

MAKING MAPS FROM OPENSTREETMAP DATA

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HSR Hochschule für Technik Rapperswil

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HSR

HOCHSCHULE FÜR TECHNIK
RAPPERSWIL

FHO Fachhochschule Ostschweiz



Overview and Previous Knowledge

Overview

- What is OpenStreetMap? How does it function
- Mapping Tools
- Demo umap
- Demo TileMill
- Database homogenization
- Cartographic generalization

Folowwing previous knowledge is assumed

- GIS and Cartography
- HTML

Some Projects of Geometa Lab

General

- **geometa.info – Geo Metadata Search Engine ()**
- **ReMaptcha – a CAPTCHA which helps repairing topological OSM errors**

Mapping and OSM related

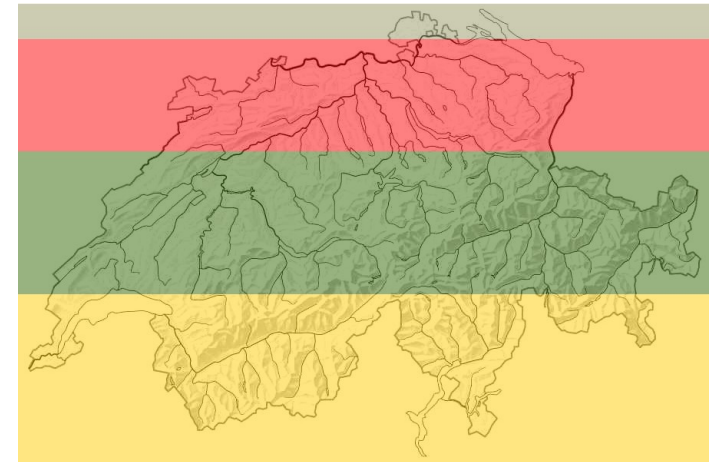
- **OpenPOIMap – Download of POIs of Switzerland**
- **Tourpl – Free tour planner of Switzerland**
- **Kort Game – Gamified Data Capturing for OSM (world wide)**
- **Accessible Map – App for sight disabled people (Switzerland)**
- **OpenEcoMap – the map for landscape planning (Switzerland)**
- **TROBDB – Traffic Obstruction Database (Switzerland)**

Goals and No Goals

- **Know the OSM project**
- **Make own maps with OSM (cartographic visualization)**
- **Know open source tools for processing OSM data**

- **With following complexity:**
 1. No programming
 2. HTML/CSS
 3. Command Line Tools and and SQL
 4. JavaScript (Python)

- **No Goals**
 - Sophisticated maps
 - Only little bit about Story Maps



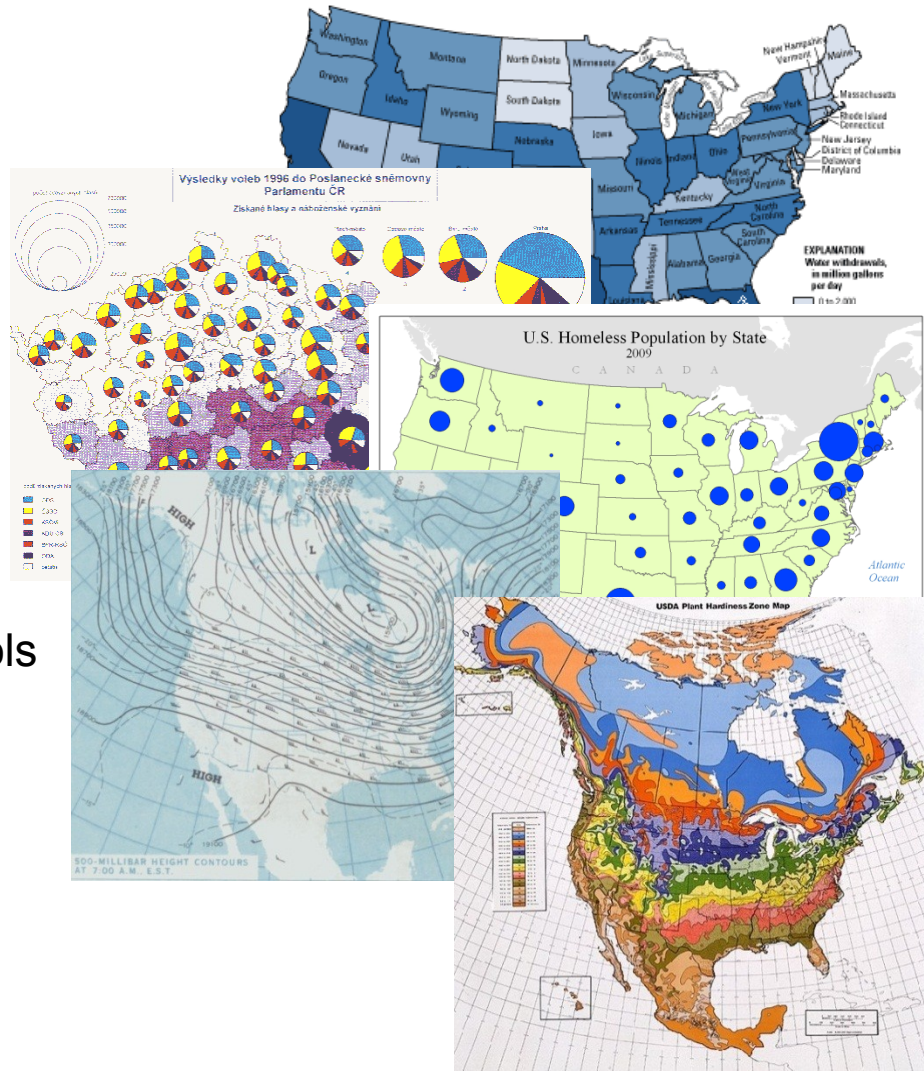
Topographic and Thematic Maps

■ Topographic Maps

- Base maps
- Examples:
 - OpenStreetMap
 - Google Map

■ Thematic Maps

- Choropleth Map
- Proportional or Graduated Symbols
- Dot Map
- Isarithmic or Contour Map
- Dasymetric Mapping



What is OpenStreetMap?

