

OpenStreetMap
→ (**PostGIS** | MySQL | SpatiaLite)
→ OpenLayers

From Map To Web

MySQL Conference & Expo 2011

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Me ...

- Hartmut Holzgraefe <hartmut@php.net>
- MySQL Support Engineer 2004-2010
- Currently working for FoeBuD e.V.,
a German NGO (<http://foebud.org/>)
- OSM-User since 2007, active since late 2009

Talk Outline

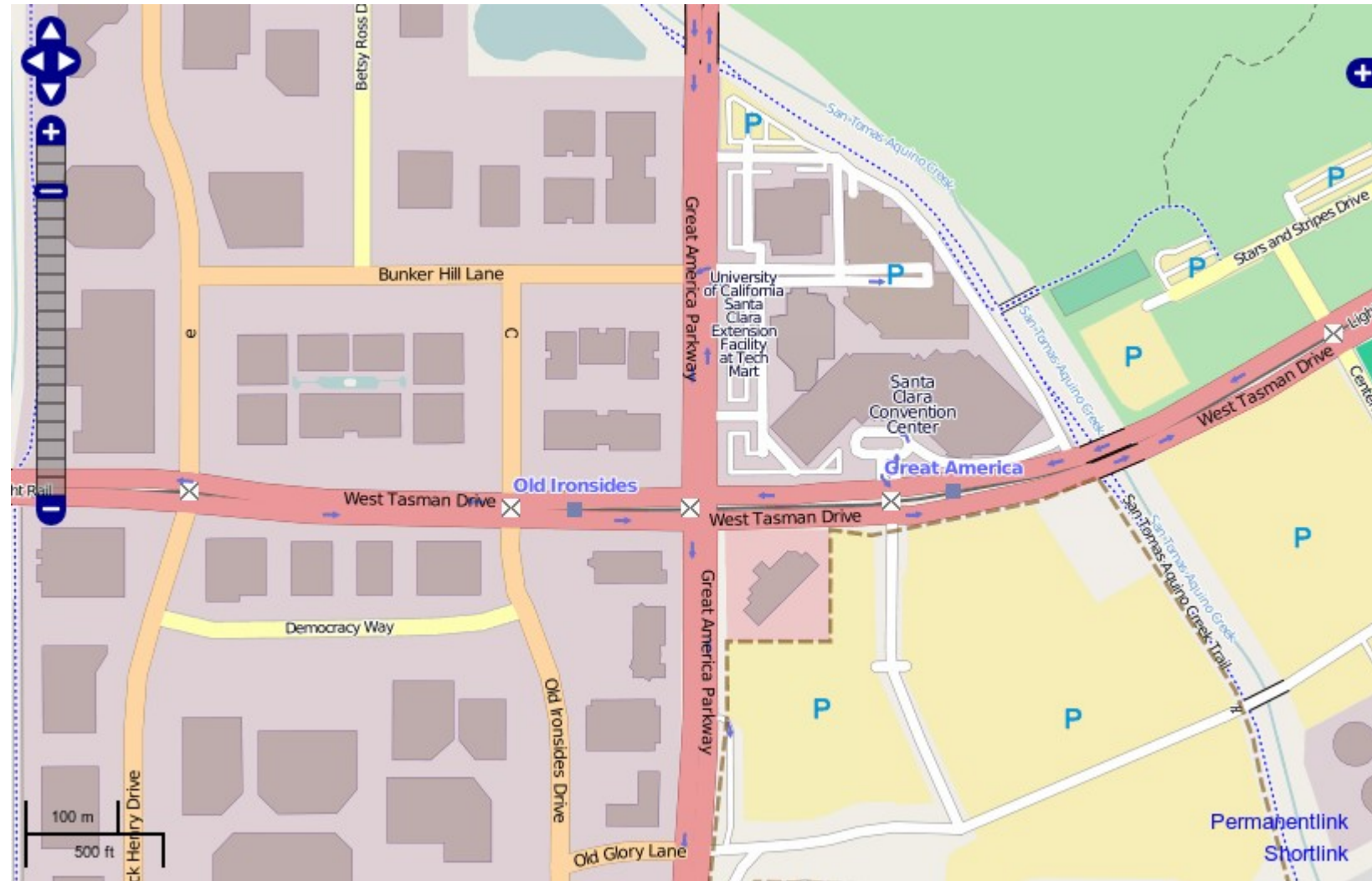
- What is OpenStreetMap
- What are PostGIS and OpenLayers
- OpenStreetMap Data Format
- OSM → Database
- Database → Web
- Ad Hoc Query Results
- Example Application

