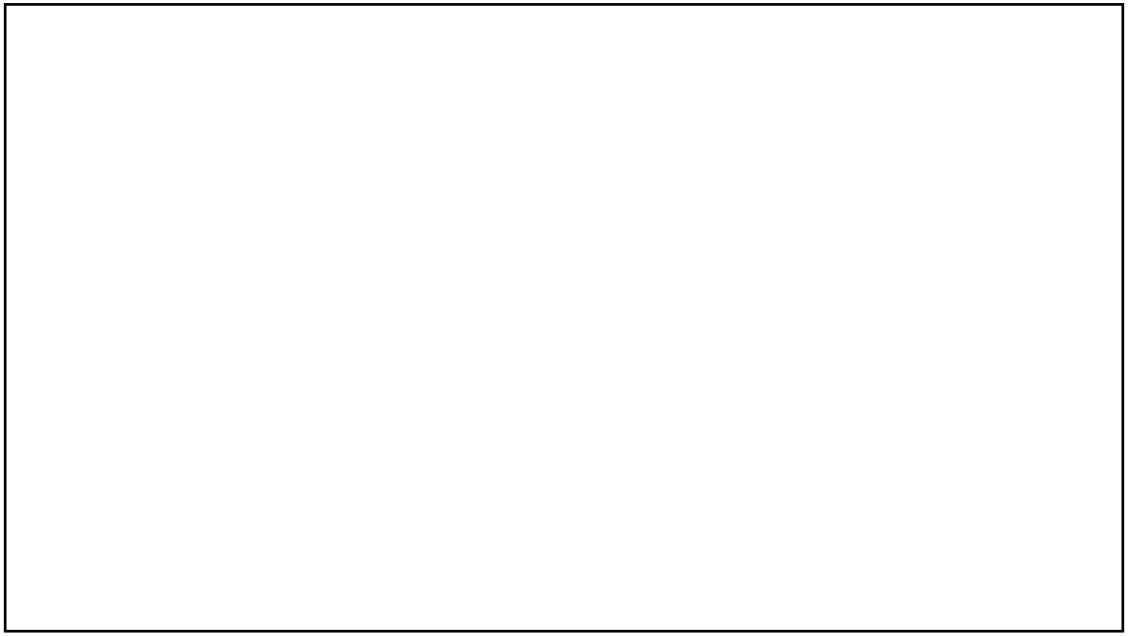
2006 @ Metacarta

Streetview



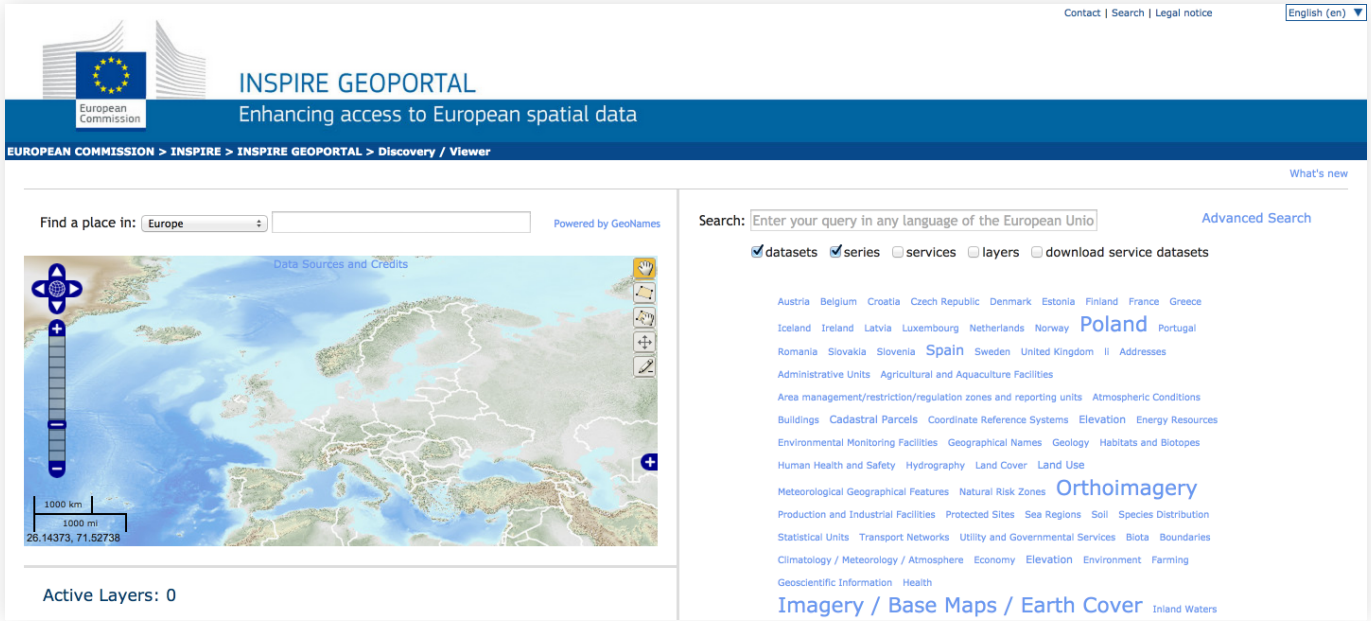
2007 @ Google

Sensors



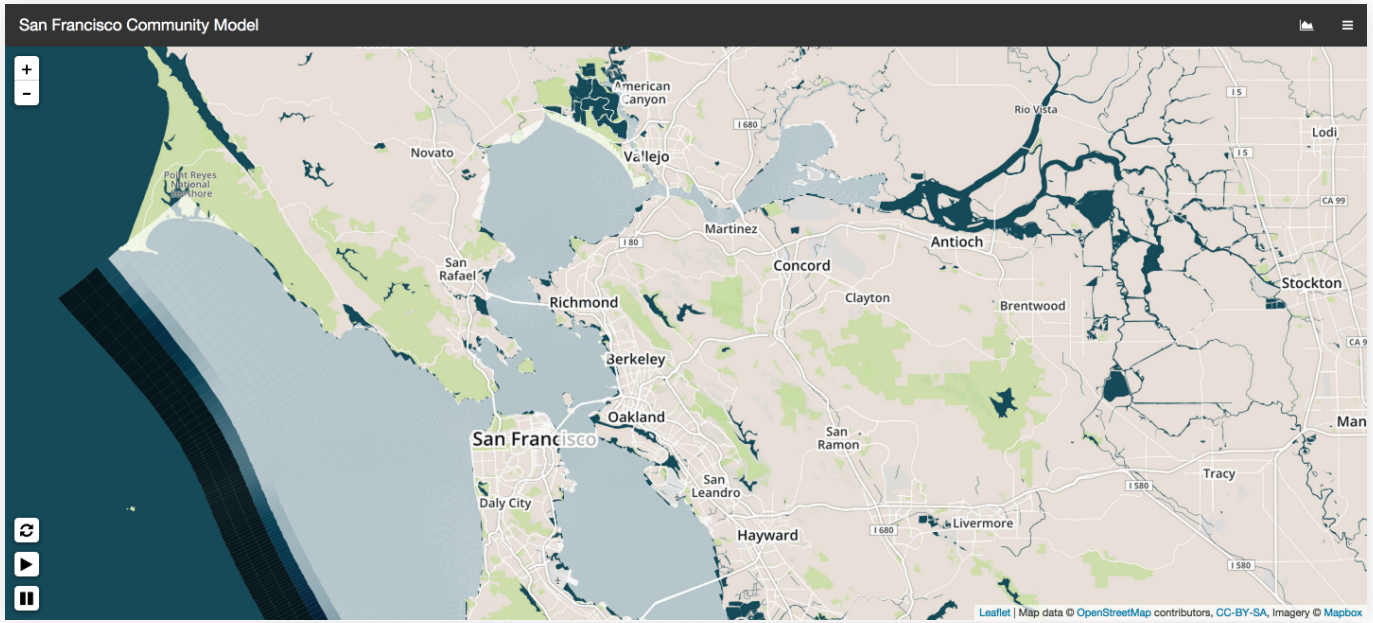
2007 @ OGC

