camp
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INNOVATIVE SOLUTIONS
BY OPEN SOURCE EXPERTS

Geodaten-Management mit PostGIS

Marion Baumgartner
Andreas Jobst

About us

Marion Baumgartner

- Full stack GIS development
- ETL with geo-data
- https://github.com/marionb

Andreas Jobst

- Geospatial Project Manager and Team Lead

About Camptocamp

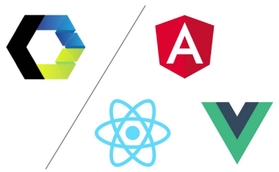
Your partner for success.

- Founded in 2001
- 190+ employees
- Offices in 3 countries:
  - Switzerland, Germany, France
- Geographic Information Systems, Enterprise Resource Planning (Odoo), IT Infrastructure Management
- A major European player in Open Source

Open Source Geospatial Software

20+ years contributions

Geospatial Open Source Software stack



OGC® Making location count.

OpenLayers

CESIUMJS™

GeoMapFish

geOrchestra

spring

MapServer
open source web mapping

QGIS

GeoServer

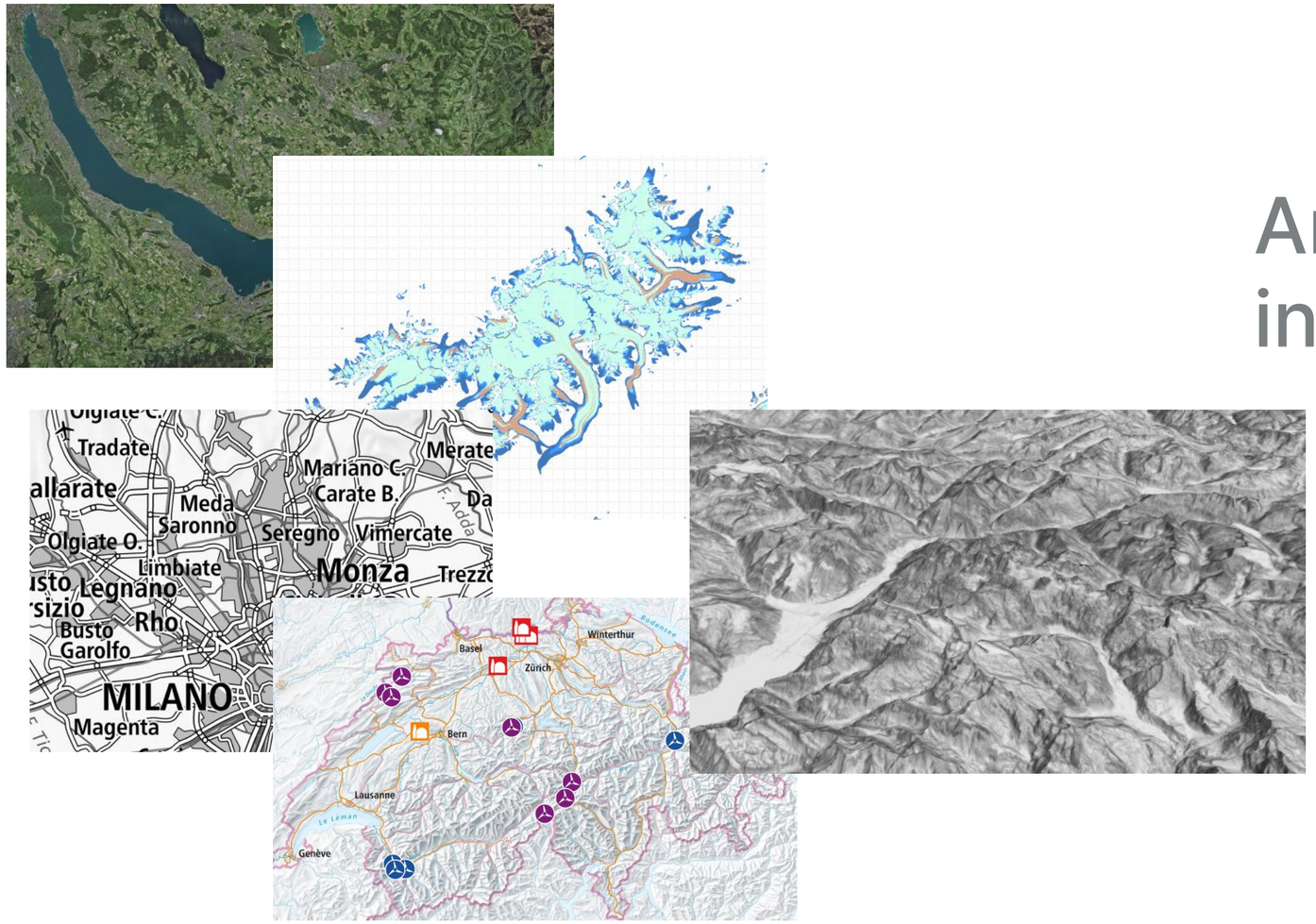
This Presentation

Why PostGIS

The Data Model

Harvesting the Data

What is geodata?



Any data with spatial information!

What is the format of geodata?

GML

GPX

csv

geotiff

jpg

gdb

NetCDF

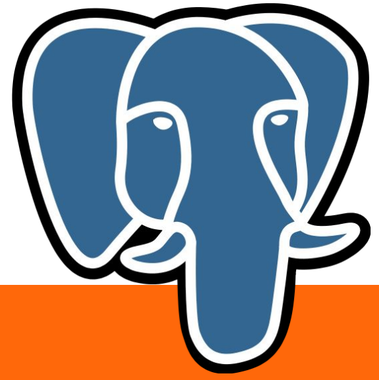
topojson

KML

shp

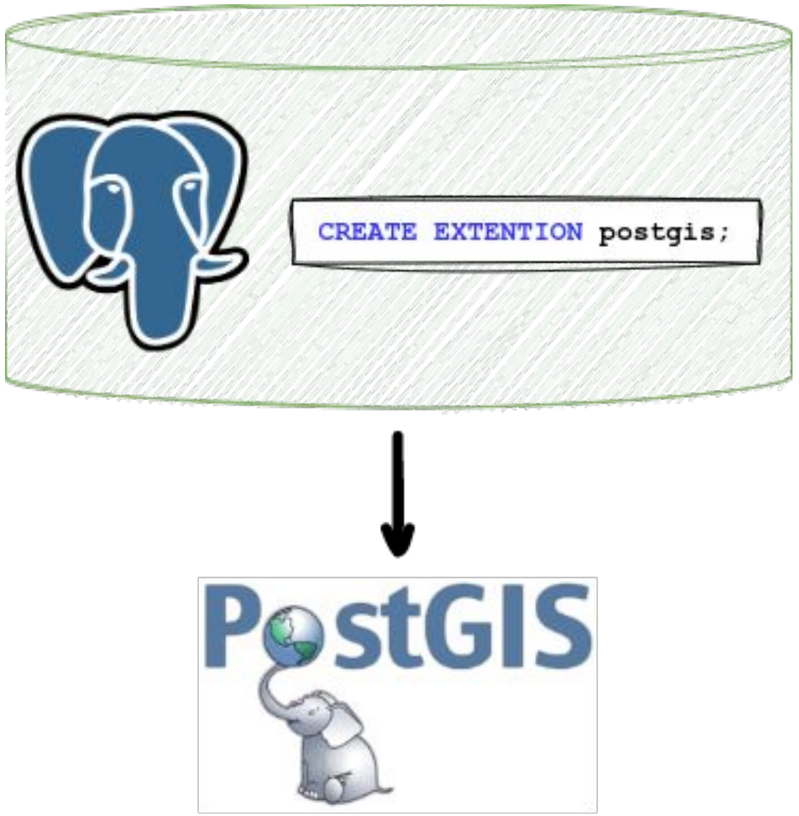
GeoPackage

osm



Why PostGIS

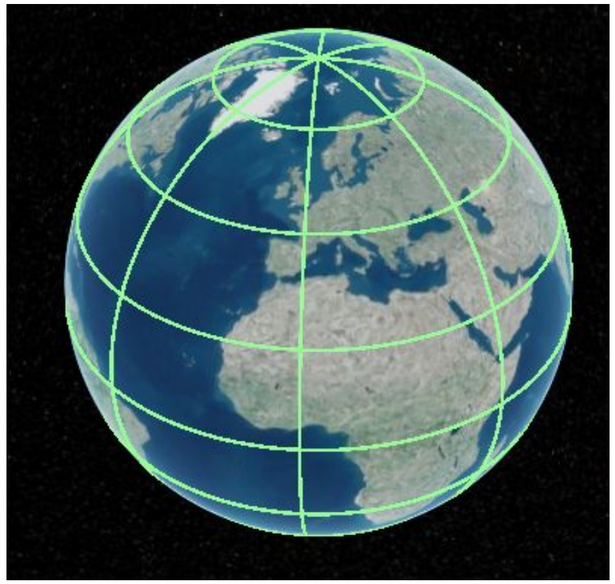
What is PostGIS?



