OpenStreetMap: Its History, Data Structure, License and Ecosystem

Prof. Dr. Franz-Josef Behr

Partially based on a a presentation of Min Qian, Virasith Phomsouvanh (2008): The OpenStreetMap (OSM) Project. Stuttgart University of Applied Sciences

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OpenStreetMap…

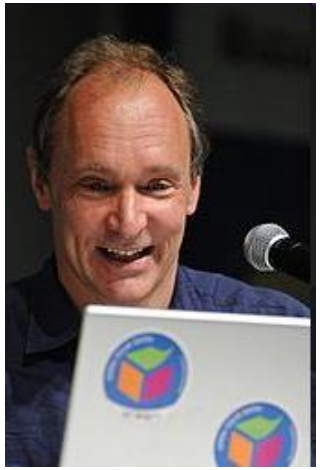
CC BY SA

- "Topographic Map" of the planet,
- offers geodata for free
- grows dynamically
- updated quite regularly
- user driven, not profit driven
- Wide range of tools

- Ideas and Background

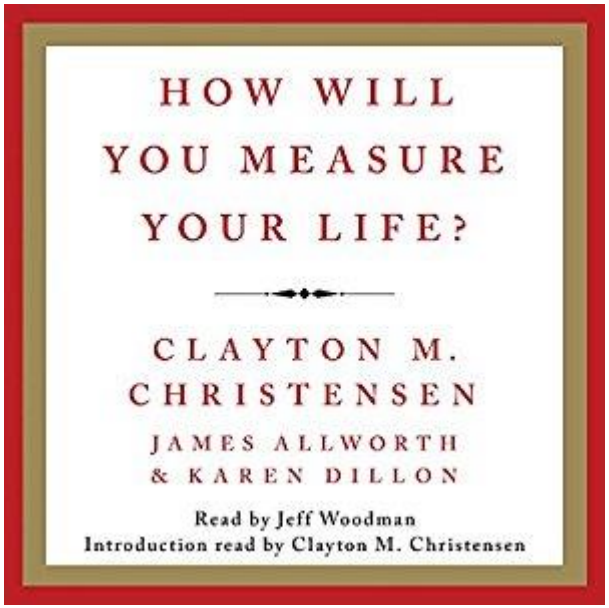
Some motivating ideas…

- "If you don't make [lower-resolution mapping data] publicly available, there will be **people with their cars and GPS devices**, driving around with their laptops," […] "They will be **cataloguing every lane**, and **enjoying** it, driving 4x4s behind your farm at the dead of night. There will, if necessary, be a **grass-roots remapping**."
  Tim Berners-Lee, 2006 [1]



[1] http://www.guardian.co.uk/society/2006/mar/23/epublic.technology#article_continue [2008-10-22]

[2] http://www.flickr.com/photos/89142790@N00/3212369167

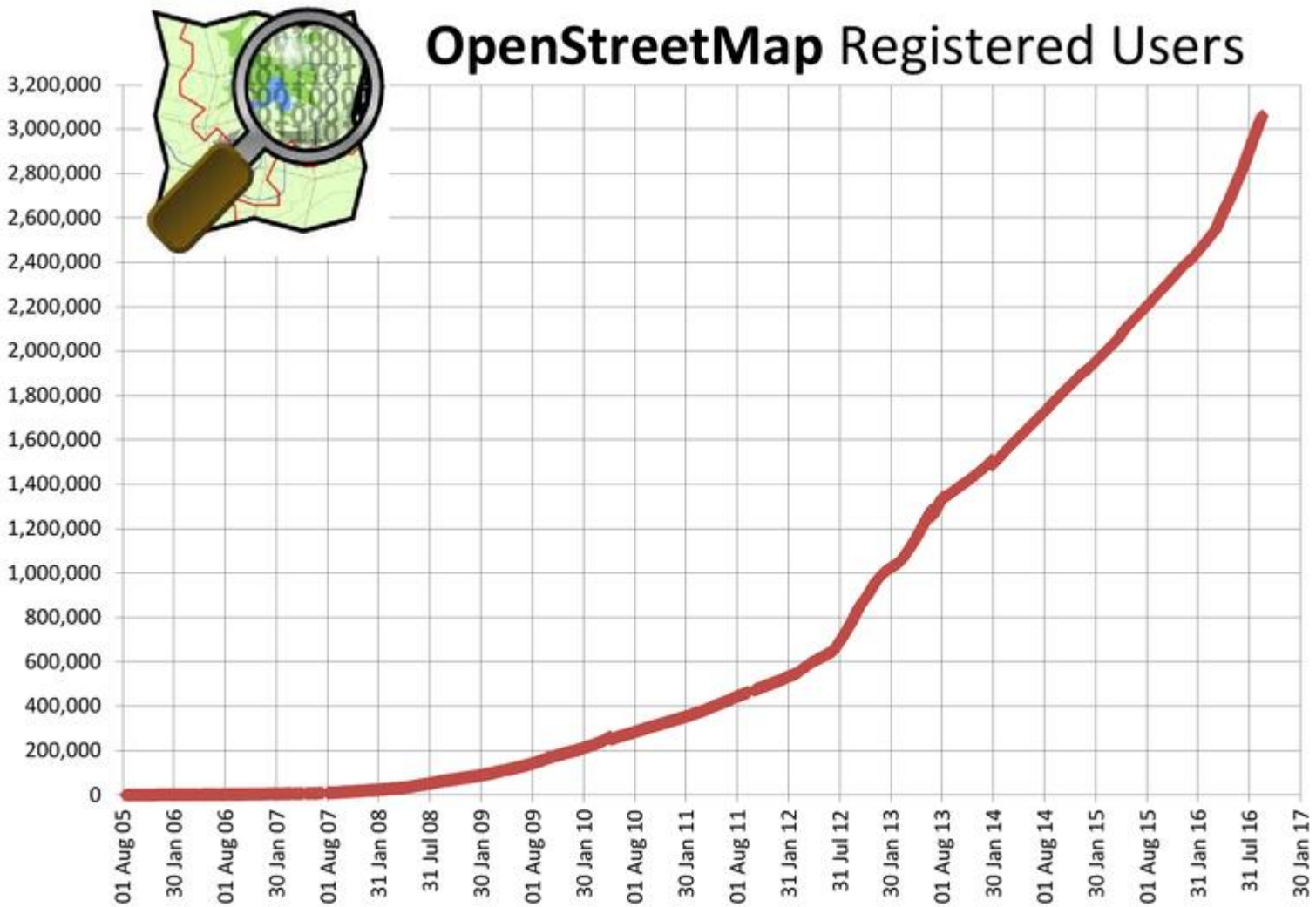


"…in almost every case, **a disruptive technology** enables a larger population of less skilled people to do things that historically only an expert could do. And to do it in a more convenient settings.
… One of the […] mechanisms through which our lives have improved"

Clayton Christensen (2010): How Will You Measure Your Life

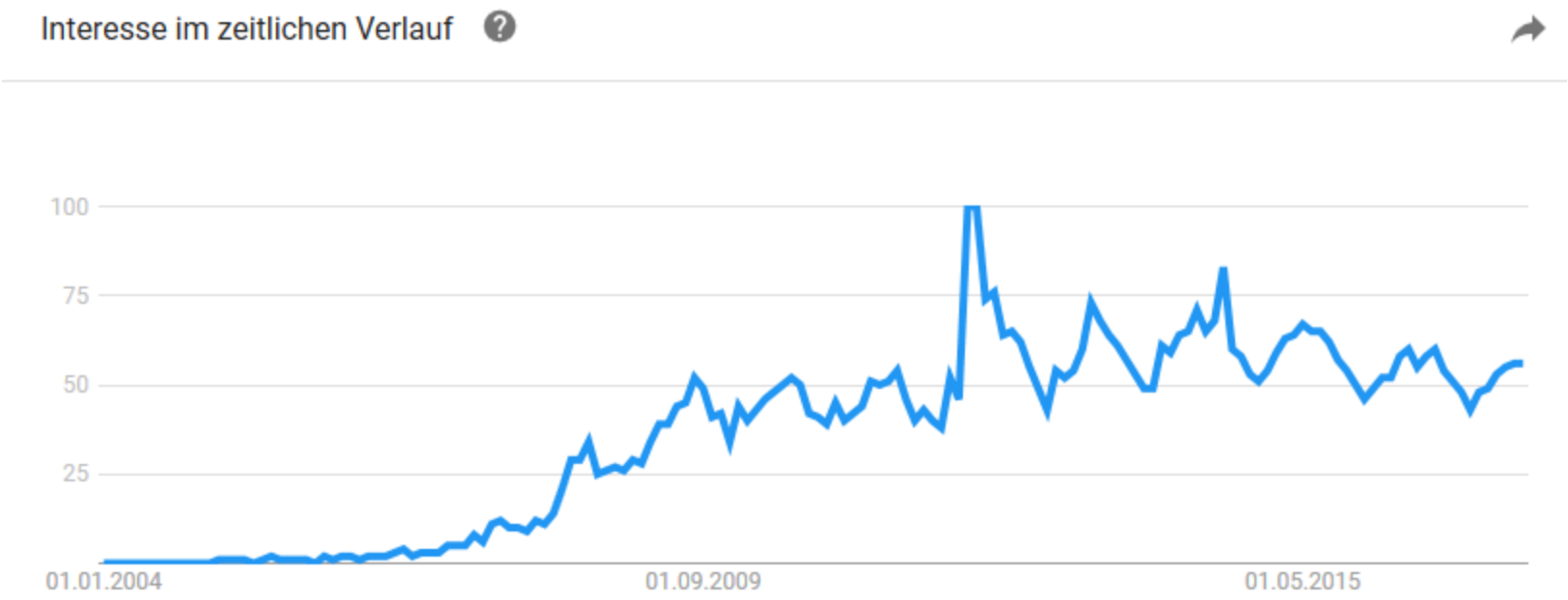
"You could have a **community** capability
where you took the **GPS** data of people driving around and started to see,
oh, there's a new road that we don't have, a new route .. And so that data eventually should just
come from the community
with the right **software infrastructure**." -- Bill Gates

Cited based on https://news.microsoft.com/speeches/bill-gates-microsoft-mix06-conference/#OVu0wkJzjoZKyycJ.97 [2017-06-22]



http://wiki.openstreetmap.org/wiki/Stats [2017-06-22]

