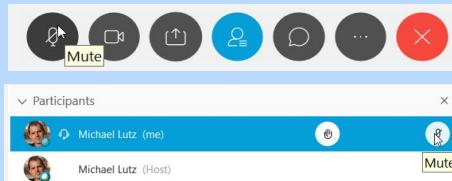


# Welcome and some hints for participants

## Mute your mic!

To mute and unmute, click the microphone icon next to your name or at the bottom of the screen.



## Turn off video

Share your webcam video **only** when you are talking. To do this, click video icon next to your name.



## Ask a question

Use “raise hand” functionality to ask a question. Click the hand icon next to your name in the participant list. If this is not available write ‘hand’ in the chat.



**SLI.DO**

<https://www.sli.do>

**Event Code:** INSPIRE2020  
**Room name:** OpenStreetMap and its synergies with INSPIRE





Goes virtual 3-12 June

## OpenStreetMap and its synergies with INSPIRE



# OpenStreetMap and its synergies with INSPIRE



Alessandro Sarretta<sup>1</sup>, Marco Minghini<sup>2</sup>

<sup>1</sup> CNR-IRPI, <sup>2</sup> EC-JRC

*INSPIRE Conference – June 11, 2020, 9:00 CET*

# Workshop program

- PART 1: 1<sup>st</sup> Slido questions poll
- PART 2: OpenStreetMap vs. INSPIRE: parallel lines that meet?
- PART 3: Let's look at some data: example on Addresses
- PART 4: 2<sup>nd</sup> Slido questions poll



# PART 1 – 1<sup>st</sup> Slido questions poll



# PART 2 – OpenStreetMap vs. INSPIRE: parallel lines that meet?

# OpenStreetMap & INSPIRE



Comparison criteria:

1. Overall approach
2. Spatial scope
3. Data structure and encoding
4. Data access
5. Licensing world edited by volunteers

Minghini M., Kotsev A. & Lutz M. (2019) Comparing INSPIRE and OpenStreetMap data: how to make the most out of the two worlds. doi: <https://doi.org/10.5194/isprs-archives-XLII-4-W14-167-2019>

# OpenStreetMap (OSM)



- The most popular VGI project to date:
    - started by Steve Coast in UK in 2004
    - a free, editable **geospatial database** of the world edited by volunteers

A screenshot of the OpenStreetMap website interface. At the top left is the logo and navigation bar with links for 'Edit', 'History', 'Export', 'Search', 'Where is this?', 'Go', and a user profile icon for aleesarrett. The main area shows a detailed map of the city of Rome, Italy, with the Tiber River flowing through the center. Key landmarks labeled include the Vatican City (Città del Vaticano), St. Peter's Basilica (Basilica di San Pietro), the Colosseum (Colosseo), the Pantheon (Panteon), the Spanish Steps (Scalinata di Trinità dei Monti), and various bridges like Ponte Sisto, Ponte Vittorio Emanuele II, and Ponte Garibaldi. The map also shows numerous streets, parks, and historical sites. A legend at the bottom left indicates distances of 500m and 1000ft. At the bottom right, there are links for 'OpenStreetMap contributors', 'Make a Donation', 'Website and API terms', and 'Imagery providers'.

<https://www.openstreetmap.org>

[https://wiki.openstreetmap.org/wiki/About\\_OpenStreetMap](https://wiki.openstreetmap.org/wiki/About_OpenStreetMap)





# INSPIRE

DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 March 2007

establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

- Aims to create a **European SDI** for the purposes of EU **environmental policies**.
- Provides a comprehensive framework for **interoperability of spatial data**:
  - environmental spatial data **sharing**
  - assisting in cross-boundary **policy-making**
- In force since **2007** and implemented in various stages.
- Based on the SDIs established and operated by EU Member States.

# 1. Overall approach

## OpenStreetMap – principles

- Emphasizes local knowledge
- Community-driven
  - bottom up approach
  - coordinated by the [OpenStreetMap Foundation](#) (OSMF)
- Open data (ODbL license)

It's, above all, a **database**



The Wikipedia of maps

<https://www.openstreetmap.org/about>

<http://opendatacommons.org/licenses/odbl/summary>

© OpenStreetMap contributors

OpenStreetMap powers map data on thousands of web sites, mobile apps, and hardware devices

OpenStreetMap is built by a community of mappers that contribute and maintain data about roads, trails, cafés, railway stations, and much more, all over the world.

### Local Knowledge

OpenStreetMap emphasizes local knowledge. Contributors use aerial imagery, GPS devices, and low-tech field maps to verify that OSM is accurate and up to date.

### Community Driven

OpenStreetMap's community is diverse, passionate, and growing every day. Our contributors include enthusiast mappers, GIS professionals, engineers running the OSM servers, humanitarians mapping disaster-affected areas, and many more. To learn more about the community, see the [OpenStreetMap Blog](#), [user diaries](#), [community blogs](#), and the [OSM Foundation website](#).

### Open Data

OpenStreetMap is *open data*: you are free to use it for any purpose as long as you credit OpenStreetMap and its contributors. If you alter or build upon the data in certain ways, you may distribute the result only under the same licence. See the [Copyright and License page](#) for details.

# 1. Overall approach Beyond the default map

Way: Cupola di San Pietro (117968816)

name

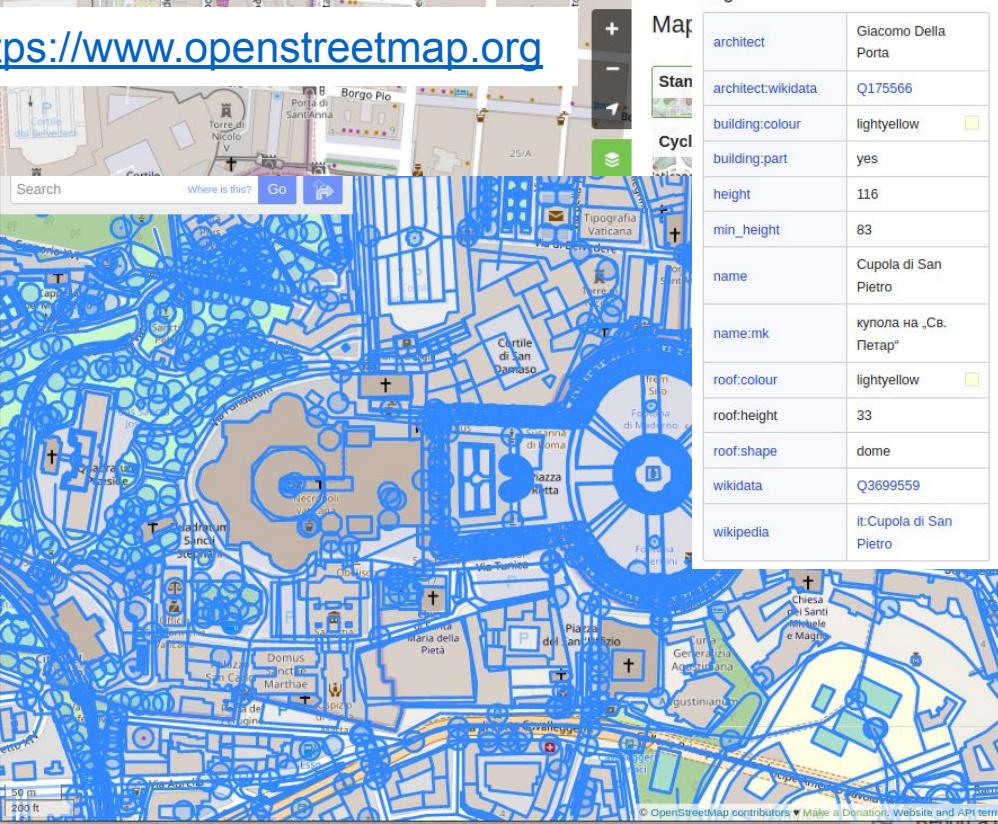
23 days ago by Mannivu

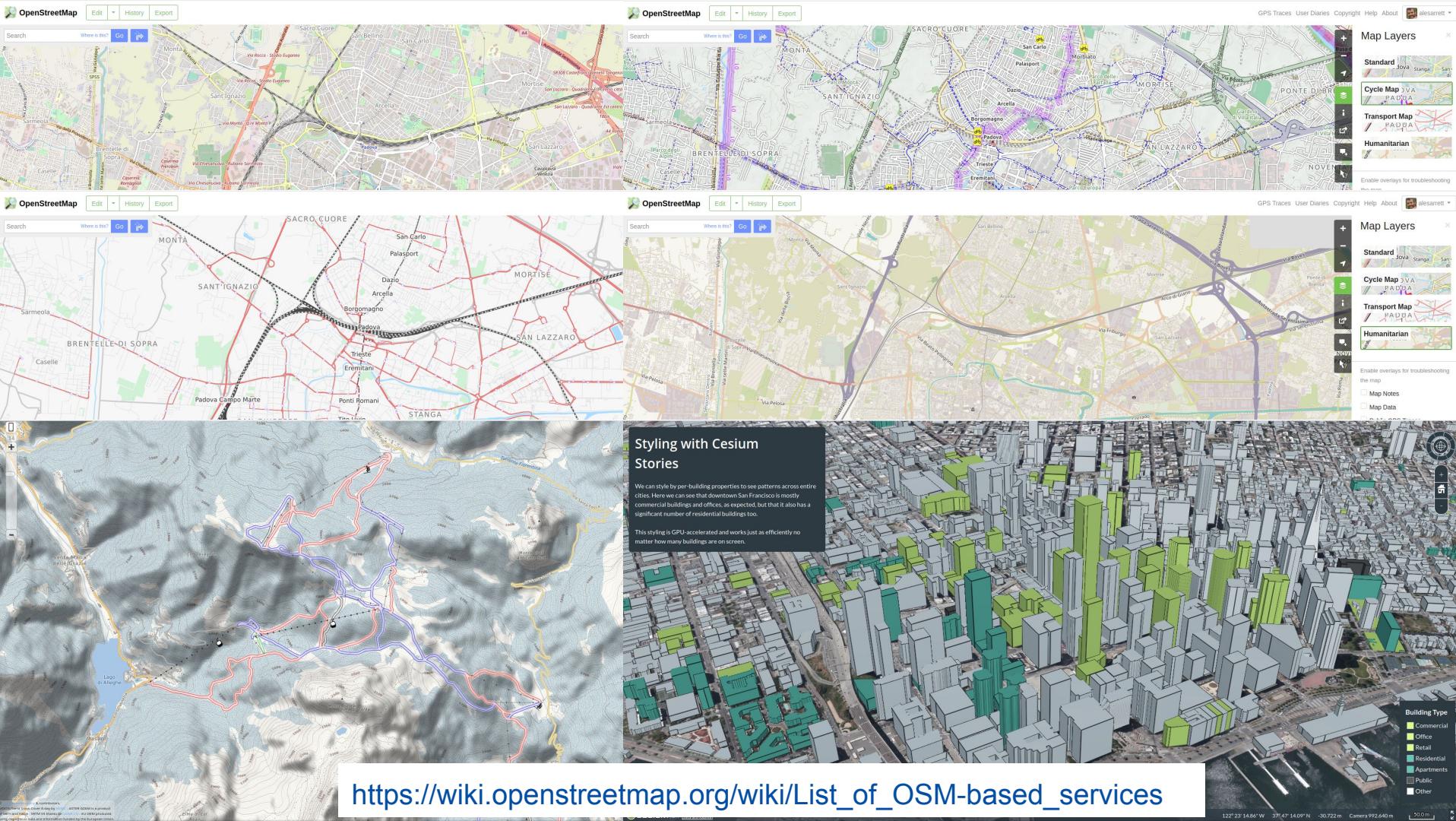
Version #17 · Changeset #83497532

Tags

architect	Giacomo Della Porta
architect:wikidata	Q175566
building:colour	lightyellow
building:part	yes
height	116
min_height	83
name	Cupola di San Pietro
name:mk	купола на „Св. Петар“
roof:colour	lightyellow
roof:height	33
roof:shape	dome
wikidata	Q3699559
wikipedia	it:Cupola di San Pietro

<https://www.openstreetmap.org>





# OpenStreetMap version of the European Commission (GISCO)



- Reflects the [official position](#) of the European Commission:



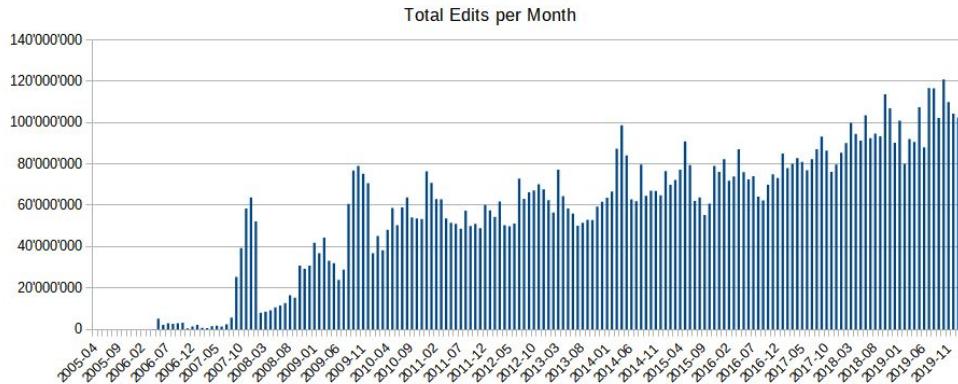
# 1. Overall approach OSM community



- Wide community of volunteers:
  - +6M registered users
  - +100M edits per month

## Edits per month

Total edits of any kind (the sum of the number of changes in all changesets, as reported by num\_changes value) per month.