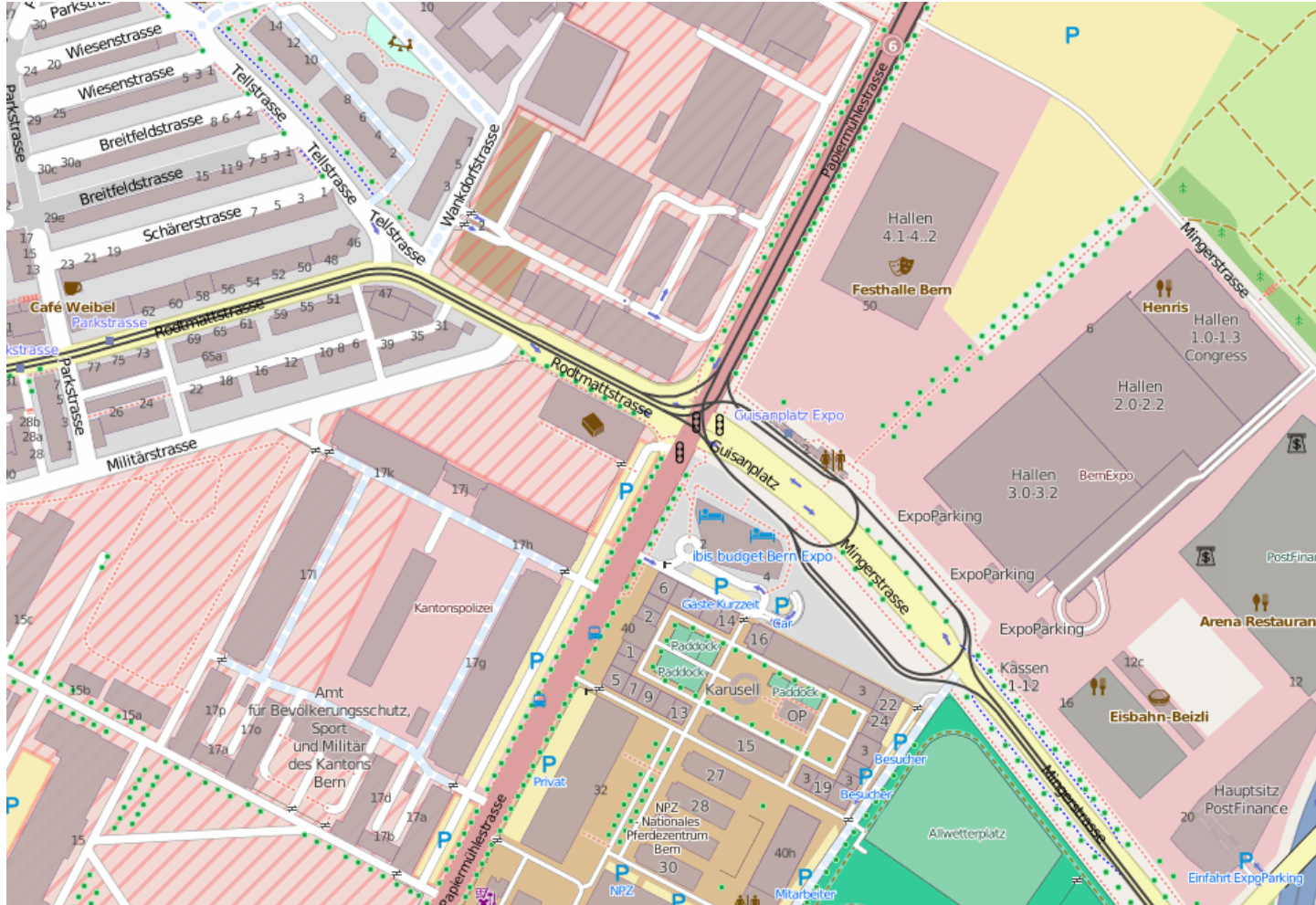


What is OpenStreetMap?

- A project with the goal to collect and share free geographic data of the world
- „The free Wiki world map“
- Lizenze Data ODbL owned by everybody, else CC-BY-SA (Share-alike, „viral“)
- Aspects:
 - Maps and Webservices
 - Geodata
 - Community
 - Software

OSM is the largest and most up-to-date free vector data set of the world!

OpenStreetMap Map



www.osm.org + www.openstreetmap.org

More Maps...



Source: openwhatevermap.org

Webservices with OSM Data

■ Geonames Search

- Nominatim: <http://nominatim.osm.org/>
- ..

■ Geocoding

- Nominatim
- MapQuest
- ...

■ Routing

- <http://map.project-osrm.org>
- openrouteservice.org
- <http://routing.osm.ch>

Facts and Figures

■ History

- Founded 2005 in England
- 6. Jan. 2013 User No. 1 Mio.

■ Registered User Switzerland (June 2014)

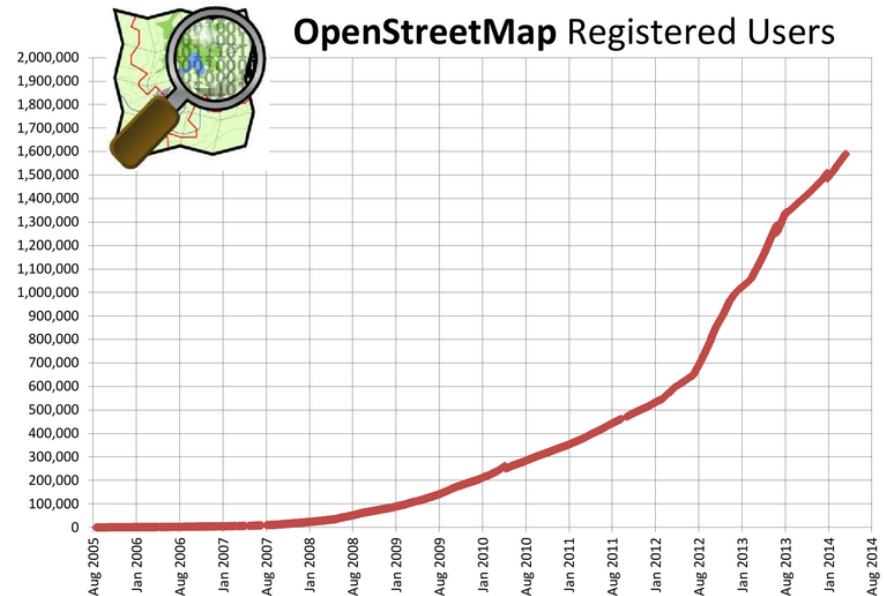
- ~ 9'000
- ~ 1'000 neue Nutzer pro Jahr

■ Registered User (worldwide)

- ~1.6 Mio.
- ~10% active

■ Data (worldwide)

- ~330 GB "Planet File" (~19GB compressed PBF)
- 2'300'000'000 Nodes (2 Billion)
- 230'000'000 Ways (230 Mio.)