Trends, observed by Google



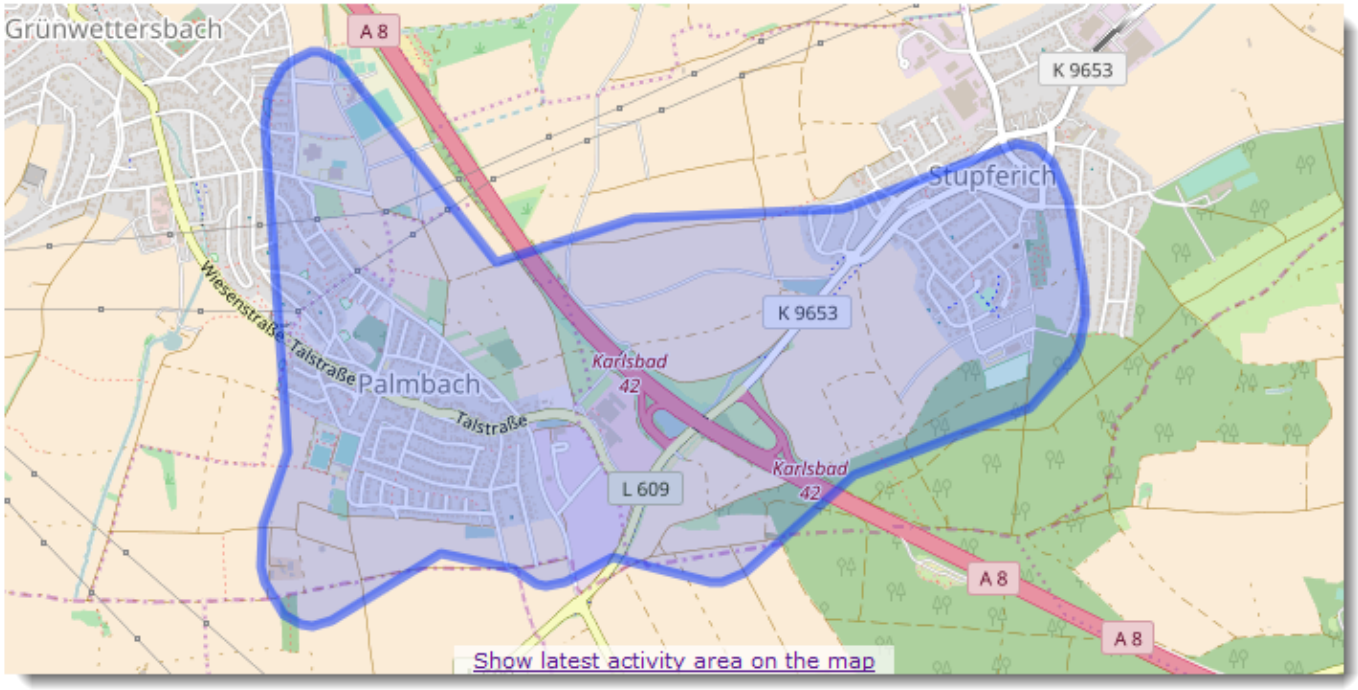
http://www.google.de/trends?q=OpenStreetMap&ctab=0&geo=all&date=all&sort=2 [2017-06-22]

Name: fjbehr (UID 8164)	Nodes	Ways	Relations
Created:	16 252	1 013	5
Modified:	15 679	1 466	87
Deleted:	1 246	35	0
last modifier of:	7 001	197	23
has the following ranks:	#24426	#53757	#9718

Changesets	With comments	Unique comments	Median length
208	77	51 (54.3%)	18.00
Amount of map changes	<15 changes: 81 changesets	>15 <150 changes: 82 changesets	>150 changes: 45 changesets

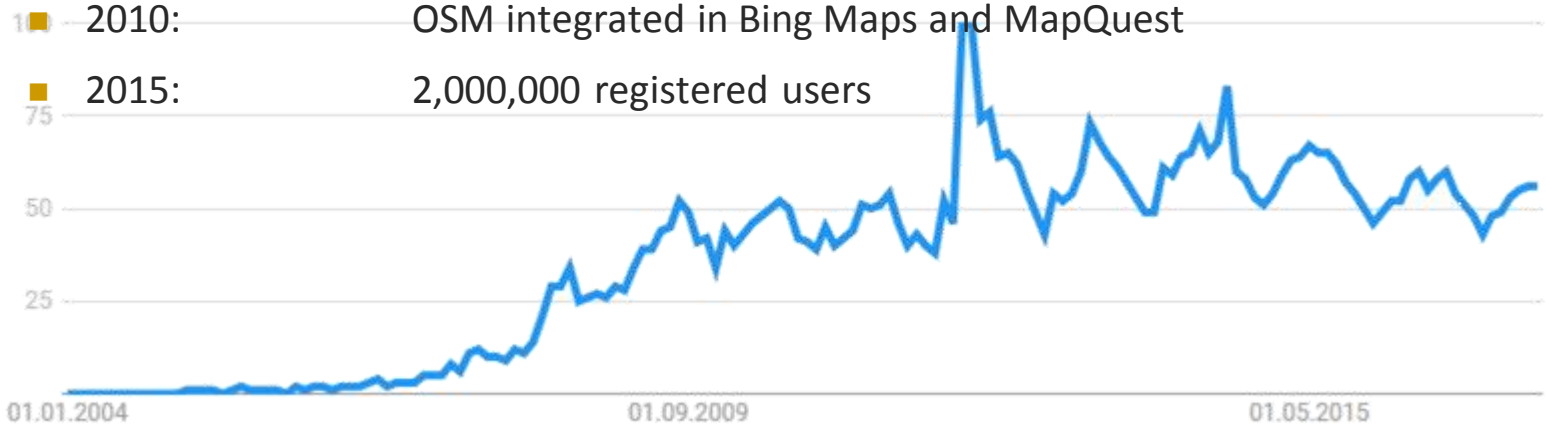
Last Modifier of way-objects with the following tags (% of all last modifier ways of the user)							
Amenity	**Building**	**Highway**	**Landuse**	**Leisure**	**Name**	**Natural**	**Addr:***
4 (2%)	38 (19%)	101 (51%)	20 (10%)	1 (1%)	27 (14%)	5 (3%)	1 (1%)

Main & latest (6 months) activity area - First created & latest edited node



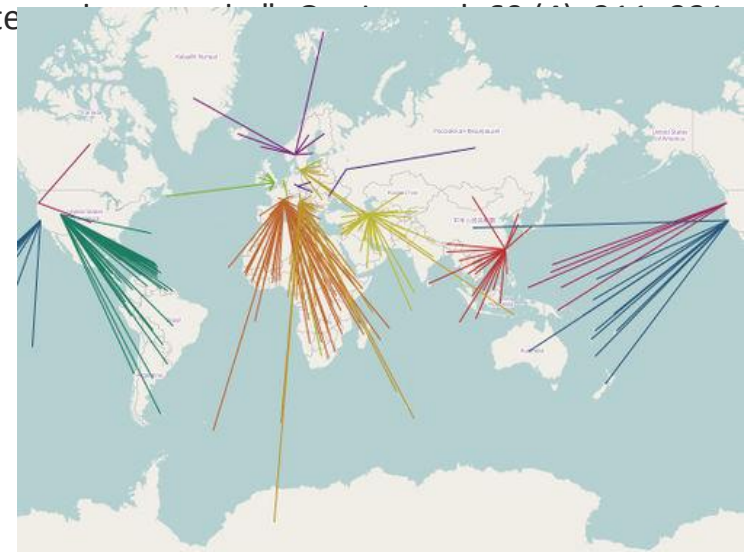
The OpenStreetMap Project - History

- Aug 2004: founded by Steve Coast (since that time working for different companies)
- Dec 2005: 1000 User
- March 2006: Osmarender
- May 2006: Isle of Wight Mapping Party
- Aug 2006: OpenStreetMap Foundation: fundraising, promotion and legal representation
- Nov 2006: Slippy Map, significantly increasing number of data
- Feb 2007: City of Cambridge completely mapped
- since 2008: several German cities completely mapped
- 2010: OSM integrated in Bing Maps and MapQuest
- 2015: 2,000,000 registered users



How does it work?

- Decentral data collection and updating primarily by
  - volunteered work (Volunteered Geographic Information, VGI) Goodchild, M.F. (2007). "Citizens as sensors: the world of volunte
  - Open-licensed data
- Central database
  stored in PostgreSQL with PostGIS
- Data processing
  by Ruby on Rails
- Rendering
  by Mapnik
- Presentation of Tiles
  by Leaflet
- Data export
  in different formats



Content Delivery Network of Tile Servers, http://wiki.openstreetmap.org/wiki/File:OSM-tileserver_worldwide_Jan2015.jpg [2017-06-22]

The VGI contributors - Motivation

- Trust
- Non-monetary motivation
- Give people ownership
- Create a short feedback loop -
- Allow especially talented people to do amazing things
- Discrete multi-size pieces
- Low-cost integration
- Fun (mapathons)
- Short time needs
- More fun

Openly-licensed data from national mapping agencies and other sources, like

- Austria: data from Stadt Wien (under CC BY), Land Vorarlberg and Land Tirol (under CC BY AT with amendments).
- Canada: data from GeoBase®, GeoGratis (© Department of Natural Resources Canada), CanVec (© Department of Natural Resources Canada), and StatCan (Geography Division, Statistics Canada).
- Finland: data from the National Land Survey of Finland's Topographic Database and other datasets, under the NLSFI License.
- France: data sourced from Direction Générale des Impôts.
- Netherlands: © AND data, 2007 (www.and.com)
- New Zealand: data sourced from Land Information New Zealand. Crown Copyright reserved.
- Slovenia: data from the Surveying and Mapping Authority and Ministry of Agriculture, Forestry and Food (public information of Slovenia).
- South Africa: data sourced from Chief Directorate: National Geo-Spatial Information, State copyright reserved.
- United Kingdom: Ordnance Survey data © Crown copyright and database right 2010-12.

Source: https://www.openstreetmap.org/copyright/en [2017-06-29]

- A closer look

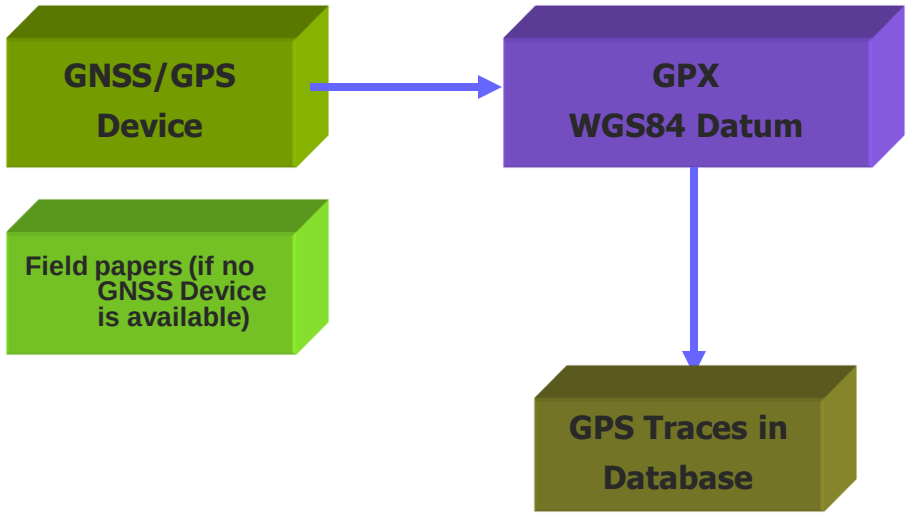
Some helpful resources

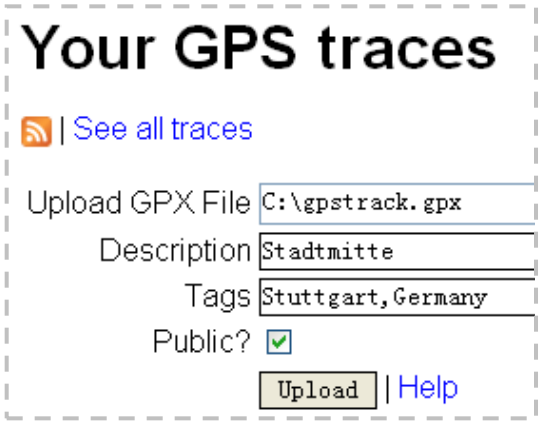
- http://wiki.openstreetmap.org/wiki/Main_Page
- http://learnosm.org/en/
- http://www.weeklyosm.eu/archives/9178
- http://teachosm.org/en/