OpenStreetMap



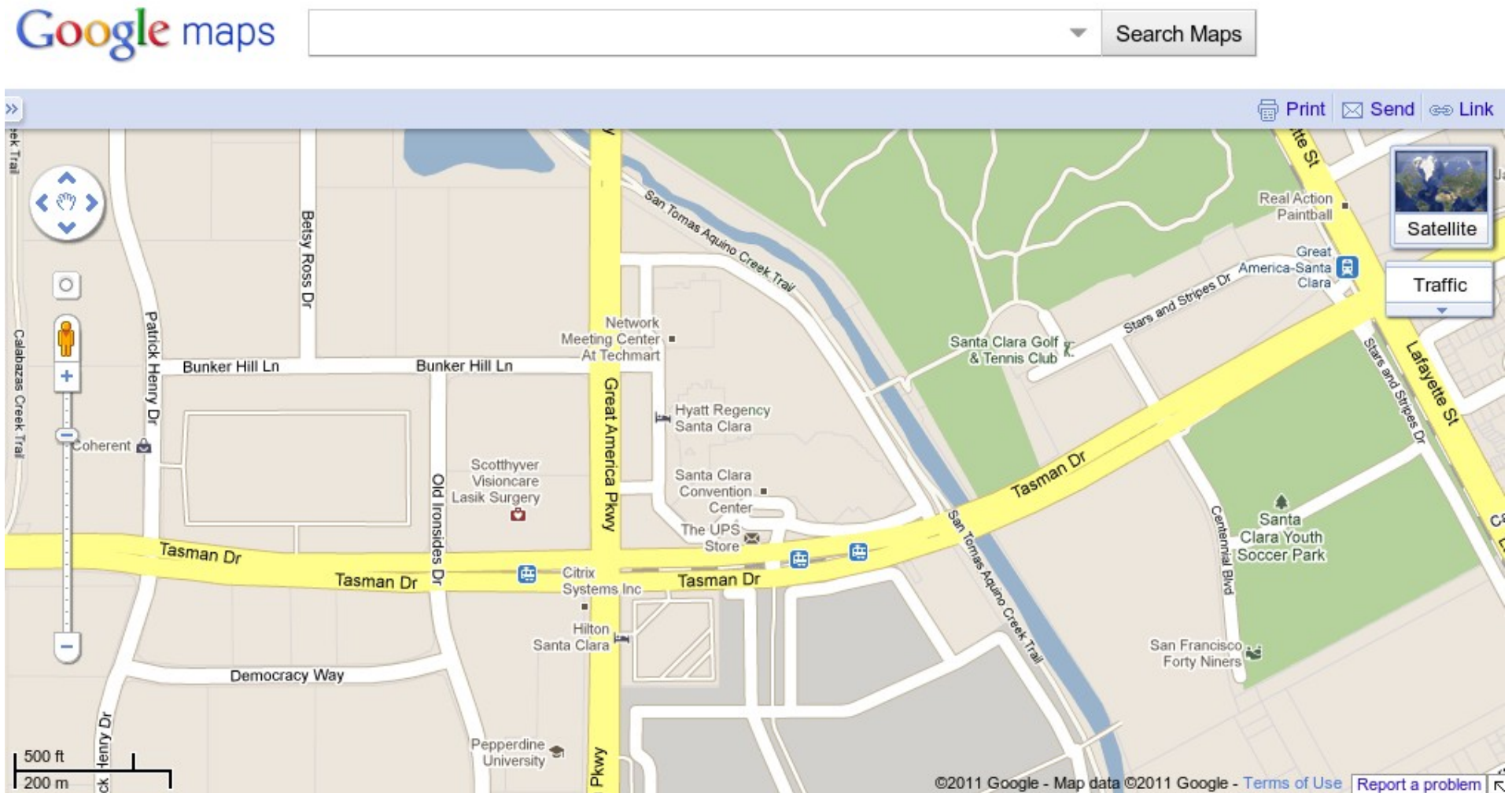
- Open Geodata
- Open license (currently: CC-by-SA License)
- Data sources contain:
 - GPS Tracks
 - Aerial Images (YaHoo!, Bing, AeroWest, ...)
 - Other Imports (OpenGeoDB, USA: Tiger, ...)
- See also <http://openstreetmap.org/>

What OpenStreetMap Looks like:



