Libosmscout

A C++ library
for
OpenStreetMap
for
offline rendering, routing, location and POI look up
on
mobile devices

Why offline

- Use application without a central server
  - No network, network unreliable or slow
  - Network access is too expensive
- You have a copy of the OSM DB on your device
  - Rendering live on the device
  - No need to provide a tile server
  - More flexibility (change style sheets, filter data)

Why a library?

I needed a week for the first map to get drawn

I needed a few years to get the database small, the rendering and routing fast and the memory footprint small

I'm still not done yet

You must take care of...

data too big for main memory

existing DB libraries not fast enough

relation parsing

build under Android, Linux, Mac, Windows, iOS/OSX

coastlines

Karlsruhe schema

route description

islands

acess tag

location index

turn restrictions

style sheet

label placement

OSM ids are 64 bit

fast spartial index

multipolygon

platform independent data format

administrative boundaries

blacklisting relation areas

roundabouts

routing graph

bridges and tunnels

optimize size of data on disk

memory usage should be <10MB

filter objects to draw based on zoom

search for POIs

Multiple projection

*.osm

*.osm.pbf

way joins/ends

oneway

objects close on map should be close in file

reduce number of objects

layer tag

multiple drawing backends

area/way rendering order

water/ground color

Finding

There is need for more than one OSM app

Why implement all the stuff again and again?

If you want to build a cool app based on OSM, put your time into the app and reuse existing code that does the dirty OSM stuff for you

Introducing libosmscout

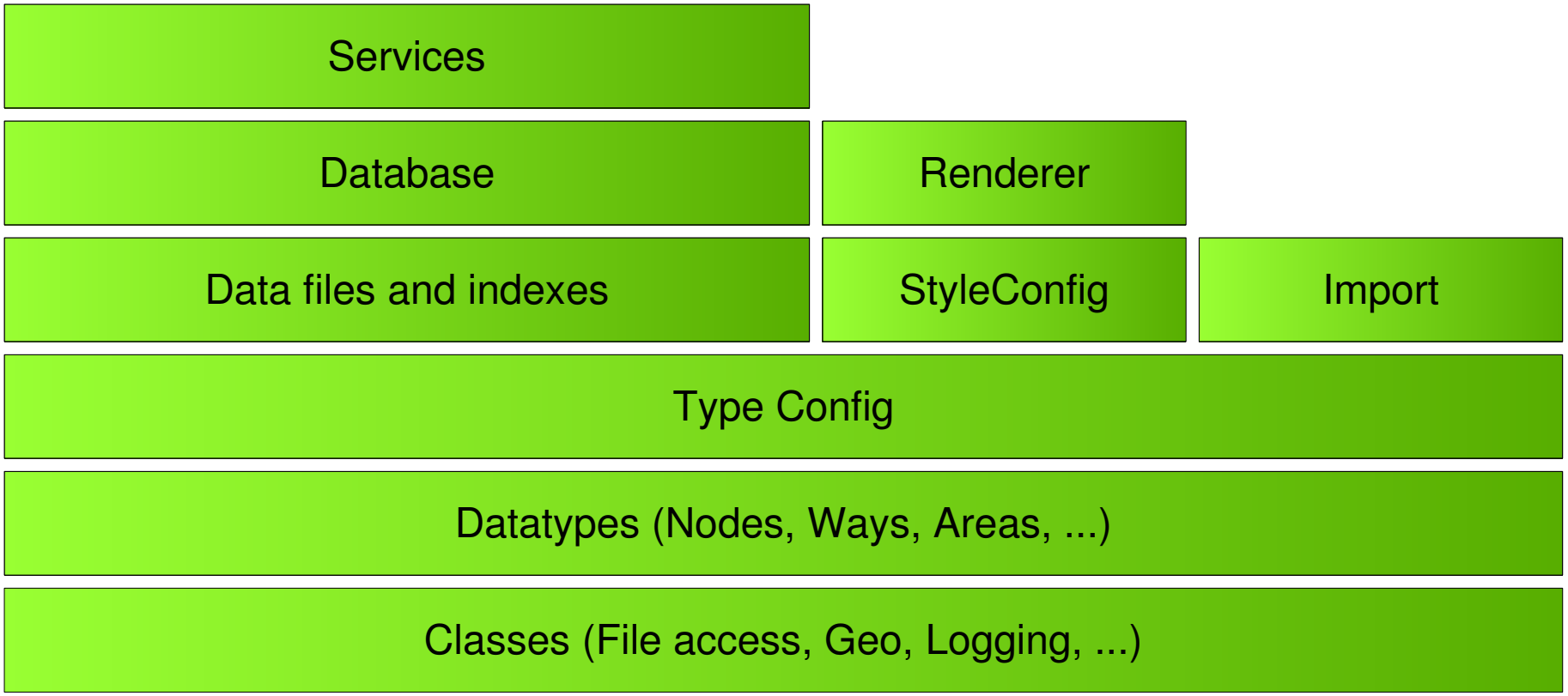
- Written in C++
- Licensed under LGPL with iOS Exceptions
- Library/Framework to offer ready to use functions for map drawing, routing, POIs search and location search - based on OSM data
- Does all the ugly stuff, just use some simple APIs
- Works well under reduced resources as on mobile devices