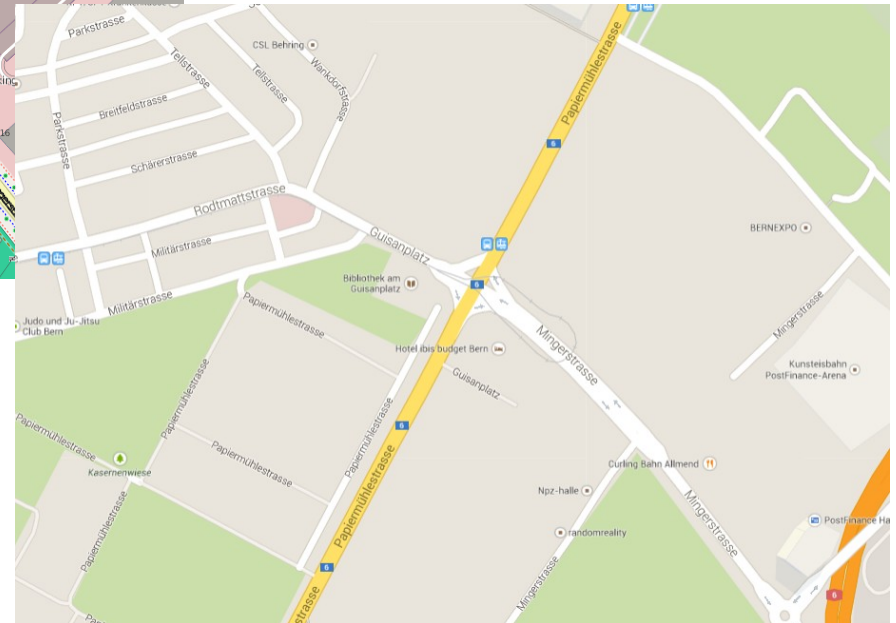
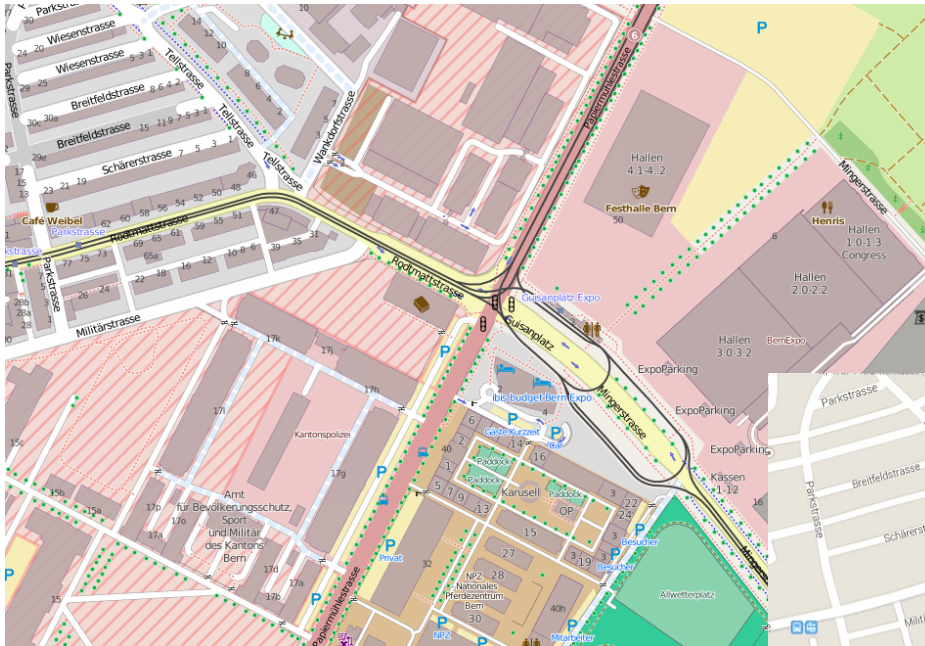
<http://wiki.openstreetmap.org/wiki/Stats>

OpenStreetMap: Drawbacks

- **No assurance or regulated workflows; „laymen at work“**
- **Precision around 1 meter**
- **Free license**
- **Almost no integrated services or e.g. WFS**

- **Quality**
 - Spatial coverage:
 - urban areas more covered
 - „First World“ 5 wealth countries make up >50% of data volume
 - Attribute Coverage (depth)
 - Web-Tools:
 - OSM Inspector - <http://tools.geofabrik.de/osmi/>
 - KeepRight - <http://keepright.at/>

OSM vs. Google Maps



The OSM Data Model

■ Node, Way und Relation

- Node with coords (lat/lon)
- Way List of of Nodes (no coords)
- Relation

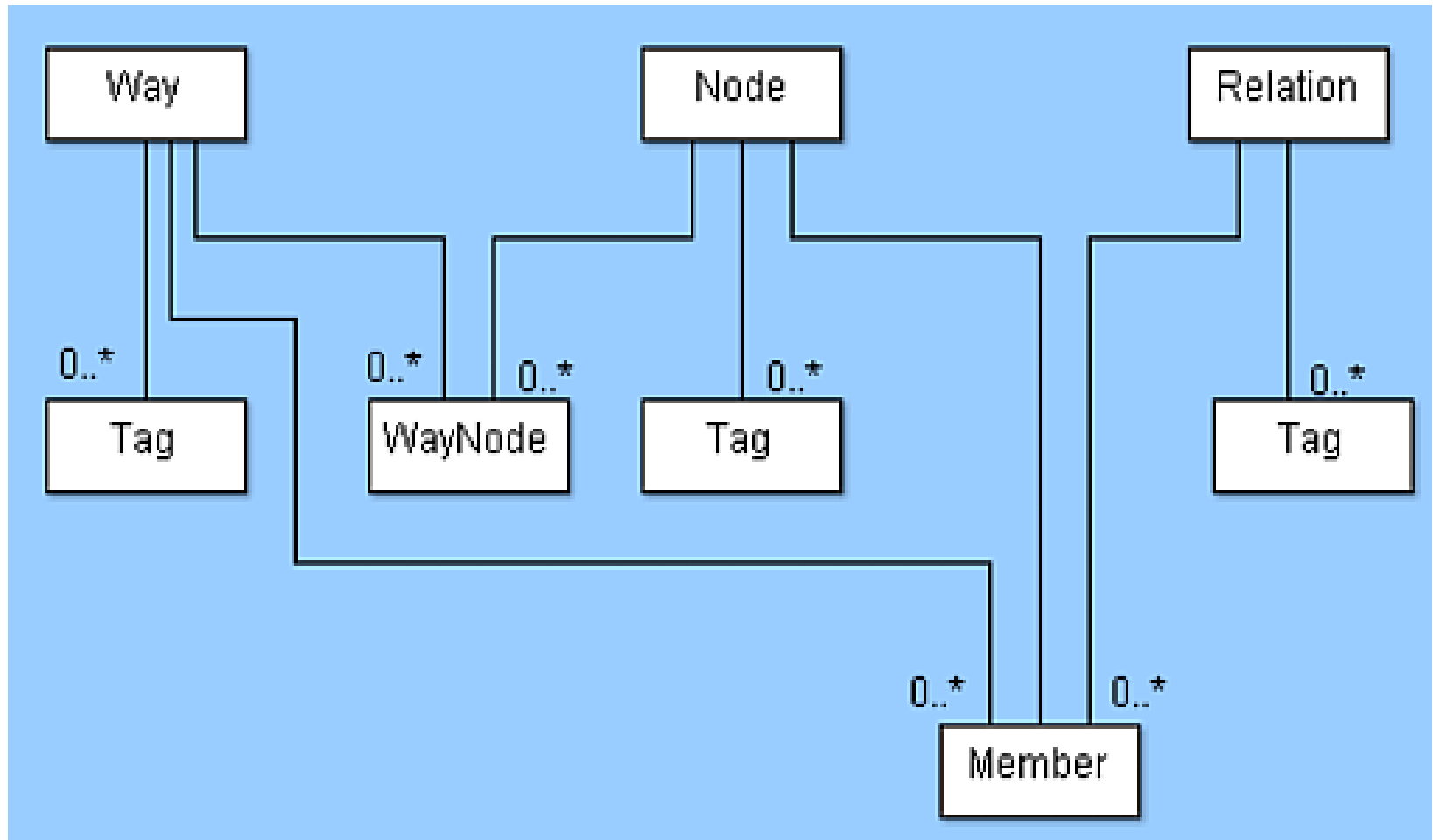
■ Properties

- Id
- Version
- Timestamp
- Changeset
- Uid, User

■ Nodes, Ways and Relations...