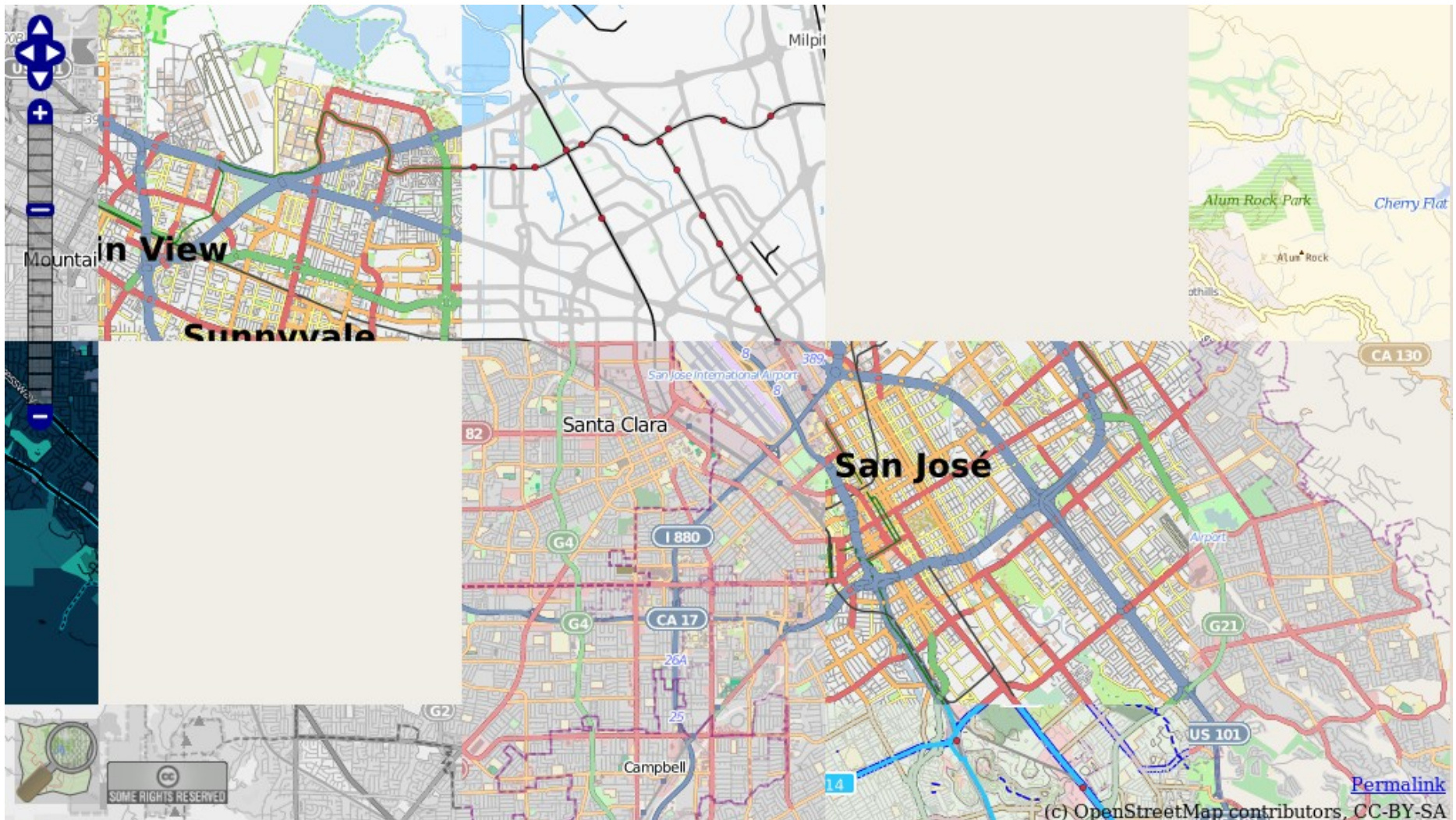
<http://osm.org/go/TZMIDJLP>

... compared to ...