Concept

- Import *.osm or *.osm.pbf files on your development machine
- Let the importer do some heavy analysis and tweaking of the data, finally getting a number of data and index files (database)
- Test and tweak data and style sheet
- Copy the database (or only parts of it) and style sheet(s) on your device for offline access

Layered and Service based

- Use only parts (Classes - Database)
- Add or exchange (Render, Services, Database)



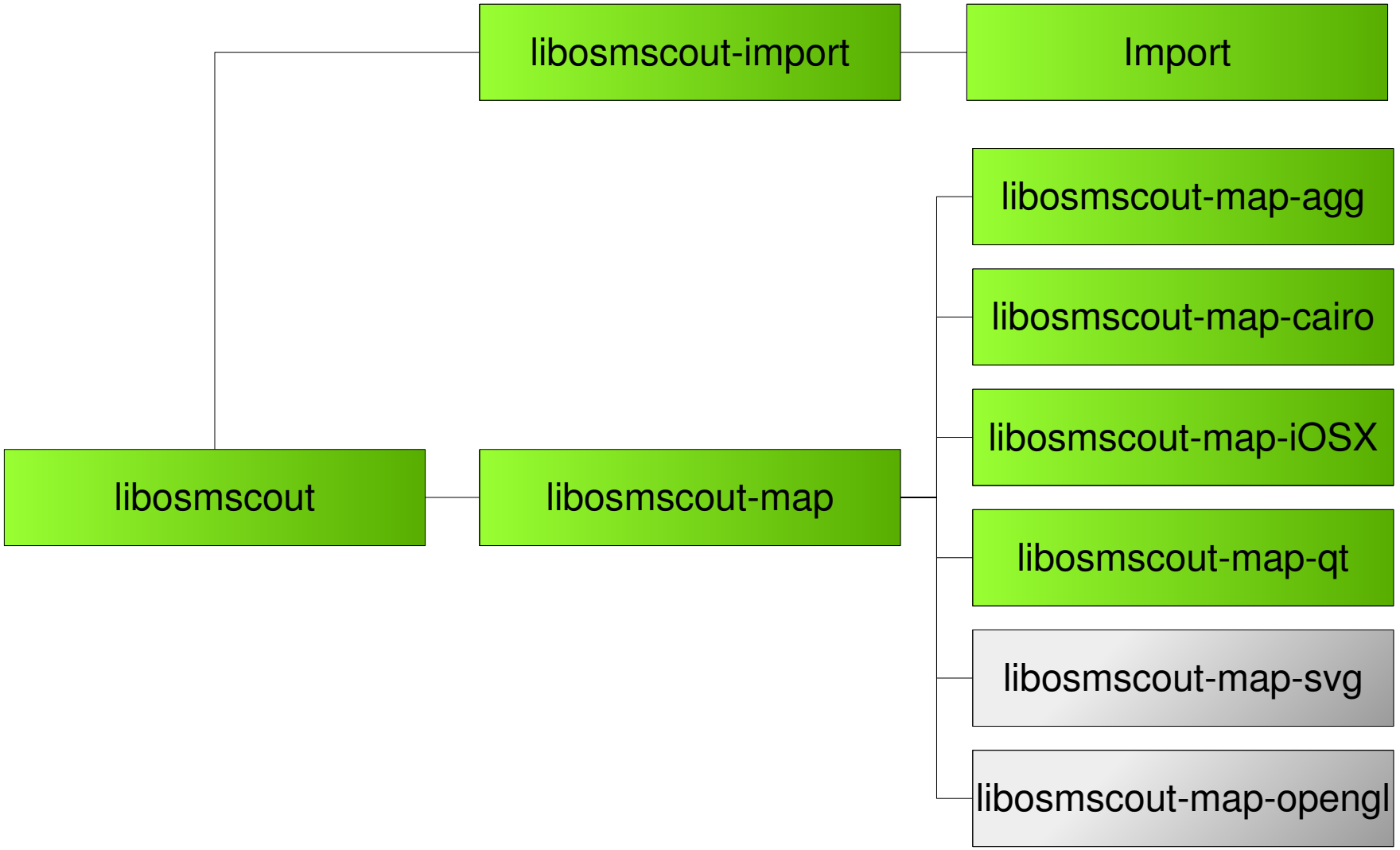
Customizable

- Import only the data your are interested in (influencing the size of the offline data)
- Change the style sheet to draw only the things you are interested in, in the way you like it
- Use configuration options to tweak renderer for different devices and resolutions
- Add additional renderings like overlays or contour lines
- Use routing profiles to influence routing

Supported platforms

- Desktop
  - Qt via Qt backend
  - Gnome and Windows (and everything else) via cairo
  - Mac OS X via cairo or better iOSX backend
- iPhone, iPad via iOSX backend
- Android via JNI or via Qt
- Windows Phone (untested)

Libraries


libosmscout-import
Import
libosmscout-map-agg
libosmscout-map-cairo
libosmscout-map-iOSX
libosmscout
libosmscout-map
libosmscout-map-qt
libosmscout-map-svg
libosmscout-map-opengl