- => Tags

The OSM Data Model



Areas

- **None!**

- **2 solutions**

- 1. Ways with Tags, or
- 2. Ways with Relations

- **Note**

- Multipolygon = Polygon + Multipolygon nach GIS-Definition

Tags

■ Tags

- Tag = Key/Value

■ Restaurant „La Fuente“

- name=La Fuente
- amenity=restaurant
- cuisine=pizza

■ Discussion

- Avoid: cuisine=pizza;local
- „No Schema“-Schema
- wrong or correct



The OSM Data Model

Typische Tags



How to contribute to OpenStreetMap?

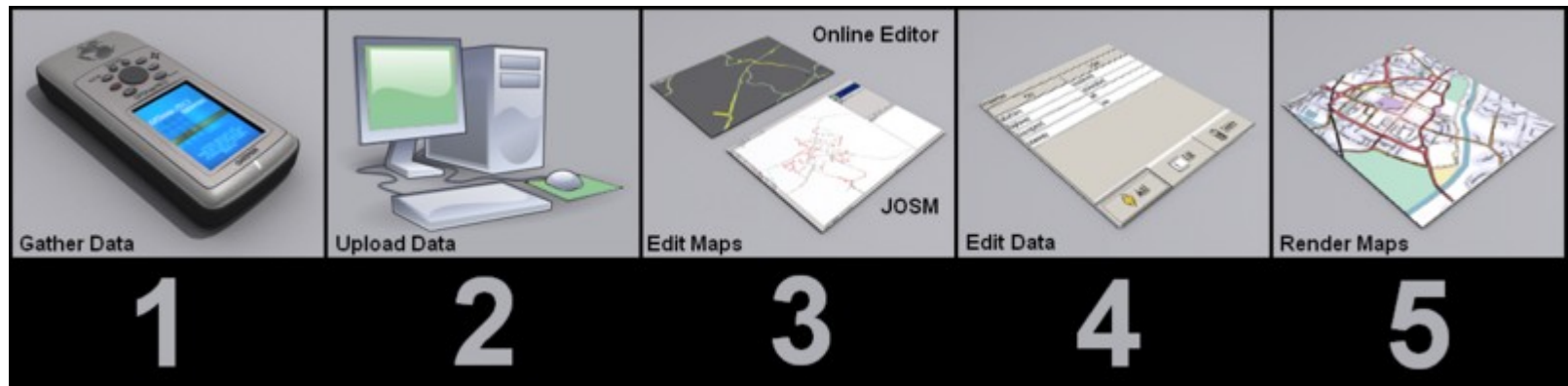
Capture OSM data: Workflow

■ Own “surveying”

■ Workflow

■ Preparation

1. Collect data (outdoors)
2. Load GPS tracks and photos on PC
3. Edit geometry („mapping“)
4. Edit attributes
5. „Render“



How is OpenStreetMap Working?

■ How is OpenStreetMap working?

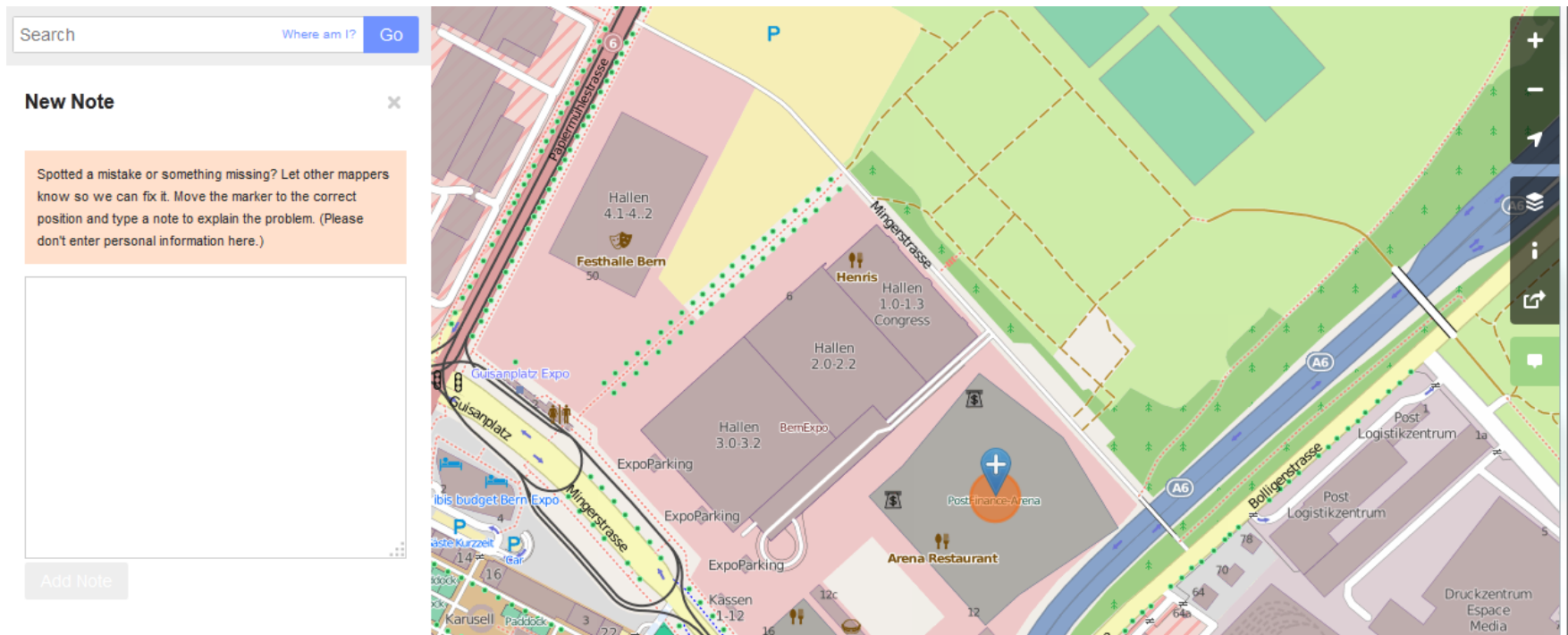
- Give hints: submit a note to OSM
- Own „surveying“
- Drawing on orthophotos („Couch Mapping“)

■ As well as:

- Data donations (import)
- Donations of GPS tracks
- Gaming (e.g. Kort Game <http://play.kort.ch>)

OpenStreetMap Notes

- Submitting errors or suggestions as notes (without registering!)