PostGIS is a spatial database:

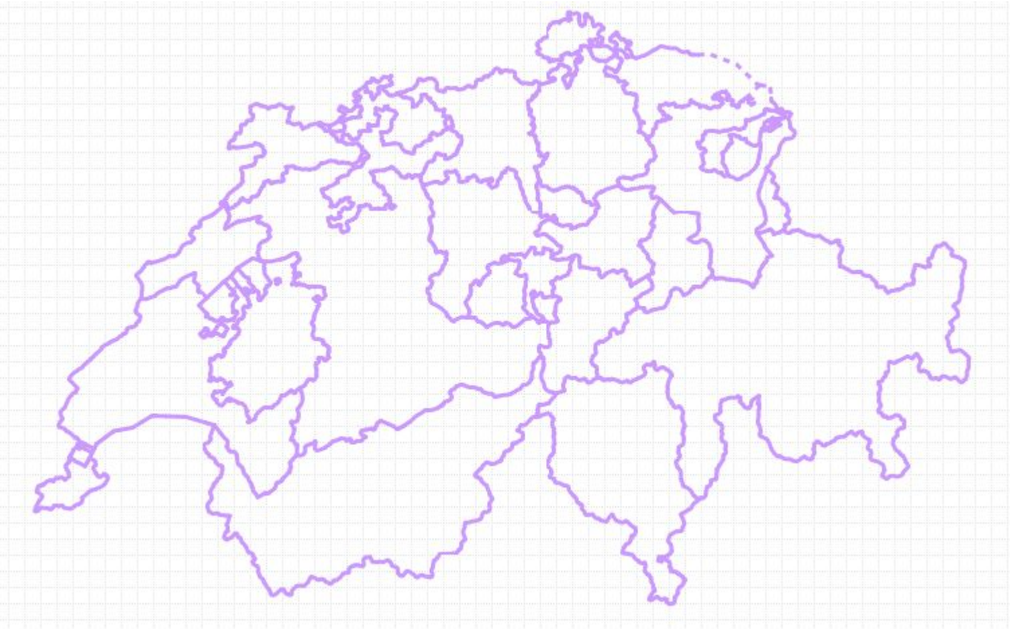
- Spatial data types
  - geometry (point, lines, polygons)
  - raster
- Spatial indexing
  - Optimised for spatially related data
- Spatial functions
  - ST_...