Collaboration

- Task Manager: mapping tool designed and built for the Humanitarian OSM Team collaborative mapping.
  - mapping jobs are divided into smaller tasks that can be completed rapidly.
  - shows which areas need to be mapped and which areas need the mapping validated.
  - http://tasks.hotosm.org/

Data upload from GNSS devices or Field Papers



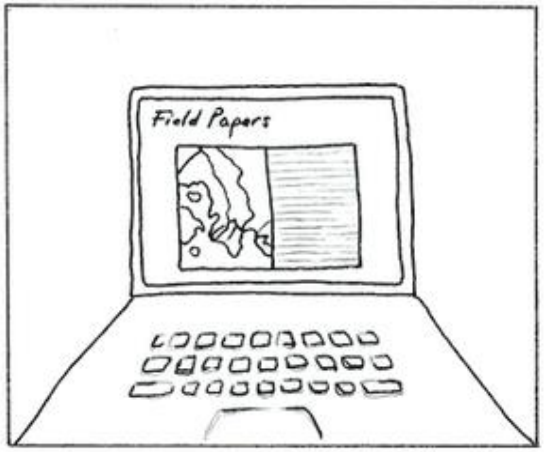


Field Papers

MAKE an atlas to print | **UPLOAD** pages you've marked | **WATCH** recent activity | **EXTEND** with advanced tools | **LOG IN** or create an account

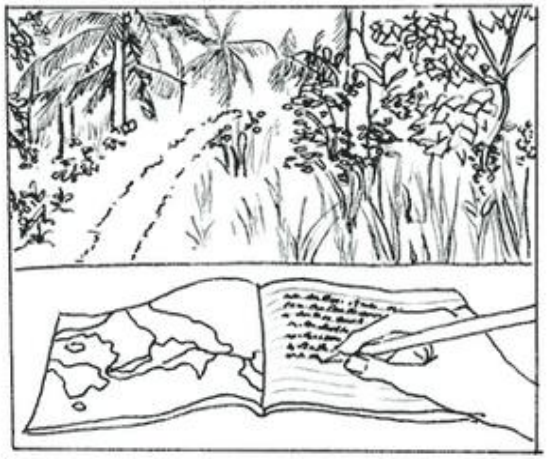
http://fieldpapers.org/?locale=en

Welcome to Field Papers



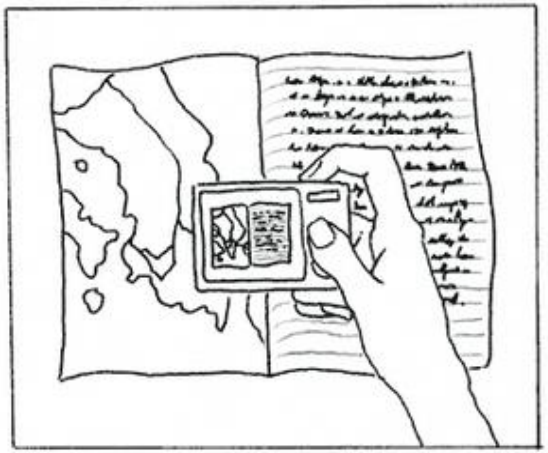
Make yourself an atlas

Print out anywhere in the world.



Take it into the field

Make your notes and observations.



Capture your notes

Upload pages you've photographed.

Field Papers is built by Stamen Design / About the Project / Help

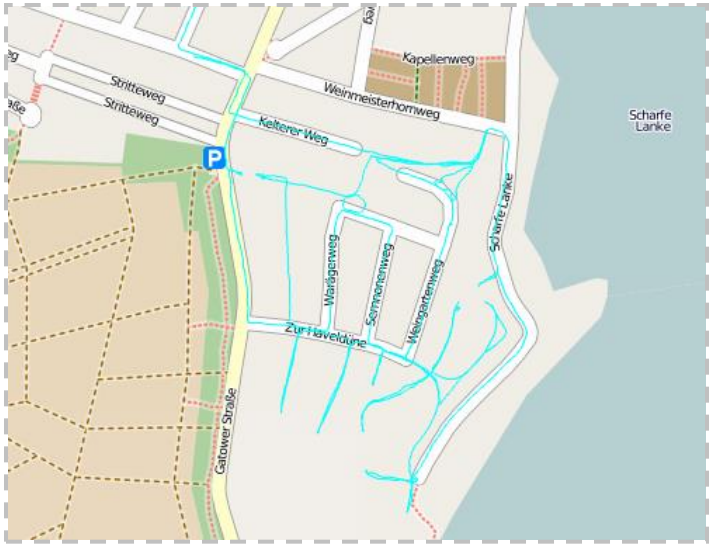
Map data © OpenStreetMap contributors, Toner by Stamen, Bing by Microsoft, Mapbox, or a combination thereof.

Dansk Deutsch English Español Français Bahasa Indonesia Italiano 日本語 عربي Nederlands Polski Português русский Kiswahili Tagalog Українська tiếng Việt 普通话 國語

Development Blog GitHub Issues Translations

Feature Creation

- Geometries do not know what they represent. We have to add "tags" to create features out of them for further rendering and evaluation.



Basic geometrical Objects Types

- “The simplest solution which could work!”

- Nodes (point objects)
- Ways (linestrings, linear rings, used for polygons as well)
- Relations (compound objects)

- For Geospatial Community: Uncommon data model, not fitting to standards.

Geomtetrical Objects

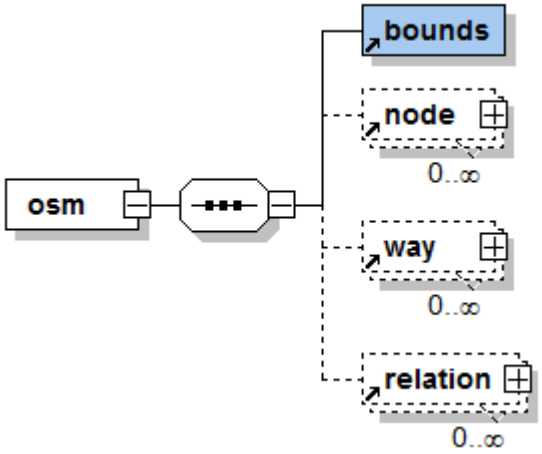
+

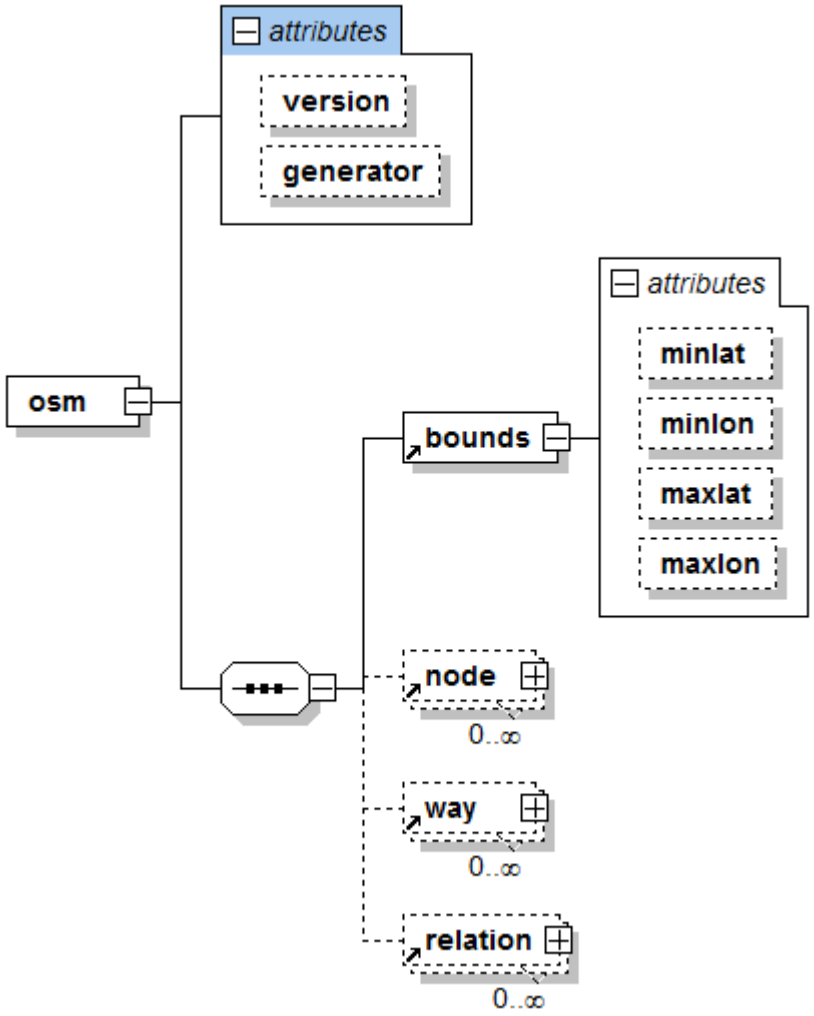
Tags

=

Features

Overview

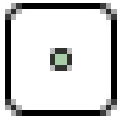

osm
bounds
node
0..∞
way
0..∞
relation
0..∞

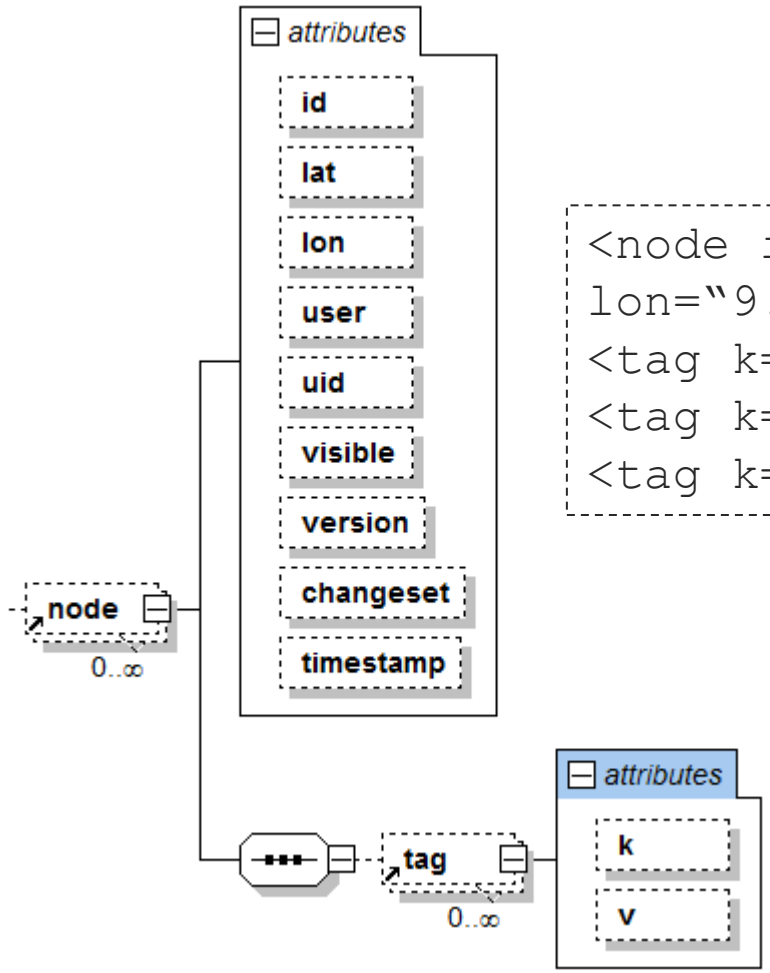

attributes
version
generator
osm
attributes
minlat
minlon
maxlat
maxlon
bounds
node
0..∞
way
0..∞
relation
0..∞