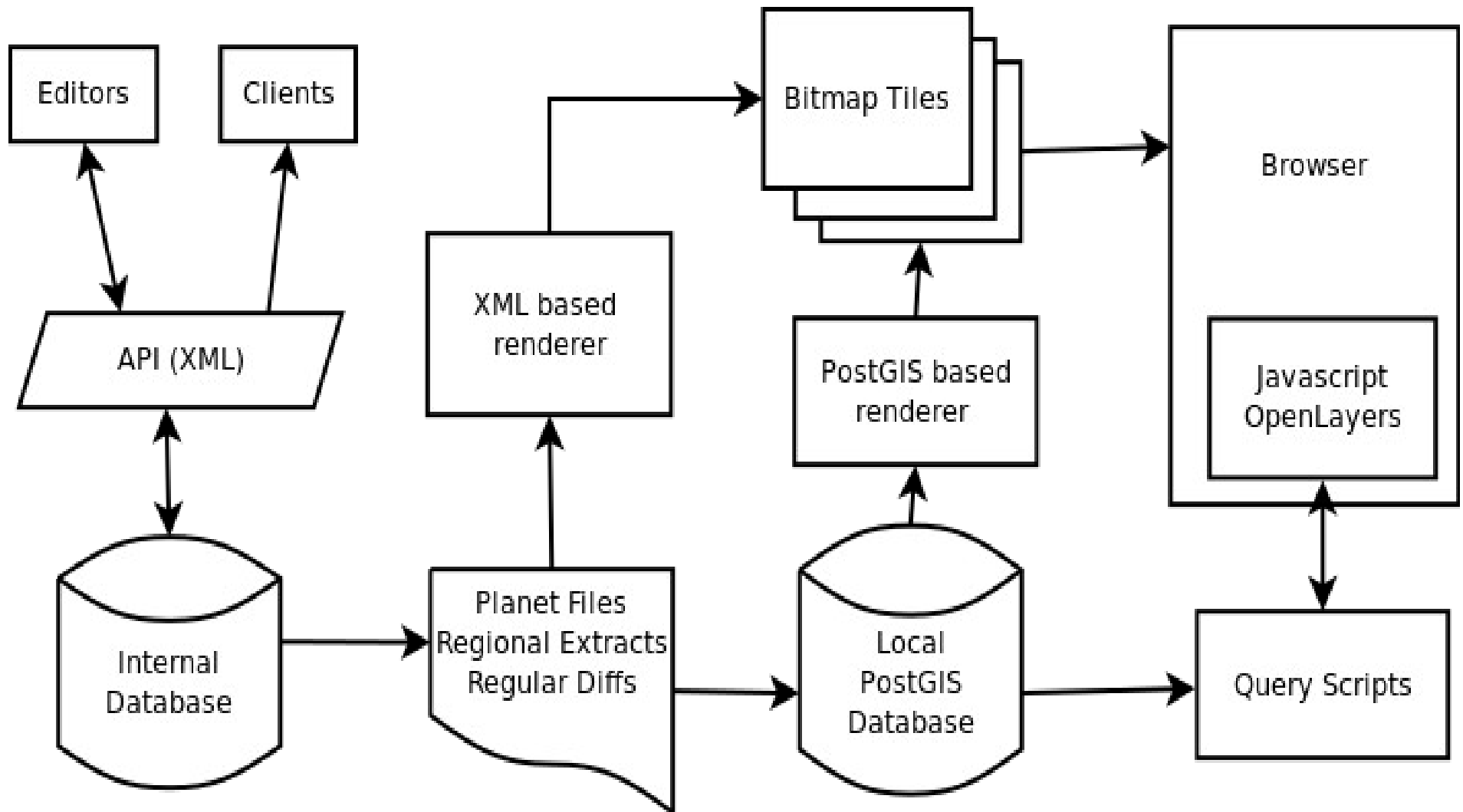
But there is more than one map style

OpenWhateverMap provides a random mix of available styles

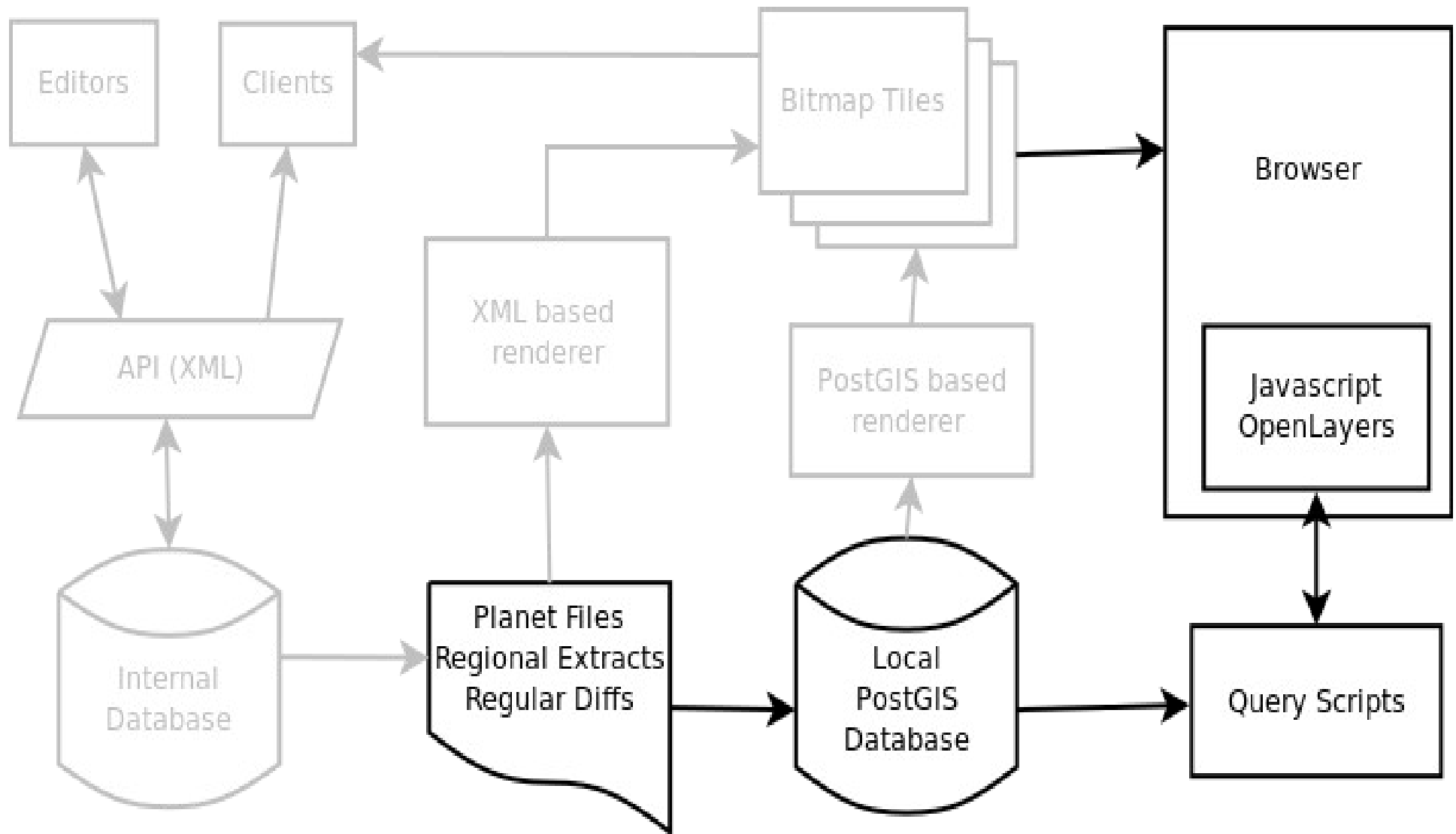


<http://www.openwhatevermap.org/?zoom=12&lat=37.35624&lon=-121.92799&layers=B>

OpenStreetMap Workflow



Of interest to us today:

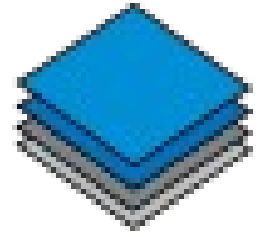


PostGIS



- GIS – Extension for PostgreSQL
- Supports standard GIS data types like POINT, LINE, POLYGON ...
- 2D GIS Index Support
- Rich set of functions supporting geometry creation, combination and processing
- See also <http://postgis.refrations.net/>

OpenLayers



- Open Source JavaScript/Ajax API for Web Maps
- Similar to the Google Maps API in some ways
- But supporting way more formats:
 - Bitmap/Image: OpenStreetMap(*), Google, Bing, ...
 - Vektor: WKT, KML, GPX, OSM, GeoJSON, ...
 - WMS
- See also <http://openlayers.org/>

OSM XML File Format

Don't let it scare you, you won't have to deal with it directly

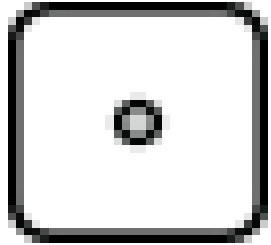
```
<?xml version='1.0' encoding='UTF-8'?>
<osm version='0.6' generator='JOSM'>
  <bounds minlat='52.02' minlon='8.51' maxlat='52.03' maxlon='8.52'/>
  <node id='27541371' timestamp='2010-04-11T12:02:42Z'
    uid='124466' user='Heros' visible='true' version='13'
    changeset='4392479' lat='52.0308503' lon='8.5233556' />
  ...
  <way id='4805339' timestamp='2010-02-18T19:18:18Z' uid='162220'
    user='SKit' visible='true' version='8' changeset='3911454'>
    <nd ref='30840398' />
    <nd ref='493865093' />
    <tag k='highway' v='residential' />
    <tag k='name' v='Weststraße' />
  </way>
  ...
  <relation id='29035' timestamp='2010-01-18T22:17:32Z' uid='162220'
    user='SKit' visible='true' version='10' changeset='3654770'>
    <member type='way' ref='5818594' role='inner' />
    <member type='way' ref='5818593' role='outer' />
    <tag k='natural' v='water' />
    <tag k='type' v='multipolygon' />
  </relation>
</osm>
```

OSM XML Building Blocks

- There are only three basic object types:
 - Nodes
 - Ways
 - Relations
- Each of these objects has:
 - ID, user, timestamp, version, changeset
 - ... plus any number of additional key/value pairs
- Refer to the OSM wiki for key/value tag definitions and suggestions for various real world object types