Accumulated registered users (linear scale)



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

# 1. Overall approach OSM community



- Wide community of volunteers:
  - +6M registered users
  - +100M edits per month
- +100 mailing lists (local, national, international, thematic) and a forum for discussion
- One annual world conference State of the Map (SotM) + continental/regional/national conferences
- local meetings

<https://lists.openstreetmap.org/listinfo>

<https://forum.openstreetmap.org/>

# 1. Overall approach OSM community + businesses



Reuse and active contribution by various big players of the geospatial (and wider) industry:

- Mapbox
- Telenav
- Strava



# 1. Overall approach OSM community + businesses



Reuse and active contribution by various big players of the geospatial (and wider) industry:

- Mapbox
- Telenav
- Strava
- Amazon logistics

## Current Users

### Editors

Here are the list of the Amazon editors who edit in OSM.

- [almaasm](#) (on osm, edits, contrib, heatmap, chngset com.)
- [smbharan](#) (on osm, edits, contrib, heatmap, chngset com.)
- [tamppava](#) (on osm, edits, contrib, heatmap, chngset com.)
- [modukv](#) (on osm, edits, contrib, heatmap, chngset com.)
- [vaidhee](#) (on osm, edits, contrib, heatmap, chngset com.)
- [veesams](#) (on osm, edits, contrib, heatmap, chngset com.)
- [accheela](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kotaprad](#) (on osm, edits, contrib, heatmap, chngset com.)
- [srmsudava](#) (on osm, edits, contrib, heatmap, chngset com.)
- [sreepam](#) (on osm, edits, contrib, heatmap, chngset com.)
- [michaedz](#) (on osm, edits, contrib, heatmap, chngset com.)
- [gundanar](#) (on osm, edits, contrib, heatmap, chngset com.)
- [tejkante](#) (on osm, edits, contrib, heatmap, chngset com.)
- [raknm](#) (on osm, edits, contrib, heatmap, chngset com.)
- [vbbukka](#) (on osm, edits, contrib, heatmap, chngset com.)
- [arosalom](#) (on osm, edits, contrib, heatmap, chngset com.)
- [begumfai](#) (on osm, edits, contrib, heatmap, chngset com.)
- [loyakis](#) (on osm, edits, contrib, heatmap, chngset com.)
- [mitesl](#) (on osm, edits, contrib, heatmap, chngset com.)
- [silashkm](#) (on osm, edits, contrib, heatmap, chngset com.)
- [dvyasha](#) (on osm, edits, contrib, heatmap, chngset com.)
- [shreeush](#) (on osm, edits, contrib, heatmap, chngset com.)
- [vardhamik](#) (on osm, edits, contrib, heatmap, chngset com.)
- [phbellamk](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ssahithi](#) (on osm, edits, contrib, heatmap, chngset com.)
- [paasthan](#) (on osm, edits, contrib, heatmap, chngset com.)
- [amarapuri](#) (on osm, edits, contrib, heatmap, chngset com.)
- [avsvr](#) (on osm, edits, contrib, heatmap, chngset com.)
- [sudhakar](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ajdoniche](#) (on osm, edits, contrib, heatmap, chngset com.)
- [poodoshi](#) (on osm, edits, contrib, heatmap, chngset com.)
- [chandek](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ejioshy](#) (on osm, edits, contrib, heatmap, chngset com.)
- [sireeshp](#) (on osm, edits, contrib, heatmap, chngset com.)
- [cheperub](#) (on osm, edits, contrib, heatmap, chngset com.)
- [batbathines](#) (on osm, edits, contrib, heatmap, chngset com.)
- [afurquan](#) (on osm, edits, contrib, heatmap, chngset com.)
- [charinikh](#) (on osm, edits, contrib, heatmap, chngset com.)
- [siddhkr](#) (on osm, edits, contrib, heatmap, chngset com.)
- [amnharsha](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kusweta](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ppijl](#) (on osm, edits, contrib, heatmap, chngset com.)
- [grathjoth](#) (on osm, edits, contrib, heatmap, chngset com.)
- [jaravrn](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ramsaivr](#) (on osm, edits, contrib, heatmap, chngset com.)
- [shshys](#) (on osm, edits, contrib, heatmap, chngset com.)
- [arjaru](#) (on osm, edits, contrib, heatmap, chngset com.)
- [srishrohan](#) (on osm, edits, contrib, heatmap, chngset com.)
- [saisum](#) (on osm, edits, contrib, heatmap, chngset com.)
- [gvennredd](#) (on osm, edits, contrib, heatmap, chngset com.)
- [pravalg](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kalampini](#) (on osm, edits, contrib, heatmap, chngset com.)
- [nehaaz](#) (on osm, edits, contrib, heatmap, chngset com.)
- [bachurev](#) (on osm, edits, contrib, heatmap, chngset com.)
- [sgudiva](#) (on osm, edits, contrib, heatmap, chngset com.)
- [agdodlapa](#) (on osm, edits, contrib, heatmap, chngset com.)
- [majumdea](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kanieela](#) (on osm, edits, contrib, heatmap, chngset com.)
- [somyuba](#) (on osm, edits, contrib, heatmap, chngset com.)
- [shushmit](#) (on osm, edits, contrib, heatmap, chngset com.)
- [payelgh](#) (on osm, edits, contrib, heatmap, chngset com.)
- [talukdm](#) (on osm, edits, contrib, heatmap, chngset com.)
- [rrkum](#) (on osm, edits, contrib, heatmap, chngset com.)
- [mcingara](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ammhiti](#) (on osm, edits, contrib, heatmap, chngset com.)
- [baswith](#) (on osm, edits, contrib, heatmap, chngset com.)
- [felevin](#) (on osm, edits, contrib, heatmap, chngset com.)
- [manognar](#) (on osm, edits, contrib, heatmap, chngset com.)
- [Dowluri](#) (on osm, edits, contrib, heatmap, chngset com.)
- [cbhave](#) (on osm, edits, contrib, heatmap, chngset com.)
- [mdahrar](#) (on osm, edits, contrib, heatmap, chngset com.)
- [bmuska](#) (on osm, edits, contrib, heatmap, chngset com.)
- [neerdixi](#) (on osm, edits, contrib, heatmap, chngset com.)
- [vkmarhy](#) (on osm, edits, contrib, heatmap, chngset com.)
- [mvadudur](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ajijohn](#) (on osm, edits, contrib, heatmap, chngset com.)
- [mohanimr](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kmeh](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kthatrian](#) (on osm, edits, contrib, heatmap, chngset com.)
- [hvanner](#) (on osm, edits, contrib, heatmap, chngset com.)
- [rawamegh](#) (on osm, edits, contrib, heatmap, chngset com.)
- [bonagarra](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ansukless](#) (on osm, edits, contrib, heatmap, chngset com.)
- [amitbish](#) (on osm, edits, contrib, heatmap, chngset com.)
- [remoh10](#) (on osm, edits, contrib, heatmap, chngset com.)
- [skodebol](#) (on osm, edits, contrib, heatmap, chngset com.)
- [shreshit](#) (on osm, edits, contrib, heatmap, chngset com.)
- [tishbb](#) (on osm, edits, contrib, heatmap, chngset com.)
- [yngit](#) (on osm, edits, contrib, heatmap, chngset com.)
- [banismit](#) (on osm, edits, contrib, heatmap, chngset com.)
- [bourisa](#) (on osm, edits, contrib, heatmap, chngset com.)
- [chhava](#) (on osm, edits, contrib, heatmap, chngset com.)
- [daggarw](#) (on osm, edits, contrib, heatmap, chngset com.)
- [sefsibit](#) (on osm, edits, contrib, heatmap, chngset com.)
- [kshtdh](#) (on osm, edits, contrib, heatmap, chngset com.)
- [malihars](#) (on osm, edits, contrib, heatmap, chngset com.)
- [rikshanm](#) (on osm, edits, contrib, heatmap, chngset com.)
- [pandypr](#) (on osm, edits, contrib, heatmap, chngset com.)
- [mansipu](#) (on osm, edits, contrib, heatmap, chngset com.)
- [himansu](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ksnghr](#) (on osm, edits, contrib, heatmap, chngset com.)
- [sinreenu](#) (on osm, edits, contrib, heatmap, chngset com.)
- [ryisingh](#) (on osm, edits, contrib, heatmap, chngset com.)

[https://wiki.openstreetmap.org/wiki/Amazon\\_Logistics](https://wiki.openstreetmap.org/wiki/Amazon_Logistics)

# 1. Overall approach OSM community + businesses



Reuse and active contribution by various big players of the geospatial (and wider) industry:

- Mapbox
- Telenav
- Strava
- Amazon logistics
- Facebook

The screenshot shows the OpenStreetMap mobile application interface. At the top, there's a header with the "Wikimedia Italia" logo and navigation buttons for "Home" and "Informazioni". Below the header is a map of the Nervi area in Italy, showing roads, green spaces, and nearby towns like Parabiago, Lainate, and Grancia-Pagliera. A callout box is overlaid on the map with three options: "Segnala un problema con la mappa" (Report a problem with the map), "Note legali sui dati della mappa" (Legal notes on map data), and "OpenStreetMap". At the bottom of the screen, there's footer information for "Wikimedia Italia, via Bergognone 34 20144 Milano" and buttons for "Chiudi" (Close) and "Indicazioni stradali" (Directions).