Node

- a point that consists of latitude and longitude

- can be a vertex of a way (or of many ways)
- can represent point features, e.g. a bus station or postal address, and all of kinds of points of interesting (POI), *having at least one tag*





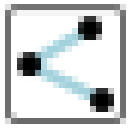

```
<node id="874039" lat="48.7728093"
lon="9.1771907"
<tag k="name" v="Oblomow" />
<tag k="created_by" v="Potlatch" />
<tag k="amenity" v="phonebox" />
```

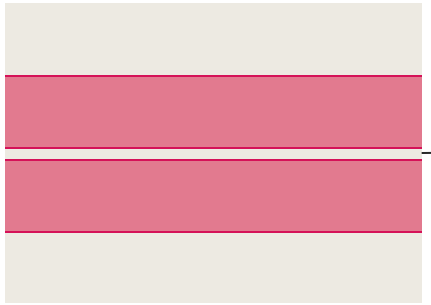
Way

- Linear feature characterized by uniform properties

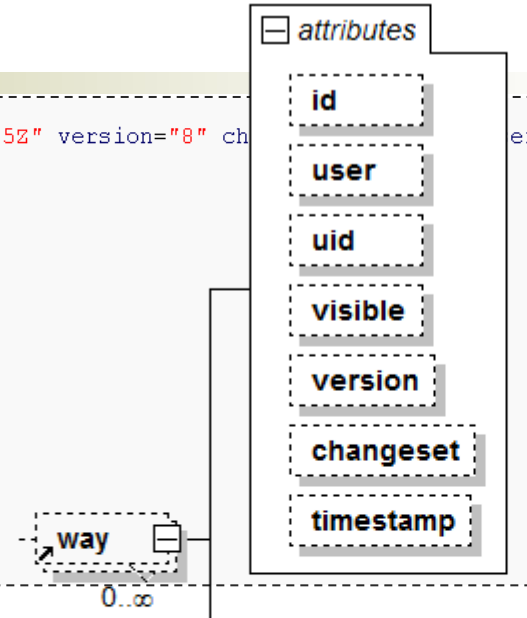
  e.g. motorway maybe mark using a way:
  tagging with `highway=motorway`

- Ways can be split into shorter way if different properties exist (e.g. different material)





```
<way id="5090250" visible="true" timestamp="2009-01-19T19:07:25Z" version="8" ch                er="Blumpsy" uid="64226">
  <nd ref="822403"/>
  <nd ref="21533912"/>
  <nd ref="821601"/>
  <nd ref="21533910"/>
  <nd ref="135791608"/>
  <nd ref="333725784"/>
  <nd ref="333725781"/>
  <nd ref="333725774"/>
  <nd ref="333725776"/>
  <nd ref="823771"/>
  <tag k="created_by" v="Potlatch 0.10e"/>
  <tag k="highway" v="unclassified"/>
  <tag k="name" v="Clipstone Street"/>
  <tag k="oneway" v="yes"/>
</way>
```



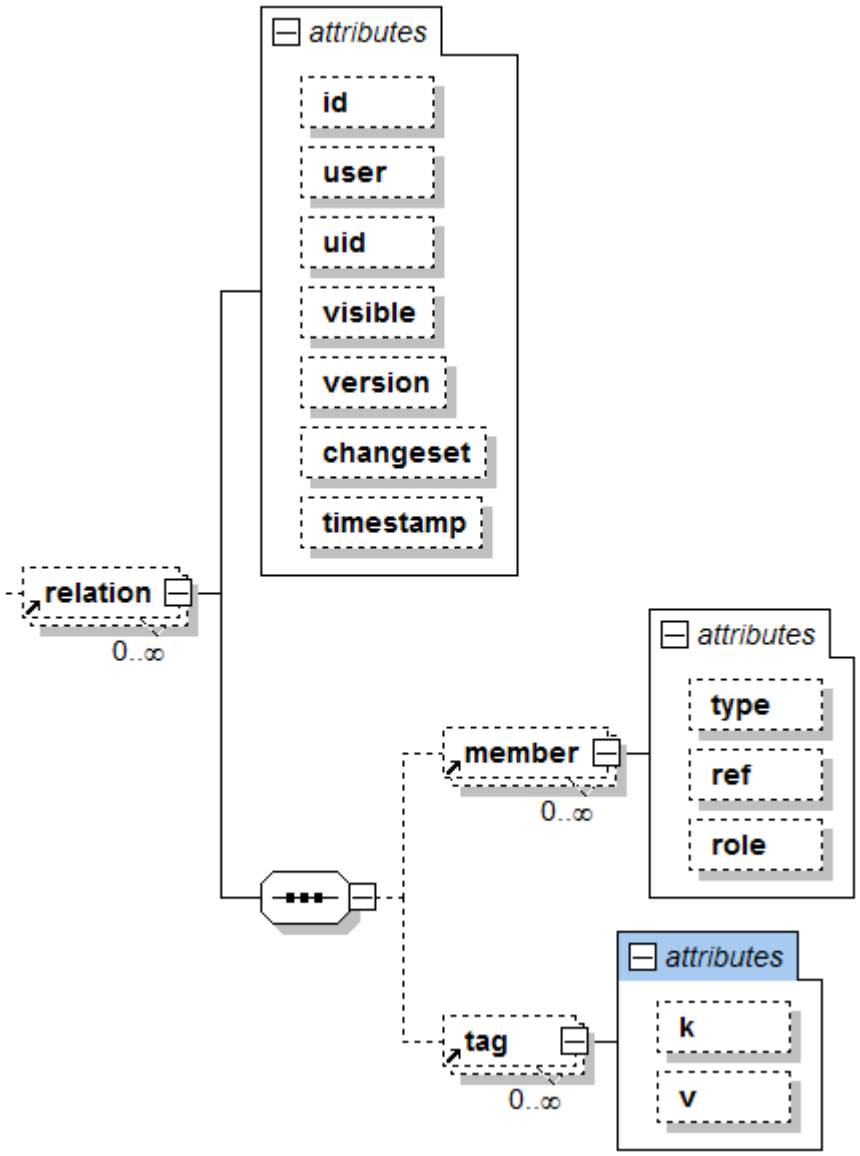

```
<way id="4876027" timestamp="2008-03-12T07:59:11Z" user="                10                ">
  <nd ref="31492372"/>
  <nd ref="31492338"/>
  <nd ref="31492370"/>
  <nd ref="31492371"/>
  <nd ref="31492372"/>
  <tag k="natural" v="water"/>
  <tag k="name" v="Spegeldammen"/>
</way>
```

Closed ways: Areal Features

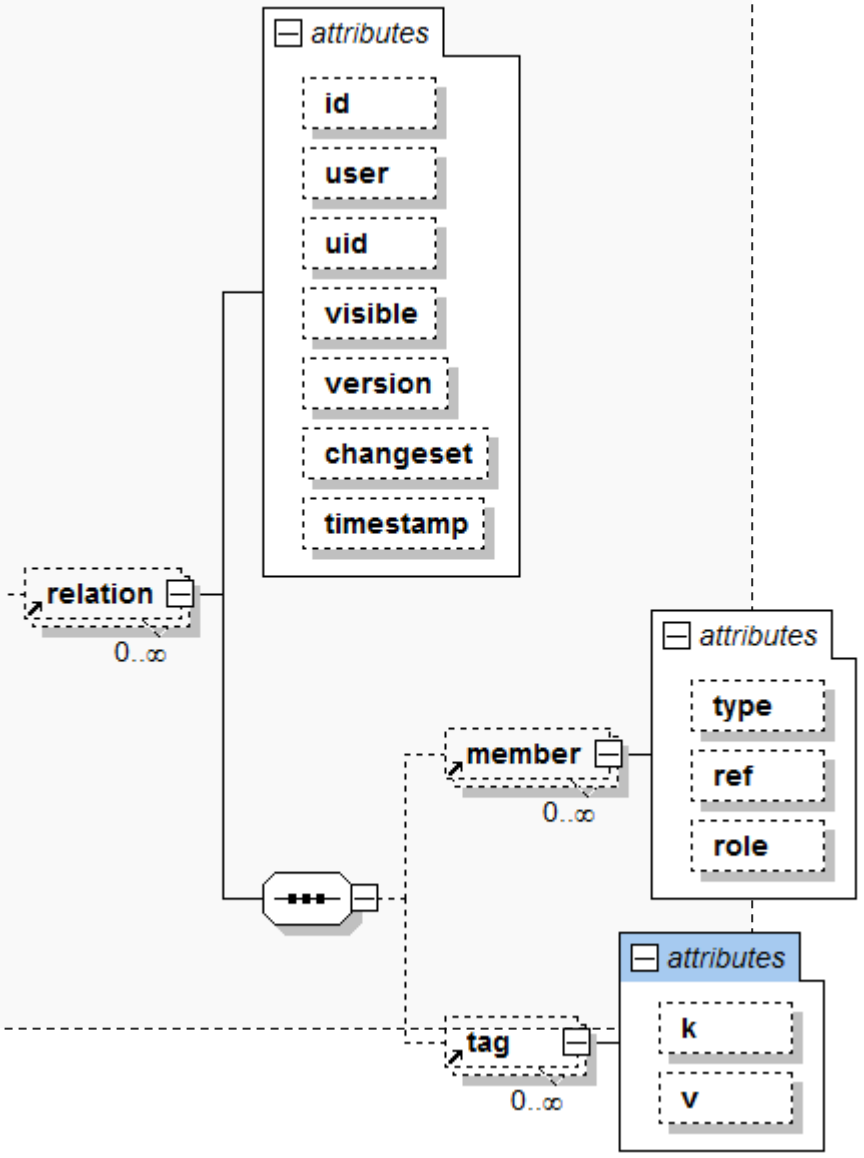
- Should have appropriate tag, e.g. `landuse`
- First node = last node
- `area = yes`

Relation

- Basically: group of objects where each object may take on a specific *role*
- specifying relationships between objects,
- may also model an abstract object.