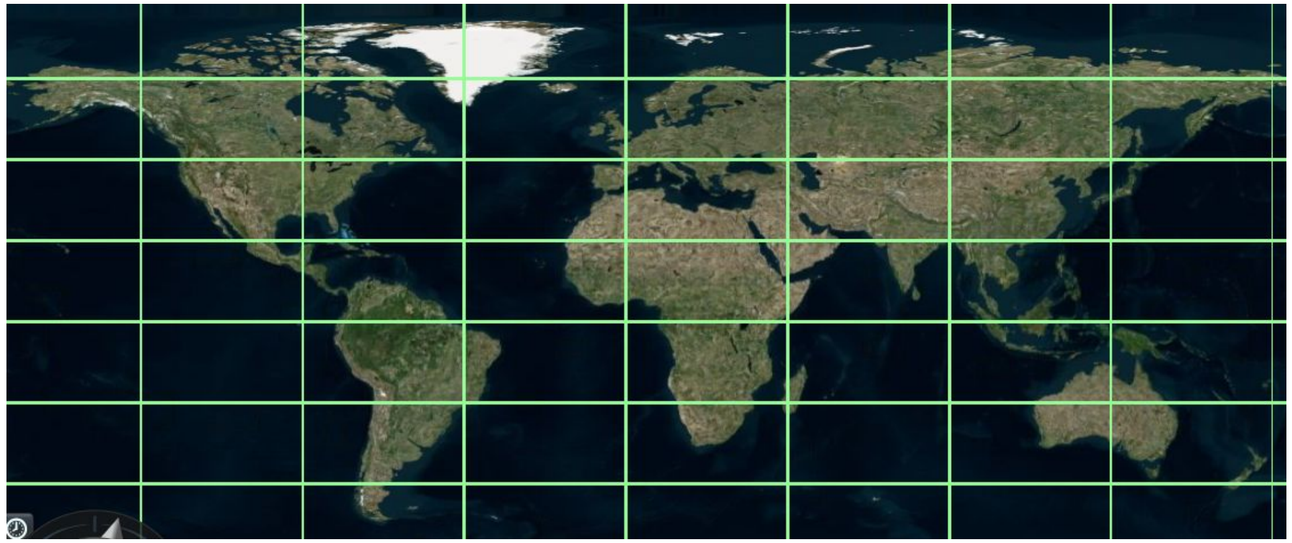
Data Types



Vector data

- → geography
- → geometry



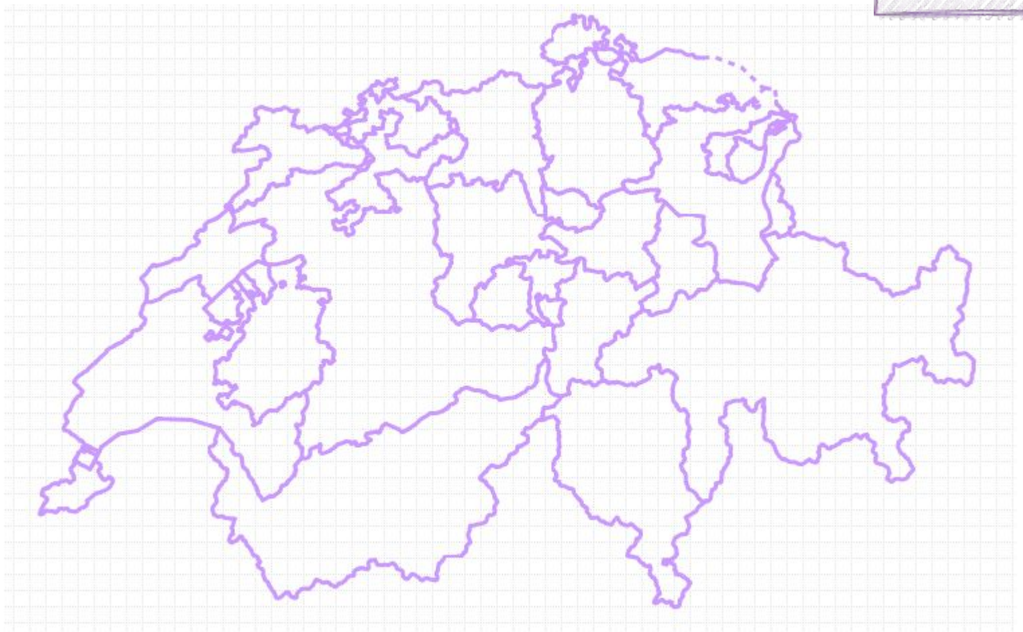


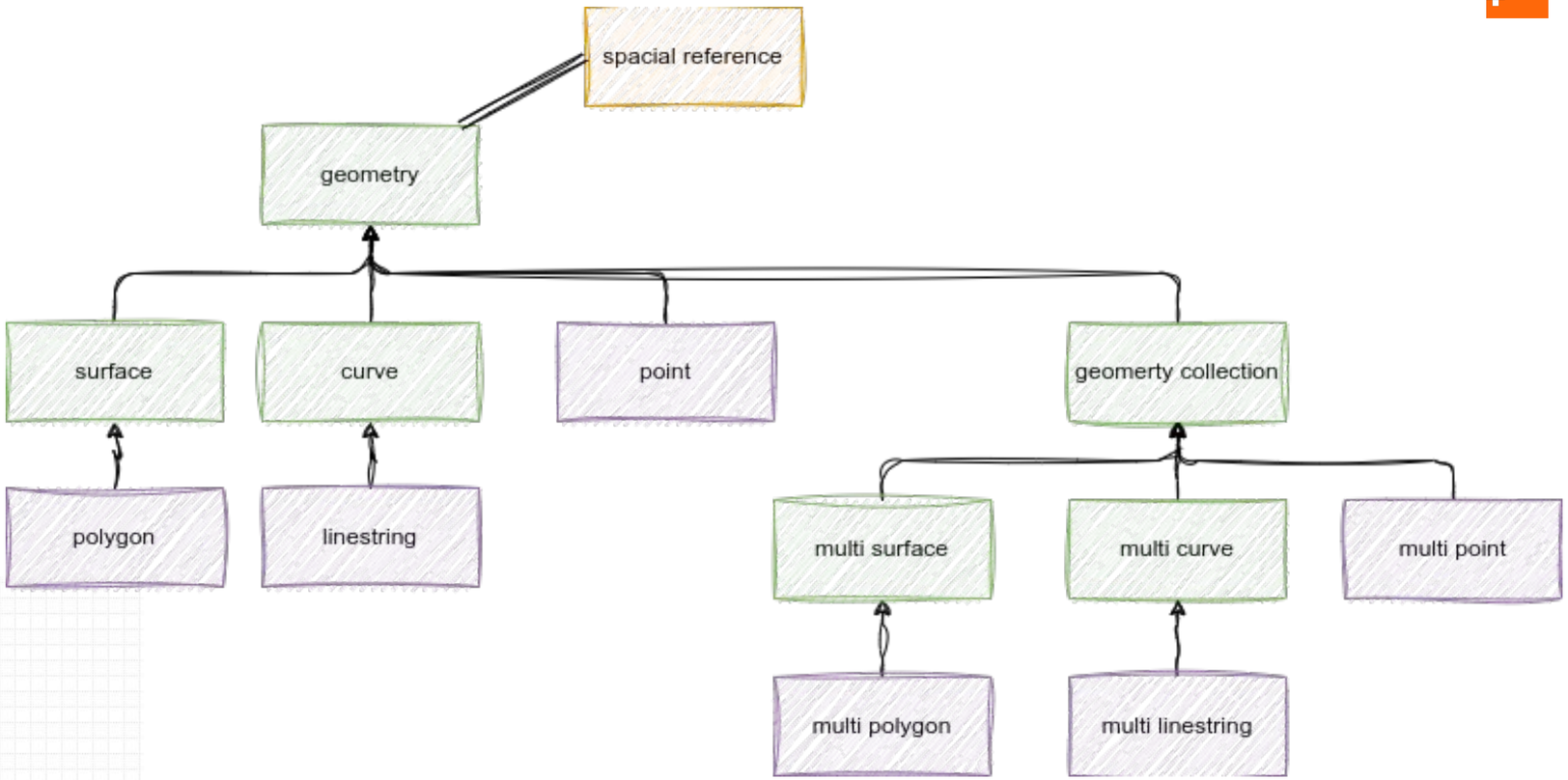
https://sandcastle.cesium.com/

Data Types

Vector data

- geography
- geometry

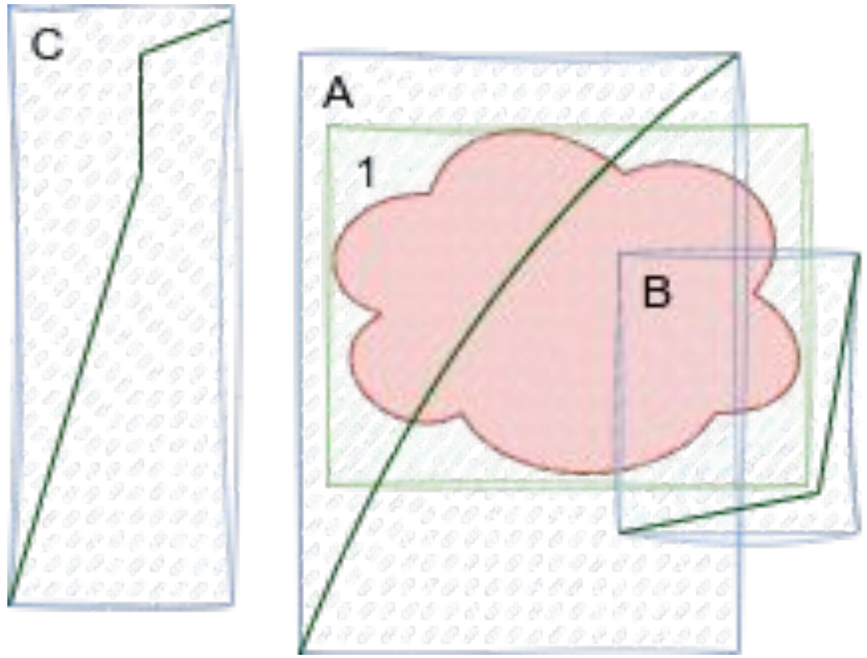




Data Types

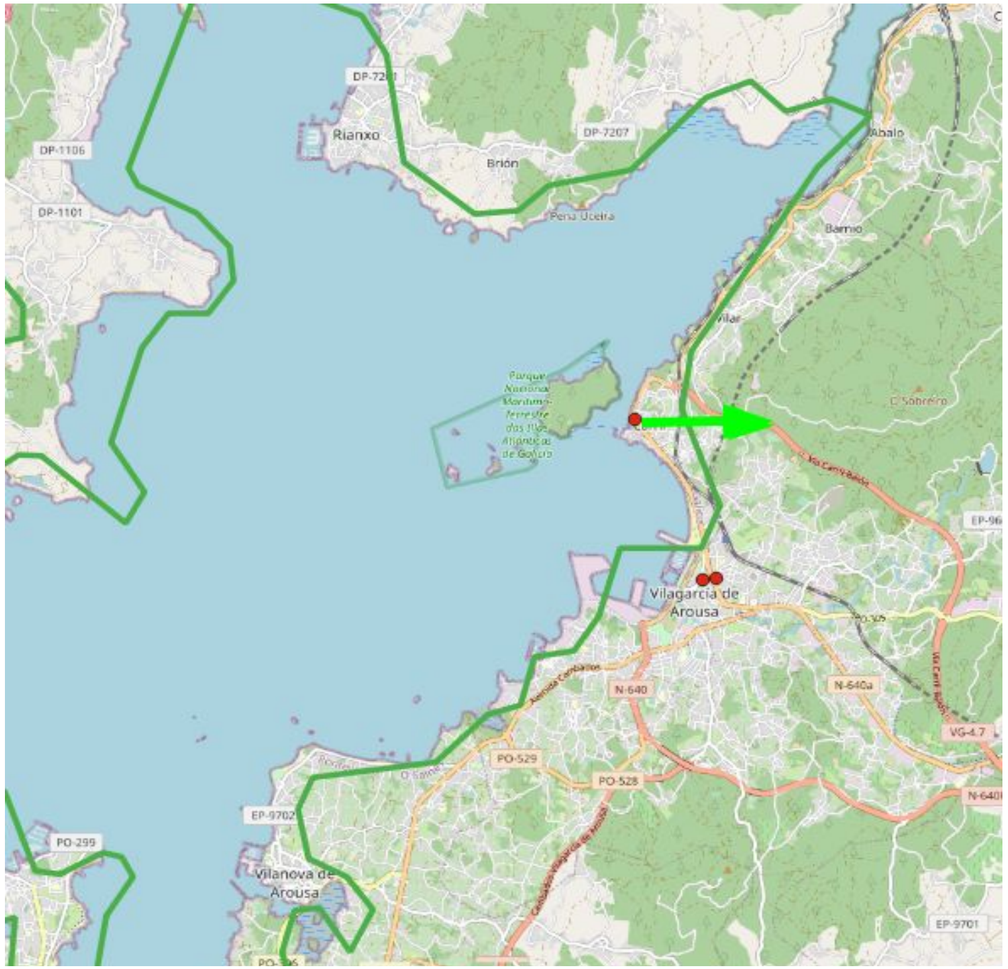
Raster data

Spatial indexes

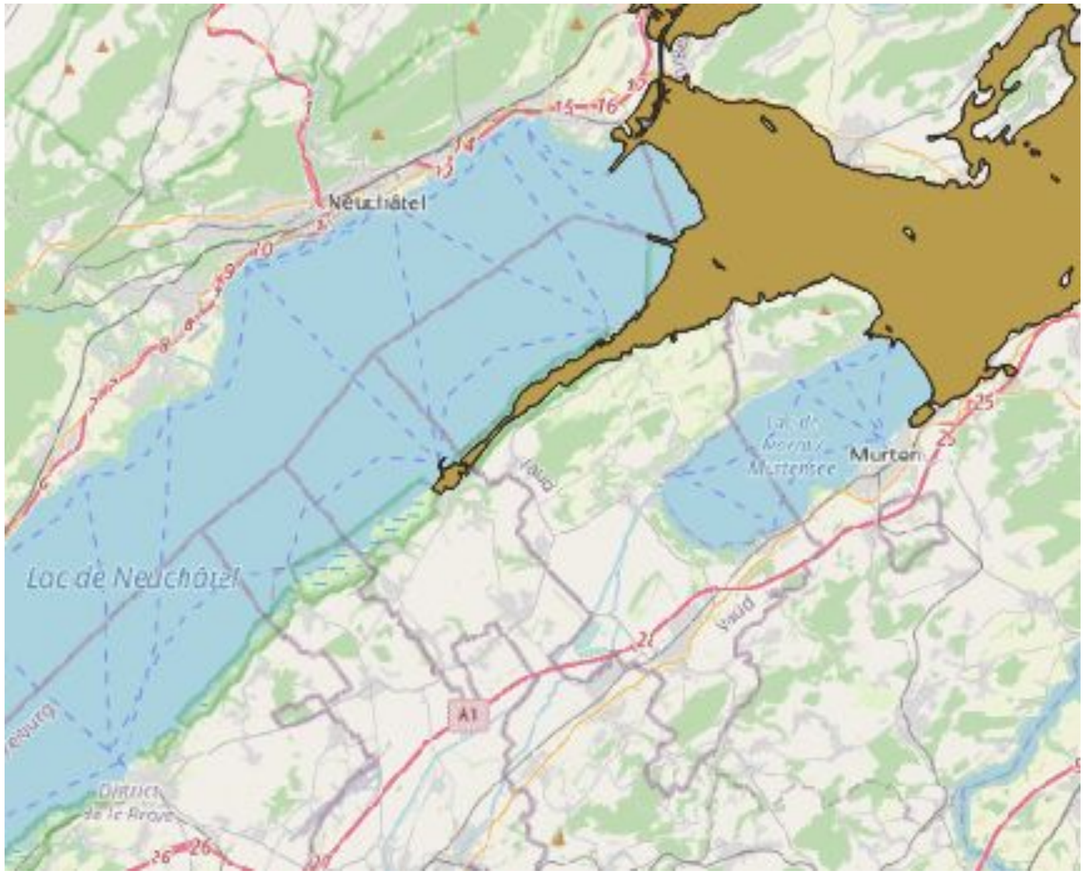


Spatial functions

```
ST_Distance(geometry A,geometry B)
```

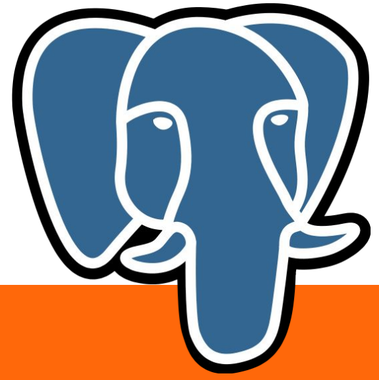



```
ST_Simplify(geometry A, float tolerance,
            [boolean preserveCollapsed])
```



Why PostGIS?