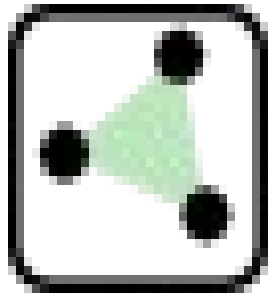
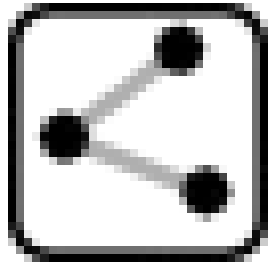
OSM XML Format: Nodes

- A Node defines a single point on the map
- 2D latitude / longitude
- Nodes can stand for themselves (POI)
- ... or can be part of a way



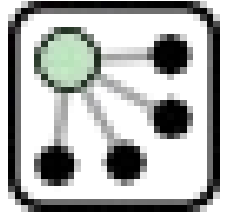
OSM XML Format: Ways

- Ways consist of an ordered list of Nodes
- Areas are just closed ways



OSM XML Format: Relations

- Relations combine other objects
- Relations can contain Nodes and Ways ...
- ... and other Relations, too
- Typical use cases
 - Multipolygons
 - Very long Ways
 - Local groups of Objects
 - Routs spanning multiple streets



Getting hold of OSM Data

- For small areas → OSM API
- For medium size areas → OSM XAPI
- For large areas → Downloads
 - Planet.osm → direktly from openstreetmap.org
 - Daily, hourly, minutely diffs → openstreetmap.org
 - \$country.osm, \$state.osm, \$district.osm
→ e.g. from [GeoFabrik.de](http://geofabrik.de)
- See also <http://wiki.openstreetmap.org/wiki/Api>,
<http://wiki.openstreetmap.org/wiki/Xapi> and
<http://wiki.openstreetmap.org/wiki/Planet.osm>

OSM XML -> Database

- Import tools: **osm2pgsql** and **ImpOSM**
- Both can import complete OSM files
- ... and daily/hourly/minutely diffs (osm2pgsql)
- Support OSM XML and the newer PBF Format
- Raw data is converted into a more usable form
 - By combining objects from relations
 - By creating separate tables for lines and polygons
- See also <http://imposm.org/> and <http://wiki.openstreetmap.org/wiki/Osm2pgsql>

Database support

- Currently PostgreSQL / PostGIS only
- Both tools are modular though so having backends for different GIS capable databases possible
- ... and being worked on, but moving slowly
- Other open source options would be:
 - MySQL
 - SpatiaLite extension for SQLite

osm2pgsql

```
osm2pgsql [options] planet.osm.{gz,bz2,pbf}
```

```
--database=name
```

```
--prefix=name
```

```
--latlong
```

```
--slim
```

```
--cache=size
```

Osm2pgsql Schema

- Main tables
 - Planet_osm_point
 - Planet_osm_line
 - Planet_osm_polygon
 - Planet_osm_roads
- Helper tables (used during import)
 - Planet_osm_nodes
 - Planet_osm_ways
 - Planet_osm_relations

Schema Details

Table "public.planet_osm_polygon"

Column	Type	Modifiers
osm_id	integer	
...		
name	text	
...		
z_order	integer	
way_area	real	
way	geometry	

Indexes:

"planet_osm_polygon_index" gist (way)

"planet_osm_polygon_pkey" btree (osm_id)

Simple Queries

Administrative town border of Stuttgart, Germany:

```
SELECT ASTEXT(way)
  FROM planet_osm_polygon
 WHERE name='Stuttgart';
```

```
POLYGON( ( 1006189.62 6231109.22,
           1006225.9   6231281.72,
           . . .
```


OpenLayers Basics

```
<script src="OpenLayers.js"/>
<script src="OpenStreetMap.js"/>

<script type="text/javascript">
var map, vectorLayer;
function init() {
    map          = new OpenLayers.Map('map');
    osmLayer      = new OpenLayers.Layer.OSM.Mapnik();
    vectorLayer  = new OpenLayers.Layer.Vector();
    map.addLayers([osmLayer, vectorLayer]);
    map.zoomToMaxExtent();
}
</script>

<body onload="init();">
    <div id="map"/>
</body>
```

WKT-Results as VectorLayer

OpenLayers directly supports the WKT format as returned by `ASTEXT()` for displaying vector features like points, lines and polygons:

```
var wkt_format = new OpenLayers.Format.WKT();  
var vectorFeature = wkt_format.read(WKT_text);  
vectorLayer.addFeatures(vectorFeature);  
map.zoomToExtent(vectorLayer.getDataExtent());
```

Markers as TextLayer

- TextLayer reads a TAB separated list
- ... and creates one map marker per input line
- Supported input fields:
 - Latitude and Longitude (mandatory)
 - Popup title and content (optional)
 - Icon image and relative position (optional)

Filling a TextLayer with Markers

- Example: Playgrounds in my home town

```
SELECT X(playground.way) AS lon
      , Y(playground.way) AS lat
      , playground.name   AS title
FROM   planet_osm_polygon AS city
JOIN   planet_osm_point   AS playground
      ON CONTAINS(city.way, playground.way)
WHERE  city.name = 'Bielefeld'
      AND playground.leisure = 'playground';
```

PostGIS Terminal

- Originally created by Marc Jansen and Till Adams for their (German) book on OpenLayers
- Simple query entry in a web form
- Results shown directly in the browser
- Slightly extended by me to support markers in addition to WKT vectors, and to support more than one WKT result row
- See also <http://openlayers-buch.de/>