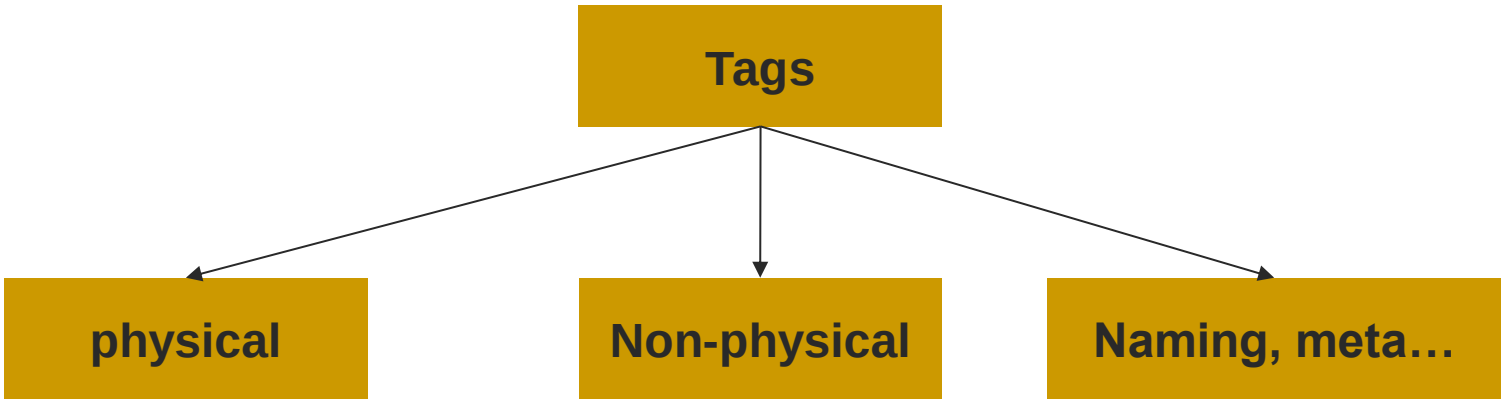


```xml
<relation id="12176" visible="true" timestamp="2008-08-09T17:55:39+01:00" user="Andy Allan">
  <member type="way" ref="4068452" role="forward"/>
  <member type="way" ref="4082616" role="forward"/>
  <member type="way" ref="4253466" role=""/>
  <member type="way" ref="4254996" role="backward"/>
  <member type="way" ref="4254997" role="forward"/>
  <member type="way" ref="4255009" role="forward"/>
  <member type="way" ref="4255103" role="forward"/>
  <member type="way" ref="4255109" role="forward"/>
  <member type="way" ref="4256129" role="forward"/>
  <member type="way" ref="5090250" role="forward"/>
  <member type="way" ref="17926237" role="backward"/>
  <member type="way" ref="17926240" role=""/>
  <member type="way" ref="17926241" role=""/>
  <member type="way" ref="17929790" role="forward"/>
  <member type="way" ref="17929795" role="forward"/>
  <member type="way" ref="17944924" role="forward"/>
  <member type="way" ref="17944925" role="forward"/>
  <member type="way" ref="17944927" role="forward"/>
  <member type="way" ref="17944928" role="forward"/>
  <member type="way" ref="19211502" role=""/>
  <member type="way" ref="19212465" role="forward"/>
  <member type="way" ref="26164616" role=""/>
  <tag k="ref" v="0"/>
  <tag k="type" v="route"/>
  <tag k="created_by" v="Potlatch 0.10b"/>
  <tag k="network" v="lcn"/>
  <tag k="route" v="bicycle"/>
</relation>
```



Tagging

- Tags with **key=value**
- Arbitrary Tags possible
- Community based process (Wiki), yielding discussions...
- Very flexible
- Partially unstructured
- Your source of information:
  http://wiki.openstreetmap.org/index.php/Map_Features



Physical Tags

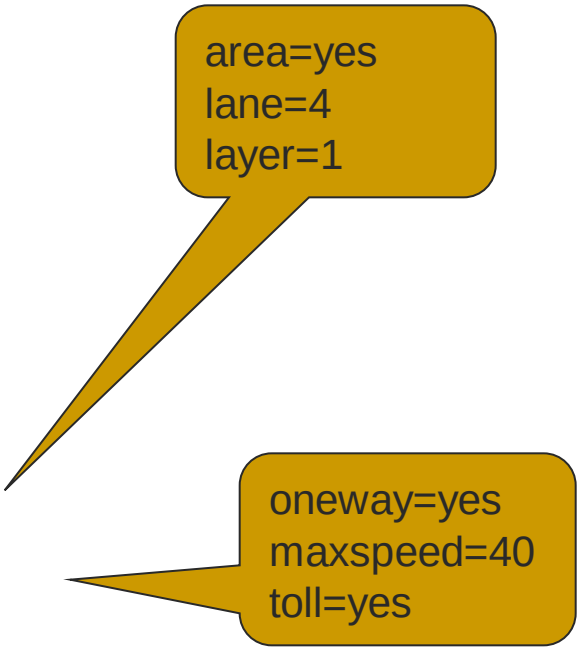
highway=motorway
highway=cycleway

- Highway (roads, paths, intersection features…)
- Waterway (river, boatyard; mooring…)
- Railway (track, stop, intersection...)
- Amenity (parking, post_box, place_of_worship…)
- Landuse (farm, forest, landfill, military…)
- Natural (spring, wood, water, coastline…)
- ……

railway=subway
railway=station
railway=subway_entrance

Non-Physical Tags

- Route (bus, ferry…)
- Sport (football, swimming…)
- Properties (area, lane, layer, width…)
- Restrictions (oneway, maxspeed, toll…)
- ……



Details: http://wiki.openstreetmap.org/index.php/Map_Features

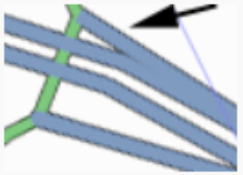
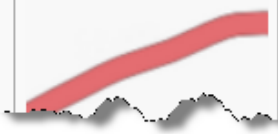
Further Tags

- Naming tags
  - Name
  - References (ref…), e.g. for street numbers
  - ……
- Annotation
  - note
  - Description
- Metatags
  - created_by
  - version

Details: http://wiki.openstreetmap.org/index.php/Map_Features

Highway http://wiki.openstreetmap.org/index.php/Map_Features

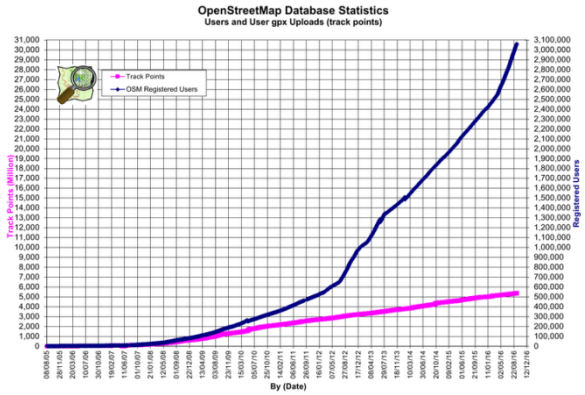
The highway tag is the primary tag used for highways. It is often the only tag. There are conventions for its use in particular countries. See Highway tag usage and Road pages for guidance.

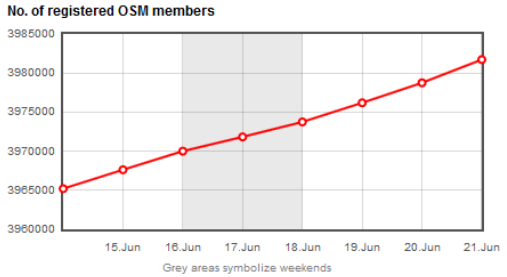
Key	Value	Element	Comment	Rendering	Photo
Roads					
highway	motorway		A restricted access major divided highway, normally with 2 or more running lanes plus emergency hard shoulder. Equivalent to the Freeway, Autobahn, etc..		
highway	motorway_link		The link roads (sliproads/ramps) leading to/from a motorway from/to a motorway or lower class highway. Normally with the same motorway restrictions.		
highway	trunk		Important roads that aren't motorways. Typically maintained by central, not local government. Need not necessarily be a divided highway. In the UK, all green signed A roads are, in OSM, classed as 'trunk'.		
highway	trunk_link		The link roads (sliproads/ramps) leading to/from a trunk road from/to a trunk road or lower class highway.		
highway	primary		Administrative classification in the UK, generally linking larger towns.		

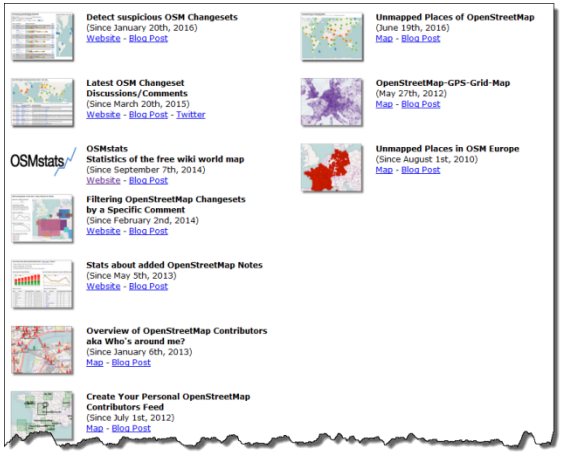
Source: http://openstreetmap.org

Statistics

- http://wiki.openstreetmap.org/wiki/Stats
- https://osmstats.neis-one.org/
- http://resultmaps.neis-one.org/