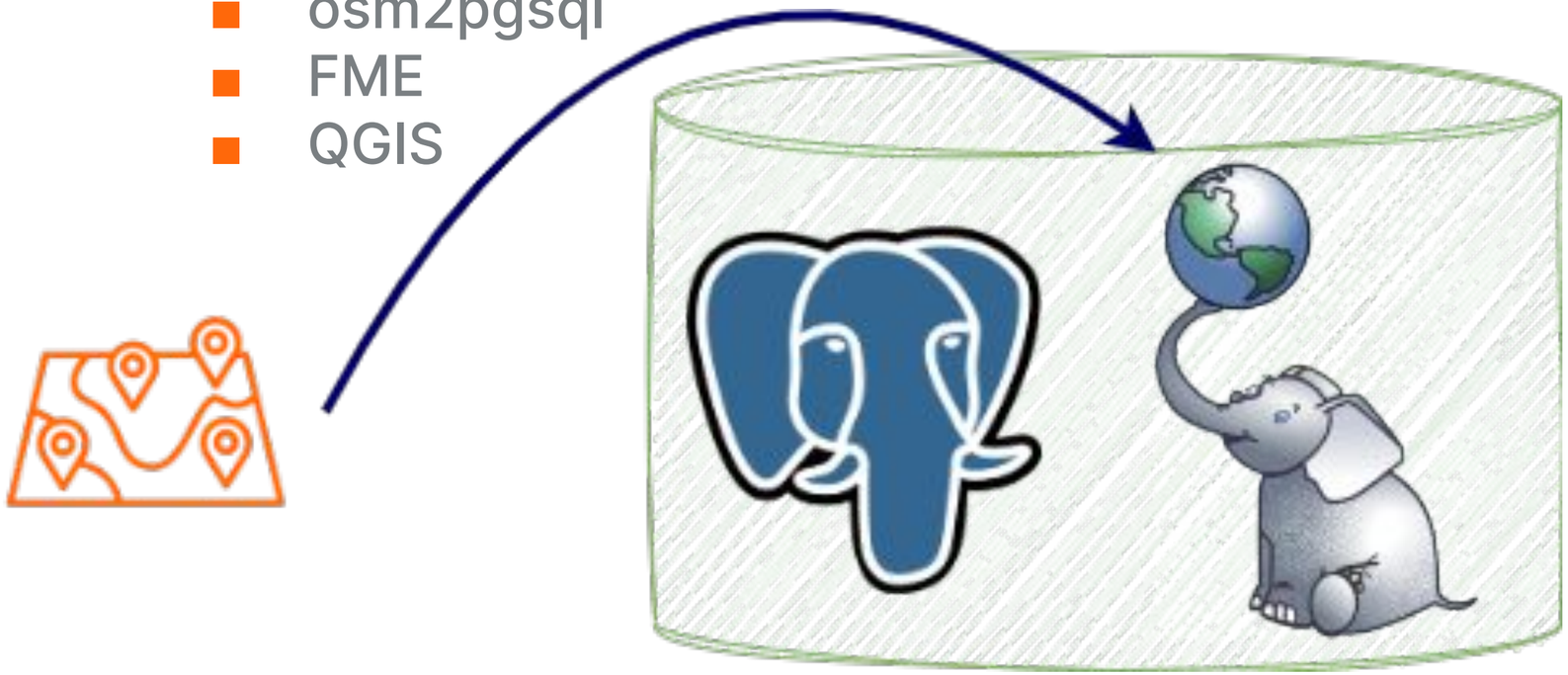
- Open source (GNU General Public License)
- A long history and active community
- Well documented
  - https://postgis.net/documentation/



The Data Model

Filling data into a PostGIS DB

- GDAL
- shp2pgsql
- osm2pgsql
- FME
- QGIS



Geodata in a Table

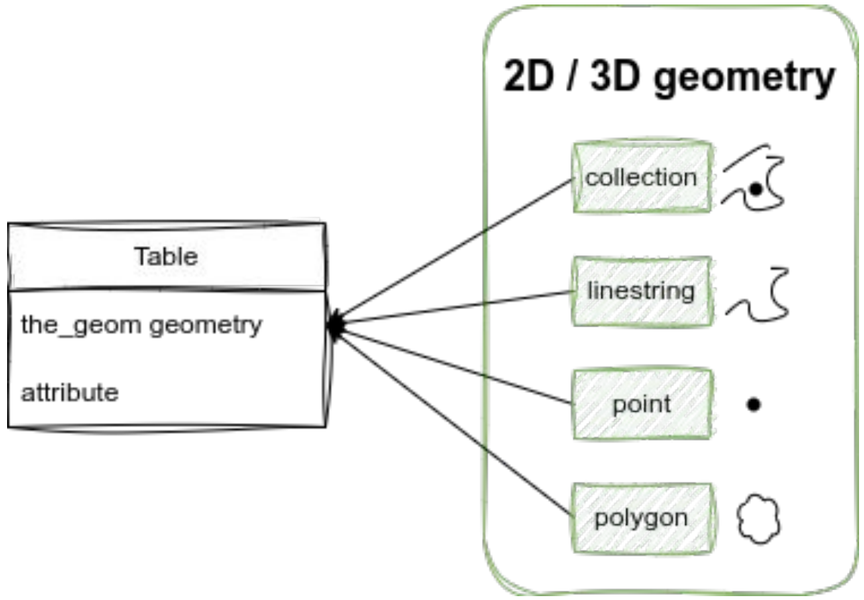
Putting **EVERYTHING** in one table and one column