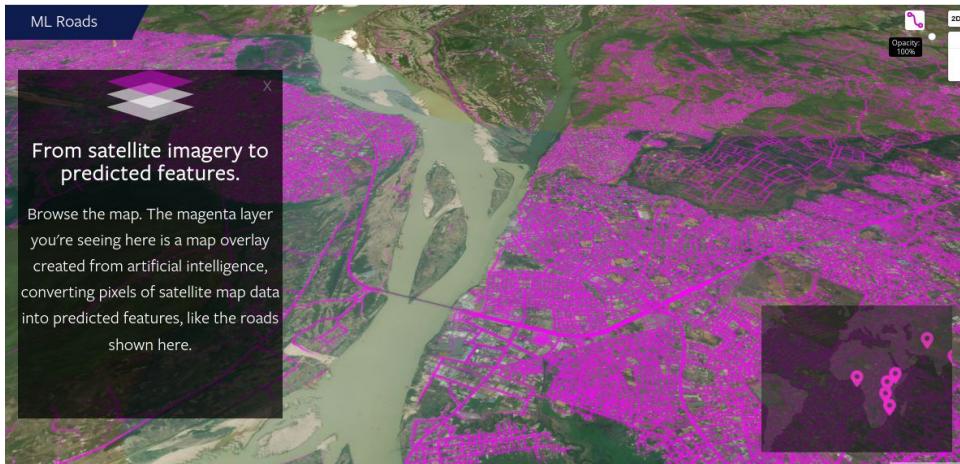
<https://wiki.openstreetmap.org/wiki/Amaz>

# 1. Overall approach OSM community + businesses



Reuse and active contribution by various big players of the geospatial (and wider) industry:

- Mapbox
- Telenav
- Strava
- Amazon logistics
- Facebook
  - RapiD: editing tool using artificial intelligence to predict features on high-resolution satellite imagery



[https://wiki.openstreetmap.org/wiki/Amazon\\_Logistics](https://wiki.openstreetmap.org/wiki/Amazon_Logistics)  
<https://mapwith.ai>

# 1. Overall approach OSM contribution



There are three main ways to contribute data to OSM:

- **outdoor mapping** (field mapping) involves going out on the field and looking at the real world
- **armchair mapping** (remote mapping) consists in digitizing objects (buildings, roads, etc.) deriving information from openly-licensed aerial/satellite imagery and is uploaded using specific software
- community **import** (bulk import) consists in the direct upload of datasets available under an open license compatible with the ODbL
  - Bulk import is a delicate operation, which must be discussed and authorized by the OSM community and is reserved for expert users.
- Ecosystem of software, tools app built specifically for OSM

# 1. Overall approach

## Data quality and checking



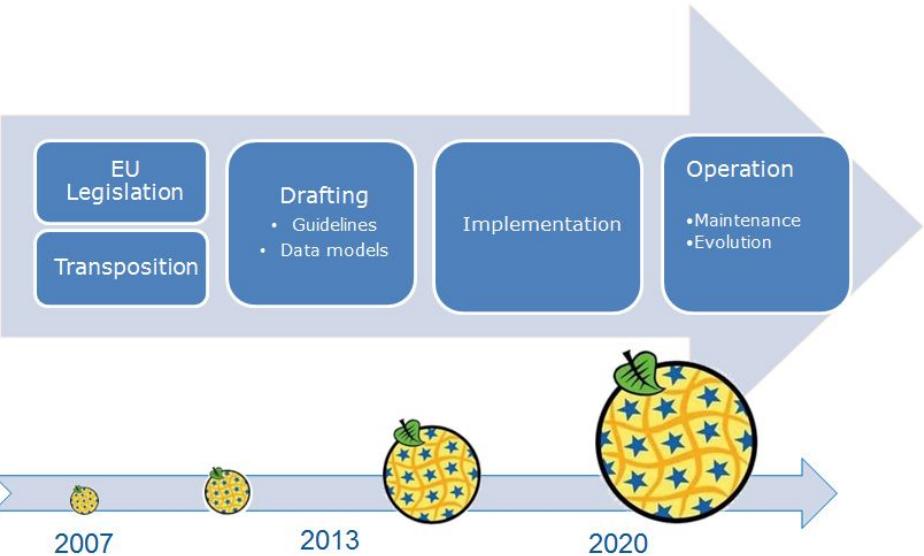
- Everything in OSM is traceable and archived:
  - each and every edit (changeset) is saved in the database
  - it can be viewed and assessed by users and can be commented and/or reverted
- The Data Working Group (DWG) is authorised by the OSMF to deal with accusations of copyright infringement, imports, and serious disputes and vandalism
- There are several tools to do deep analysis, validation, quality check on edits:
  - OSMcha (<https://osmcha.org/>), Achavi (<https://overpass-api.de/achavi/>), OSM change per tiles (<https://resultmaps.neis-one.org/osm-change-tiles>), osmose (<http://osmose.openstreetmap.fr>)

# 1. Overall approach

## INSPIRE



- Top-down initiative:
  - public sector data
  - legislatively defined
  - transposition in MS
  - full implementation for 2020
  - governance (CT, MIG)
- Implementation
- Maintenance and evolution
- Growing community:
  - 7200+ providers
  - annual conference



# 2. Spatial scope

## OpenStreetMap

The **richest** and **most diverse** geospatial database:

- any **verifiable object** with a physical location can be mapped
- several hundreds spatial object types, but **no historical events and no rasters**
- list maintained & updated collaboratively on the **Map Features** wiki page

### Building

This is used to identify individual buildings or groups of connected buildings. See the page [Buildings](#) for further details on the usage of this tag and `man_made=*` for tagging of various other structures.

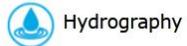
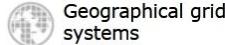
Key	Value	Element	Comment	Photo
<b>Accommodation</b>				
building	apartments	<input type="checkbox"/>	A building arranged into individual dwellings, often on separate floors. May also have retail outlets on the ground floor.	
building	bungalow	<input type="checkbox"/>	A single-storey detached small house, Dacha.	
building	cabin	<input type="checkbox"/>	A cabin is a small, roughly built house usually with a wood exterior and typically found in rural areas.	
building	detached	<input type="checkbox"/>	A detached house, a free-standing residential building usually housing a single family.	
building	dormitory	<input type="checkbox"/>	For a shared building, as used by college/university students (not a share room for multiple occupants as implied by the term in British English). Alternatively, use <code>building=residential</code> plus <code>residential=university</code> .	
building	farm	<input type="checkbox"/>	A residential building on a farm (farmhouse). For other buildings see below <code>building=farm_auxiliary</code> , <code>building=barn</code> , ... If in your country farmhouse looks same as general residential house then you can tag as <code>building=house</code> as well. See also <code>landuse=farmyard</code> for the surrounding area	

1 Primary features	
1.1 Aerialway	
1.2 Aeroway	
1.3 Amenity	
1.3.1 Sustenance	
1.3.2 Education	
1.3.3 Transportation	
1.3.4 Financial	
1.3.5 Healthcare	
1.3.6 Entertainment, Arts & Culture	
1.3.7 Others	
1.4 Barrier	
1.4.1 Linear barriers	
1.4.2 Access control on highways	
1.5 Boundary	
1.5.1 Attributes	
1.6 Building	
1.6.1 Accommodation	
1.6.2 Commercial	
1.6.3 Religious	
1.6.4 Civic/Amenity	
1.6.5 Agricultural/Plant production	
1.6.6 Sports	
1.6.7 Storage	
1.6.8 Cars	
1.6.9 Power/Technical buildings	
1.6.10 Other Buildings	
1.6.11 Additional Attributes	
1.7 Craft	
1.8 Emergency	
1.8.1 Medical Rescue	
1.8.2 Firefighters	
1.8.3 Lifeguards	
1.8.4 Assembly point	
1.8.5 Other Structure	
1.9 Geological	
1.10 Highway	
1.10.1 Roads	
1.10.2 Link roads	
1.10.3 Special road types	
1.10.4 Paths	
1.10.5 Lifecycle	
1.10.6 Attributes	
1.10.7 Other highway features	
1.11 Historic	
1.12 Landuse	
1.12.1 Common Landuse Key Values - Develop	
1.12.2 Common Landuse Key Values - Rural	

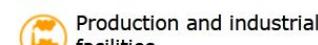
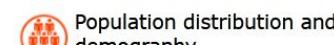
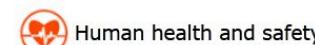
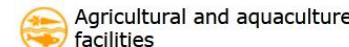
# 2. Spatial scope INSPIRE

- 34 spatial data themes for environmental applications:
  - 340 spatial object types
  - incl. raster, historical, spatio-temporal

## ANNEX: 1



## ANNEX: 3



# 3. Data structure and encoding

## OpenStreetMap



- The conceptual data model is based on a **flat** data structure
  - easy transformation through GDAL into several formats
- Any object is described by:
  - an element (geometry) – **node**, **way** or **relation**



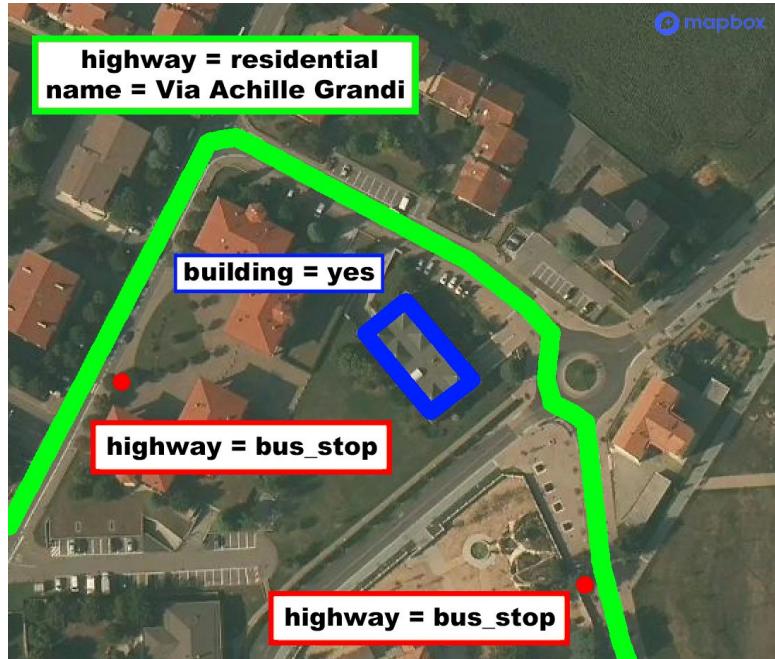
<https://wiki.openstreetmap.org/wiki/Elements>  
<https://wiki.openstreetmap.org/wiki/Tags>

# 3. Data structure and encoding

## OpenStreetMap



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  - one or more **tags** (simple attributes based on **key-value pairs**)



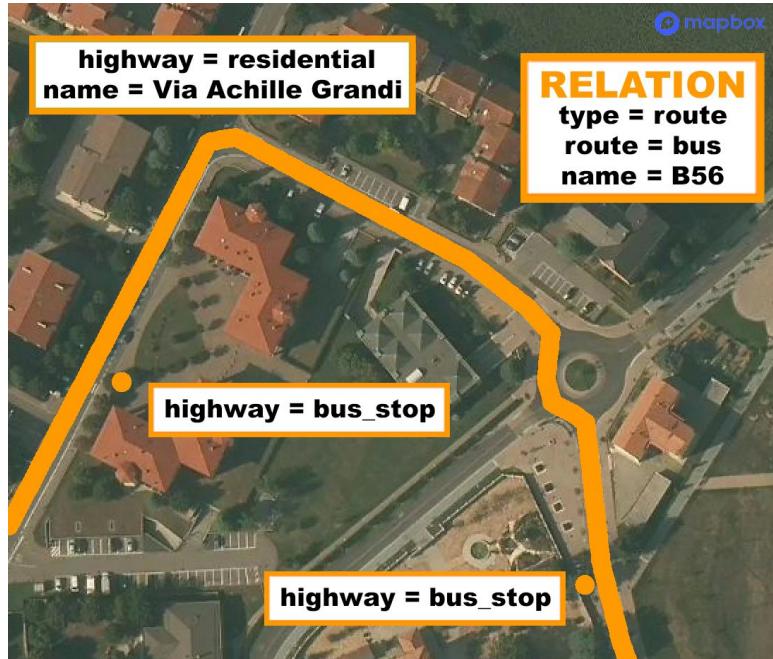
<https://wiki.openstreetmap.org/wiki/Elements>  
<https://wiki.openstreetmap.org/wiki/Tags>

# 3. Data structure and encoding

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  - an element (geometry) – **node**, **way** or **relation**
  - one or more **tags** (simple attributes based on **key-value pairs**)



