

# Open Street Map API

OpenStreetMap is an international project with the aim to create a free, editable map of the world.

The data is contributed voluntarily by users. At the moment OSM has more than 5 Mio Users.

The basic components of OpenStreetMap's conceptual data model of the physical world are **Elements**. They consist of the following data:

## Elements

- **Nodes(id, lat,lon,tags)** are points with a geographic position, stored as coordinates (pairs of a latitude and a longitude) and a node Id. They can have multiple tags. Outside of their usage in ways, they are used to represent map features without a size, such as points of interest or mountain peaks. In February 2018 OSM contains 4.3 billion nodes.

```
<node id="25496583" lat="51.5173639" lon="-0.140043" version="1" changeset="203496" user="80n" uid="1238" visible="true" timestamp="2007-01-28T11:40:26Z">
  <tag k="highway" v="traffic_signals"/>
</node>
```

Illustration 1 : Example of a node

- **Ways** are ordered lists of nodes. A way can have between 2 and 2000 nodes. They are used both for representing linear features such as streets and rivers, and areas, like forests, parks, parking areas and lakes. An **open way** (polyline<sup>1</sup>) is way describing a linear feature which does not share a first and last node. Many roads, streams and railway lines are open ways. A **closed way** (polygon<sup>2</sup>) is a way where the last node of the way is shared with the first node with suitable tagging. A closed way that also has a `area=yes` tag should be interpreted as an area.

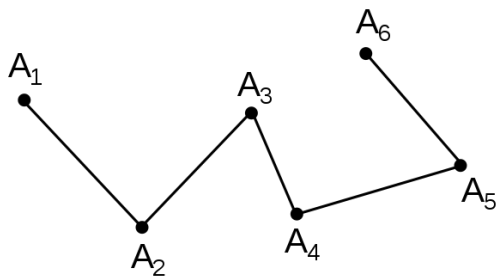


Illustration 2 : Polyline

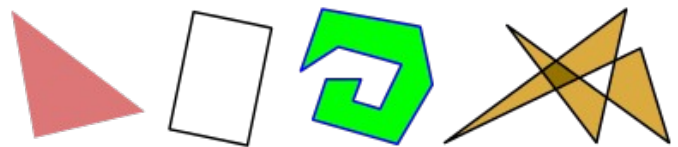


Illustration 3: Polygon

- An **area** (or filled polygon) can be defined as an enclosed filled area defined as a closed way with appropriate associated tags or using a multipolygon relation creating an area from one of more ways. Areas are not distinct data primitives and some closed ways (for example `landuse=*`) are assumed to be areas, but others, such as `highway=footway` are not, being treated as linear features instead, except when there is also an `area=yes` tag.
- A **Relation** is a group of elements. Relations consists of one or more tags and also an ordered list of one or more nodes, ways and/or relations as members which is used

1 Illustration 2

2 Illustration 3

to define logical or geographic relationships between other elements. A member of a relation can optionally have a **role** which describes the part that a particular feature plays within a relation. A **role** is an optional textual field describing the function of a member of the relation. For example, in North America, east indicates that a way would be posted as East on the directional plate of a route numbering shield.

- **Tags** are key-value pairs (both arbitrary strings). Tags describe specific features of map elements (nodes, ways, or relations). For example: *highway=residential* a tag with a key of **highway** and a value of **residential** which should be used on a way to indicate a road along which people live.

## Data storage

Data is stored in a PostgreSQL database. The complete data can be downloaded either in XML or in BPF.

## Routing & search data

**Nominatim** is a search engine service for geocoding and reverse geocoding OSM data.

Nominatim comprises of:

- osm2pgsql output routine
- Postgresql module
- Set of plpgsql functions

**Geocoding:** e. g. search by postcode

```
https://nominatim.openstreetmap.org/search?q=89075&format=xml&polygon=1&addressdetails=1
```

## Result:

```
<?xml version="1.0" encoding="UTF-8"?>
<place place_id="25081668" osm_type="node" osm_id="2430737061" place_rank="21" boundingbox="48.4183281,48.4184281,10.0009394,10.0010394" polygonpoints="
[[10.0009894,48.4184281],[10.00102475533906,48.418413455339056],[10.0010394,48.4183781],[10.00102475533906,48.41834274466094],[10.0009894,48.4183281],
[10.00095404466094,48.41834274466094],[10.0009394,48.4183781],[10.00095404466094,48.418413455339056]]" lat="48.4183781" lon="10.0009894"
display_name="Oststadt, Örlingen, Ulm, Regierungsbezirk Tübingen, Baden-Württemberg, 89075, Deutschland" class="place" type="postcode" importance="0.335">
  <suburb>Oststadt</suburb>
  <hamlet>Örlingen</hamlet>
  <city>Ulm</city>
  <state_district>Regierungsbezirk Tübingen</state_district>
  <state>Baden-Württemberg</state>
  <postcode>89075</postcode>
  <country>Deutschland</country>
  <country_code>de</country_code>
</place>
```