- geography
- geometry
- raster

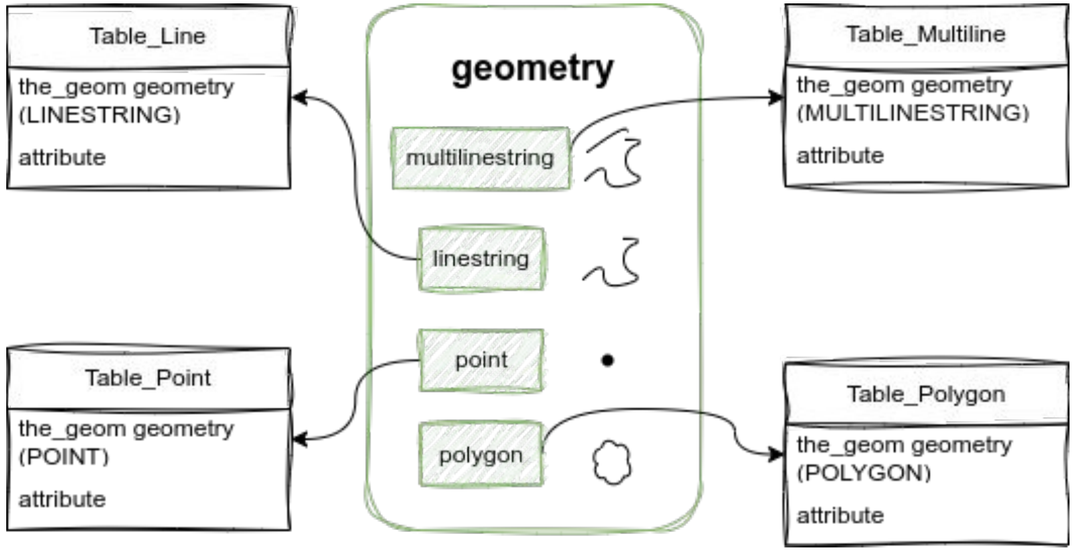
you are likely in trouble

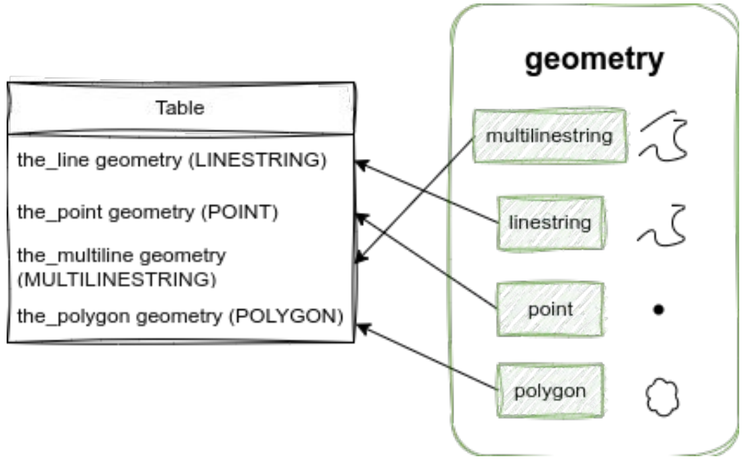
Geodata in a Table

Heterogeneous



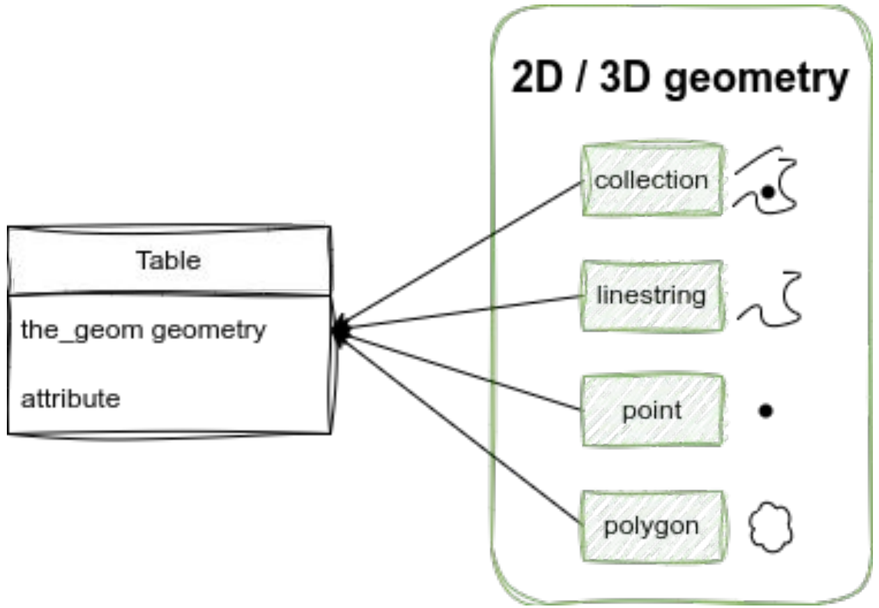
Homogeneous





Heterogeneous

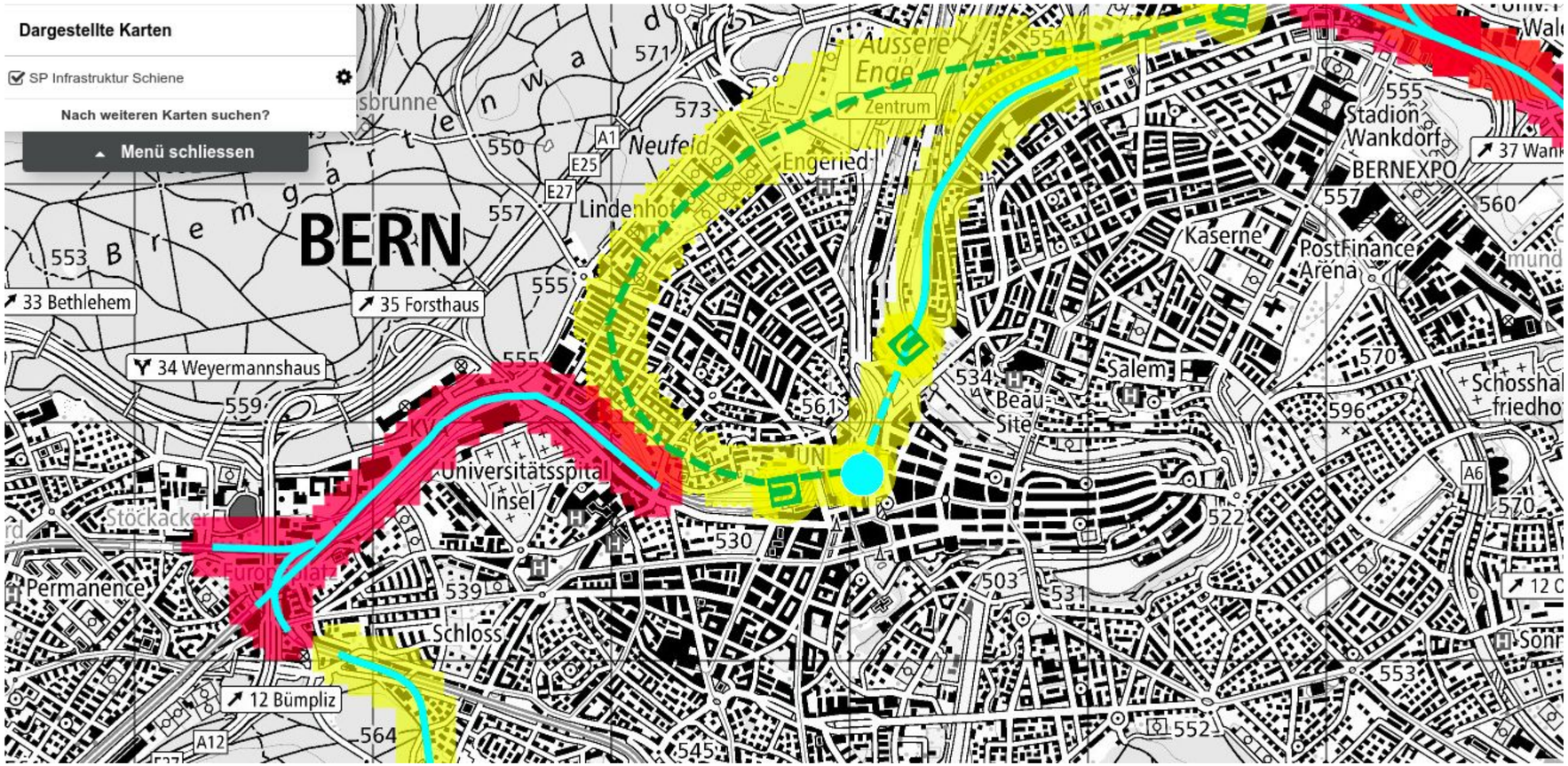
Pros & Cons



➔ Simple
- query
- model

➔ Data corruption
➔ Need to filter on types
➔ Self joins when aggregating
➔ Hard to read for many tools

Heterogeneous: Example

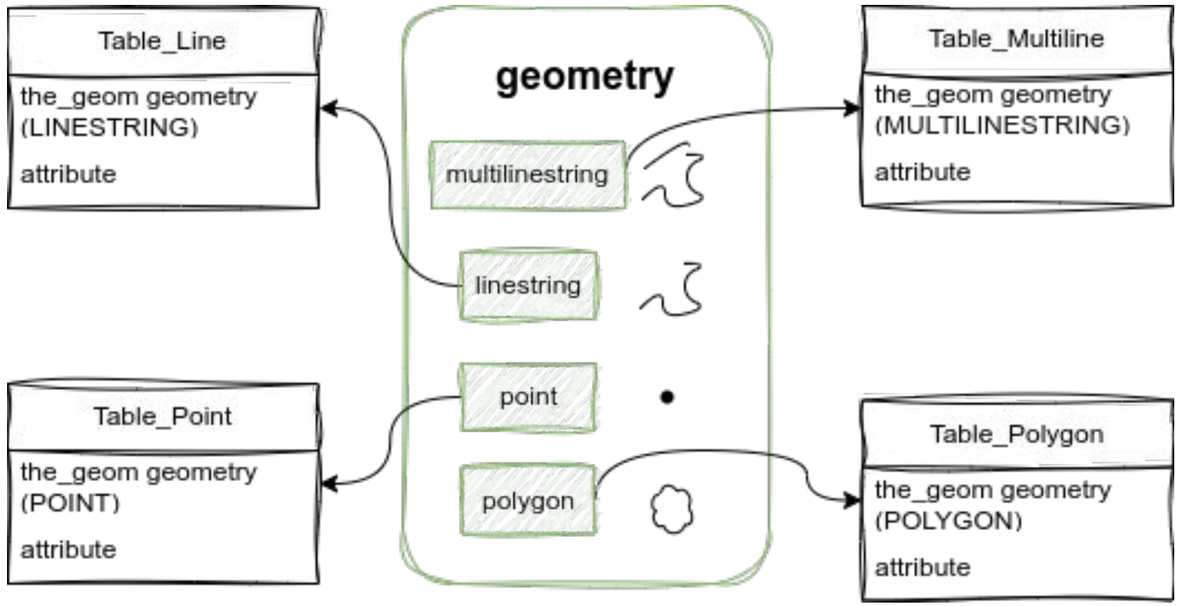


ST_GeometryType:

ST_MultiPolygon
ST_MultiPoint
ST_MultiLineString

Homogeneous

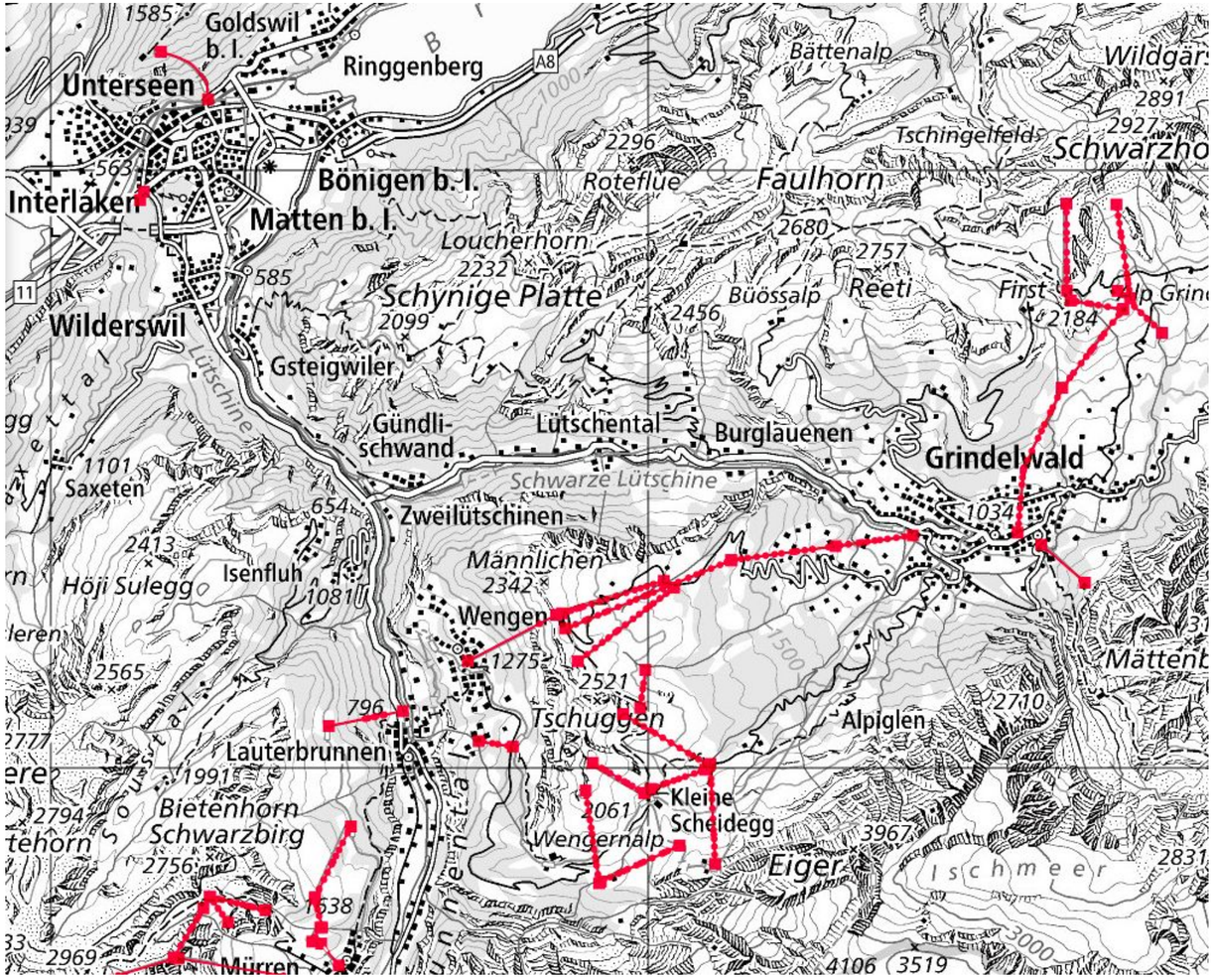
Pros & Cons



- ➔ Consistency
- ➔ Easier to access
- ➔ Performance on joining
- ➔ Easier for handling monstrous data set

- ➔ Multi-geometry queries need a union

Heterogeneous Table: Example



Multiple tables with constraint on geometry type:

- ST_LineString

  OR

- ST_Point

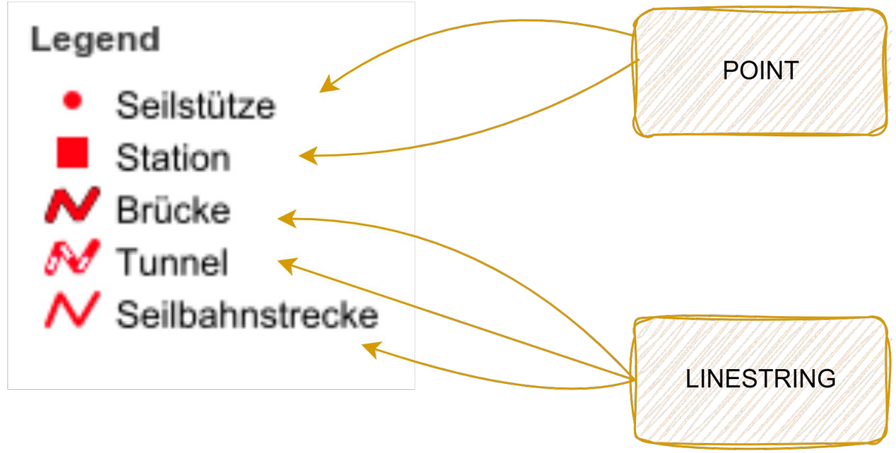


Table Inheritance

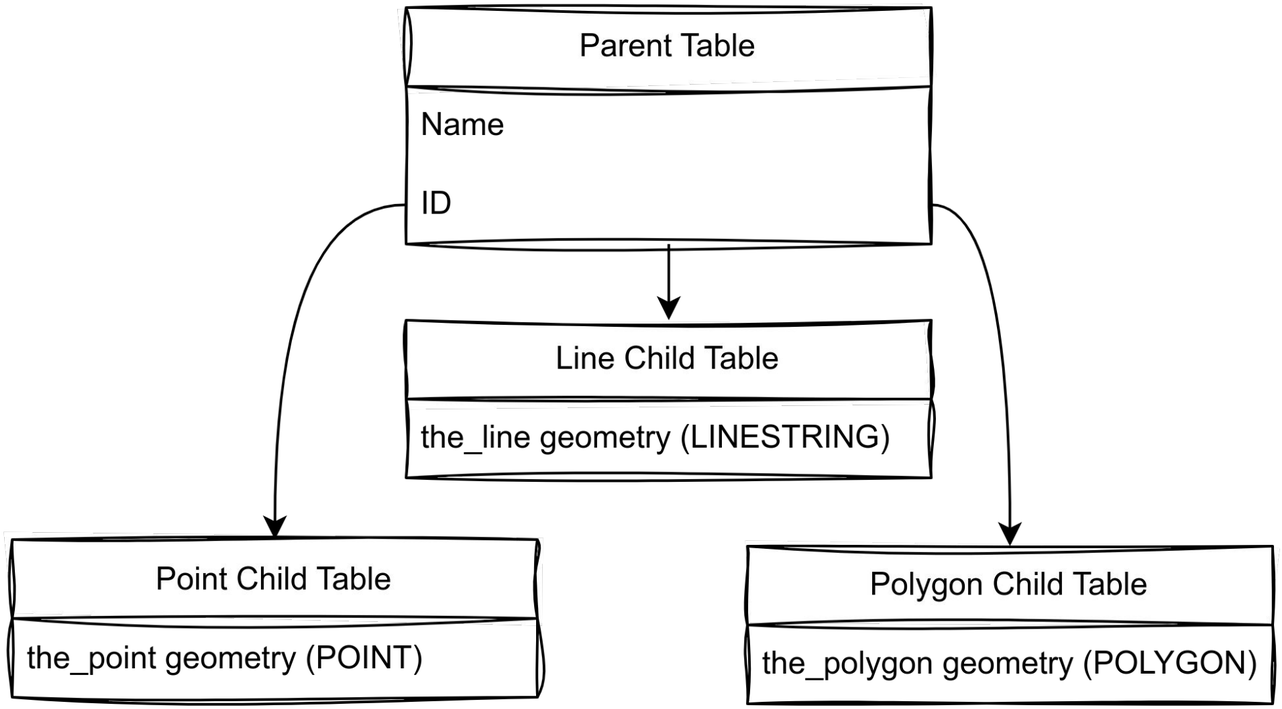


Table Inheritance

Pros & Cons

- Supported by most third party tools
- Query a hierarchy as if they were single table
- Query for specific geom type if splitting by geom

- Complex data model
- Unique in Postgresql
- Primary & foreign key constraints are not inherited
- Data is not added automatically in the correct table
- Performance

Table Partitioning

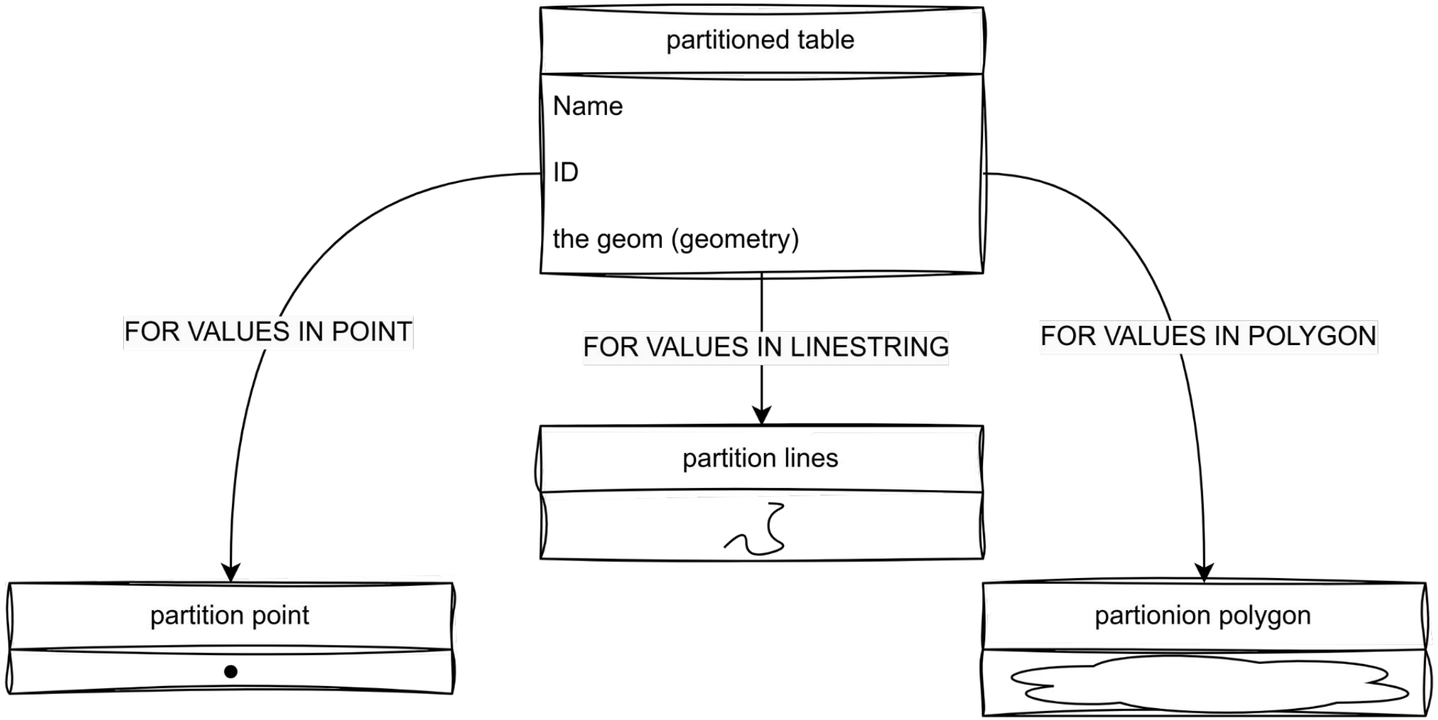
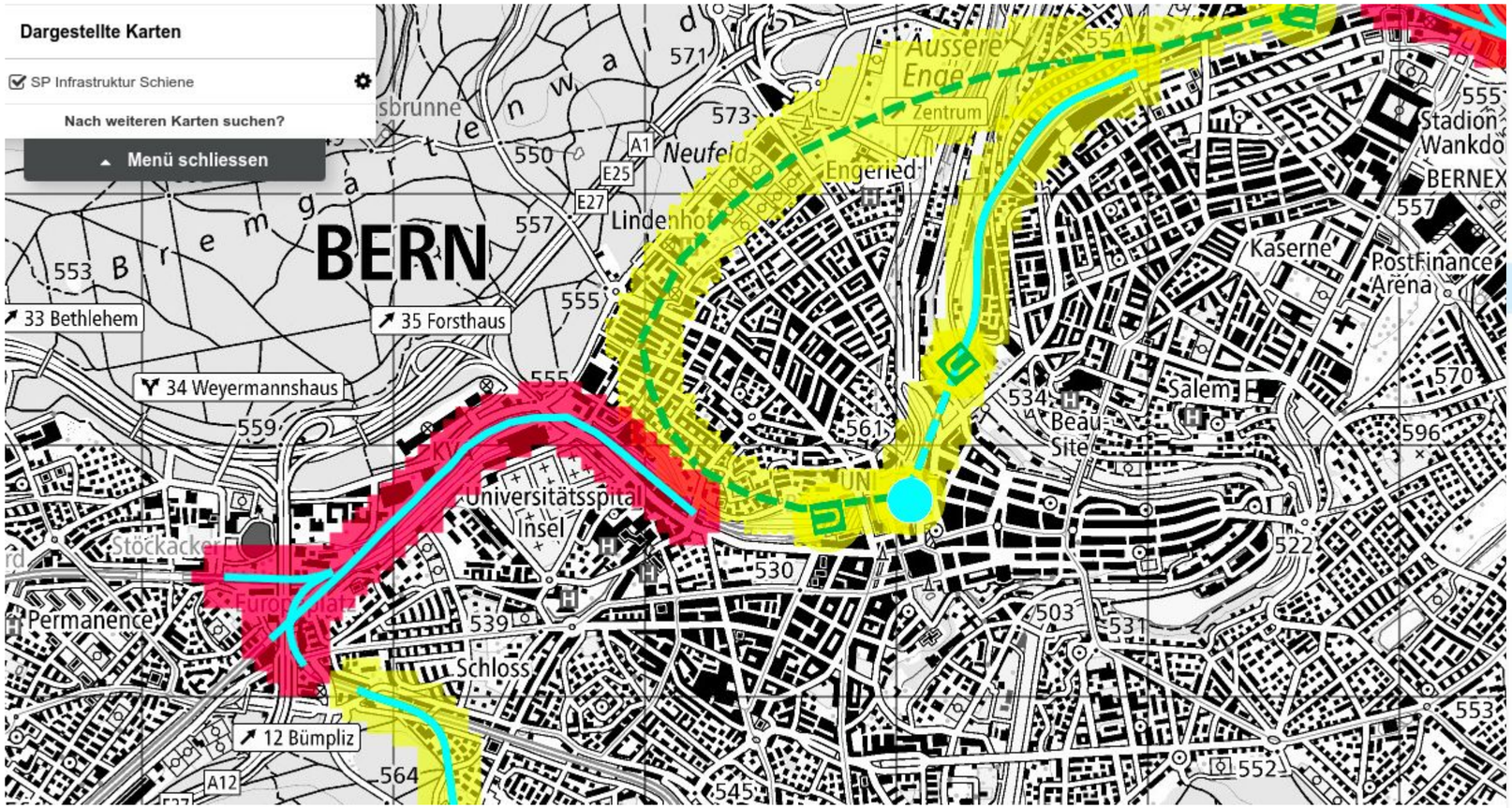