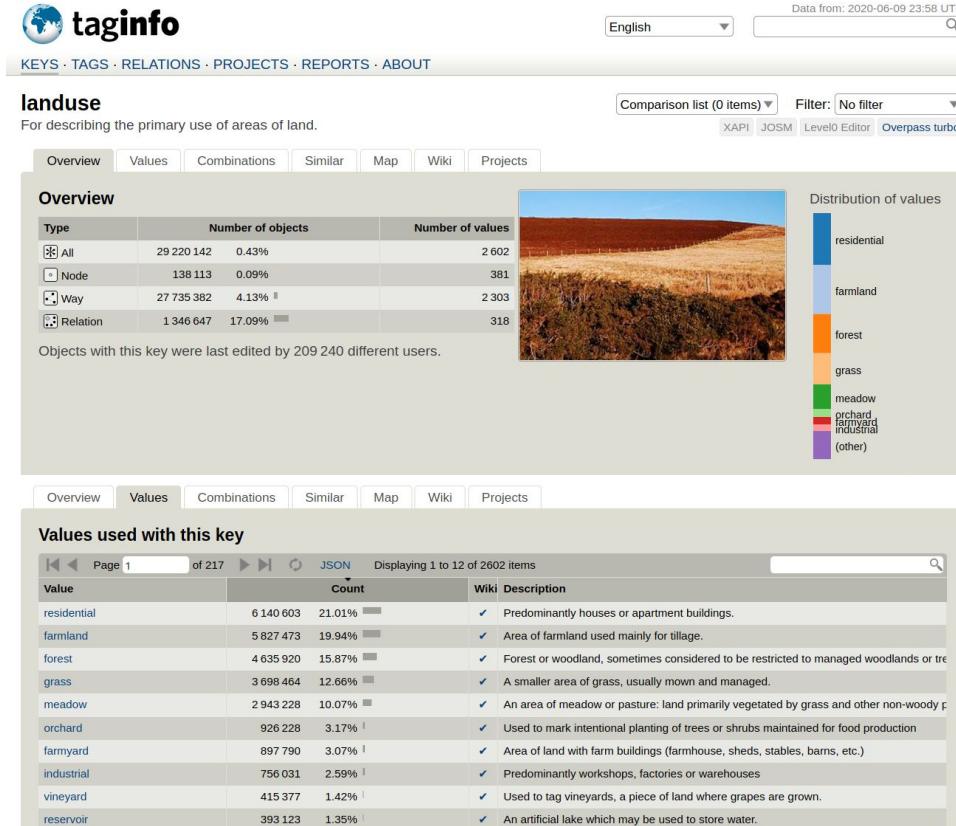
<https://wiki.openstreetmap.org/wiki/Elements>  
<https://wiki.openstreetmap.org/wiki/Tags>

# 3. Data structure and encoding

## OpenStreetMap



- Only basic data validation (e.g. on topology) available
- Tags are **flexible**
  - contributors can introduce new ones!
  - But there is a collaborative reference documentation:  
<https://wiki.openstreetmap.org>
  - And tools/services to evaluate their use and spread:  
<https://taginfo.openstreetmap.org>
- Active and continuous discussion on general and specific mailing lists



# 3. Data structure and encoding

## INSPIRE



- Conceptual data model (UML class diagrams) allows **complex data structures**
- Encoding based on same conceptual model
- Default encoding:
  - GML
- Alternative encodings:
  - GeoJSON
  - GeoPackage (tbd)
- Central components:
  - Registry
  - Validator

The image displays three main components illustrating the INSPIRE data structure and its applications:

- UML Class Diagram:** Shows the conceptual data model with classes like `SpeciesDistributionDataSet`, `SpeciesDistributionUnit`, and `GCM - Document Reference`. Associations include `+documentBasis` from `SpeciesDistributionDataSet` to `GCM - Document Reference`, and `+member` from `SpeciesDistributionUnit` to `SpeciesDistributionDataSet`.
- GitHub Repository:** A screenshot of the GitHub interface for the `INSPIRE-MIF / 2017.2` repository. It shows 17 issues, 0 pull requests, 0 projects, 0 wiki pages, 0 security vulnerabilities, 0 insights, and 0 settings. The repository has 1 contributor, 32 lines (32 sloc), and 1.46 KB of code. The URL is `https://github.com/2017.2/GeoJSON/blob/ads/examples/ads_example_1.geojson`.
- Map-based Application:** A map showing a geographic area with a legend on the right. The legend includes items such as `inspireId.localId`, `inspireId.namespace`, `position.specification`, `position.specification.href`, `position.method`, `position.method.href`, `position.default`, `locator.designator.addressNumber`, `locator.level`, `locator.level.href`, and `component.ThoroughfareName`. The map itself shows a street network.



# 3. Data Coordinate Reference System

## OpenStreetMap

- All data provided in **WGS84** (with no 3D component):
  - intrinsic CRS compatibility



## INSPIRE

- Specific 2D and 3D pan-European CRSs are required:
  - based on both geodetic and plane coordinates
- Provision of data sets in **additional CRSs** under current discussion:
  - CRS transformation to be implemented using existing tools (e.g. proj4, GDAL)
  - would lower the implementation burden



# 4. Data access

## OpenStreetMap – export



- No metadata catalogues, search is only based on tags.
- Several ways to access data:
  - [Export](#) button from the OSM website

The screenshot shows the OpenStreetMap website interface. On the left, there's a sidebar titled 'Export' with coordinates (44.43898, 26.10127) and (26.11192, 44.43543), and a note to 'Manually select a different area'. Below this is a section for 'Licence' stating: 'OpenStreetMap data is licensed under the [Open Data Commons Open Database License \(ODbL\)](#)'. At the bottom of the sidebar is a blue 'Export' button. The main area is a map of Bucharest, Romania, with many streets labeled in Romanian. A large orange road is labeled 'Bulevardul Carol I'. Various landmarks are marked with icons, such as 'Casino Bucharest', 'Muzeul Teatrului Național „Ion Luca Caragiale”', and 'Teatrul Național Ion Luca Caragiale'. A legend in the bottom right corner of the map area indicates symbols for 'P' (parking), 'B' (bus stop), and 'A' (atm). The bottom of the page includes a copyright notice: '© OpenStreetMap contributors ▾ Make a Donation. Website and API terms'.

<https://www.openstreetmap.org/export>

# 4. Data access

## OpenStreetMap – extracts



- No metadata catalogues, search is only based on tags.
- Several ways to access data:
  - **Export** button from the OSM website
  - predefined OSM **extracts** by Geofabrik, Interline, etc.

<http://download.geofabrik.de>

<https://www.interline.io/osm/extracts>

<https://osmaxx.hsr.ch>

# 4. Data access

## OpenStreetMap – Planet



- No metadata catalogues, search is only based on tags.
- Several ways to access data:
  - [Export](#) button from the OSM website
  - predefined OSM [extracts](#) by Geofabrik, Interline, etc.
  - Planet & Full History Planet

### Complete OSM Data

#### [Latest Weekly Planet XML File](#)

**90 GB**, created 6 days ago.  
md5: d39b1b3eedeed5b0ae37585ff97b1cf6.

#### [Latest Weekly Changesets](#)

**3.4 GB**, created 6 days ago.  
md5: fe1b418f5a31cb4655b6fc3a6f263540.

#### [Latest Weekly Planet PBF File](#)

**51 GB**, created 6 days ago.  
md5: ef5414e1fd2dfb10d4faaa462c3addf6.

### Complete OSM Data History

#### [Latest Full History Planet XML File](#)

**136 GB**, created 6 days ago.  
md5: 2eee3822b3365bbfcfecc426ac0a4084.

#### [Latest Full History Planet PBF File](#)

**84 GB**, created 6 days ago.  
md5: 6062f3acd323da67f7f390678167a77d.

<https://planet.openstreetmap.org>

<https://planet.openstreetmap.org/planet/full-history>

# 4. Data access

## OpenStreetMap – APIs



- No metadata catalogues, search is only based on tags.
- Several ways to access data:
  - Export button from the OSM website
  - predefined OSM **extracts** by Geofabrik, Interline, etc.
  - Planet & Full History Planet
  - APIs
    - OSM API
    - Overpass API
      - Overpass Turbo
    - Ohsome platform

<https://wiki.openstreetmap.org/wiki/API>

[https://wiki.openstreetmap.org/wiki/Overpass\\_API](https://wiki.openstreetmap.org/wiki/Overpass_API)

<https://overpass-turbo.eu/>

<https://heigit.org/big-spatial-data-analytics-en/ohsome>

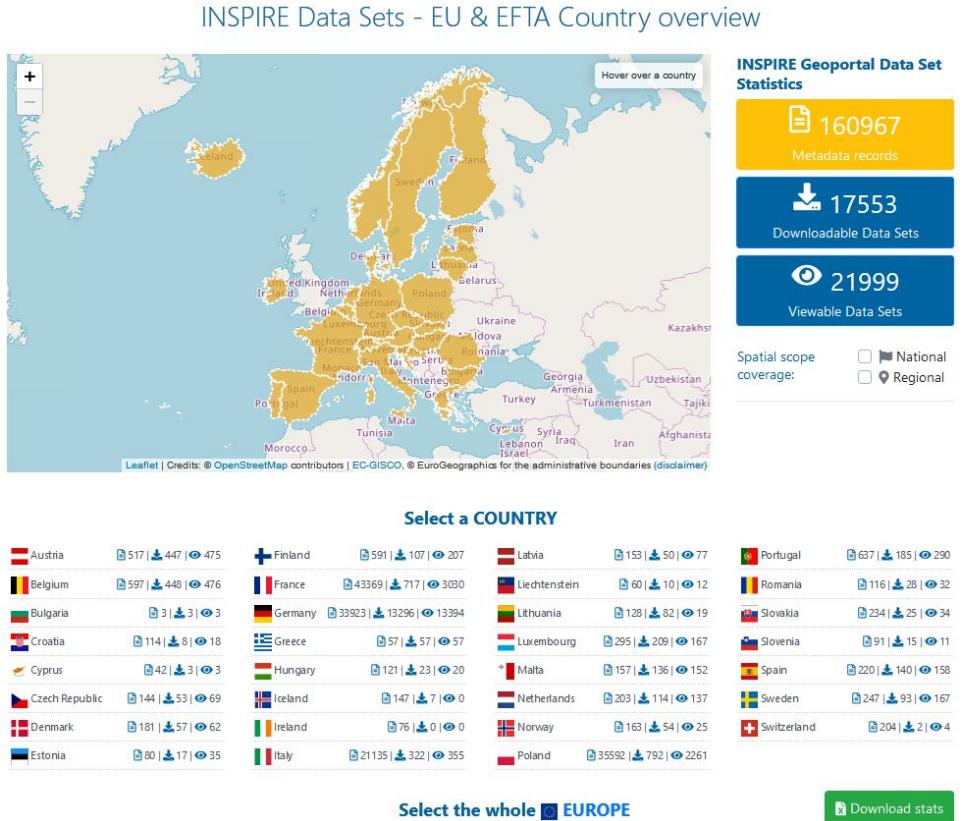
The screenshot shows the Overpass Turbo web application. At the top, there's a navigation bar with options like Run, Share, Export, Wizard, Save, Load, Settings, Help, and Overpass turbo. Below the bar is a code editor window containing an Overpass query. The query is designed to find museums in Bucharest. It includes a search for "Bucharest", a search area for "museum", and a gather results section. The main part of the interface is a map of Bucharest, Romania, with many blue circles overlaid on the map, each representing a found museum location. The map also shows street names and other geographical features. At the bottom of the interface, there's some descriptive text about the loaded data: "Loaded - nodes: 313, ways: 15, relations: 1" and "Displayed - pois: 58, lines: 0, polygons: 13".

```
1 /*
2  * This has been generated by the overpass-turbo
3  * wizard.
4  * The original search was:
5  * "tourism=museum" in Bucharest
6  */
7 [out:json][timeout:25];
8 // fetch area "Bucharest" to search in
9 ({geocodeArea:Bucharest})->.searchArea;
10 // gather results
11 (
12   // query part for: "tourism=museum"
13   node["tourism"]="museum";
14   way["tourism"]="museum";
15   relation["tourism"]="museum";
16 );
17 // print results
18 out body;
19 >;
20 out skel qt;
```