INSPIRE



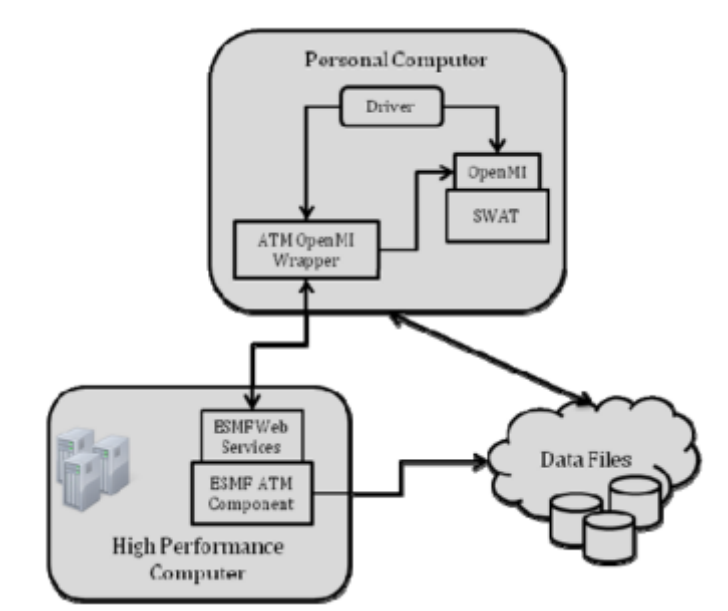
2007 @ EU

Stylesheets



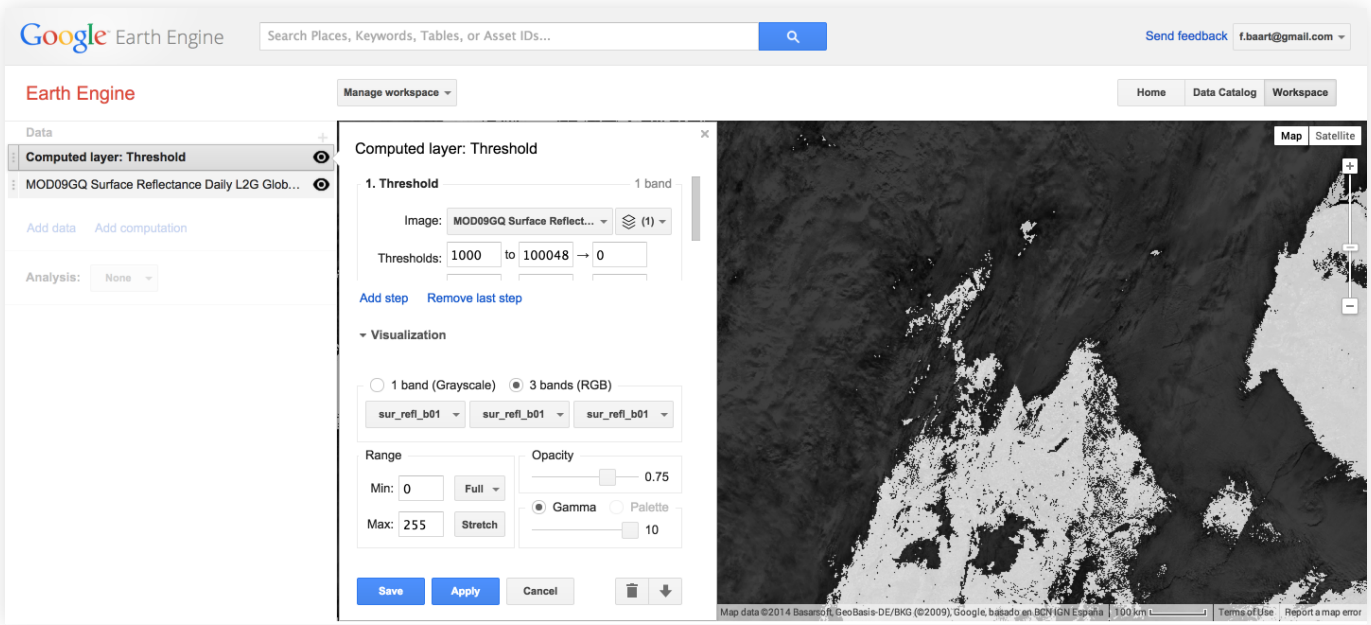
2008 @ Mapnik & Tilemill

Model as a service



2010 @ ESMF (Saint)