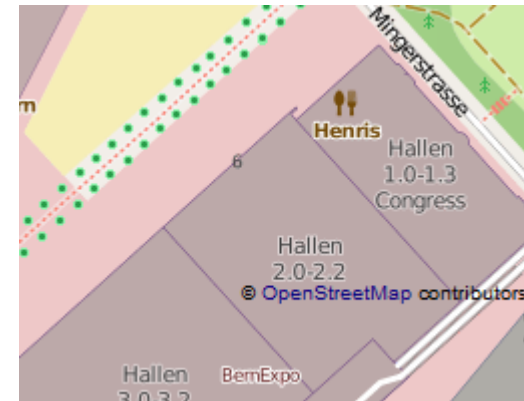
Example: Building with Address

■ Building outline

- Tag „building=yes“
- Hint: make building outline orthogonal by pressing "q" iD editor

■ Adresses

- On Node or Way (with „building=yes“)
- Example: BernExpo, Mingerstrasse 6, 3014 Bern
- Tags
 - addr:housenumber=6
 - addr:street=Mingerstrasse
 - addr:postcode=3014
 - addr:city=Bern
 - addr:country=CH



Example: Bench, Tree, Playground

■ Bench

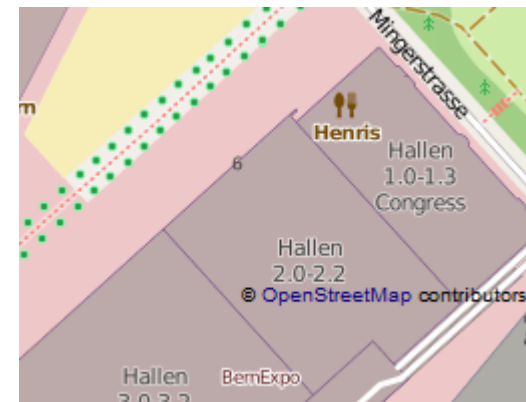
- amenity=bench
- backrest=yes
- colour=white (color values: white, silver, red, yellow, lime, aqua, blue, fuchsia, black, gray, maroon, olive, green, teal, navy, purple)

■ Tree

- natural=tree
- type=broad leaved/conifer/palm
- genus=*
- species=* // latin name,e.g. 'Acer campestre'
- circumference=* // in meters
- height=* // in meters
- denotation=natural monument

■ Playground

- Map it as area or point
- leisure=playground



Data Visualization on osm.org

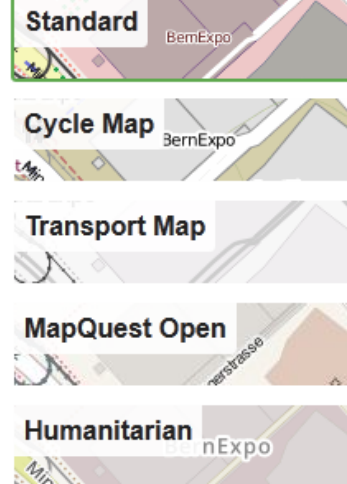
www.osm.org/#map=18/46.95887/7.46639&

[GPS Traces](#) [User Diaries](#) [Copyright](#) [Help](#) [About](#)

 Geonick ▾



Map Layers



Enable overlays for troubleshooting the map

- ☒ Map Notes
- ☐ Map Data

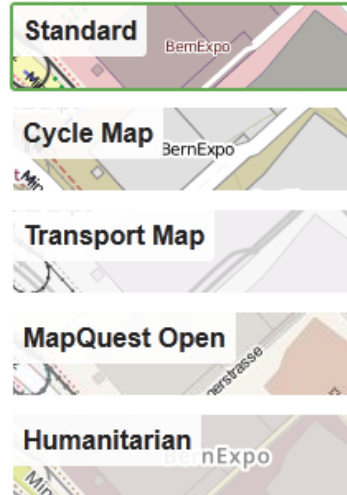
Data Visualization on osm.org

www.osm.org/#map=18/46.95887/7.46639&layers=ND



[GPS Traces](#) [User Diaries](#) [Copyright](#) [Help](#) [About](#)

Map Layers



Enable overlays for troubleshooting the map

- ☒ Map Notes
- ☒ Map Data

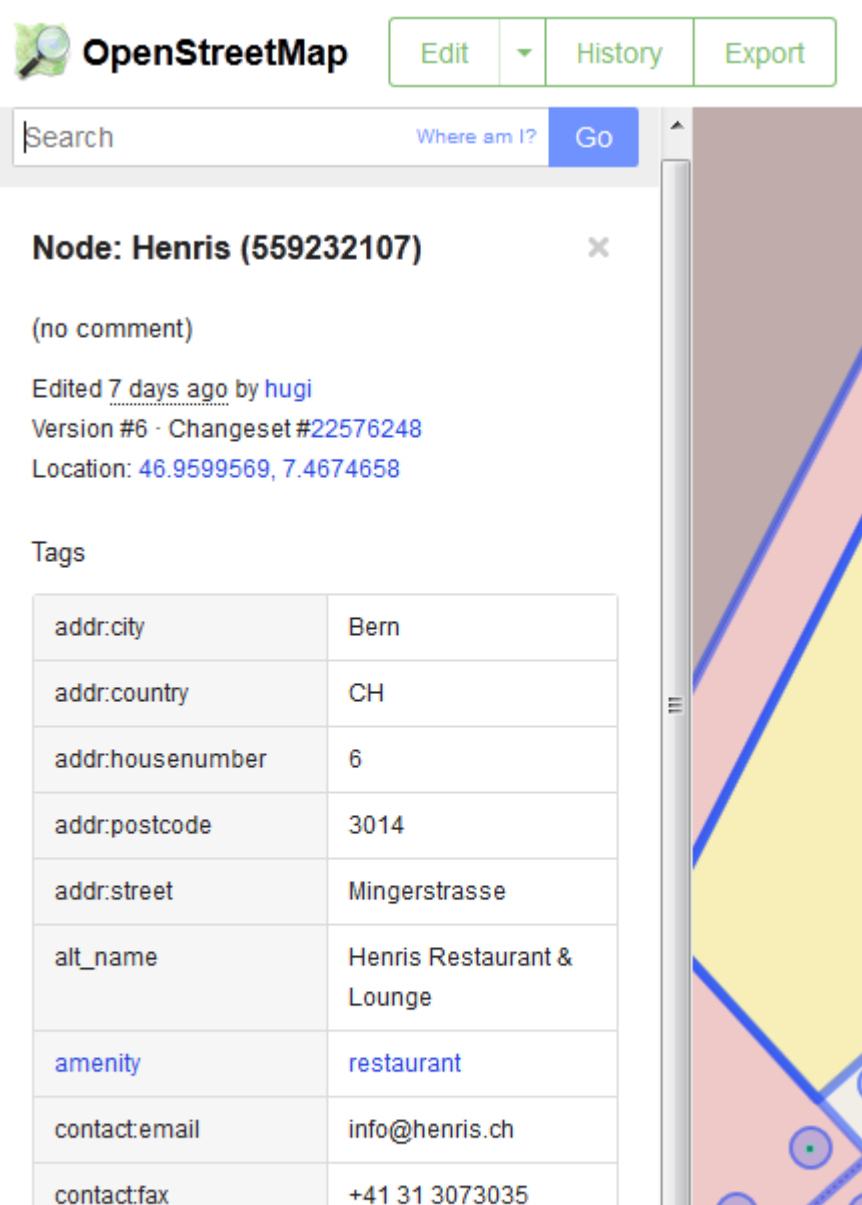
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UNIGIS Webinar: Making Maps from
OpenStreetMap Data. Prof. S. Keller