# 4. Data access

## INSPIRE

- Based on:
  - OGC standards
  - distributed SOA approach
- APIs (aka Network Services):
  - Discovery (CSW)
  - View (WMS, WMTS)
  - Download (ATOM, WFS, SOS, WCS)
  - new OGC API standards
- INSPIRE Geoportal:
  - single access point



# 5. Data license

## OpenStreetMap

- Database **fully open access**:
  - available since late 2012 under the Open Database License (ODbL):  
<https://www.openstreetmap.org/copyright>
  - CC BY-SA 2.0 before



## INSPIRE

- No obligation set on the data license:
  - the infrastructure is very **heterogeneous**
  - partially open access
  - standard vs. country-specific, multi-lingual licenses



# OpenStreetMap vs. INSPIRE – Overall comparison



Characteristic	INSPIRE	OpenStreetMap
Approach	top-down	bottom-up
Spatial scope	34 environmental spatial data themes	any spatial object (verifiable)
Data structure and encoding	complex data model, GML encoding	flat data model, GDAL supported formats
Data CRS	INSPIRE-specific CRSs	WGS84
Data access	OGC-compliant clients, Geoportal	APIs, Planet File, predefined extracts
Data license	different, depending on MS data providers	ODbL



# PART 3 – Let's look at some data: example on Addresses

# Introduction & purpose

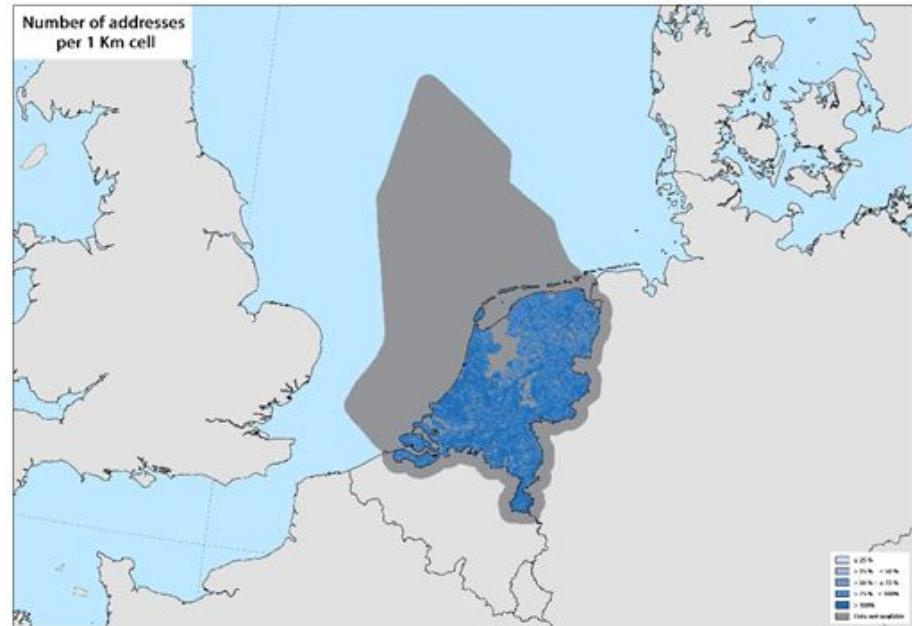
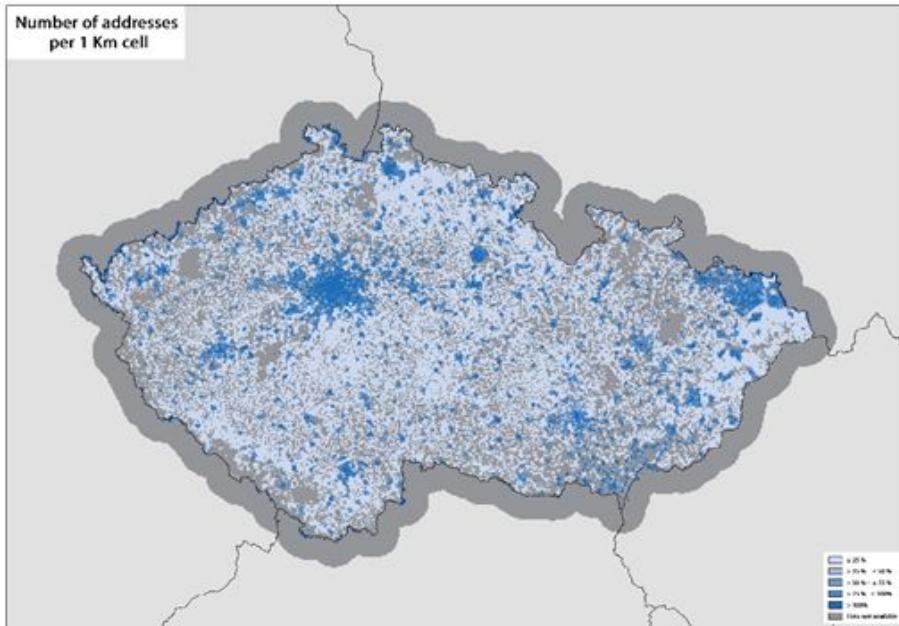
- OpenStreetMap can be used to **integrate**, **complement** and/or **update** authoritative datasets (including INSPIRE):
  - differences in **spatial scope**
  - differences in **data quality** (crowdsourced vs. authoritative datasets)
  - differences in **availability/licensing**
- Step-by-step exercise on Addresses:
  - **compare** data models of OpenStreetMap and INSPIRE
  - **(down)load** OpenStreetMap and INSPIRE datasets in QGIS
  - **perform ETL transformations** on both datasets to align the data models
  - **integrate** the datasets

# A relevant EC study on OpenStreetMap

- Project Evaluation of EU gazetteer:
  - managed by JRC and ESTAT + Contractors, funded by ELISE
  - aimed at expanding the range of authoritative gazetteer datasets to support different Commission Services, also looking at OpenStreetMap
- Tasks:
  - comparison between INSPIRE/authoritative and OpenStreetMap Addresses performed for 6 Member States (BE, NL, LU, FR, ES, CZ)
  - transformation of INSPIRE/authoritative datasets in the OpenStreetMap data model
- Results:
  - INSPIRE/authoritative and OpenStreetMap Addresses datasets are complementary
  - OpenStreetMap Addresses completeness is heterogeneous:
    - lower than authoritative datasets in rural areas
    - higher than authoritative datasets in urban areas

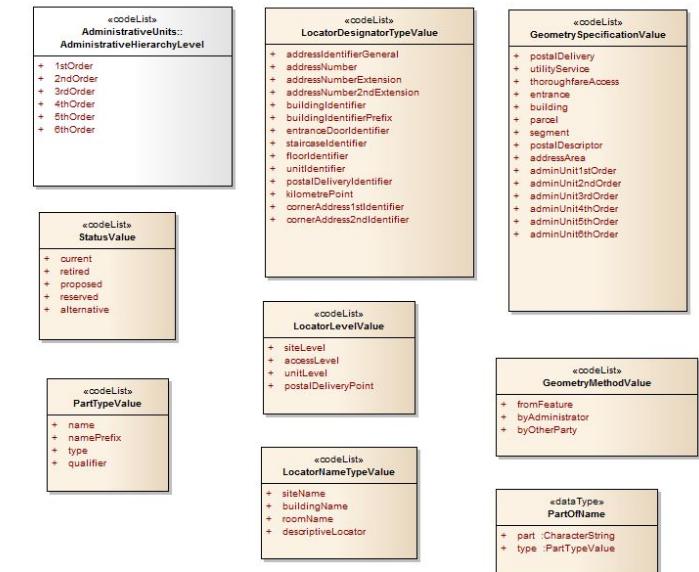
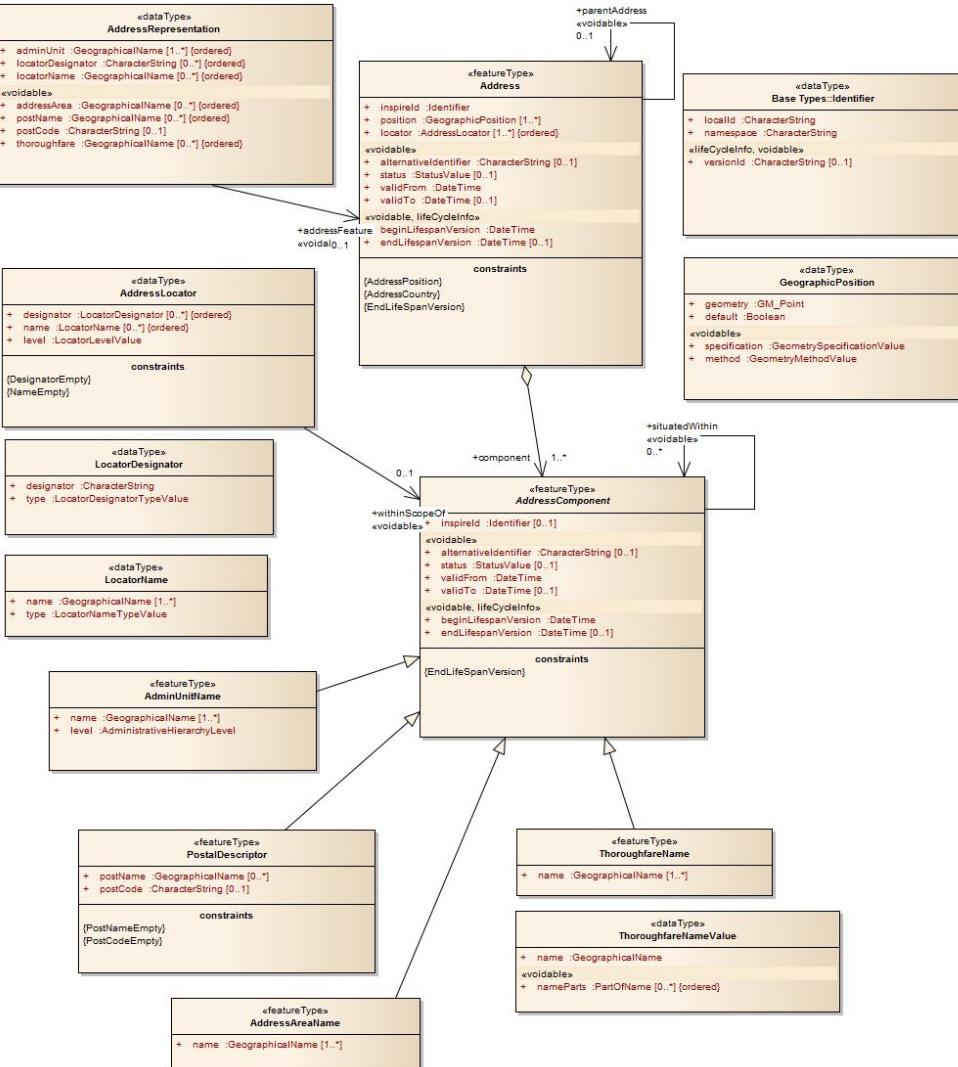
# A relevant EC study on OpenStreetMap

- Ratio between the number of OSM and authoritative Addresses datasets:
  - often  $> 100\%$ , also due to imports (e.g. in NL)





# Addresses – INSPIRE



<https://inspire.ec.europa.eu/Themes/79/2892>  
<https://inspire.ec.europa.eu/id/document/tg/ad>