Table Partitioning: Example



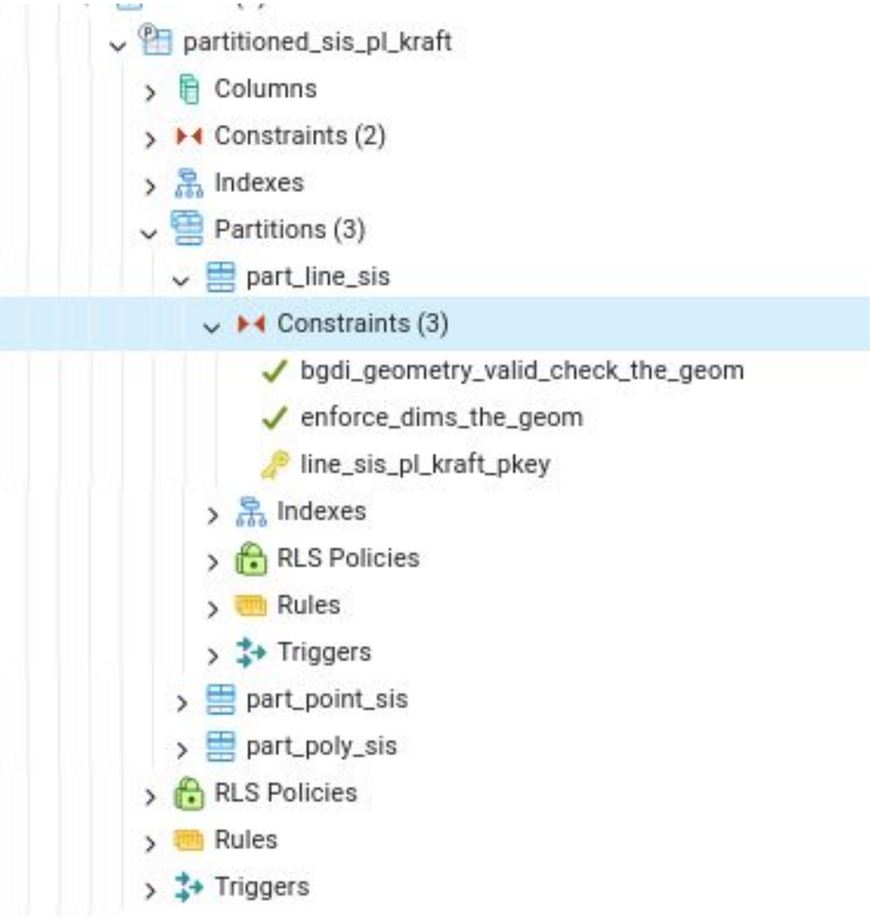
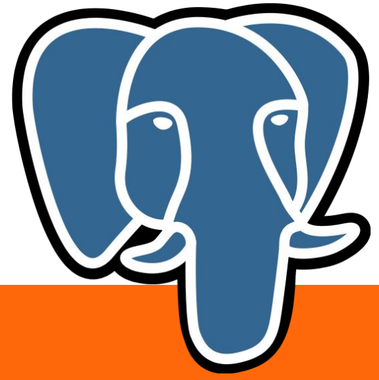


Table Partitioning

Pros & Cons

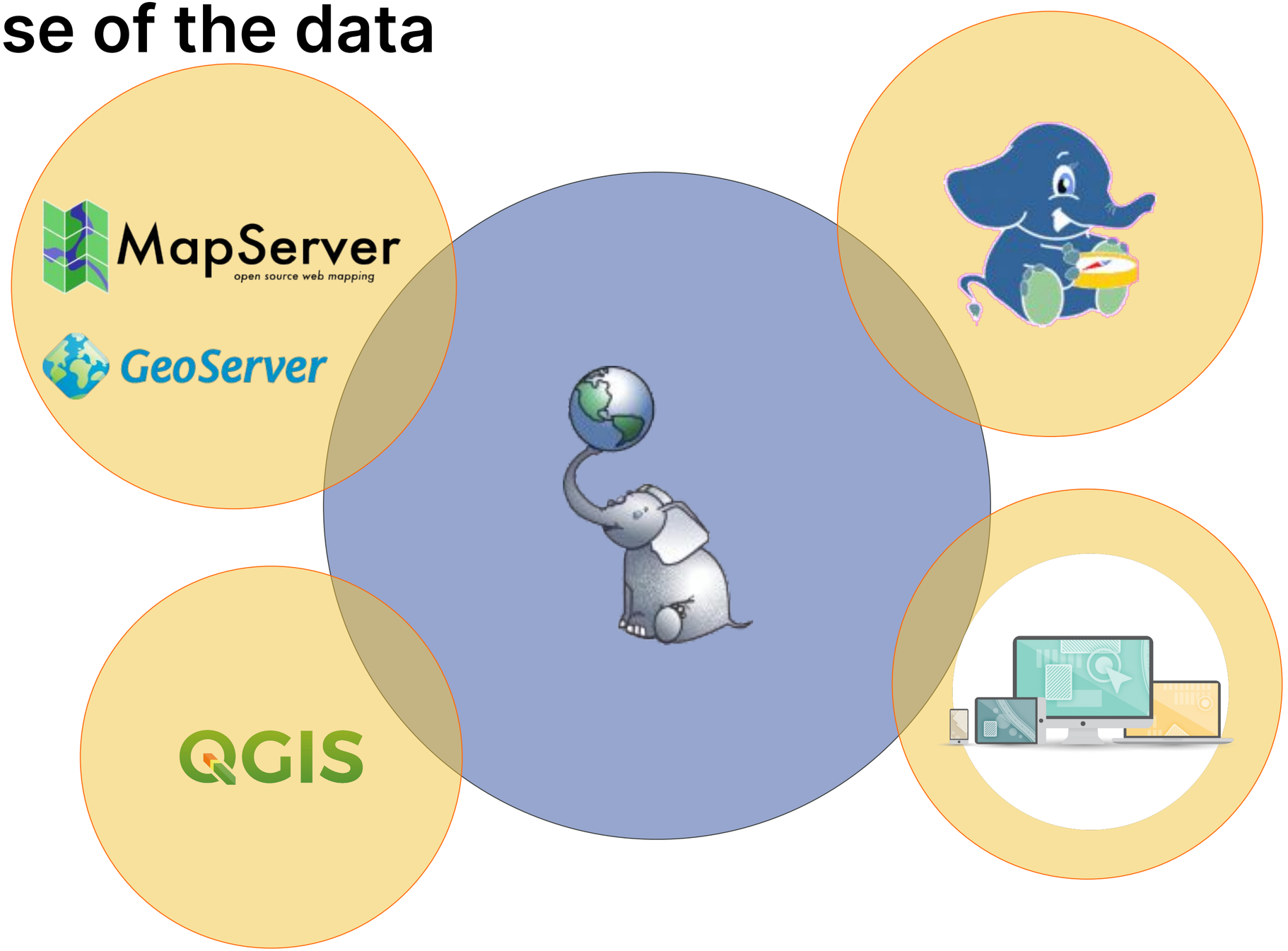
- Is understood by third-party tools (i.e QGIS)
- Generally good query performance
- Insert & update is automatically
- Indexes are inherited

- Complex data model
- No additional columns in “sub-tables”
- better used with **huge** tables
- strategy/model needs to be predefined
- Partitioning keys are limited