Data Henri's on osm.org

www.osm.org/node/559232107

Download as XML



OpenStreetMap Edit History Export

Search Where am I? Go

Node: Henri's (559232107) x

(no comment)

Edited 7 days ago by hugi

Version #6 · Changeset #22576248

Location: 46.9599569, 7.4674658

Tags

addr:city	Bern
addr:country	CH
addr:housenumber	6
addr:postcode	3014
addr:street	Mingerstrasse
alt_name	Henri's Restaurant & Lounge
amenity	restaurant
contact:email	info@henris.ch
contact:fax	+41 31 3073035

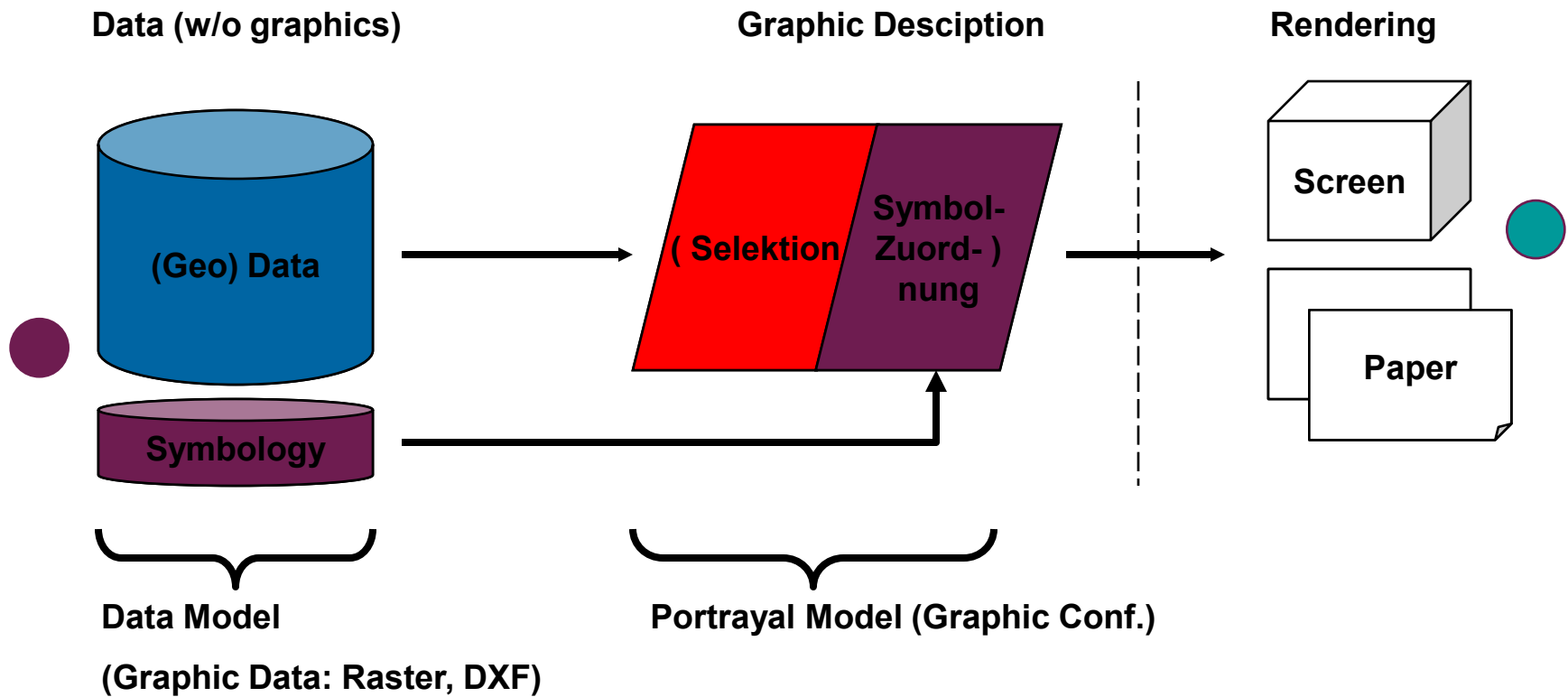
```
<?xml version="1.0" encoding="UTF-8"?>
<osm version="0.6">
  <node id="559232107"
    visible="true"
    version="6"
    changeset="22576248"
    timestamp="2014-05-27T06:32:57Z"
    user="hugi"
    uid="65044"
    lat="46.9599569"
    lon="7.4674658">
    <tag k="addr:city" v="Bern"/>
    <tag k="addr:housenumber" v="6"/>
    <tag k="addr:postcode" v="3014"/>
    <tag k="addr:street" v="Mingerstrasse"/>
    <tag k="amenity" v="restaurant"/>
    <tag k="contact:email" v="info@henris.ch"/>
    <tag k="contact:phone" v="+41 31 3073035"/>
    <tag k="name" v="Henri's"/>
    <tag k="website" v="http://www.henris.ch"/>
  </node>
</osm>
```