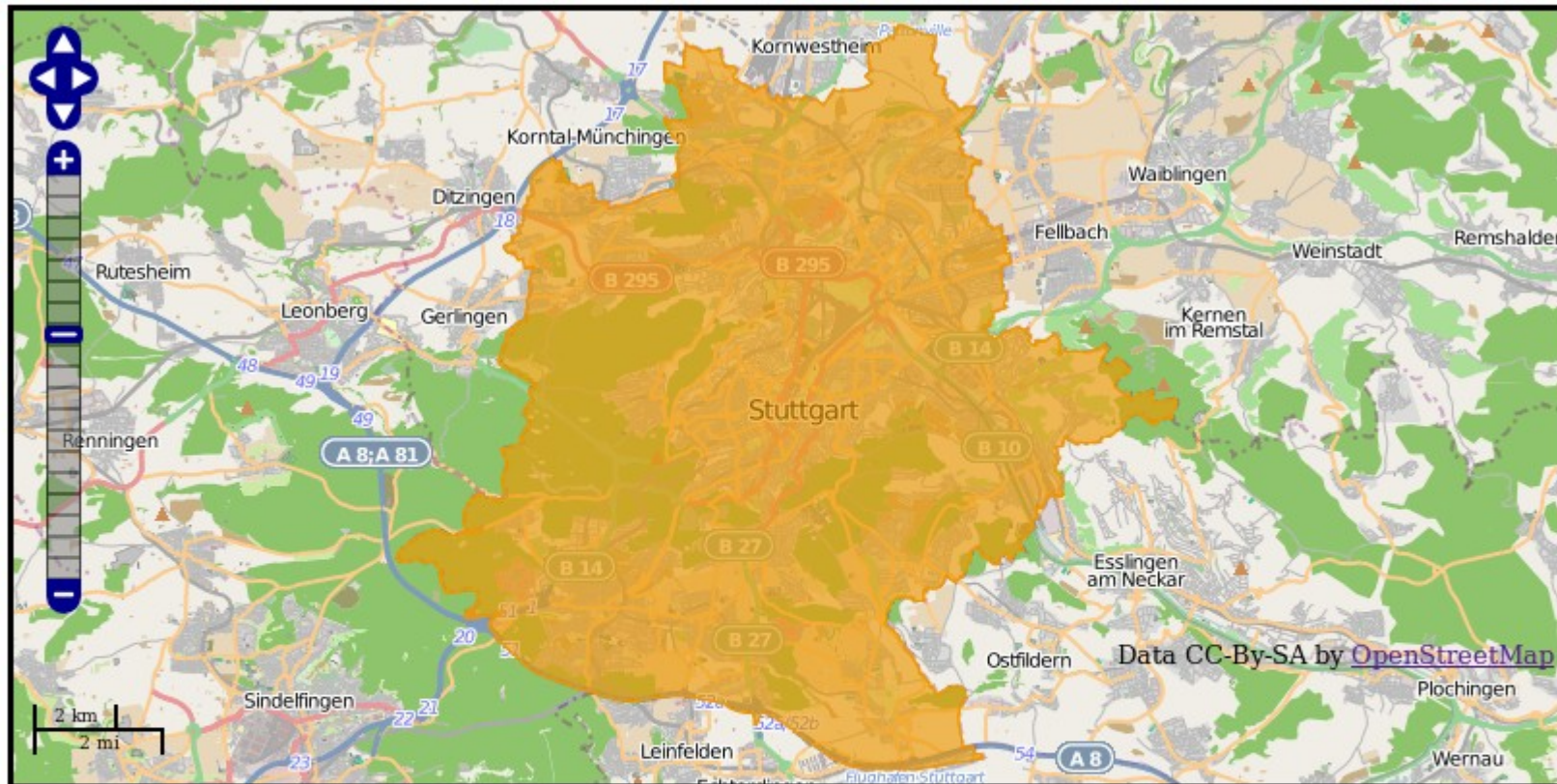
Screenshot



Example: City borders

```
SELECT ASTEXT(way)
FROM planet_osm_polygon
WHERE name='Stuttgart';
```

Result Screenshot



```
SELECT ST_ASTEXT(way)
FROM planet_osm_polygon
WHERE name='Stuttgart';
```


Example: the main roads in ...

```
SELECT ATEXT(r.way)
FROM planet_osm_polygon city
JOIN planet_osm_roads road
ON CONTAINS(city.way, road.way)
WHERE city.name = 'Stuttgart'
AND road.highway
IN ('primary', 'secondary', 'tertiary');
```