Import Results

types.dat

bounding.dat

Germany, NRW:
375 MB osm.pbf
=>**641 MB**

nodes.dat

areas.dat

ways.dat

areanode.idx

areaarea.idx

areaway.idx

areasopt.dat

waysopt.dat

location.idx

water.idx

intersections.dat

routefoot.dat

routebicycle.dat

routecar.dat

routefoot.idx

routebicycle.idx

routecar.idx

Main classes for integration

TypeConfig

Database

DatabaseParameter

LocationService

POIService

*Visitor

LocationSearch/Result

MapService

RoutingService

MercatorProjection

StyleConfig

MapParameter

AreaSearchParameter

MapData

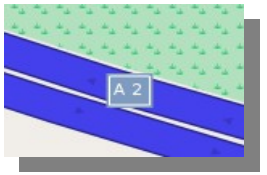
RouterParameter

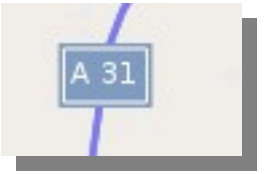
RoutingProfile

RoutingPostProcessor

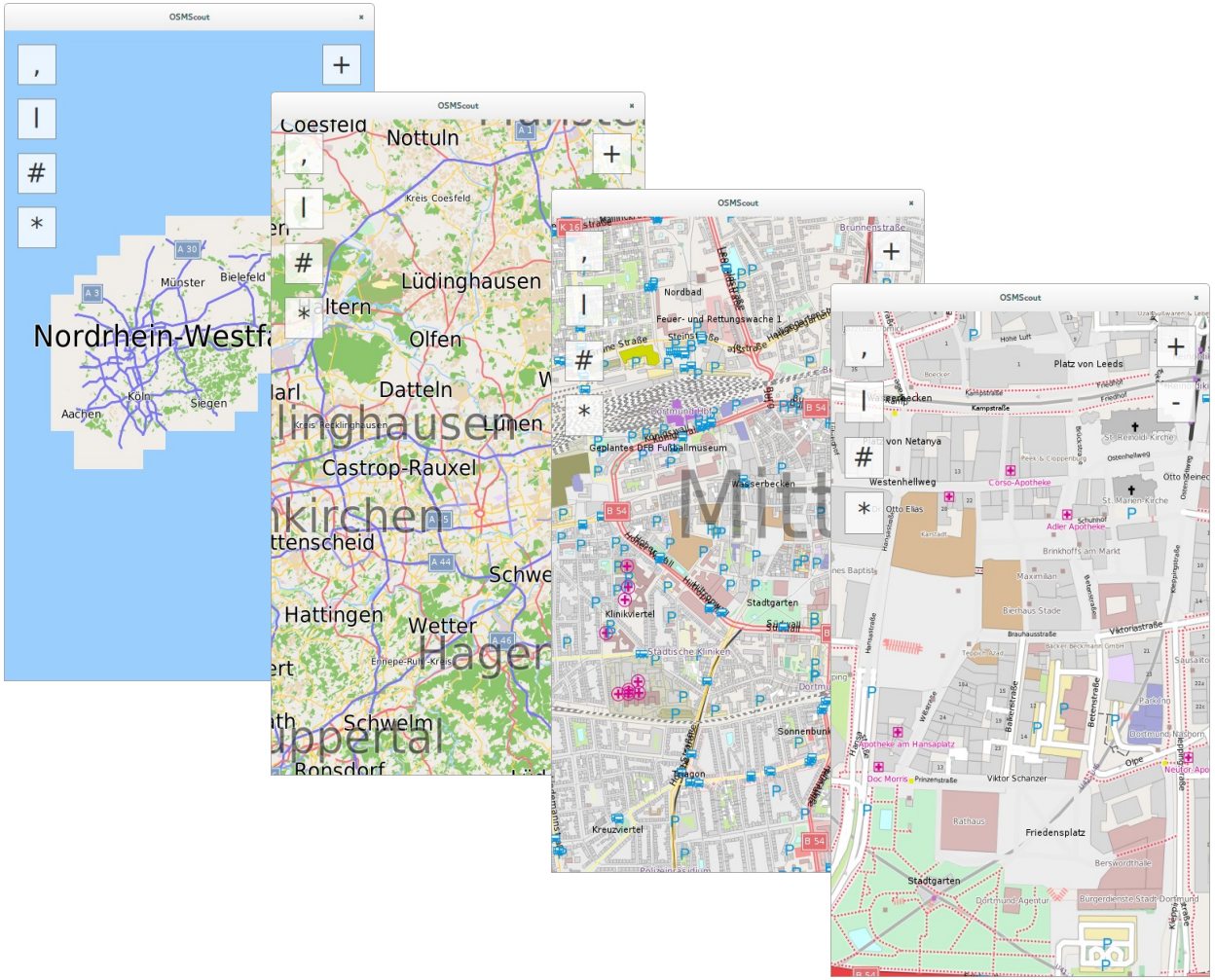
Style Sheet

```
 ORDER WAYS
  GROUP _route
  GROUP highway_motorway
  GROUP waterway_river, waterway_canal, waterway_drain
...
CONST
  MAG stepsMag                    = block;
  MAG labelPathsMag               = veryClose;
...
  // Label priorities
  UINT labelPrioContinent          = 1;
  UINT labelPrioIsland             = 1;
  UINT labelPrioCountry            = 2;
...
  COLOR buildingColor              = #d9d9d9;
  COLOR buildingBorderColor        = darken(@buildingColor, 0.3);
  COLOR buildingLabelColor         = darken(@buildingColor, 0.5);
...
 [MAG continent-] {
   [TYPE highway_motorway] {
     [SIZE 20m 0.45mm:3px<] {
       WAY#outline { color: darken(@motorwayColor,0.4); width: 20m; displayWidth: 0.5mm; priority: -1;
joinCap: butt; }
       WAY { color: @motorwayColor; width: 20m;}
     }
     [SIZE 20m <0.45mm:3px] WAY { color: lighten(@motorwayColor,0.3); displayWidth: 0.45mm;}
   }
 }
```





Rendering Example



- Supports tile rendering
- Various tuning options
- Coastline rendering
- Support for icons
- DPI aware
- Intelligent labeling
- Supports unicode rendering
- Way overlays (one way arrows)
- Overlay labels
- Custom extensions possible (own 3D rendering, contour lines)