# Addresses – OpenStreetMap



Key	Value	Element	Comment	Rendering	Photo
<b>Tags for individual houses</b>					
addr:housenumber	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	The house number (may contain letters, dashes or other characters). Addresses describes ways to tag a single building with multiple addresses. Please do not only tag <code>addr:housenumber=*</code> , but also add at least <code>addr:street=*</code> or <code>addr:place=*</code> for places without streets (or map the belonging to a street with a relation using <code>associatedStreet</code> relation or <code>street relation</code> .)		
addr:housename	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	The name of a house. This is sometimes used in some countries like England instead of (or in addition to) a house number.		
addr:flats	user defined	<input type="radio"/>	The unit numbers (a range or a list) of the flats or apartments located behind a single entrance door.		
addr:conscriptionnumber	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	This special kind of housenumber relates to a settlement instead of a street. Conscription numbers were introduced in the Austro-Hungarian Empire and are still in use in some parts of Europe, sometimes together with street-related housenumbers which are also called <i>orientation numbers</i> .		
addr:street	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	The name of the respective street. A way with <code>highway=*</code> or a square with <code>place=square</code> and the corresponding name should be found nearby. The belonging to a street can alternatively be represented by a <code>associatedStreet</code> relation or <code>street relation</code> . The keys <code>addr:housenumber=*</code> and <code>addr:street=*</code> in principle are the only necessary ones if there are valid border polygons. If you are not sure if it is so, just add <code>addr:city=*</code> , <code>addr:postcode=*</code> and <code>addr:country=*</code> .		
addr:place	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	This is part of an address which refers to the name of some territorial zone (usually a <code>place=*</code> like island, square or very small village) instead of a street ( <code>highway=*</code> ). Should not be used together with <code>addr:street=*</code> .		
addr:postcode	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	The postal code of the building/area. Some mappers prefer to use <code>boundary=postal_code</code>		
addr:city	user defined	<input type="radio"/> <input checked="" type="checkbox"/>	May not be required if <code>boundary=administrative</code> is used correctly. May or may not be a clone of <code>is_in:city=*</code> (in some places the city in the address corresponds to the post office that serves the area rather than the actual city, if any, in which the building is located!) The name of the city as given in postal addresses of the building/area.		

# Addresses – OpenStreetMap



addr:country	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	<p>May not be required if <code>boundary=administrative</code> is used correctly. The ISO 3166-1 alpha-2 two letter country code in <i>upper case</i>.</p> <p>Example: "DE" for Germany, "CH" for Switzerland, "AT" for Austria, "FR" for France, "IT" for Italy.</p> <p>Caveat: The ISO 3166-1 code for Great Britain is "<b>GB</b>" and not "<b>UK</b>". See also: <a href="#">is_in:country=*</a></p>		
addr:full	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	<p>Use this for a full-text, often multi-line, address if you find the structured address fields unsuitable for denoting the address of this particular location. Examples: "Fifth house on the left after the village oak, Smalltown, Smallcountry", or addresses using special delivery names or codes (possibly via an unrelated city name and post code), or PO Boxes.</p> <p>Beware that these strings can hardly be parsed by software: "1200 West Sunset Boulevard Suite 110A" is still better represented as <code>addr:housenumber=1200 + addr:street=West Sunset Boulevard + addr:flats=Suite 110A</code></p>		

## For countries using hamlet, subdistrict, district, province, state

addr:hamlet	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	The <b>hamlet</b> of the object.		
addr:suburb	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	If an address exists several times in a city. You have to add the name of the settlement. See Australian definition of <b>suburb</b> .		
addr:subdistrict	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	The <b>subdistrict</b> of the object.		
addr:district	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	The <b>district</b> of the object.		
addr:province	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	The <b>province</b> of the object. For Canada, uppercase two-letter postal abbreviations ( <b>BC, AB, ON, QC</b> , etc.) are used. In Russia a synonym <code>addr:region</code> is widely used		
addr:state	user defined	<input type="checkbox"/> <input checked="" type="checkbox"/>	The <b>state</b> of the object. For the US, uppercase two-letter postal abbreviations ( <b>AK, CA, HI, NY, TX, WY</b> , etc.) are used.		



## Tags for interpolation ways

addr:interpolation	all/even/odd/ alphabetic	<input checked="" type="checkbox"/>	How to interpolate the house numbers belonging to the way along the respective street. <a href="#">See detailed description</a> .		
addr:interpolation	Number <i>n</i>	<input checked="" type="checkbox"/>	Every <i>n</i> th house between the end nodes is represented by the interpolation way.		
addr:inclusion	actual/estimate/ /potential	<input checked="" type="checkbox"/>	Optional tag to indicate the accuracy level of survey used to create the address interpolation way. <a href="#">See detailed description</a> .		



[https://wiki.openstreetmap.org/wiki/Map\\_Features#Addresses](https://wiki.openstreetmap.org/wiki/Map_Features#Addresses)  
<https://wiki.openstreetmap.org/wiki/Addresses>

# Addresses Dataset – INSPIRE

- Addresses in Helsinki, Finland:
  - provided by the National Land Survey (NLS) of Finland under CC BY 4.0
  - served by an OGC API - Features implementation:  
<https://beta-paikkatieto.maanmittauslaitos.fi/simple-addresses/features/v1/>
    - partially aligned with the draft proposal of Good Practice for INSPIRE Download Services based on OGC API - Features:  
<https://github.com/INSPIRE-MIF/gp-ogc-api-features>
  - available in flat encodings (e.g. GeoJSON & GeoPackage) based on:
    - the UML-to-GeoJSON encoding rule developed by MIWP Action 2017.2:  
<https://github.com/INSPIRE-MIF/2017.2/blob/master/GeoJSON/geojson-encoding-rule.md>
    - the GeoJSON encoding rule for INSPIRE Addresses:  
<https://github.com/INSPIRE-MIF/2017.2/blob/master/GeoJSON/ads/simple-addresses.md>
  - presented at the INSPIRE Conference (session on OGC API - Features on June 9: [https://inspire.ec.europa.eu/sites/default/files/inspire-virtual-2020\\_oapif-inspire-ad.pdf](https://inspire.ec.europa.eu/sites/default/files/inspire-virtual-2020_oapif-inspire-ad.pdf))



# Addresses Dataset – INSPIRE

Spatial Data View

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help

Layers

- ad-helsinki (171012) (selected)
- OpenStreetMap

Identify Results

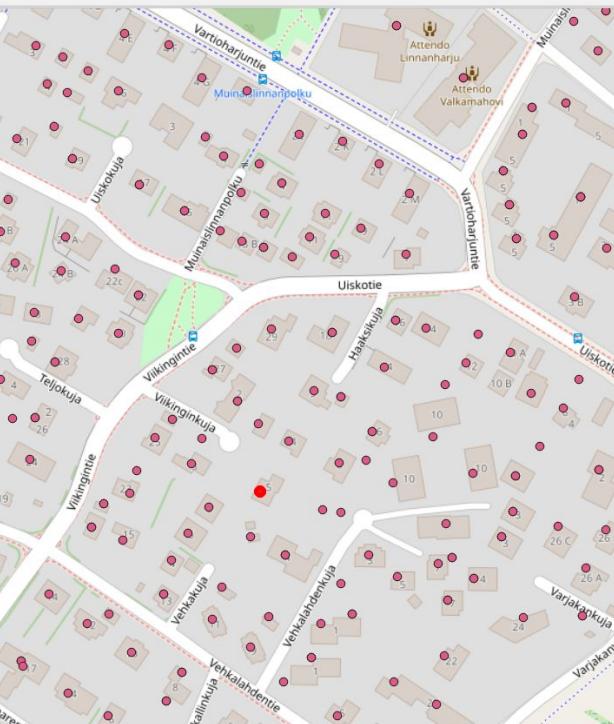
Feature	Value
ad-helsinki	
inspireId_namespace	
(Derived)	
(Actions)	
fid	52113
id	Address_1642883
inspireId_localId	Address_1642883
inspireId_namespace	<a href="http://paikkatiedot.fi/so/1001073/ad/Address/">http://paikkatiedot.fi/so/1001073/ad/Address/</a>
beginLifespanVersion	2014-11-10T12:21:19.000
position_specification	
position_specification_href	<a href="http://inspire.ec.europa.eu/codelist/GeometrySpecificationValue/building">http://inspire.ec.europa.eu/codelist/GeometrySpecificationValue/building</a>
position_method	
position_method_href	<a href="http://inspire.ec.europa.eu/codelist/GeometryMethodValue/byOtherParty">http://inspire.ec.europa.eu/codelist/GeometryMethodValue/byOtherParty</a>
position_default	true
locator_designator_addressIdentifierGeneral	
locator_level	5
siteLevel	
http://inspire.ec.europa.eu/codelist/LocatorLevelValue/siteLevel	
building	101594315Y
parcel	09104504540012
component_ThoroughfareName	Viikinginkuja
component_PostalDescriptor	00950
component_AdminUnitName_1	Suomi
component_AdminUnitName_4	Helsinki
inspireId_namespace	

Mode Current layer

View Tree

Coordinate 2796142.8,8448266.5 Scale 1:4636 Magnifier 100% Rotation 0,0° Render EPSG:3857 Help

Search: Type to locate (Ctrl+k) Toggles the editing state of the current layer



# Addresses Dataset – OpenStreetMap



- Addresses in Biella, Italy:
  - derived from an import of the Addresses dataset from the Province of Biella (under CC BY 3.0 IT, plus an explicit consent to import into OSM) performed in 2016 & 2017: [https://wiki.openstreetmap.org/wiki/Import/Catalogue/Provincia\\_di\\_Biella](https://wiki.openstreetmap.org/wiki/Import/Catalogue/Provincia_di_Biella)
  - downloaded from the OSM database through the QuickOSM plugin in QGIS (based on the Overpass API):

The screenshot shows the QuickOSM plugin interface within QGIS. The left sidebar has icons for 'Quick query' (highlighted), 'Query', 'OSM File', 'Parameters', and 'About'. The main window title is 'Overpass query'. The query text area contains the following Overpass API script:

```
<osm-script output="xml" timeout="25">
  <id-query {{geocodeArea:Biella}} into="area_0"/>

  <query type="node">
    <has-kv k="addr:housenumber"/>
    <has-kv k="addr:street"/>
    <area-query from="area_0"/>
  </query>

  <print mode="body"/>
</osm-script>
```

Below the query text are 'Advanced' settings, 'Generate query' and 'Run query' buttons, and links for 'Overpass Turbo' and 'Documentation'.

# Addresses Dataset – OpenStreetMap



The screenshot shows the QGIS interface with the following details:

- Project Bar:** Includes options for Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, Processing, and Help.
- Toolbar:** Contains icons for file operations, selection, measurement, and other spatial analysis tools.
- Layers Panel:** Shows the current layers:
  - AD-OSM Biella** (checked)
  - OpenStreetMap.AD [171012]**
  - ad-helsinki [171012]**
  - OpenStreetMap** (checked)
- Map View:** Displays a street map of Biella, Italy, with buildings, roads, and labels in Italian. A yellow highlighted area covers the central part of the city.
- Identify Results Panel:** Shows the details of the selected feature, "Farmacia Balestrini".

Feature	Value
AD-OSM_Biella	
name	Farmacia Balestrini
(Derived)	
(Actions)	
fid	44144
full_id	n5910181106
osm_id	5910181106
osm_type	node
addr:city	Biella
addr:housenumber	8
addr:postcode	13900
addr:street	Via Pietro Micca
name	Farmacia Balestrini
shop	pharmacy
barrier	
amenity	pharmacy
contact:email	
contact:phone	
contact:website	
entrance	
dispensing	yes
website	<a href="http://www.farmacibalestrini.it/index.php">http://www.farmacibalestrini.it/index.php</a>
information	
phone	+39 015 2522071
tourism	
opening_hours	Mo-Fr 08:30-19:00; Sa 08:30-12:30; Su, PH off
wheelchair	
cuisine	
email	<a href="mailto:info@farmacibalestrini.it">info@farmacibalestrini.it</a>
fax	
internet_access	
smoking	
microbrewery	
toilets:wheelchair	
- Bottom Panel:** Includes buttons for Current layer, Tree, Auto open form, and Help.