Earth Engine



2010 @ Google

Vectors and 3D

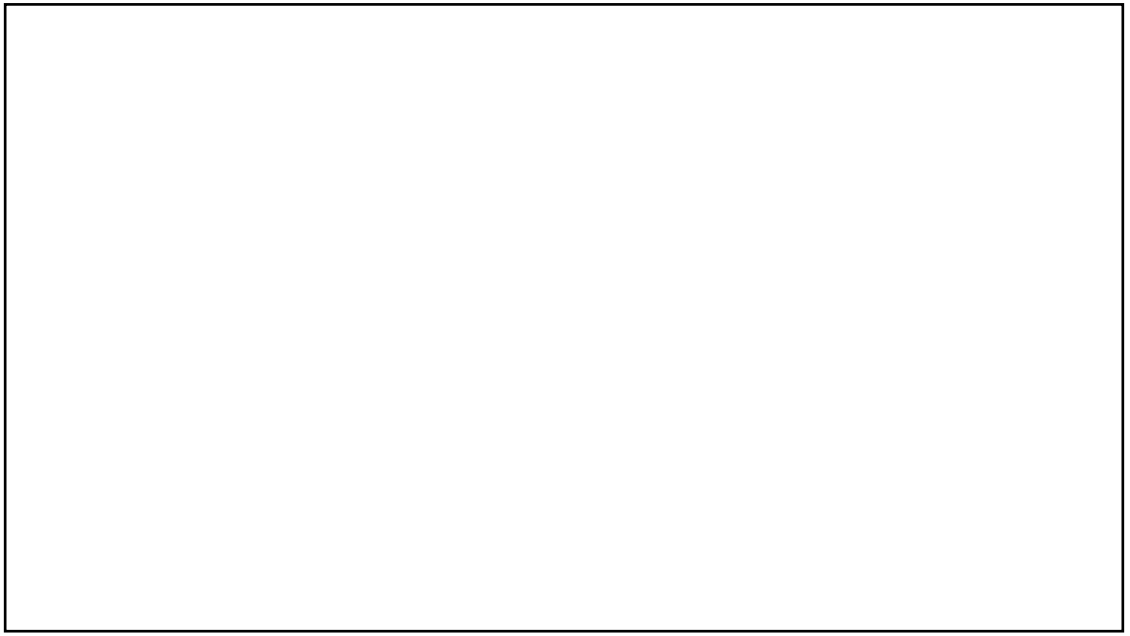
transitions

2011@W3

Vectors and 3D

2011@W3

Animations

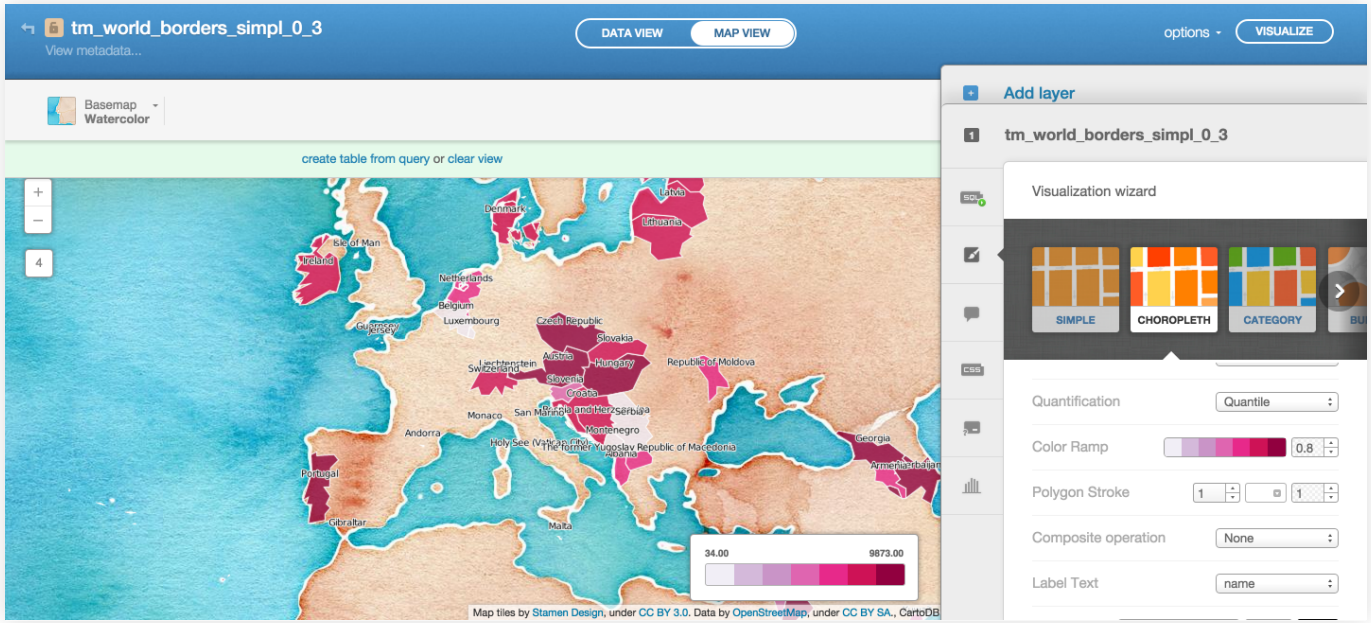


2011@W3

Animations

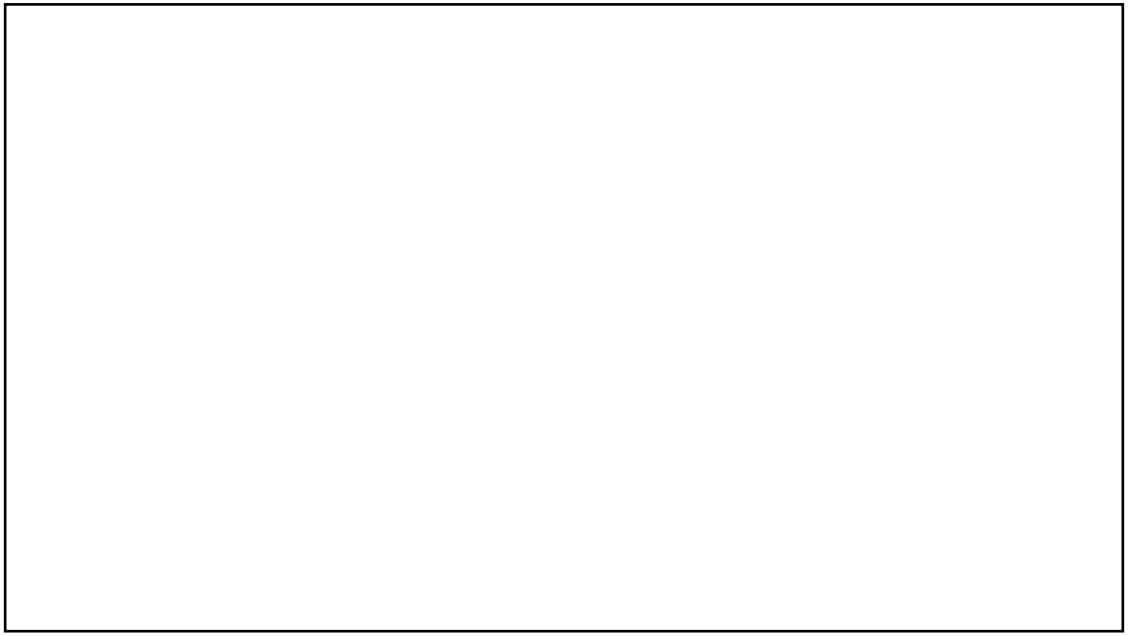
2011@W3

Map Content Management



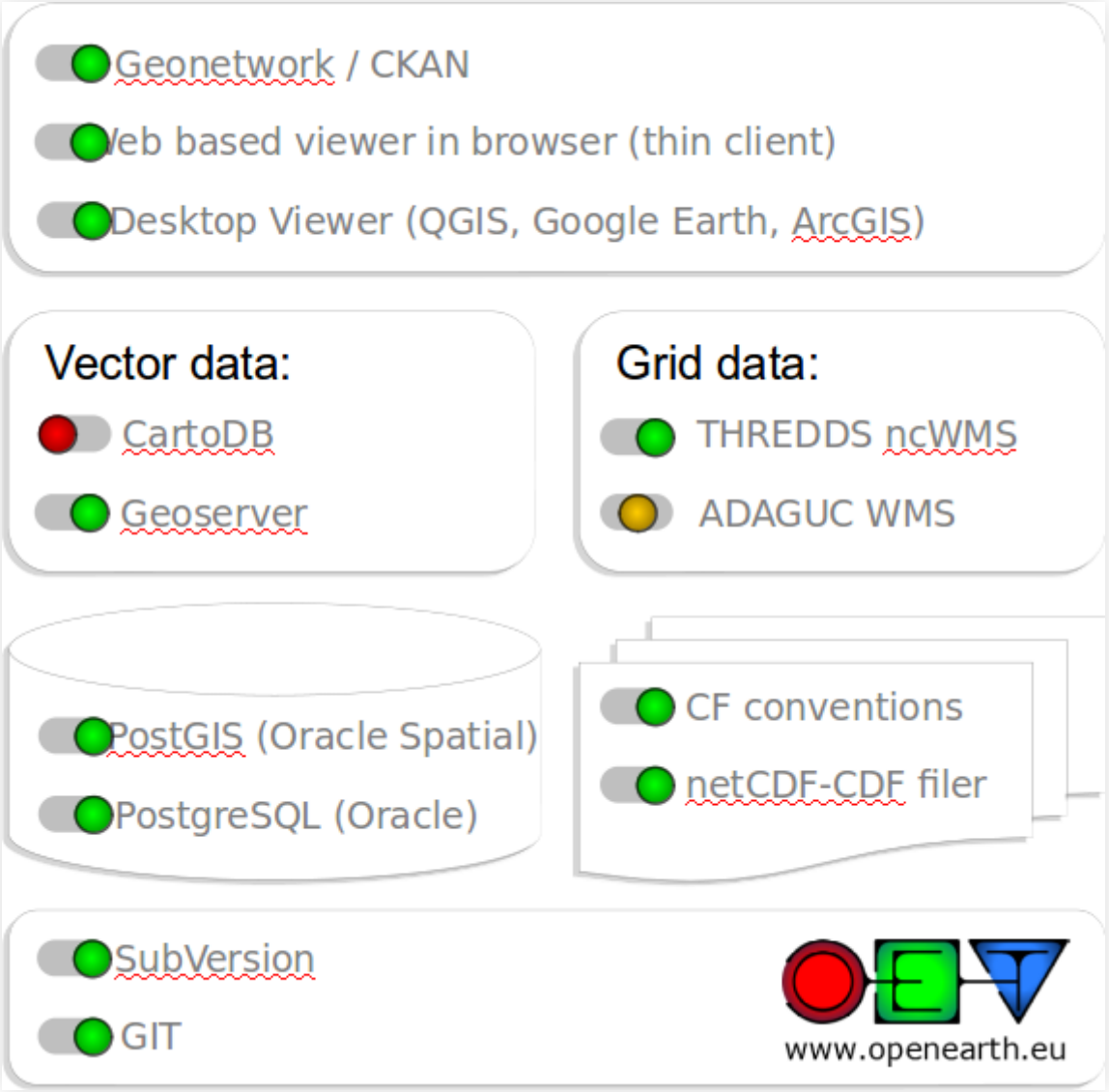
2011 @ CartoDB

Interactive models



2014 @ 3Di

OpenEarth stack



Future

- Sensors
- Push/Messages
- Global processing
- Model setup

OGC Service

Web Map Services

- Get map in bitmap form
- Get information for 1 location
- Custom bounding box
- Map rendered by server on request
- Query by time and elevation
- Coordinate transformation

GetCapabilities

```
<wms_capabilities>
    <service>
        <title>OpenEarth test server</title>
        <maxwidth>2048</maxwidth>
    </service>
    <capability>
        <request>
            <getmap>
                <format>image/png</format>
                <dcptype><http><get><onlineresource xlink:type="simple" xlink:
            </getmap>
        </request>
        <layer>
            <crs>EPSG:4326</crs>
            <title>daily averaged meteo parameter.</title>
        </layer>
    </capability>
```

Implementations

- Geoserver
- Mapserver
- ncWMS
- ADAGUC

GetMap

http://geoport.whoi.edu/thredds/wms/bathy/srtm30plus_v6?