Routing Example

```
-------------------------------------------------
     At| After|  Time| After|
-------------------------------------------------
  0.0km          0:00h        Start at 'Start'
                              Drive along 'In den Hüchten'
  0.1km  0.1km  0:00h  0:00h At crossing 'In den Hüchten'
                              Turn right into 'In den Hüchten'
  0.1km  0.1km  0:00h  0:00h At crossing 'In den Hüchten', 'Rauher Dorn'
                              Turn left into 'Rauher Dorn'
  0.4km  0.3km  0:01h  0:01h At crossing 'Am Birkenbaum', 'Evinger Straße (B 54)', 'Rauher Dorn'
                              Turn left into 'Evinger Straße (B 54)'
  1.5km  1.0km  0:02h  0:01h At crossing 'B 54', 'Evinger Straße (B 54)'
                              Enter roundabout
  1.5km  0.0km  0:02h  0:00h Leave roundabout (1. exit) into street 'Evinger Straße (B 54)'
  3.0km  1.5km  0:03h  0:01h Way changes name from 'Evinger Straße (B 54)' to 'Dortmunder Straße (B 54)'
  3.0km  0.0km  0:03h  0:00h At crossing 'B 236', 'Dortmunder Straße (B 54)'
                              Enter motorway 'B 236'
 17.8km 14.9km  0:13h  0:09h Leave motorway 'B 236' into 'Berghofer Straße (B 236)'
 18.4km  0.5km  0:13h  0:00h Way changes name from 'Berghofer Straße (B 236)' to 'Hörder Straße (B 236)'
 19.8km  1.4km  0:14h  0:01h At crossing 'A3 Kön Frankfurt', 'Hörder
                              Enter motorway 'A 1'
 86.8km 67.0km  0:52h  0:38h Change motorway from 'A 1' to 'A 3'
 99.5km 12.7km  0:59h  0:07h Way changes name from 'A 3' to 'A 3;A 4'
101.6km  2.1km  1:00h  0:01h Change motorway from 'A 3;A 4' to 'A 59'
104.9km  3.3km  1:02h  0:02h Change motorway from 'A 59' to 'A 59'
127.0km 22.1km  1:15h  0:13h Change motorway from 'A 59' to 'A 562'
130.8km  3.8km  1:17h  0:03h Leave motorway 'A 562' into 'A 562'
131.0km  0.2km  1:18h  0:00h At crossing 'A 562', 'August-Bebel-Allee
                              Turn left into 'August-Bebel-Allee'
131.6km  0.6km  1:18h  0:01h Way changes name from 'August-Bebel-Alle
132.1km  0.5km  1:19h  0:01h At crossing 'Godesberger Straße', 'Hochk
                              Turn right into 'Hochkreuzallee'
132.5km  0.4km  1:19h  0:01h At crossing 'Bernkasteler Straße', 'Hoch
                              Enter roundabout
132.6km  0.0km  1:19h  0:00h Leave roundabout (3. exit) into street '
132.8km  0.2km  1:20h  0:00h At crossing 'Bernkasteler Straße', 'Frie
                              Turn slightly right into 'Friesdorfer St
132.8km  0.1km  1:20h  0:00h At crossing 'Am Buschacker', 'Friesdorfe
                              Turn left into 'Am Buschacker'
133.0km  0.2km  1:20h  0:00h At crossing 'Am Buschacker', 'Im Erlengr
                              Turn left into 'Im Erlengrund'
133.1km  0.1km  1:20h  0:00h At crossing 'Im Erlengrund', 'unnamed ro
                              Turn left into 'Im Erlengrund'
133.3km  0.1km  1:21h  0:00h At crossing 'Im Erlengrund', 'Promenaden
                              Turn right into 'Promenadenweg'
133.3km  0.1km  1:21h  0:00h Target reached 'Target'
```

- A*
- Separate files for car, bicycle, foot
- Routing description, extendable
- Evaluates speed limits, surface quality, turn restrictions, one ways and a reasonable subset of access rights
- Profile customizable, allows you to adapt routing algorithm during runtime

Location Search Example

Signal Iduna Park Dortmund

- **Signal Iduna Park**
  Dortmund
  Regierungsbezirk Arnsberg
  Nordrhein-Westfalen
  Area 125403384
- Parkplatz-A8 (Westfalenhallen / Signal-Iduna-Park)
  Dortmund
  Regierungsbezirk Arnsberg
  Nordrhein-Westfalen
  Area 124999397
- Parkplatz-B1 (Westfalenhallen / Signal-Iduna-Park)
  Dortmund
  Regierungsbezirk Arnsberg
  Nordrhein-Westfalen
  Area 125208880
- Signal Iduna Park
  Dortmund
  Regierungsbezirk Arnsberg
  Nordrhein-Westfalen
  Area 125403384

Promenadenweg 146 Bonn

- **Promenadenweg 146**
  Godesberg-Nord
  Bad Godesberg
  Bonn
  Regierungsbezirk Köln
  Nordrhein-Westfalen
  Area 96128521
- Promenadenweg
  Friesdorf
  Bad Godesberg
  Bonn
  Regierungsbezirk Köln
  Nordrhein-Westfalen
  Way 36479212
- Promenadenweg
  Schweinheim
  Bad Godesberg
  Bonn
  Regierungsbezirk Köln
  Nordrhein-Westfalen
  Way 36462418
  Way 36770219

Thanks!

Thanks to all the committer and users of libosmscout!

Thanks to the audience for listening!

Contact

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Ask on the mailing list!