# Mapping: INSPIRE → OpenStreetMap

- The data model for Addresses is **richer in INSPIRE than OpenStreetMap.**
- The INSPIRE Helsinki Addresses dataset can be transformed according to the OpenStreetMap data model using the following mapping:

<b>INSPIRE</b>	<b>OpenStreetMap</b>
locator_designator_addressIdentifierGeneral	addr:housenumber
component_ThoroughfareName	addr:street
component_PostalDescriptor	addr:postcode
component_AdminUnitName_4	addr:city
component_AdminUnitName_1	addr:country

# Mapping: INSPIRE → OpenStreetMap

- Some attributes are NOT present in this specific INSPIRE dataset, but if present they would have a correspondence in OpenStreetMap:

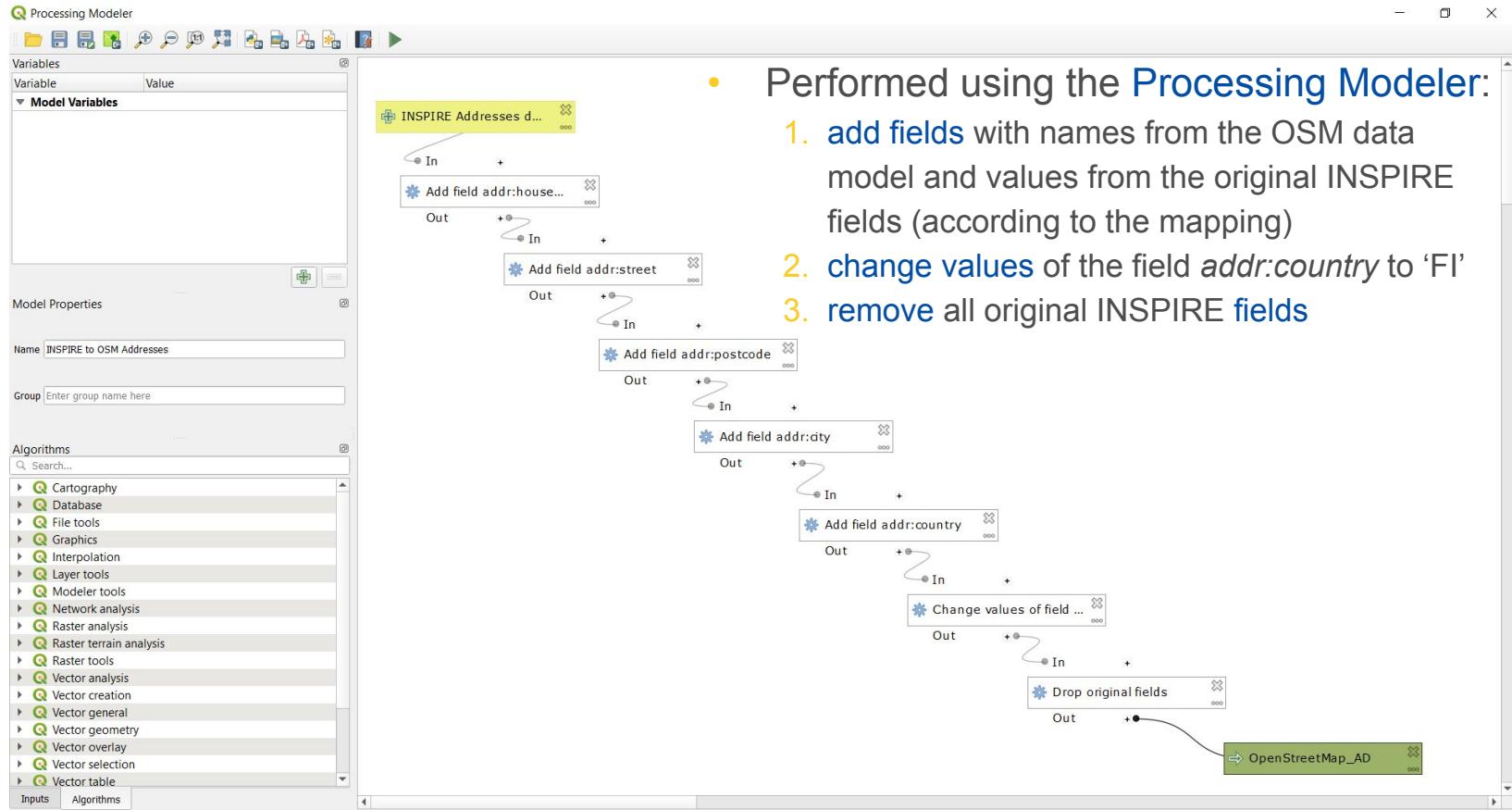
INSPIRE	OpenStreetMap
component_AddressAreaName	addr:place
position_specification = entrance	entrance

# Mapping: INSPIRE → OpenStreetMap

- Some attributes are present in this specific INSPIRE dataset, but they do NOT have a correspondence in OpenStreetMap:

INSPIRE	definition
locator_level	The level to which the locator refers.
position_default	Specifies whether or not this position should be considered as the default.
position_method	Description of how and by whom the geographic position of the address was created or derived.
building	ID of the building the address refers to.
parcel	ID of the cadastral parcel the address refers to.

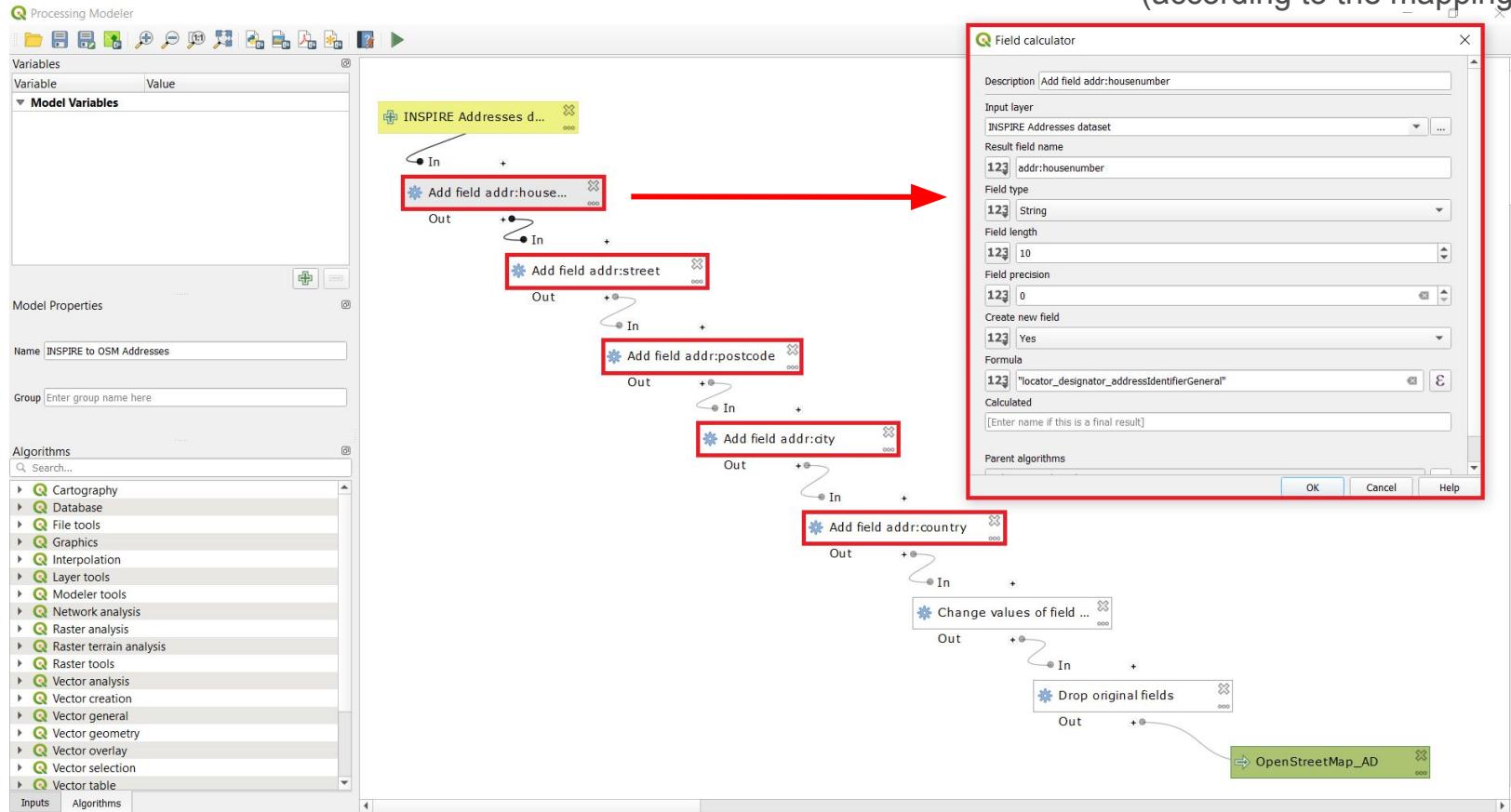
# ETL transformation in QGIS



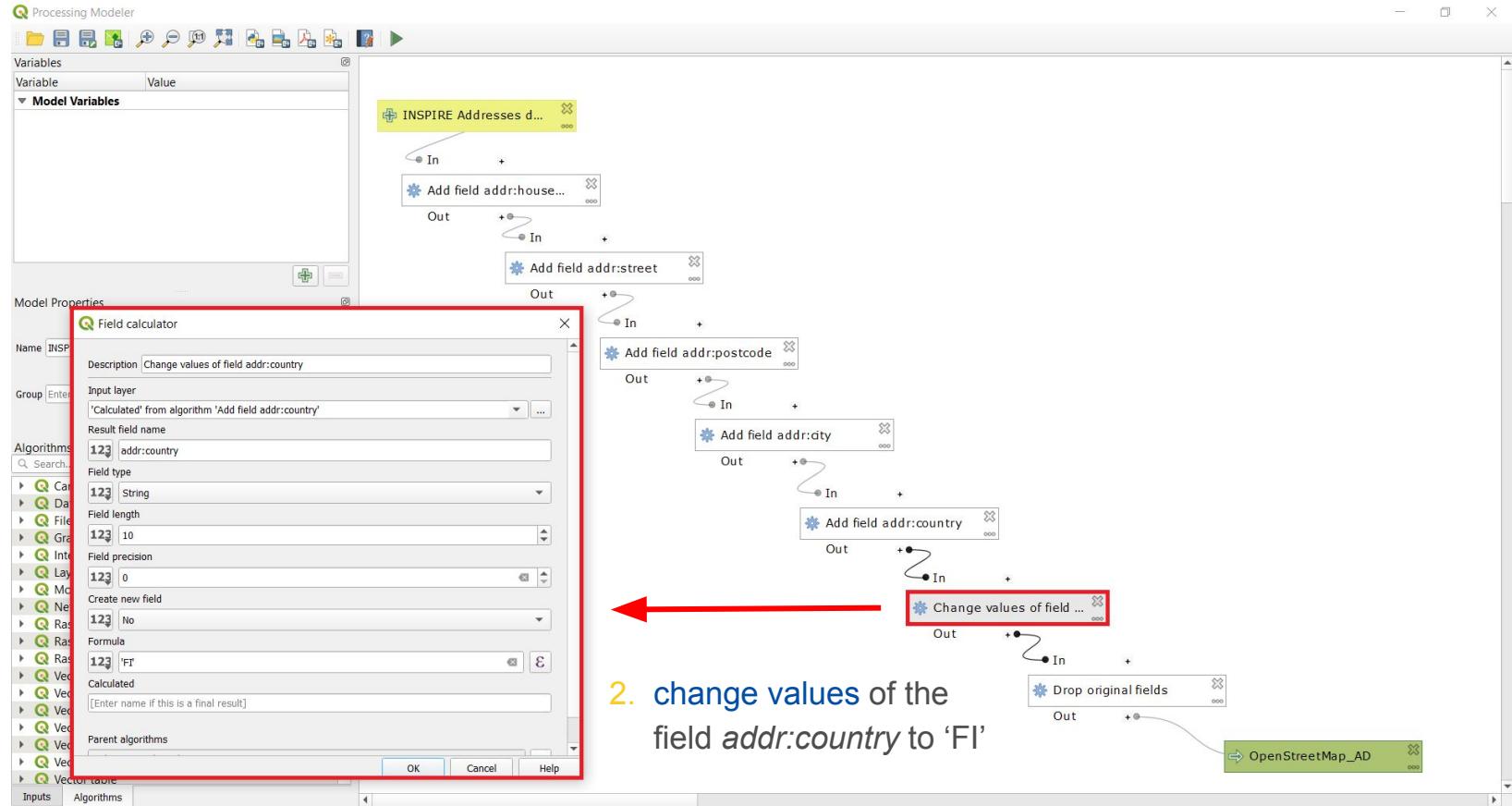
- Performed using the [Processing Modeler](#):
  1. **add fields** with names from the OSM data model and values from the original INSPIRE fields (according to the mapping)
  2. **change values** of the field `addr:country` to 'FI'
  3. **remove all original INSPIRE fields**