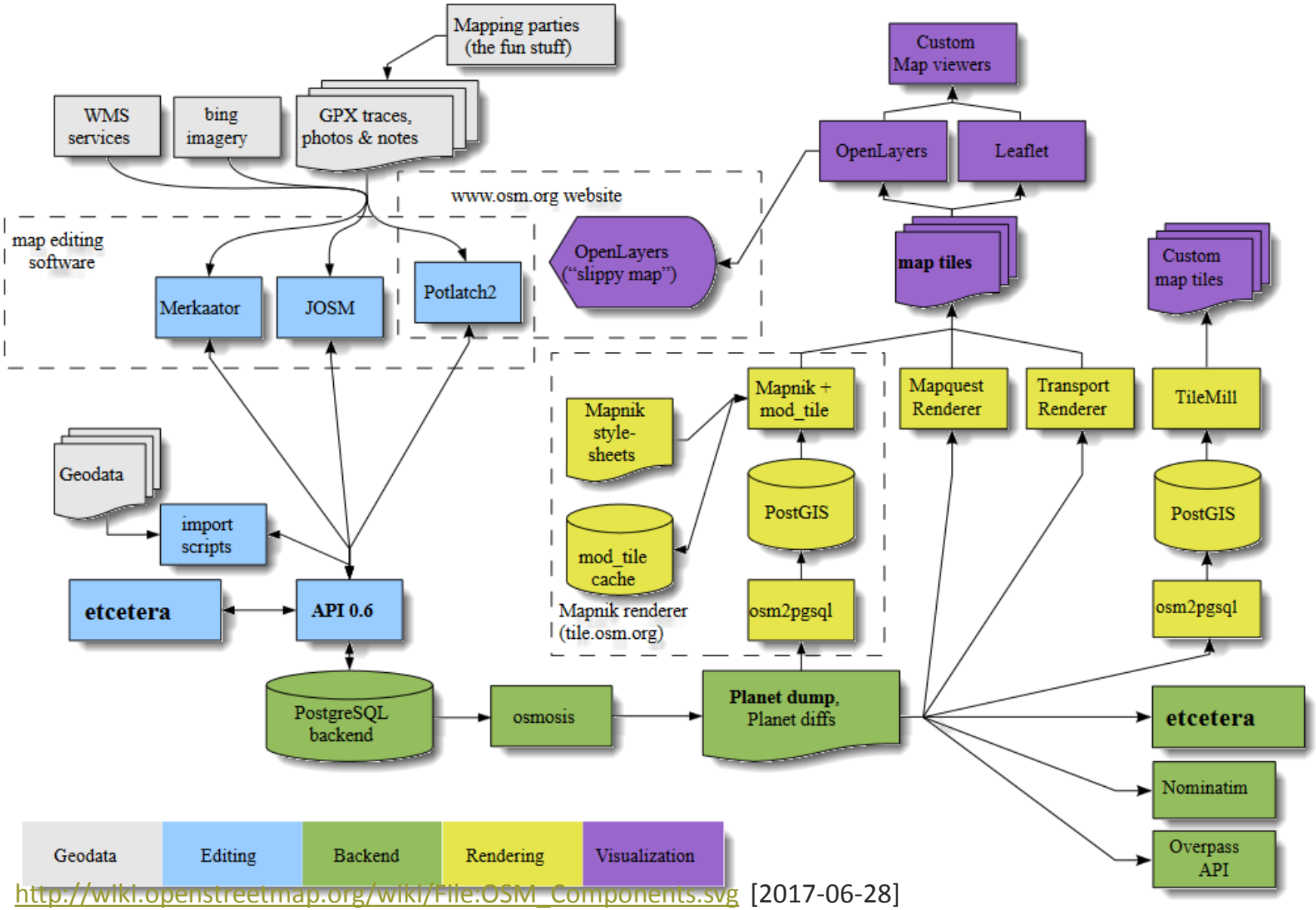






Ecosystem and Tools

The ecosystem (2017)



http://wiki.openstreetmap.org/wiki/File:OSM_Components.svg [2017-06-28]

Planet.osm

- Planet.osm is the OpenStreetMap data in one file: all the nodes, ways and relations that make up our map.
- A new version is released every week, Wednesday morning.
- Big (2017-04-15):
  - XML variant over 784.5GB uncompressed,
  - 56.3GB bz2 compressed and
  - 35.2GB PBF

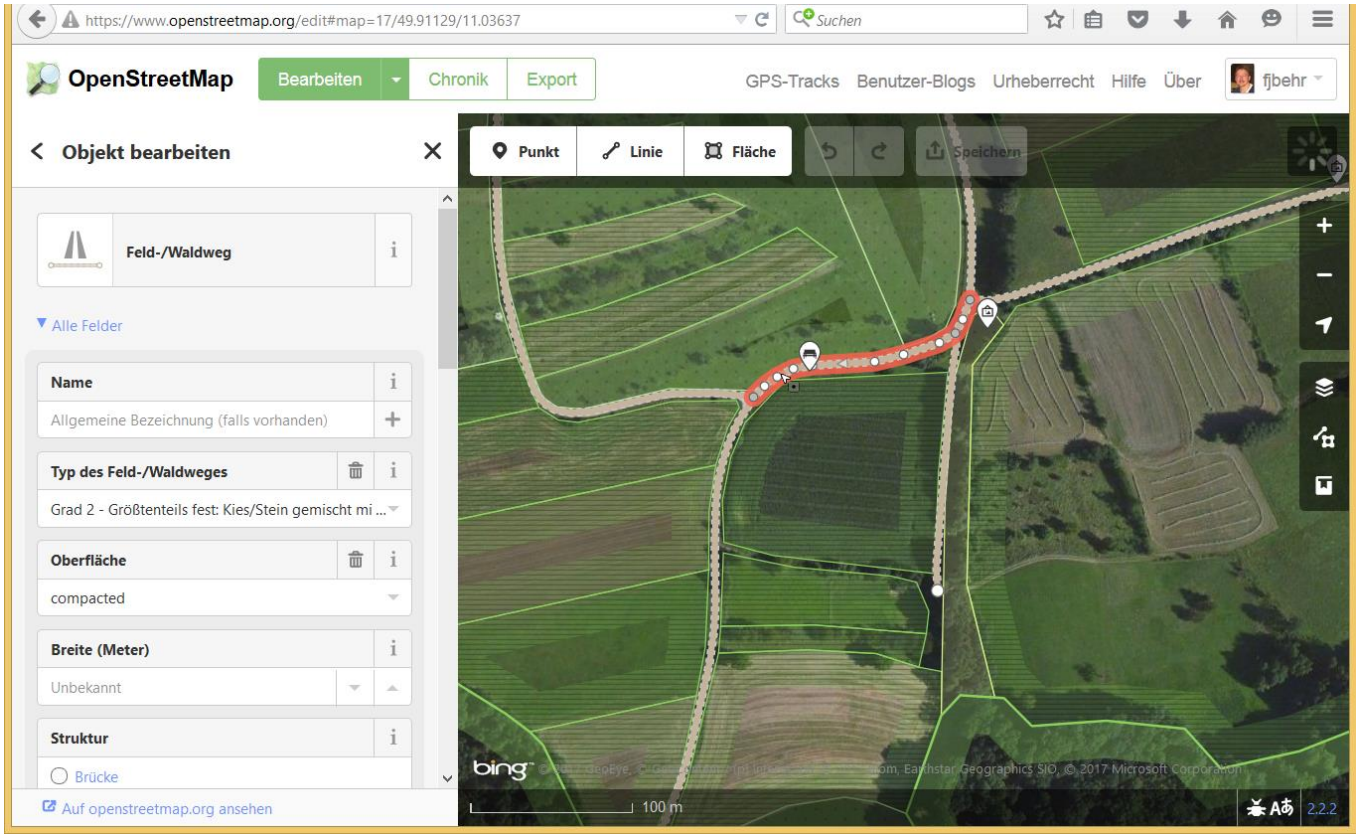
Data Editing

- JOSM
- Potlach 2
- ID – “an overall usable tool for novice users” (Behrens 2014, http://repositum.tuwien.ac.at/download/pdf/1633966 [2017-06-22])
- Merkaartor

Short hands on session: iD

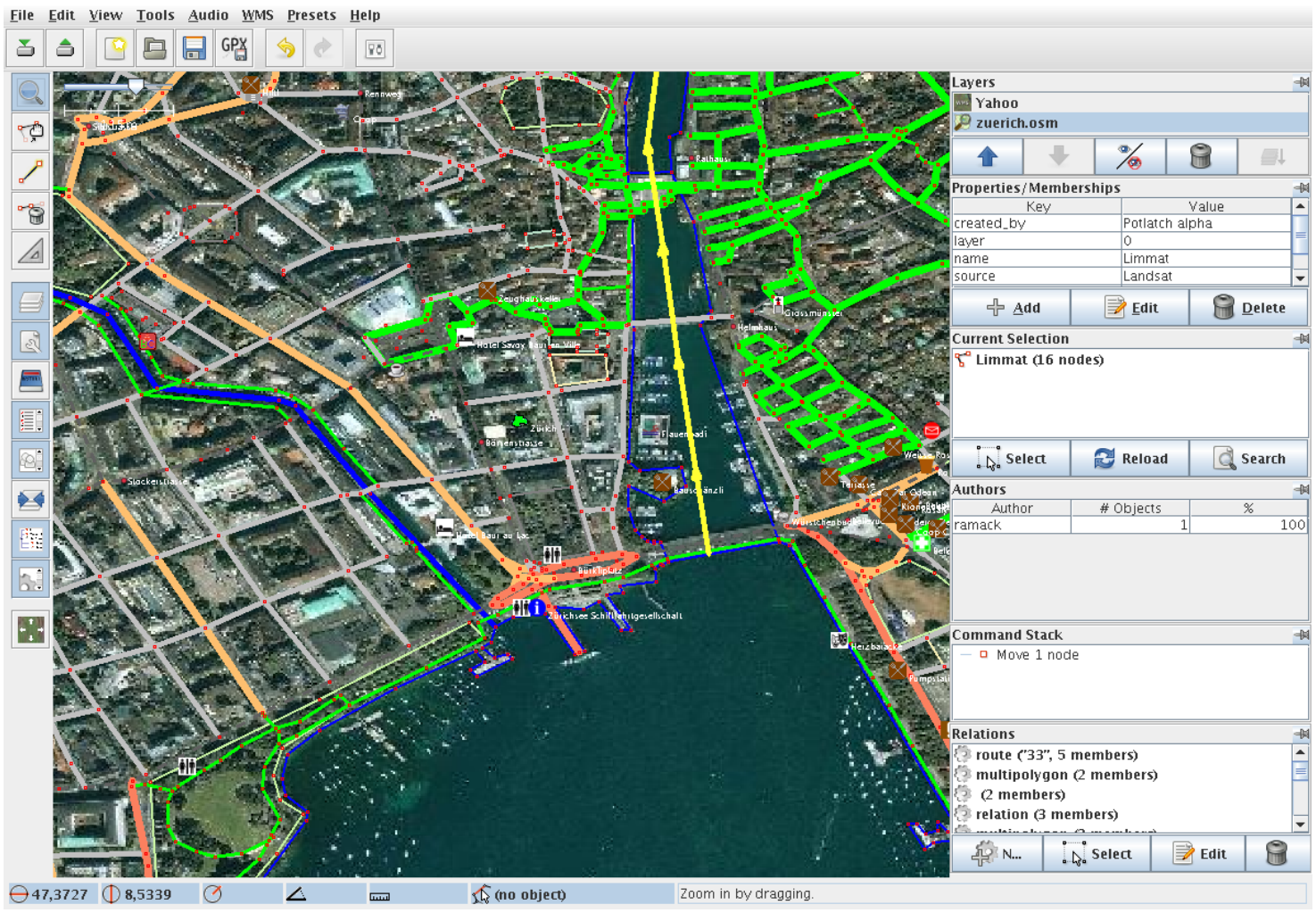
Data Editing: Using iD

- Embedded in web browser
- Easy to learn and to handle (IMHO)