service=WMS&

request=GetMap&

layers=topo&

version=1.3.0&

CRS=epsg:4326&

bbox=50,0,55,10&

width=256&height=256&

styles=&

format=image/png

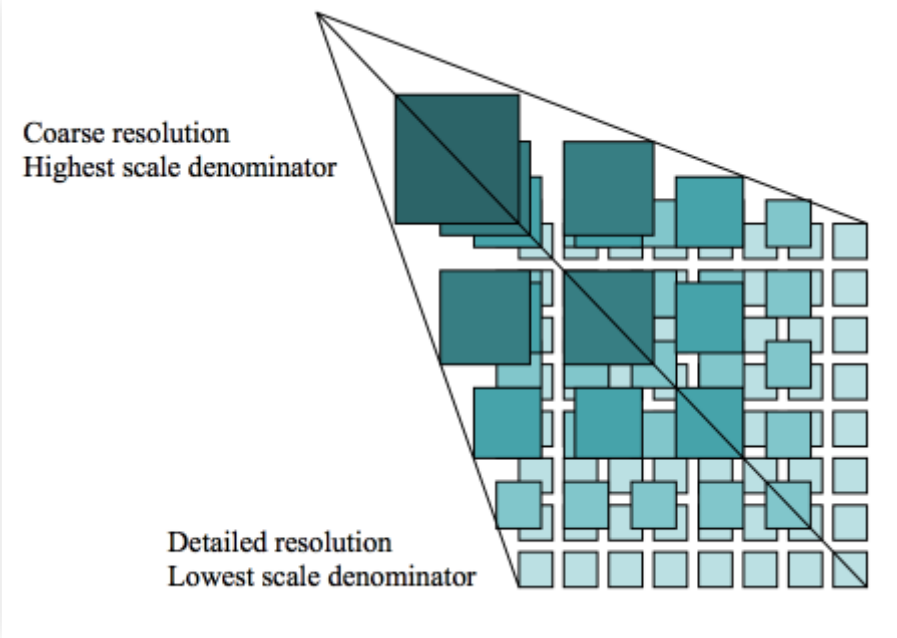
Example

http://geoport.whoi.edu/thredds/wms/bathy/srtm30plus_v6

Extensions

- COLORSCALERANGE
- LOGSCALE

WMTS


Coarse resolution
Highest scale denominator
Detailed resolution
Lowest scale denominator

UTFGrid

Challenges

Video

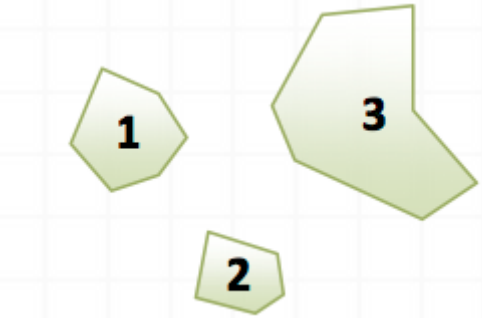
Streaming

Voxels

Vector

Everything is a feature

Id	Name	Population
1	Delft	96168
2	Gouda	71873
3	Utrecht	640000



The question "What is a feature?" leads directly to a philosophical rabbit hole which deposits the unwary questioner in a wonderland from which it is difficult to return.

Nordgren, 2006

Web Feature Service

- Get list of features
- Get table with feature info
- Custom bounding box
- Not rendered
- Coordinate transformation

GetFeature

http://geo.vliz.be/geoserver/wfs?
request=GetFeature&
service=wfs&
typeName=World:worldcities&
bbox=51,2,55,5&

Coverages

Feature that acts as a function to return values from its range for any direct position within its spatiotemporal domain

a grid

Web Coverage Service

- Get a grid file
- Custom bounding box
- Not rendered
- Coordinate transformation

GetCoverage

http://geoport.whoi.edu/thredds/wcs/bathy/srtm30plus_v6?

request=GetCoverage

&version=1.0.0

&service=WCS

&format=geotiff

&coverage=topo

&BBOX=0,50,10,55

OPeNDAP vs WCS

array or spatial?

10.1111/j.1467-9671.2012.01312.x

Other services

- Sensor Observation Service
- Open Model Interface
- Catalogue Service for the Web
- OPeNDAP

Client libraries

- OGR/GDAL (C,python,R)
- OWSLib (python)
- geotools (java)

Client software

- QGis (desktop)
- uDig (desktop)
- Leaflet (web)
- OpenLayers (web)

Web Processing Services

Processes

- Call a function
- Define input variables/files
- Define output variables/files
- Custom bounding box
- Can be rendered or not
- Start process
- Chain processes