Screenshot

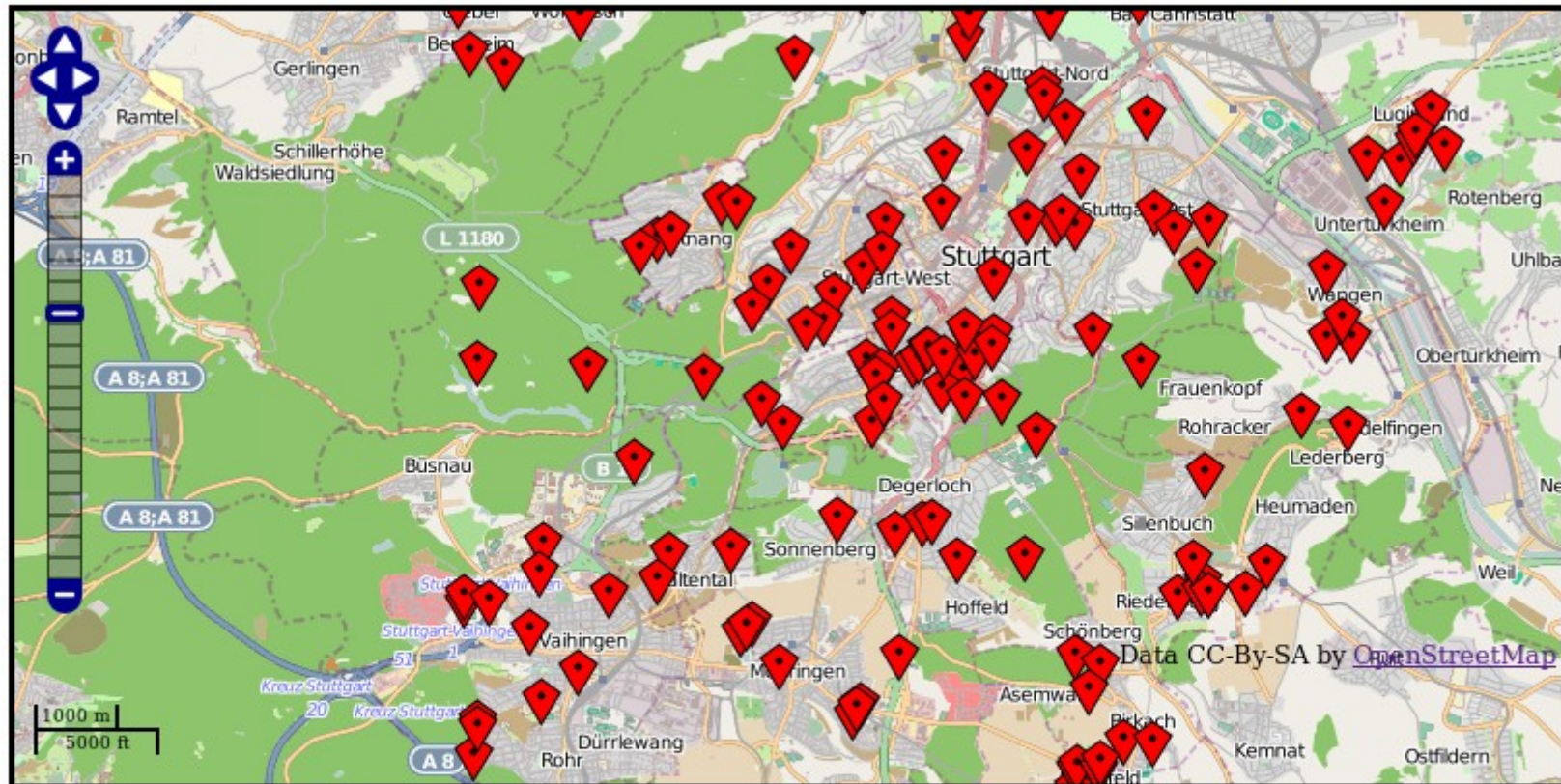


```
SELECT ST_ASTEXT(ST_Union(r.way))
FROM planet_osm_polygon p
JOIN planet_osm_roads r
ON ST_CONTAINS(p.way, r.way)
WHERE p.name = 'Stuttgart'
AND r.highway
IN ('primary', 'secondary', 'tertiary');
```

Example: Playground markers

```
SELECT X(playground.way) AS lon,  
       X(playground.way) AS lat,  
       playground.name   AS title  
FROM   planet_osm_polygon AS city  
JOIN   planet_osm_point   AS playground  
       ON CONTAINS(city.way, playground.way)  
WHERE  city.name = 'Stuttgart'  
       AND playground.leisure = 'playground';
```


Screenshot

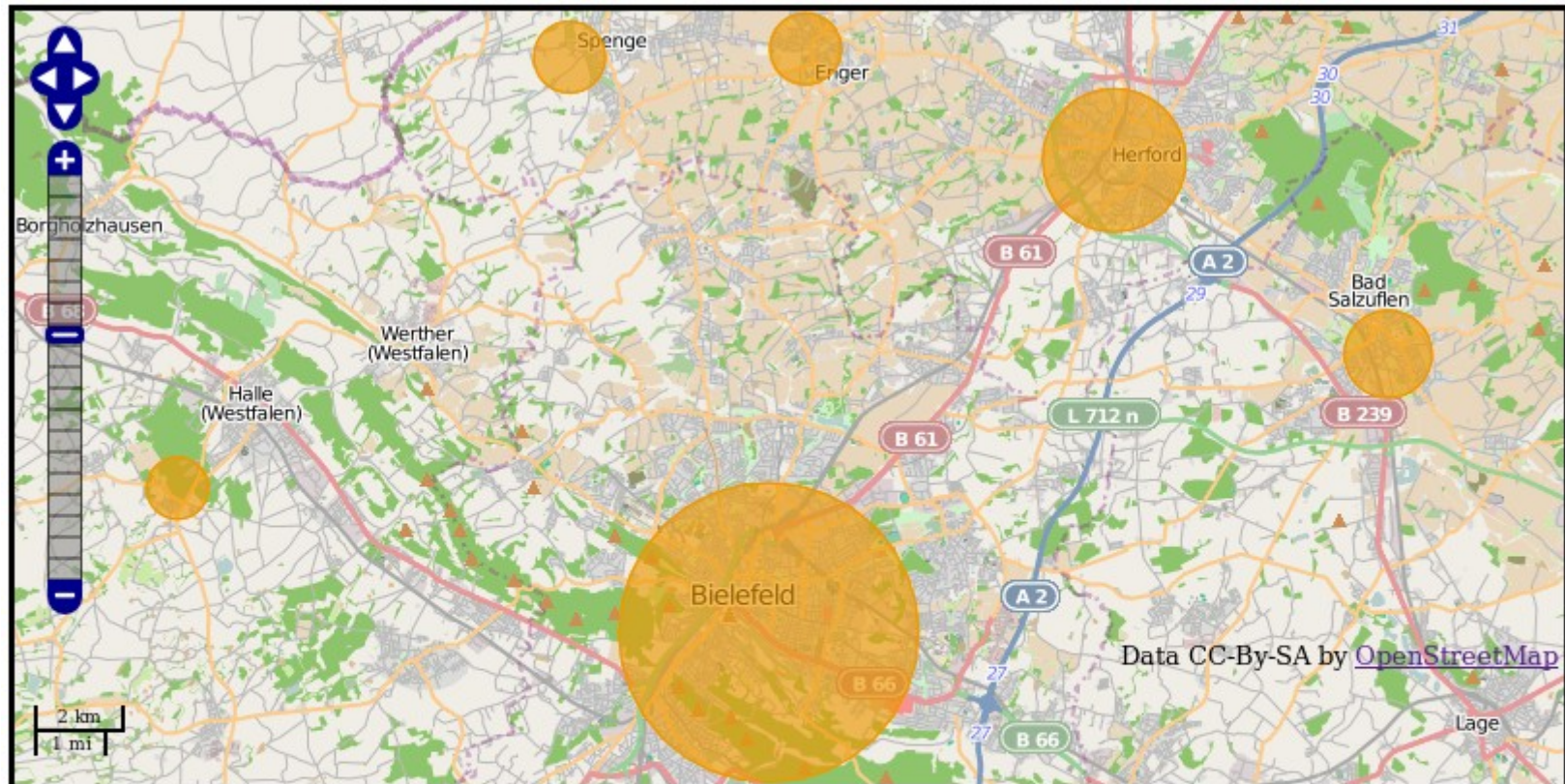


```
SELECT st_x(pt.way) AS lon, st_y(pt.way) AS lat, pt.name AS title
FROM planet_osm_polygon AS p
JOIN planet_osm_point AS pt
ON ST_CONTAINS(p.way, pt.way)
WHERE p.name = 'Stuttgart'
AND pt.leisure = 'playground';
```