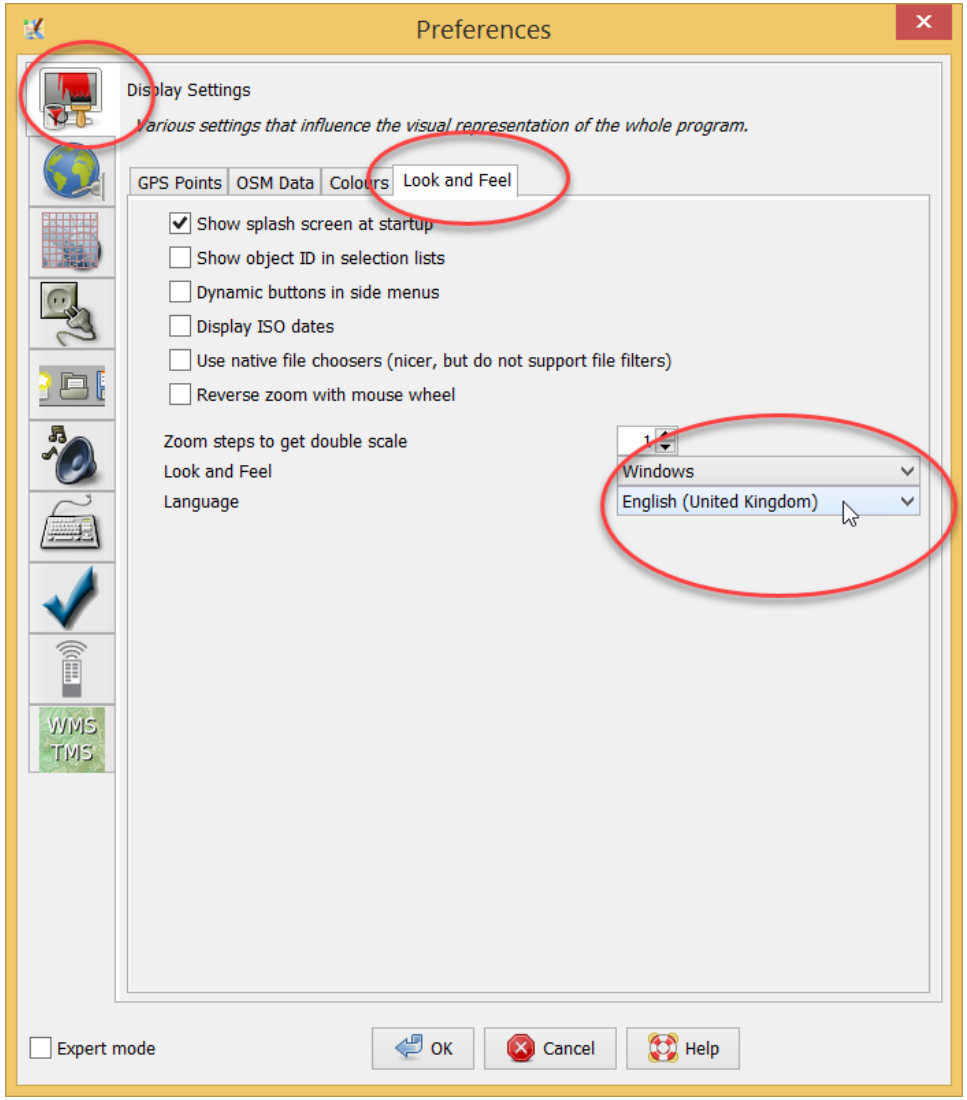


Hands on session: JOSM

Data Editing: JOSM

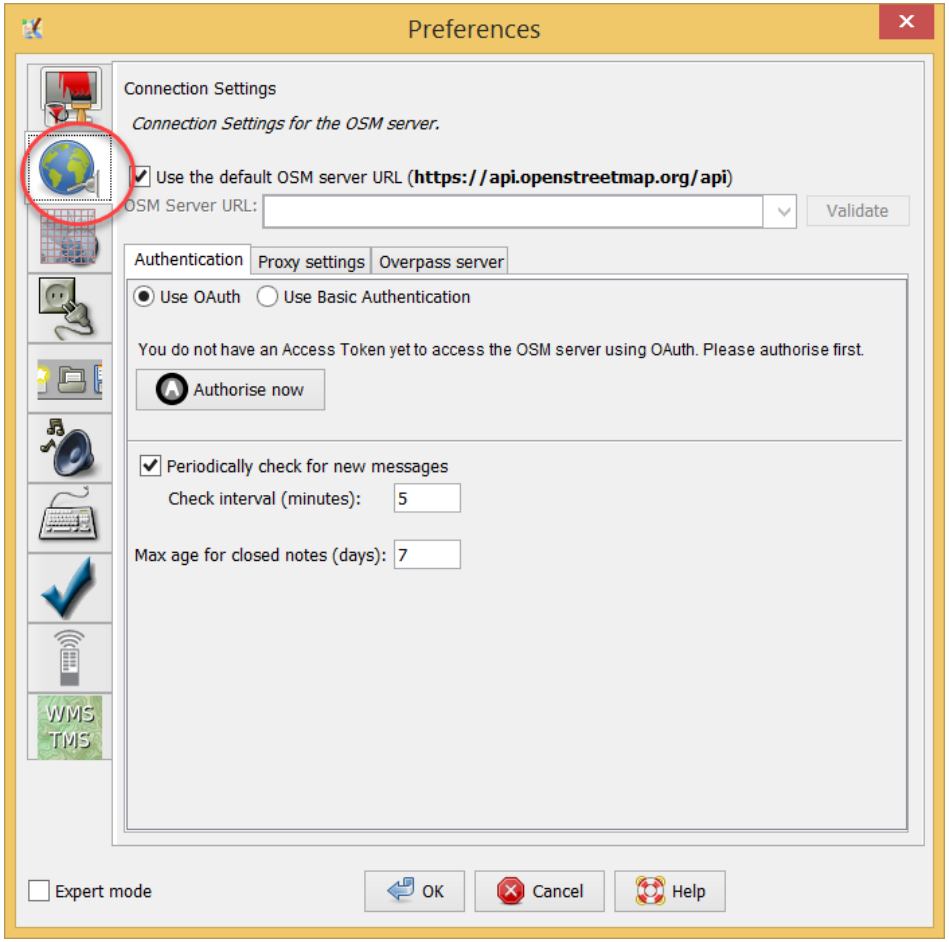


Setting-up JOSM



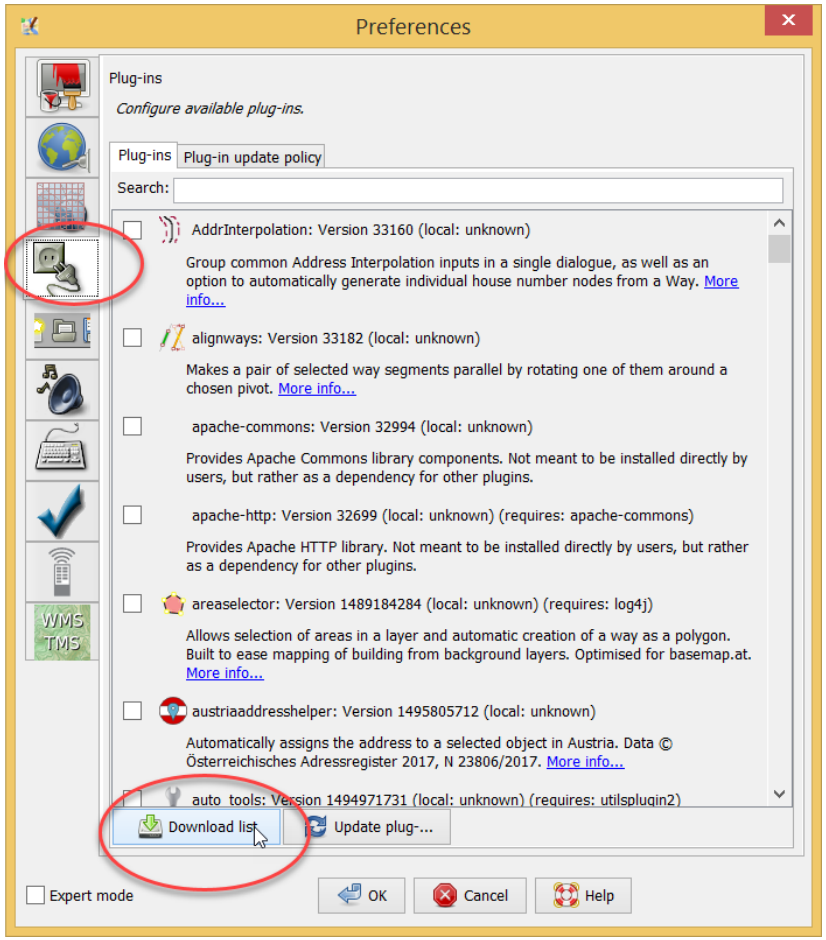
Setting Up JOSM

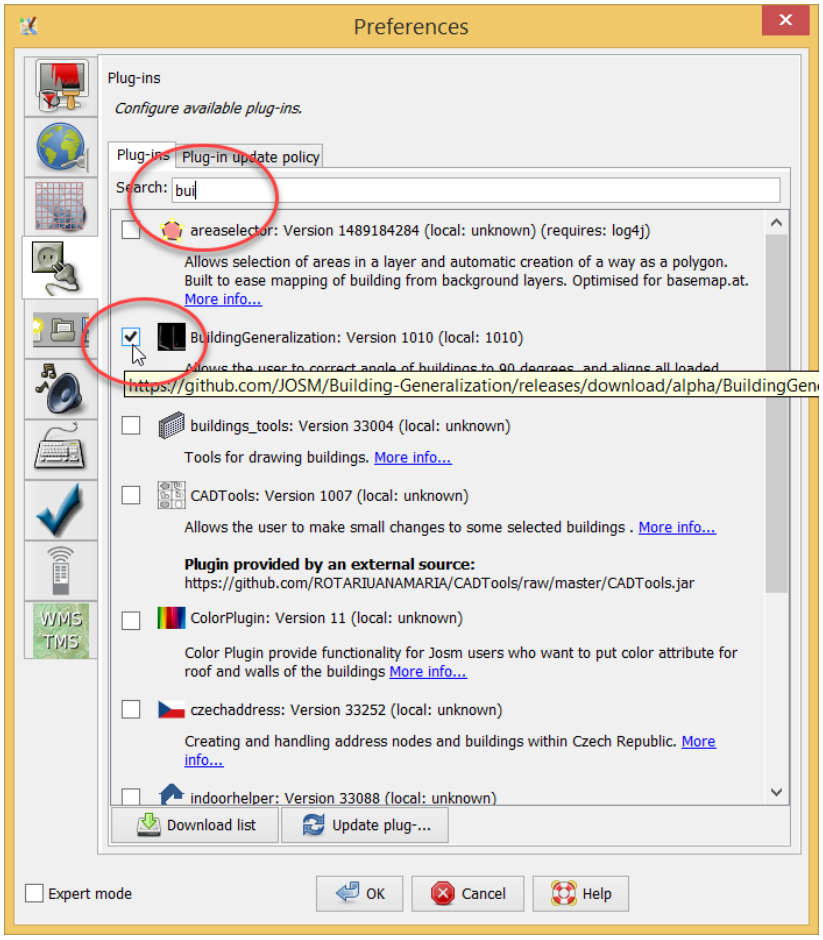
- Activate "Connection Settings" tab
- Provide OSM login credentials