Typical examples

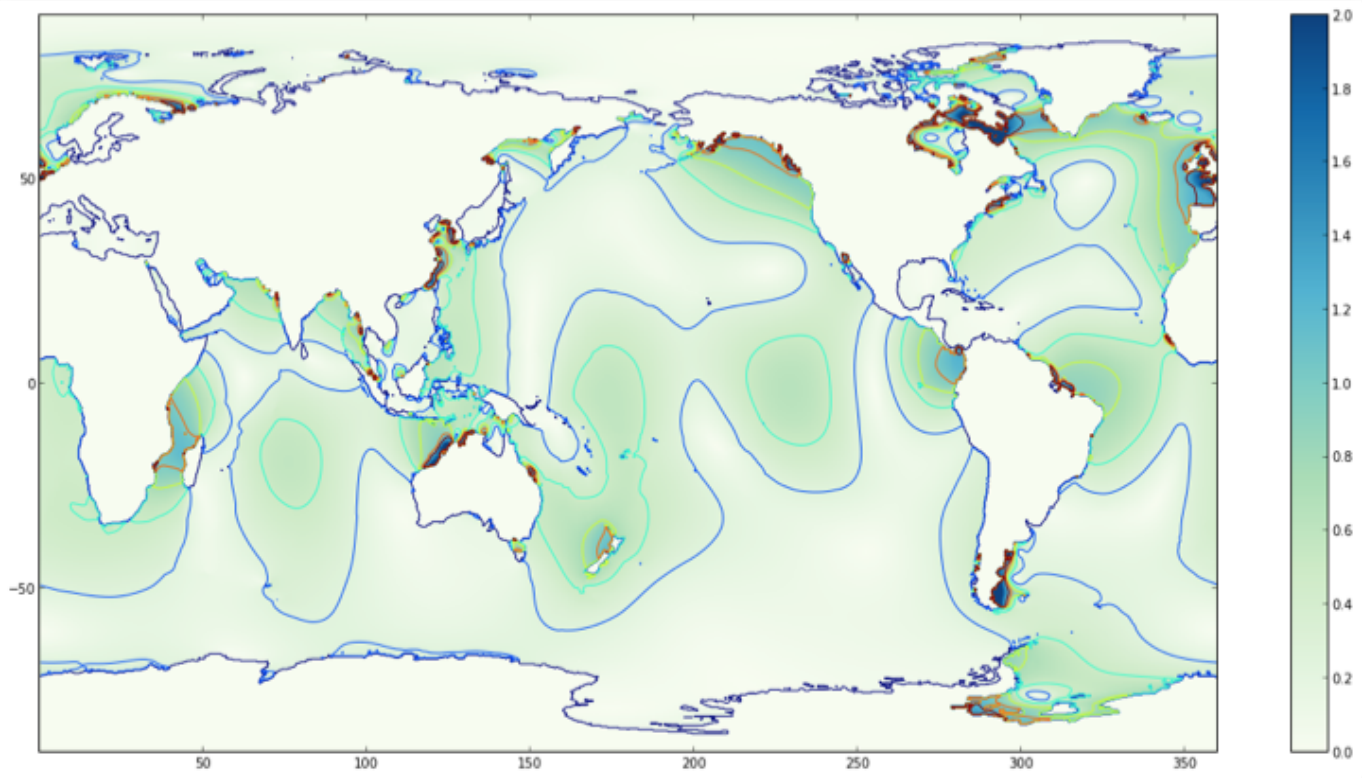
- Spatial operations
- Conversions
- Process @ data
- Simple models
- Facade to complex models

Operations

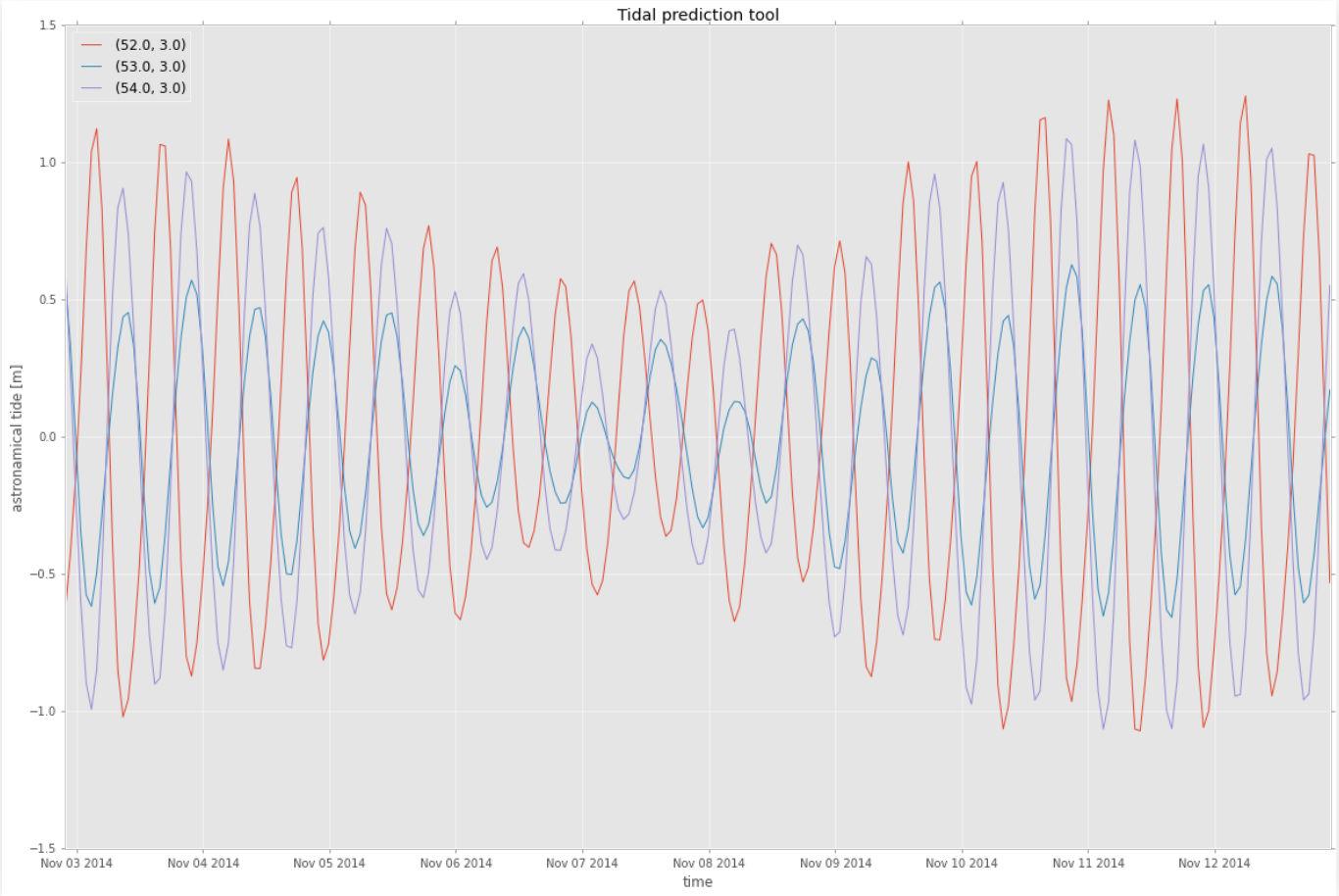
- GetCapabilities
- DescribeProcess
- Execute