Example: combining with non-OSM data

```
SELECT ATEXT( /* draw circle around center of gravity */
              BUFFER(CENTROID(city.way),
                     sqrt(pop.population)*10))
FROM planet_osm_polygon city
JOIN population          pop
  ON city.name = pop.name
 AND ( city.admin_level = '8'
      OR ( city.name = 'Bielefeld'
          AND city.admin_level = '6'))
/* German cities usually have admin_level 8, district-free cities are on
the higher level 6 */
```

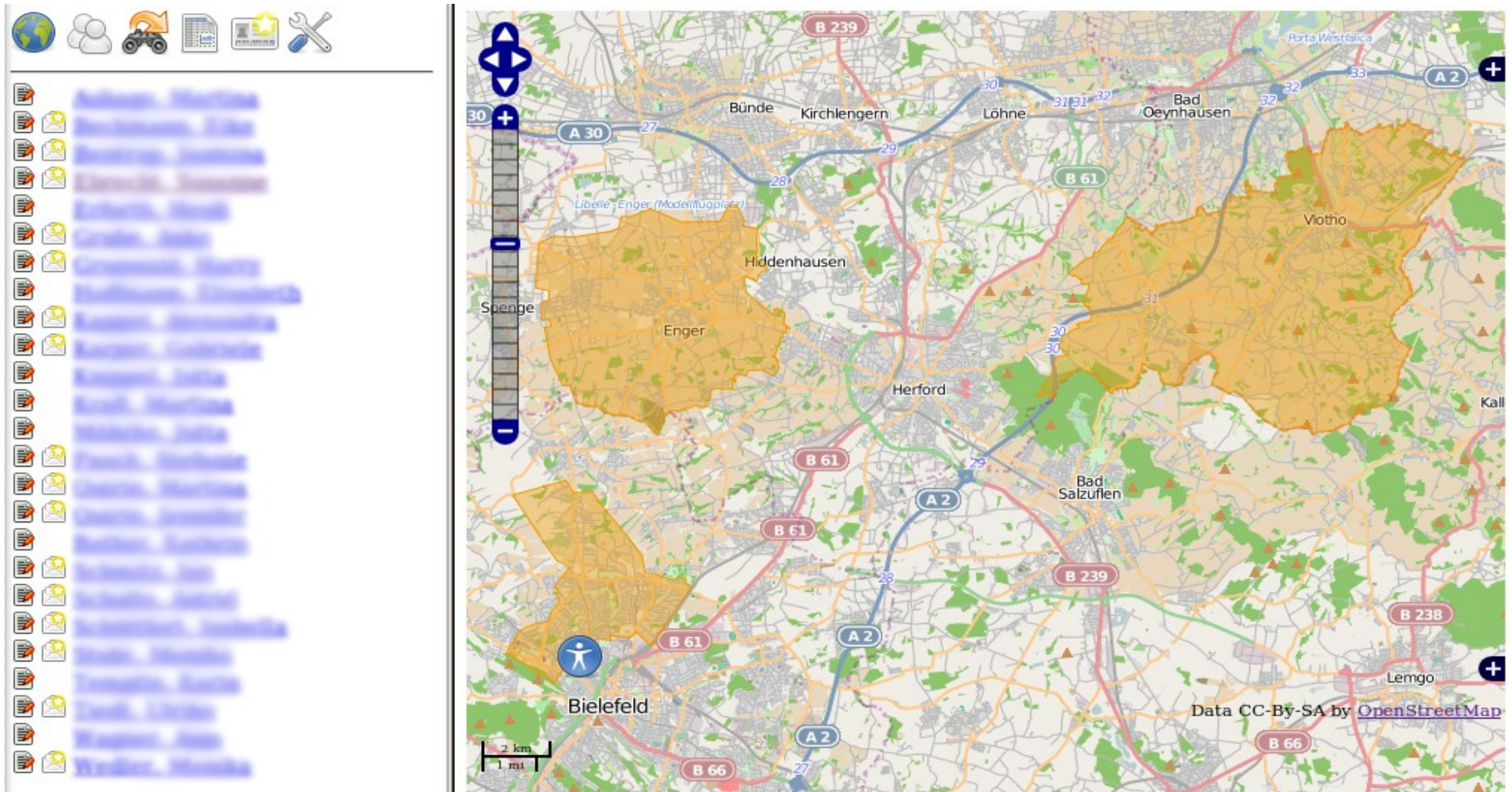

Screenshot



```
SELECT ST_ASTEXT(ST_UNION(ST_BUFFER(ST_CENTROID(c.way), sqrt(p.population)*10)))
FROM planet_osm_polygon c
JOIN population p
  ON c.name = p.name
AND ( c.admin_level = '8' OR ( c.name = 'Bielefeld' AND c.admin_level = '6'))
```


Example Application

- “Cat inspectors”



Cat Inspectors cnt.