Setting Up JOSM

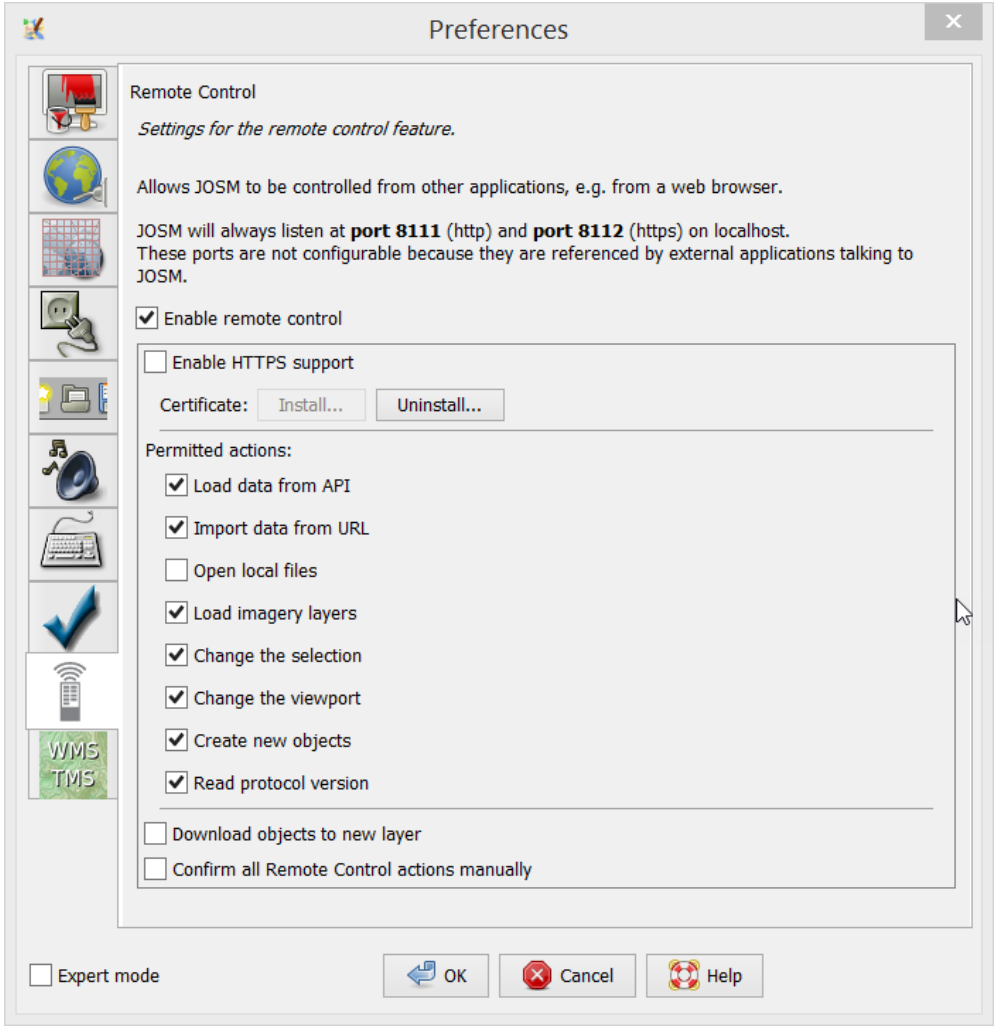
- Select Plugins-Tab





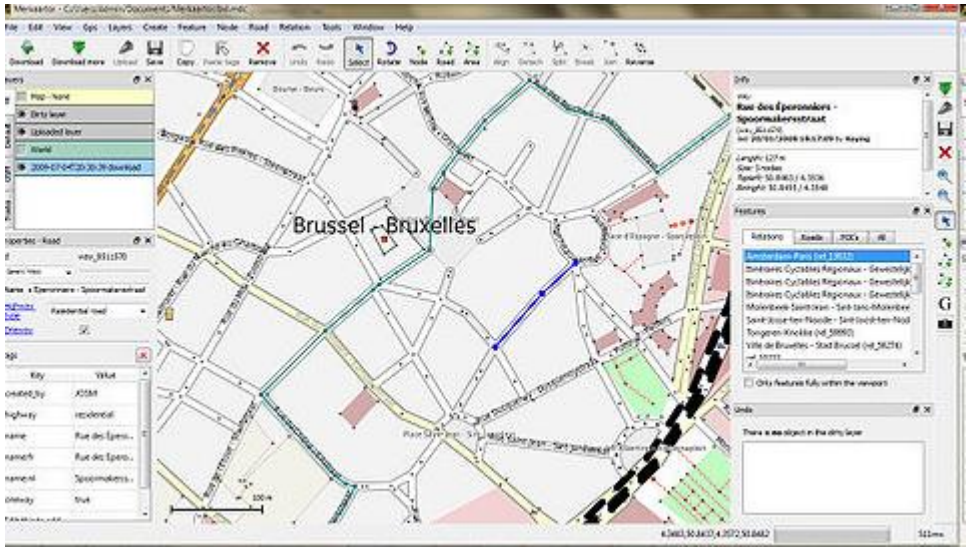
Setting Up JOSM

- For linking JOSM to your web browser:
- In the “Remote Control” tab activate "Enable Remote Control"



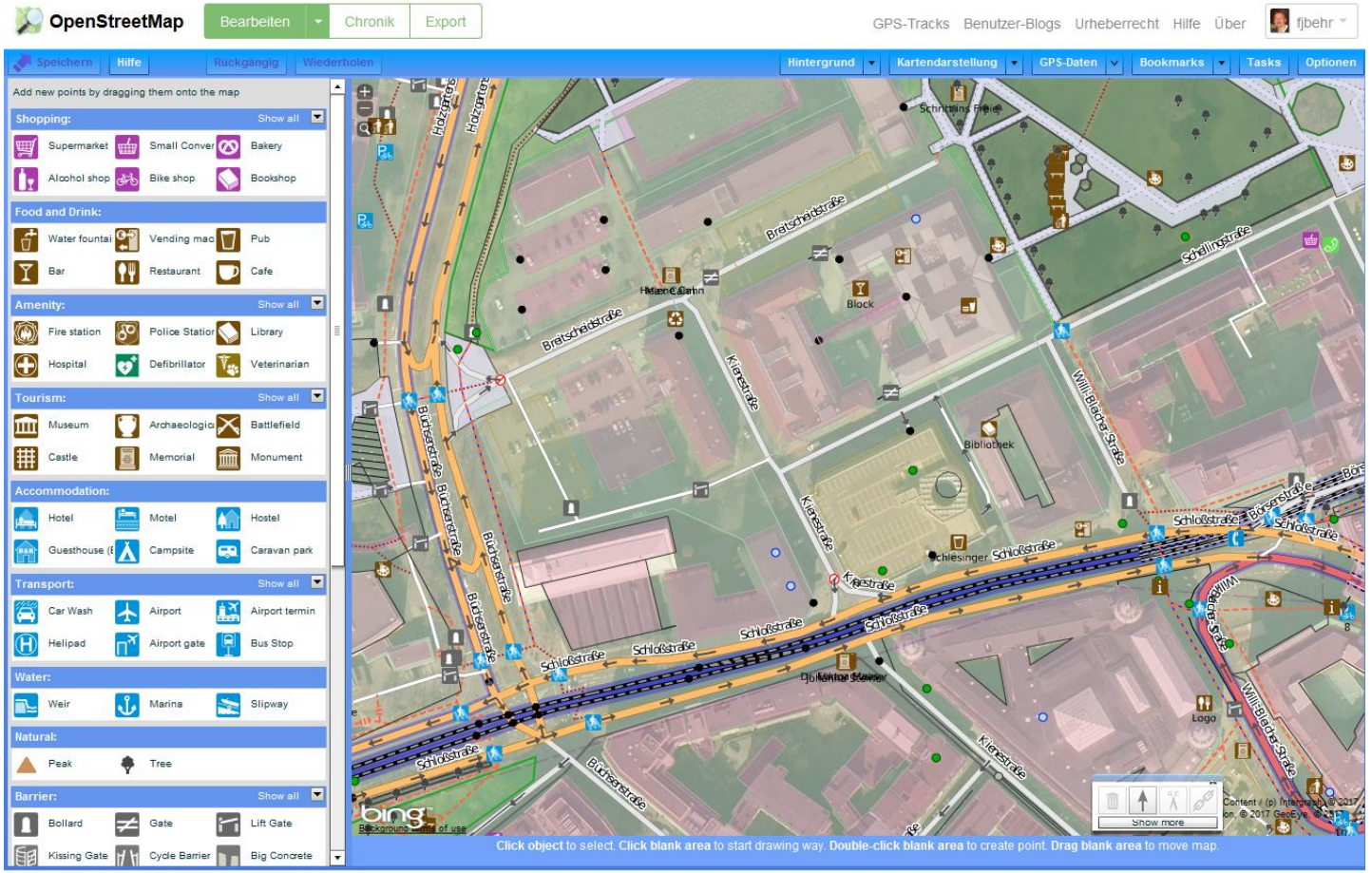
Data Editing: Mercartoor

- an openstreetmap mapping program
- focuses on providing a visually pleasing but performant editing environment for free geographical data
- http://www.merkaartor.org/



Data Editing: Using Potlach 2

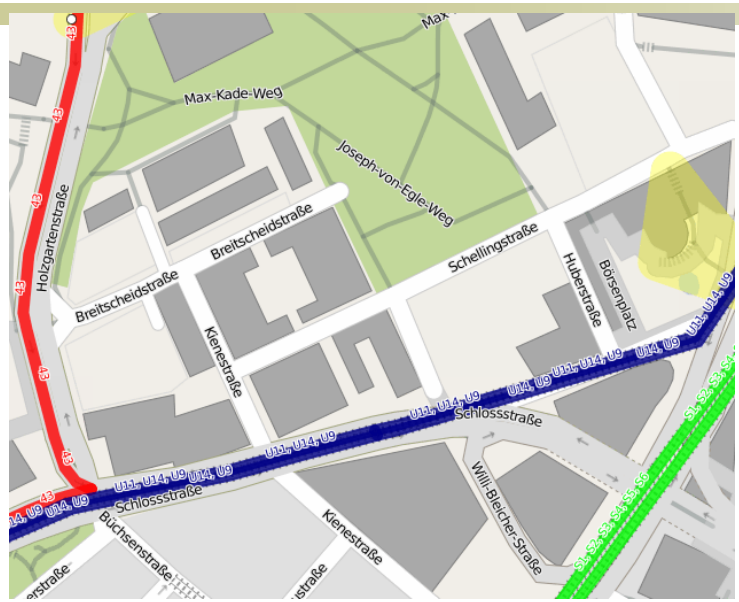
- Embedded in web browser
- Easy to learn and to handle (IMHO)
- Still using



Data rendering for visualization

- Mapnik
  - Programmed in C, very efficient
  - Can be used for
    - OSM,
    - data in Shape format
    - Data from PostGIS geo database
- For the Slippy Map on OSM's main site.
- For special purpose cartography

Render Styles



http://tools.geofabrik.de/mc/index.html?mt0=googlemap&mt1=mapnik&lon=76.294384&lat=9.9262423&z=12

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[1] https://opendatacommons.org/licenses/odbl/1.0/
[2] http://wiki.osmfoundation.org/wiki/Main_Page

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Summary

- ODbL, not copyrightd by Teleatlas, Navteq, Google, . . .
- no restrictions on use
- Data, NOT images,
- No censoring

- Encouraging people from using them in creative, productive or unexpected ways.

- Fun ;-)

Your gain

- Its your map, your project
- You see very soon the results of their hard work
- You have the Ownership of the data
- Something useful
- You’r part of the community

References

- Nick Black 2007: How OpenStreetMap is mapping the world
- Mikel Maron 2008: FreeMap West Bank. Bethlehem. http://slideshare.net/mikel_maron