„iD“ - The Online Map Editor for OSM

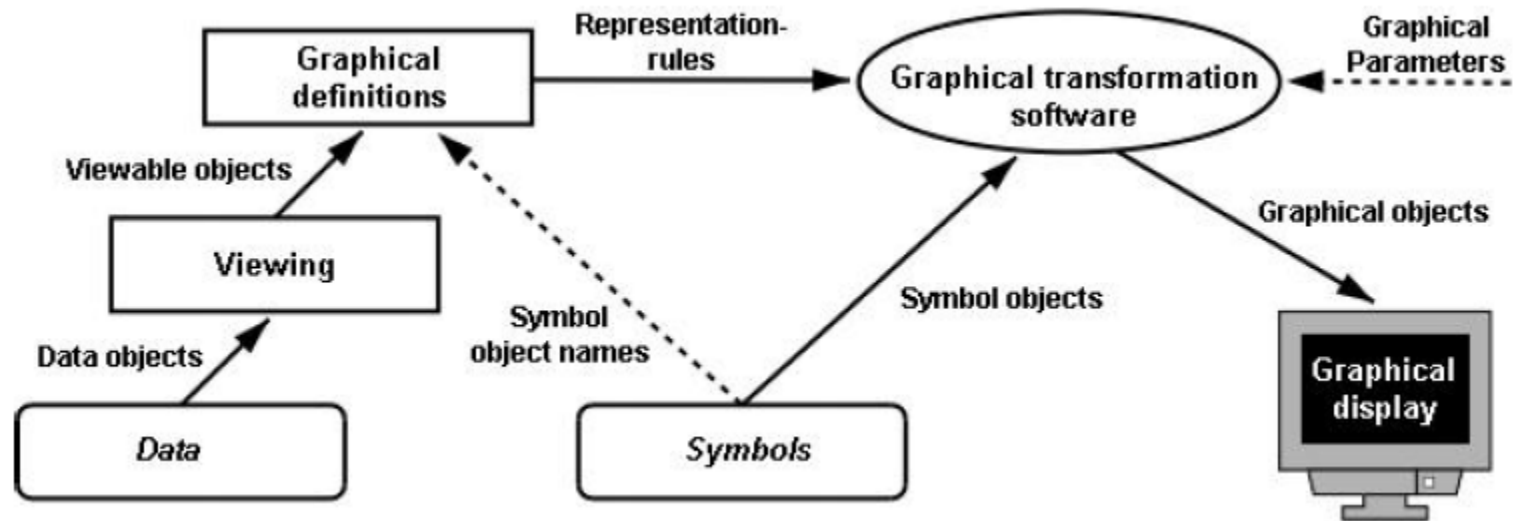
The screenshot displays the OpenStreetMap iD editor interface. At the top, the OpenStreetMap logo is on the left, and navigation links for 'Edit', 'History', and 'Export' are in the center. On the right, there are links for 'GPS Traces' and 'User Diaries'. Below the top bar, the 'Edit feature' panel is active, showing a 'Building' feature. The panel includes fields for 'Name' (Hallen 4.1-4.2), 'Building' type (yes, house, residential...), 'Levels' (2, 4, 6...), and 'Address' (50, Papiermühlestrasse, Bern, 3014). A toolbar at the top of the map area shows 'Point', 'Line', and 'Area' tools, along with a 'Save' button. The map itself shows an aerial view of a city area with several buildings. One building, labeled 'Hallen 4.1-4.2', is highlighted with a red outline and a circular menu of editing tools. Other buildings are labeled 'Hallen 1.0-1.3 Congress', 'Hallen 2.0-2.2', 'Hallen 3.0-3.2', and 'BernExpo'. Streets shown include 'Papiermühlestrasse', 'Mingerstrasse', 'Rodtmaistrasse 99', and 'Gülsenplatz'.

Data Driven Cartography

The „View Principle“



The „View Principle“ ff.



INTERLIS Version 2 – Reference Manual

OSM Data Extraction Tools

GIS Formats: Shape Files, GeoJSON, SQLite

■ Shape Files (soon: SQLite/Spatialite/GeoPackage?)

- Download it from <http://download.geofabrik.de>
- Geofabrik (also RoutingShapes)
- <http://trac.openstreetmap.org/browser/applications/utils/export/osm2shp>
- <https://github.com/joto/osmium>
- <http://gdal.org>

■ For easy making maps with OSM data we recommend to use

- either GeoJSON
- or SQLite/Spatialite!

■ (WMS – not customizable background map!)

- Europe WMS (Wheregroup, see <http://wiki.openstreetmap.org/wiki/WMS>)
- Geofabrik WMS
- Self made (Osmosis, osm2pgsql, PostGIS, Mapnik, mod_wms)

The Schema Mapping Problem

Key/Value data model =>

- Table Node
 - lat, lon
 - id
 - ...
- Table Tags
 - node_id
 - key
 - value
- Restaurant Henris:
 - k="addr:city" v="Bern"
 - k="addr:housenumber" v="6"
 - k="addr:postcode" v="3014"
 - k="addr:street" v="Mingerstrasse"
 - k="amenity" v="restaurant"
 - k="contact:email" v=info@henris.ch
 - k="name" v="Henris"

Relational data model

- Table POIs
 - geom: Point2D
 - name : [0..1] TEXT
 - amenity : [0..1] TEXT
 - addr_city : [0..1] TEXT
 - addr_housenumber : [0..1] TEXT
 - addr_postcode : [0..1] TEXT
 - addr_street : [0..1] TEXT
 - contact_phone : [0..1] TEXT
 - contact_email : [0..1] TEXT
 - website : [0..1] TEXT
 - tourism : [0..1] TEXT
 - shop : [0..1] TEXT
 -

Direct Usage of OSM Data in GIS

■ Access to raw OSM data:

- Download up to 0.25°² directly from www.openstreetmap.org (“Export”)
- Make copy of planet.openstreetmap.org, then clip with Osmosis
- Download a country from download.geofabrik.de as PBF or OSM

■ Desktop GIS Tools

- QGIS Version >2: Menu „Load Vector Data...” (uses OGR internally)
- ArcGIS Desktop Version >10: Extension „OSME Editor Toolbar“

OSM Data Extraction Tool OGR

- Desktop vector data conversion and extraction tool for users
- Main project called GDAL (raster processing)
- Example download of Liechtenstein and filter to county Triesen:

```
ogr2ogr -f "SQLite" triesen.sqlite  
/vsicurl/http://download.geofabrik.de/europe/liechtenstein-  
latest.osm.pbf  
-dsco SPATIALITE=YES -skipfailures  
-progress -overwrite -gt 65536  
--config OSM_CONFIG_FILE osmconf.ini  
-clipsrc  
"http://tools.wmflabs.org/wiwosm/osmjson/getGeoJSON.php?lang=e  
n&article=Triesen"  
-clipsrclayer OGRGeoJSON  
-nlt PROMOTE_TO_MULTI
```

- Note:
 - osmconf.ini controls which attributes go from Tags to database tables

Other OSM Data Extraction Tools

■ Online Editing Tool

- GeoJSON.io - <http://geojson.io>

■ Online Data Extraction Tools for Power-User

- OpenPOIMap (only POIs - experimental): <http://openpoimap.ch/>
- Overpass, Overpass-Turbo <http://overpass-turbo.eu/>

■ Professional Tools

- osm2pgsql and PostgreSQL database

■ See also

- http://giswiki.hsr.ch/Making_Maps_from_OpenStreetMap_Data

Geo Visualization Tools („Styling“)

Overview of Selected Geo Visualization Tools

■ Criteria

- Skill prerequisites
- Application type (Desktop, Web)
- Supported thematic maps types
- Predefined base maps
- Supported formats (and webservice) for import and export or publishing
- License
- Remarks (e.g. hosting service available?)