Tide Example

OSU Tidal constituents



Tidal predict



GetCapabilities

```
<wps:capabilities service="WPS" version="1.0.0">
  <ows:serviceidentification>
    <ows:title>OpenEarth WPS server</ows:title>
    <ows:accessconstraints>none</ows:accessconstraints>
  </ows:serviceidentification>
  <ows:serviceprovider>
    <ows:providername>Deltares</ows:providername>
  </ows:serviceprovider>
  <wps:processofferings>
    <wps:process wps:processversion="0.1">
      <ows:identifier>tidal_predict</ows:identifier>
      <ows:title>Tidal prediction tool</ows:title>
    </wps:process>
  </wps:processofferings>
</wps:capabilities>
```

DescribeProcess

```
<wps:processdescriptions service="WPS" version="1.0.0" xml:lang="en-CA">
  <processdescription>
    <ows:identifier>tidal_predict</ows:identifier>
    <ows:title>Tidal prediction tool</ows:title>
    <datainputs>
      ...<identifier>startdate</identifier>...
    </datainputs>
    <processoutputs>
      <output>
        <ows:identifier>tide</ows:identifier>
        <ows:title>Calculated water level for requested locations and date</ow
        <complexoutput>
          ...<mimetype>text/csv</mimetype>...
        </complexoutput>
      </output>
    </processoutputs>
  </processdescription>
```

Input/Output

- Title/Abstract
- Description
- Unit
- Default
- Min/max occurance

Types

- Literal (string, number)
- Bounding Box
- Complex (raster, vector)

Execute

```
<wps:executeresponse>
<wps:process wps:processversion="0.1">
  <ows:identifier>tidal_predict</ows:identifier>
  <wps:status creationtime="2014-11-02T19:50:39Z">
    <wps:processsucceeded>PyWPS Process tidal_predict successfully calculated<
  </wps:status>
  <wps:processoutputs>
    <wps:output>
      <ows:title>Calculated water level for requested locations and date</ows:
      <wps:data>
        <wps:complexdata mimetype="text/csv">
date,h,lat,lon
2014-11-02 19:50:37,0.3735264572229592,3.0,52.0
        </wps:complexdata>
      </wps:data>
    </wps:output>
  </wps:processoutputs>
```

Server Implementations

- Zoo
- PyWPS
- Geoserver
- 52North

Tools and languages

- JTS
- GRASS
- Orfeo
- Sextante
- python, R, java

Implementing a process

```
class Process(WPSProcess):
    def __init__(self):
        WPSProcess.__init__(self, "tidal_predict",
            title="Tidal prediction tool")
    def execute(self):
        """execute a tidal prediction"""
        date = self.date.getValue()
        location = self.location.getValue()
        df = openearthtools.physics.tide.predict(location, date=date)
        self.tide.setValue(df.to_json())
```

Client Implementations

- OpenLayers
- OWSLib
- Geotools (unsupported)

Client Example

```
// OpenLayers example
client = new OpenLayers.WPSClient({
  servers: {
    opengeo: 'http://demo.opengeo.org/geoserver/wps'
  }
});

intersect = client.getProcess('opengeo', 'JTS:intersection');
intersect.configure({
  inputs: {
    a: features,
    b: geometry
  },
  success: function(outputs) {
    map.baseLayer.addFeatures(outputs.result);
  }
});
```

Setting up a server

1. Get OSX/linux computer with VirtualBox
2. Install ansible
3. Install vagrant
4. Download OpenEarth stack @ github
5. $ vagrant up wps

Missing features

- Stop a process
- REST
- Spatial types (everything is complex)
- Layout hints/classes
- Variable relations
- Push/notifications

Planned in WPS 2

Fall of 2014?

- Pause,Resume,Dismiss
- REST?

Excercises

WMS + WFS

wfs/wms client

WPS

wps client