**Reverse geocoding:** search by lat and lon

```
https://nominatim.openstreetmap.org/reverse?
format=xml&lat=48.4183781&lon=10.0009894&zoom=18&addressdetails=1
```

```
▼<reversegeocode timestamp="Mon, 12 Nov 18 11:38:16 +0000" attribution="Data © OpenStreetMap contributors, ODbL 1.0. http://www.openstreetmap.org/copyright"
querystring="format=xml&lat=48.4183781&lon=10.0009894&z=18&addressdetails=1">
▼<result place_id="25038632" osm_type="node" osm_id="2430737076" lat="48.4188131" lon="10.0009168" boundingbox="48.4187131,48.4189131,10.0008168,10.0010168">
36, Eichengrund, Eichenplatz, Oststadt, Örlingen, Ulm, Regierungsbezirk Tübingen, Baden-Württemberg, 89075, Deutschland
</result>
▼<addressparts>
<house_number>36</house_number>
<road>Eichengrund</road>
<neighbourhood>Eichenplatz</neighbourhood>
<suburb>Oststadt</suburb>
<hamlet>Örlingen</hamlet>
<city>Ulm</city>
<state_district>Regierungsbezirk Tübingen</state_district>
<state>Baden-Württemberg</state>
<postcode>89075</postcode>
<country>Deutschland</country>
<country_code>de</country_code>
</addressparts>
</reversegeocode>
```

**Find special location:** search *e.g. sushi stores near Ulm* by lat and lon

[https://nominatim.openstreetmap.org/search.php?q=sushi%2048.40847065,%209.9976292944672&polygon\\_geojson=1&accept-language=de&format=json](https://nominatim.openstreetmap.org/search.php?q=sushi%2048.40847065,%209.9976292944672&polygon_geojson=1&accept-language=de&format=json)

## Result:

```
▼<searchresults timestamp="Mon, 12 Nov 18 12:03:37 +0000" attribution="Data © OpenStreetMap contributors, ODbL 1.0. http://www.openstreetmap.org/copyright"
querystring="sushi 48.40847065, 9.9976292944672" polygon="false" exclude_place_ids="6857566,43850321,17336158,45814993"
more_url="https://nominatim.openstreetmap.org/search.php?
q=sushi+48.40847065%2C+9.9976292944672&polygon_geojson=1&exclude_place_ids=6857566%2C43850321%2C17336158%2C45814993&format=xml&accept-language=de-
DE%2Cde%3Bq%3D0.9%2Cen-US%3Bq%3D0.8%2Cen%3Bq%3D0.7">
<place place_id="6857566" osm_type="node" osm_id="702270748" place_rank="30" boundingbox="48.3976556,48.3977556,9.993161,9.993261" geojson="
{"type":"Point","coordinates":[9.993211,48.3977056]}> lat="48.3977056" lon="9.993211" display_name="Sushi Lounge, Brautgasse, Fischerviertel, Oststadt,
Arbeidersiedlung Untere Bleiche, Ulm, Regierungsbezirk Tübingen, Baden-Württemberg, 89073, Deutschland" class="amenity" type="restaurant" importance="0.001"
icon="https://nominatim.openstreetmap.org/images/mapicons/food_restaurant.p.20.png"/>
<place place_id="43850321" osm_type="node" osm_id="3152519560" place_rank="30" boundingbox="48.3946955,48.3947955,9.9984159,9.9985159" geojson="
{"type":"Point","coordinates":[9.9984659,48.3947455]}> lat="48.3947455" lon="9.9984659" display_name="Sushi-Wok, Marienstraße, Vorfeld, Neu-Ulm, Landkreis Neu-
Ulm, Schwaben, Bayern, 89231, Deutschland" class="amenity" type="fast_food" importance="0.001"
icon="https://nominatim.openstreetmap.org/images/mapicons/food_fastfood.p.20.png"/>
<place place_id="17336158" osm_type="node" osm_id="1603484081" place_rank="30" boundingbox="48.3941605,48.3942605,10.001729,10.001829" geojson="
{"type":"Point","coordinates":[10.001779,48.3942105]}> lat="48.3942105" lon="10.001779" display_name="Kon-Ya Sushi, 11, Ludwigstraße, Vorfeld, Wiley, Neu-Ulm,
Landkreis Neu-Ulm, Schwaben, Bayern, 89231, Deutschland" class="amenity" type="restaurant" importance="0.001"
icon="https://nominatim.openstreetmap.org/images/mapicons/food_restaurant.p.20.png"/>
<place place_id="45814993" osm_type="node" osm_id="3407582736" place_rank="30" boundingbox="48.3933153,48.3934153,10.0044594,10.0045594" geojson="
{"type":"Point","coordinates":[10.0045094,48.3933653]}> lat="48.3933653" lon="10.0045094" display_name="Lado Food Sushi, 1, Bahnhofstraße, Vorfeld, Offenhausen,
Neu-Ulm, Landkreis Neu-Ulm, Schwaben, Bayern, 89231, Deutschland" class="amenity" type="fast_food" importance="0.001"
icon="https://nominatim.openstreetmap.org/images/mapicons/food_fastfood.p.20.png"/>
</searchresults>
```