■ Preferred

- Online
- Open Source

Geo Visualization Tools

■ Umap

- Free online mapping tool (incl. embedding web maps)
- <http://umap.openstreetmap.fr>
- Ex. http://umap.openstreetmap.fr/de/map/swiss-postgres-conference-2014_10363

■ ArcGIS Online

- Find relevant and useful basemaps, data, configurable GIS resources
- Manage you organization's geospatial content
- Create maps and apps from APIs, templates, and tools
- Publish maps and data
- Collaborate
- Data capturing and deploying for
 - Smartphones including Windows Mobile
 - Tablets (ArcPad)
- <http://www.arcgis.com/>

Geo Visualization Tools

■ CartoDB

- Upload, query, analyze and integrate data
- Quickly create and customize maps
- Generate fast, interactive and stylish maps (tiles)
- hosting – as well as all code based on Open Source (PostGIS etc.)
- <http://cartodb.com/>

■ GIS Cloud

- Desktop GIS features in the cloud
- Easy and efficient visualization, analysis and exploration
- Mainly hosting
- <http://www.giscloud.com/>

Geo Visualization Tools

■ QGIS Desktop and QGIS Cloud

- Direct viewing of vector and raster data
- Mapping and interactive exploration
- Create, edit and export
- Perform spatial analysis
- www.qgis.ch and www.giscloud.com

■ TileMill

- CartoCSS
- Shapefiles , SQLite, PostGIS
- TileMill for Processing
- <http://mapbox.com/tilemill/>

Geo Visualization Tools

■ End user web mapping tool:

- Umap - <http://umap.openstreetmap.fr/en/>
- No programming needed!

■ Map rendering tools for power users (only with HTML/CSS):

- TileMill (uses Mapnik)
- QGIS
- ArcGIS
- All
 - Require OSM data!
 - Some HTML/CSS and/or SQL knowledge needed!
 - See next slide

Geo Visualization Tools

■ Web Map Programming Tools for „Power-User“

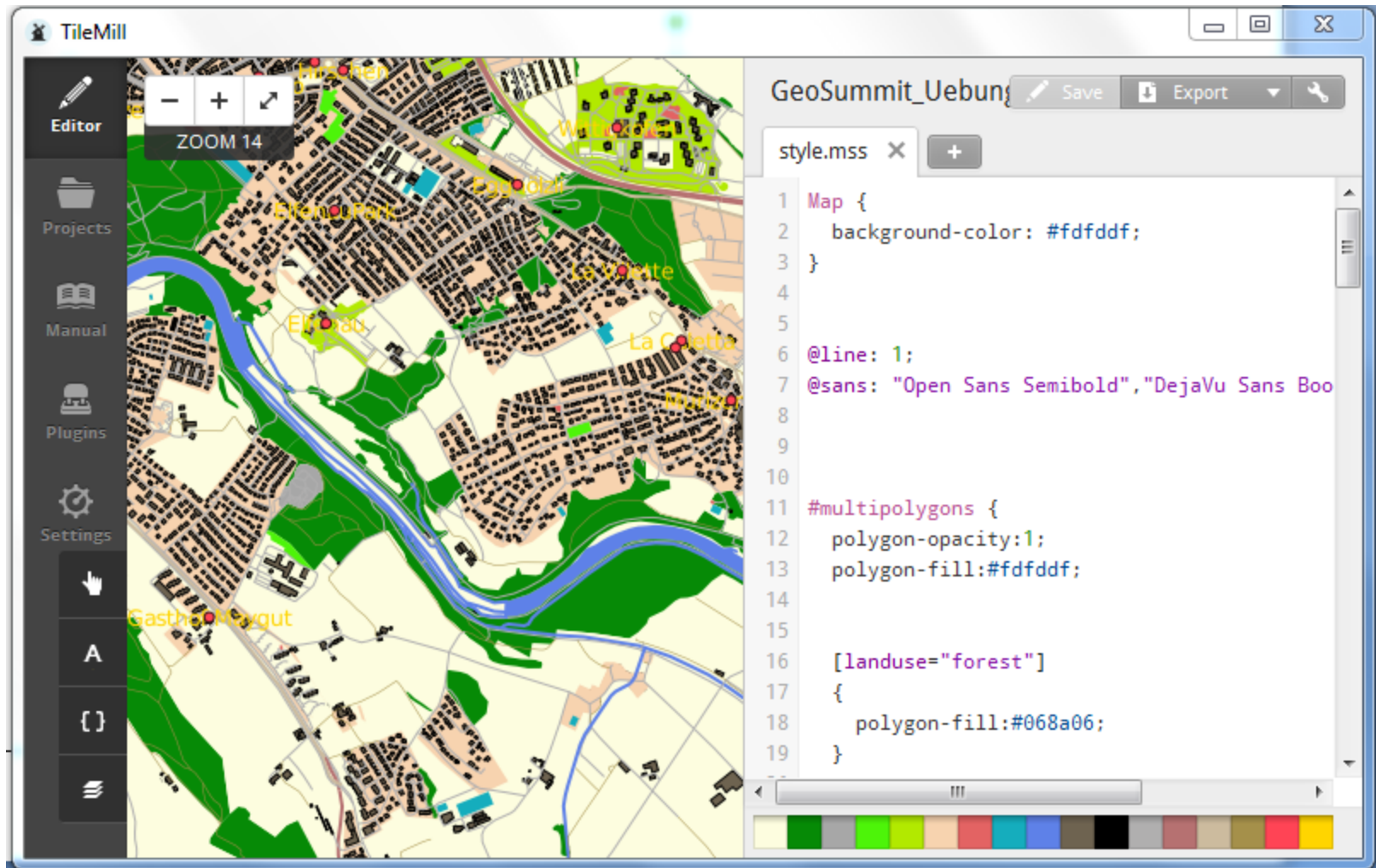
- Leaflet
- Mapbox API
- All:
 - Need JavaScript knowledge

■ Technical Report TR-1401 Geometa Lab, IFS, HSR:

- „Online Geovisualization Tools“ (tba.): <http://eprints.hsr.ch>

Rendering OSM Data with TileMill

TileMill



Database Homogenization Tools

Database Homogenization Tools

■ Online Tools

- (none known)

■ Other Tools

- SQLite/Spatialite Database (requires SQL knowledge)
- GeoKettle – the ETL tool (requires JavaScript knowledge)
- Python – (requires programming knowledge)

■ See also

- http://giswiki.hsr.ch/Webinar_Making_Maps_from_OpenStreetMap_Data

Cartographic Generalization Tools

Cartographic Generalization Tools

■ Online Tools

- OGRE Online Geodata Converter <http://ogre.adc4gis.com/>
- Mapshaper: <http://www.mapshaper.org/>

■ Desktop Tools

- OGR www.gdal.org or <https://www.mapbox.com/tilemill/docs/guides/gdal/>
- QGIS => Plugins

■ See also

- http://giswiki.hsr.ch/Webinar_Making_Maps_from_OpenStreetMap_Data

A Workflow for End Users

A Workflow for End Users

■ The handbook (cookbook) for end users

■ Steps

- Step 0. Define map goals and prepare software and data
- Step 1. Download, convert and clip OSM data using ogr2ogr
- Step 2a. If needed: Enhance SQLite dataset (requires SQL)
- Step 2b. If needed: Do some other preprocessing (requires JavaScript or SQL)
- Step 3. Style data using TileMill - requires CSS
- Step 4. Publish map - e.g. on MapBox, umap, etc.

■ See:

- http://giswiki.hsr.ch/Webinar_Making_Maps_from_OpenStreetMap_Data

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