# ETL transformation in QGIS

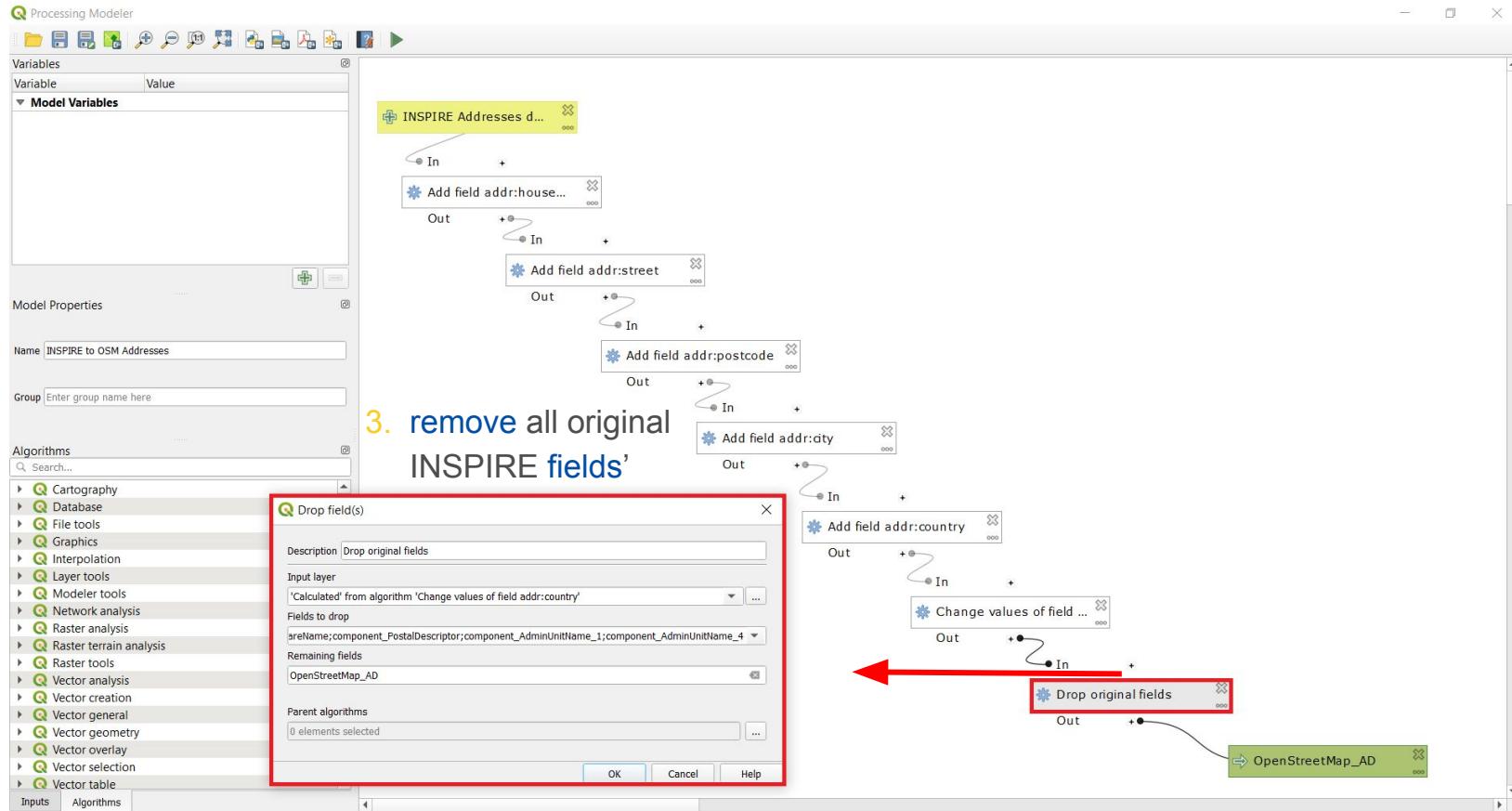
1. add fields with names from the OSM data model and values from the original INSPIRE fields (according to the mapping)



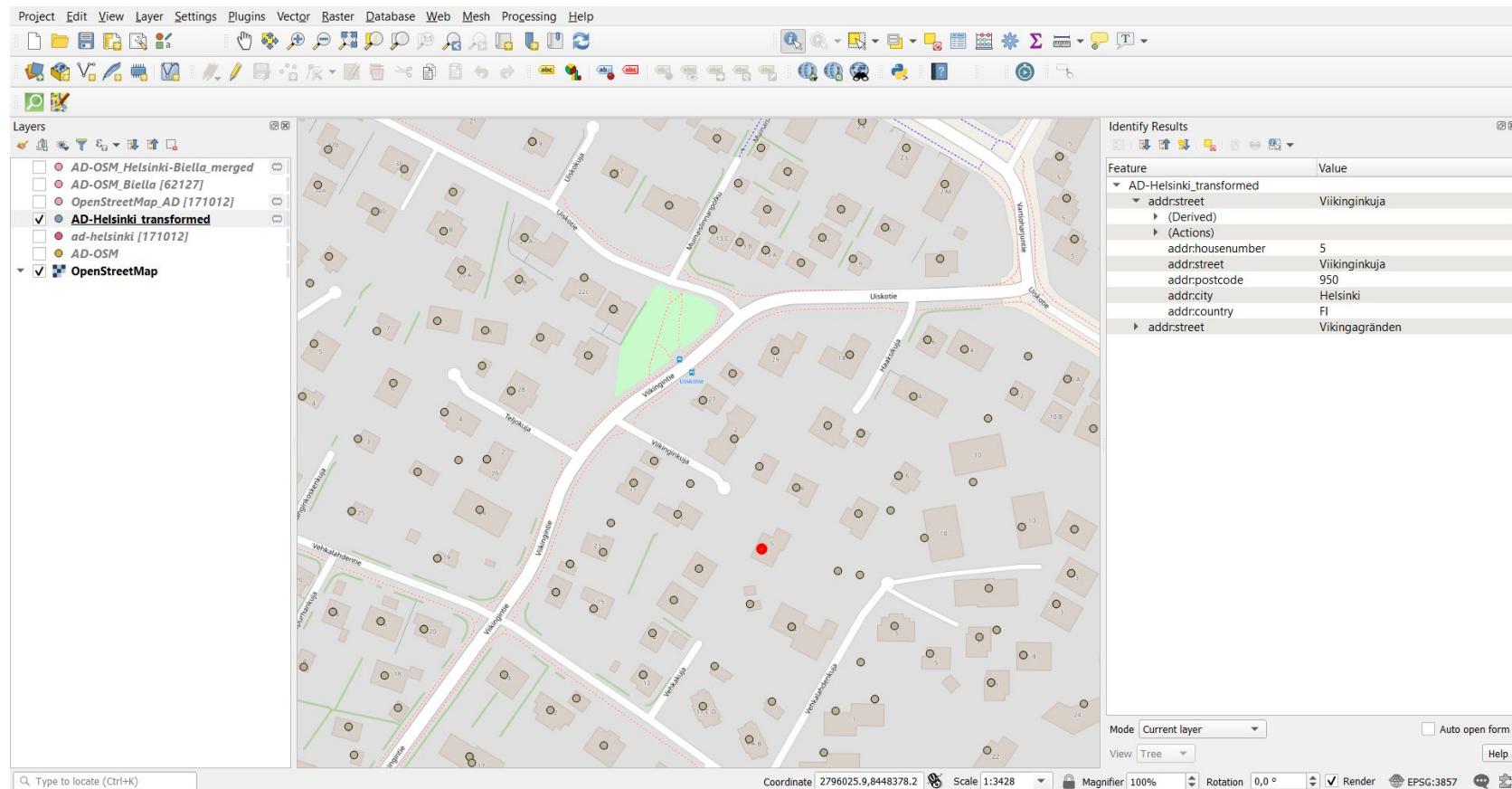
# ETL transformation in QGIS



# ETL transformation in QGIS



# INSPIRE Addresses dataset transformed



# Addresses Dataset – OpenStreetMap



- Some additional ETL processing is necessary to:
  - remove the points with missing address information OR add missing information (e.g. `addr:country` which is missing, `addr:postcode` which derives from `addr:city`)
  - change the data type of `addr:postcode` from *string* to *integer*

# Merging of Addresses datasets

\*workshop\_exercise - QGIS

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help

Layers

- AD\_INSPIRE
- AD\_INSPIRE\_OSM merged**
- AD\_INSPIRE\_transformed
- AD\_OSM\_transformed
- AD\_OSM

OpenStreetMap

AD\_INSPIRE\_OSM\_merged :: Features Total: 232382, Filtered: 232382, Selected: 0

fid	addr:city	addr:housenumber	addr:street	addr:country	addr:postcode	
61363	61363	Verrone	16	Strada del Tocchetto	IT	13871
61364	61364	Verrone	15	Via Giovanni Paolo II	IT	13871
61365	61365	Verrone	13	Via Giovanni Paolo II	IT	13871
61366	61366	Verrone	11	Via Giovanni Paolo II	IT	13871
61367	61367	Verrone	5	Via Favone	IT	13871
61368	61368	Verrone	2	Via Giovanni Paolo II	IT	13871
61369	61369	Verrone	12	Via Don F. Marinelli	IT	13871
61370	61370	Verrone	10	Via Don F. Marinelli	IT	13871
61371	61371	Espoo	2	Perilänniitty	FI	2600
61372	61372	Espoo	2	Periläängen	FI	2600
61373	61373	Vantaa	2	Pirttakuja	FI	1260
61374	61374	Vantaa	2	Väskedsgränden	FI	1260
61375	61375	Vantaa	2	Pirttakuja	FI	1260

Show All Features

The screenshot shows the QGIS desktop application. The main window displays a map of Europe with various countries and regions labeled in multiple languages. A legend on the left side lists several address datasets, with 'AD\_INSPIRE\_OSM merged' checked and highlighted in blue. Below the legend is a detailed table of address records from this dataset. The table has columns for fid, addr:city, addr:housenumber, addr:street, addr:country, and addr:postcode. Most entries are for 'Verrone' in Italy, with some for 'Espoo' and 'Vantaa' in Finland. The table also includes a 'Show All Features' button at the bottom. At the very bottom of the interface, there is a search bar and a status bar showing coordinates, scale, magnifier, rotation, and EPSG code.

# Thank you!

The materials of this workshop (presentations, data and algorithms) are available at  
[https://github.com/MarcoMinghini/INSPIRE-OSM/tree/master/2020-06-11\\_Workshop-INSPIRE-Conference](https://github.com/MarcoMinghini/INSPIRE-OSM/tree/master/2020-06-11_Workshop-INSPIRE-Conference)



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# PART 4 – 2<sup>nd</sup> Slido questions poll

## Keep in touch



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