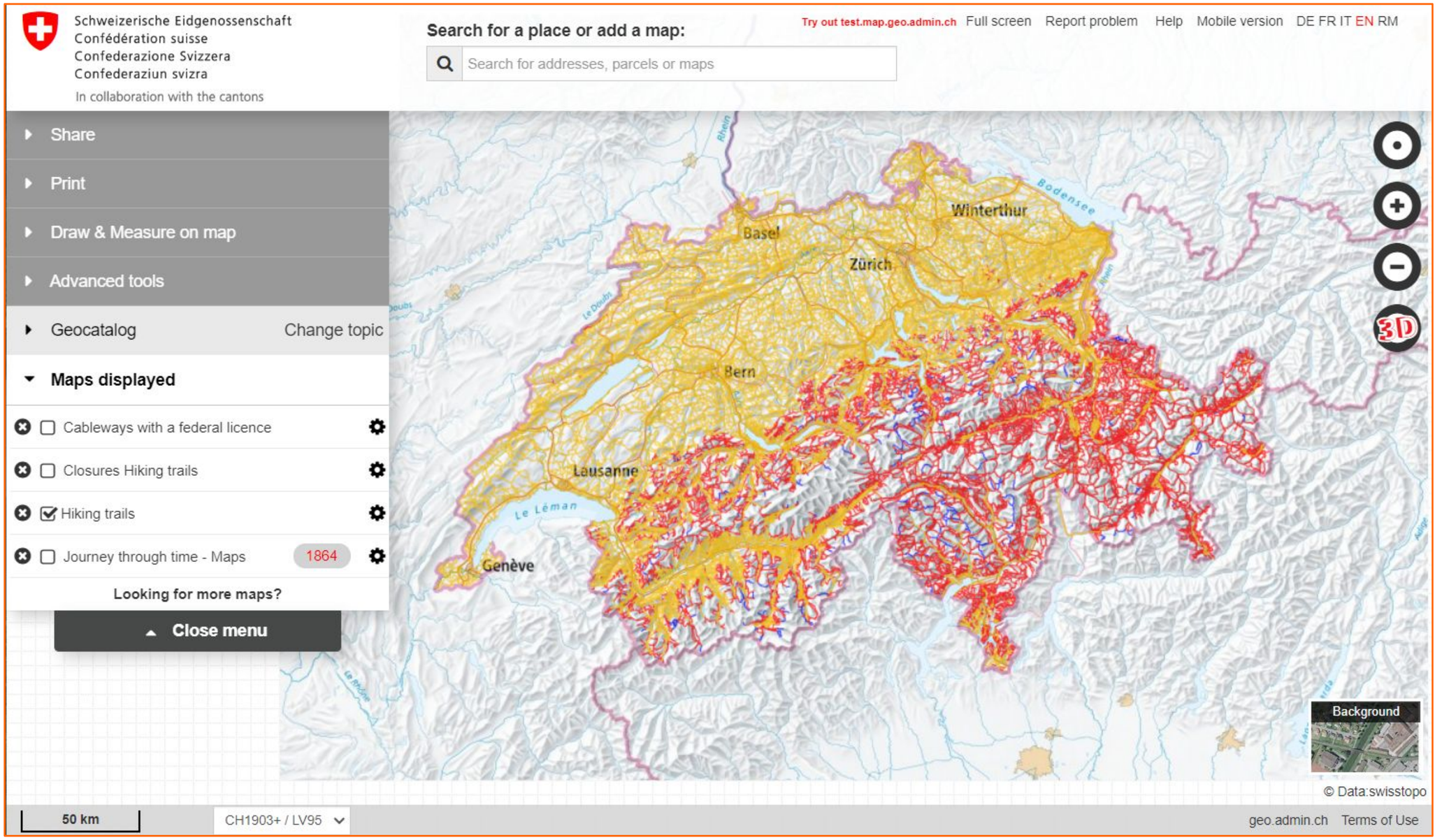


Harvesting the Data

Make use of the data



Swisstopo: A large GDI



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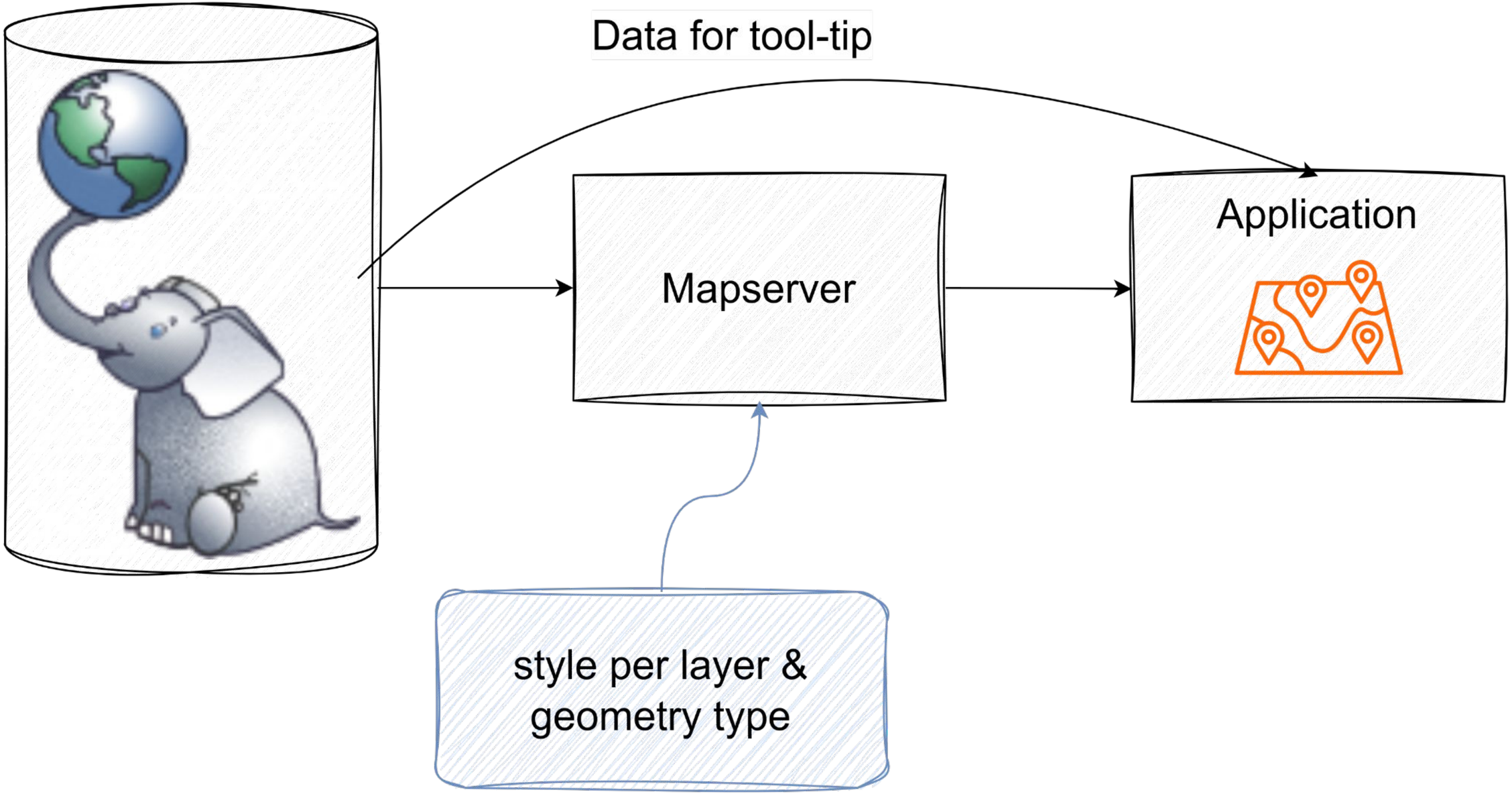
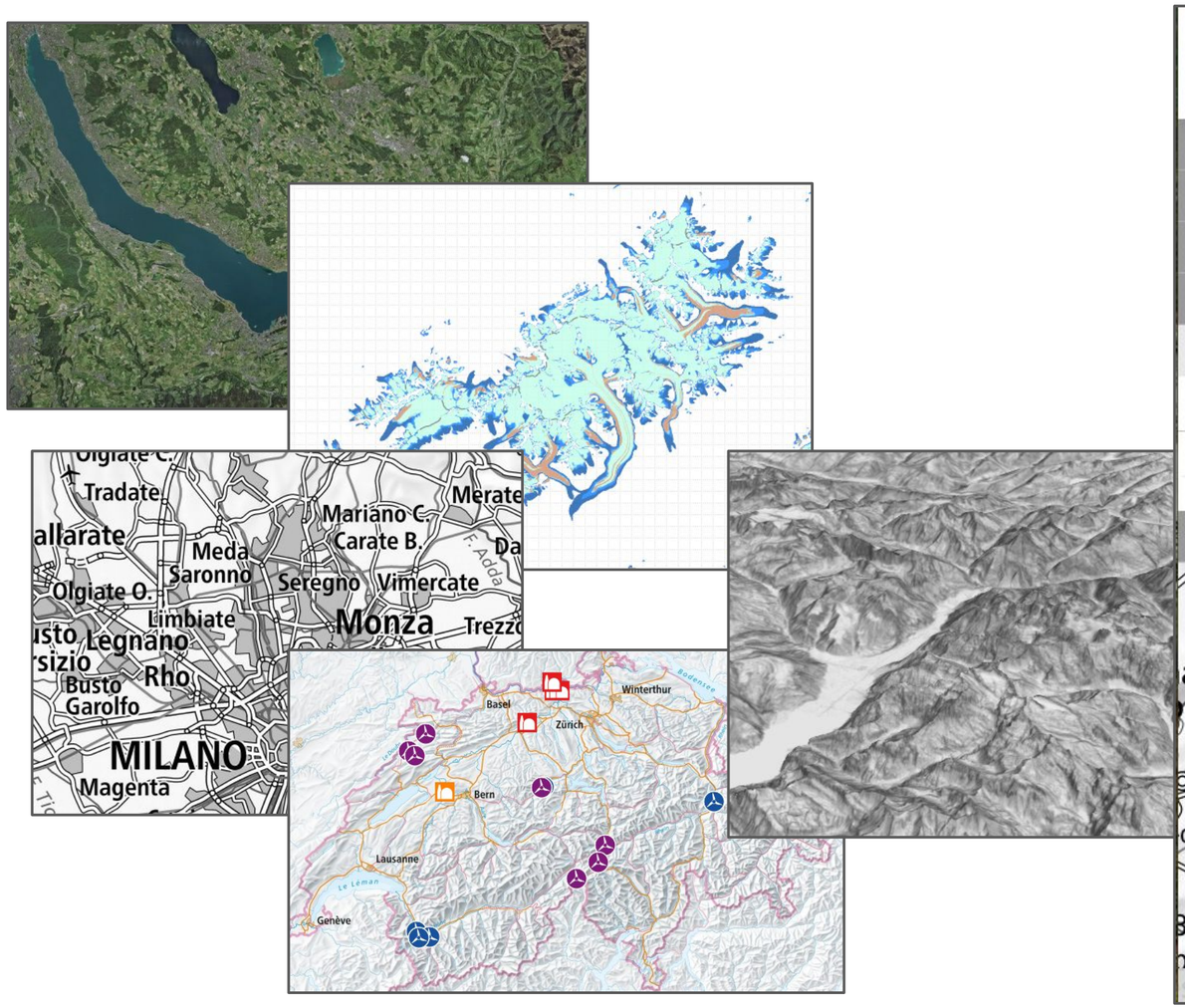
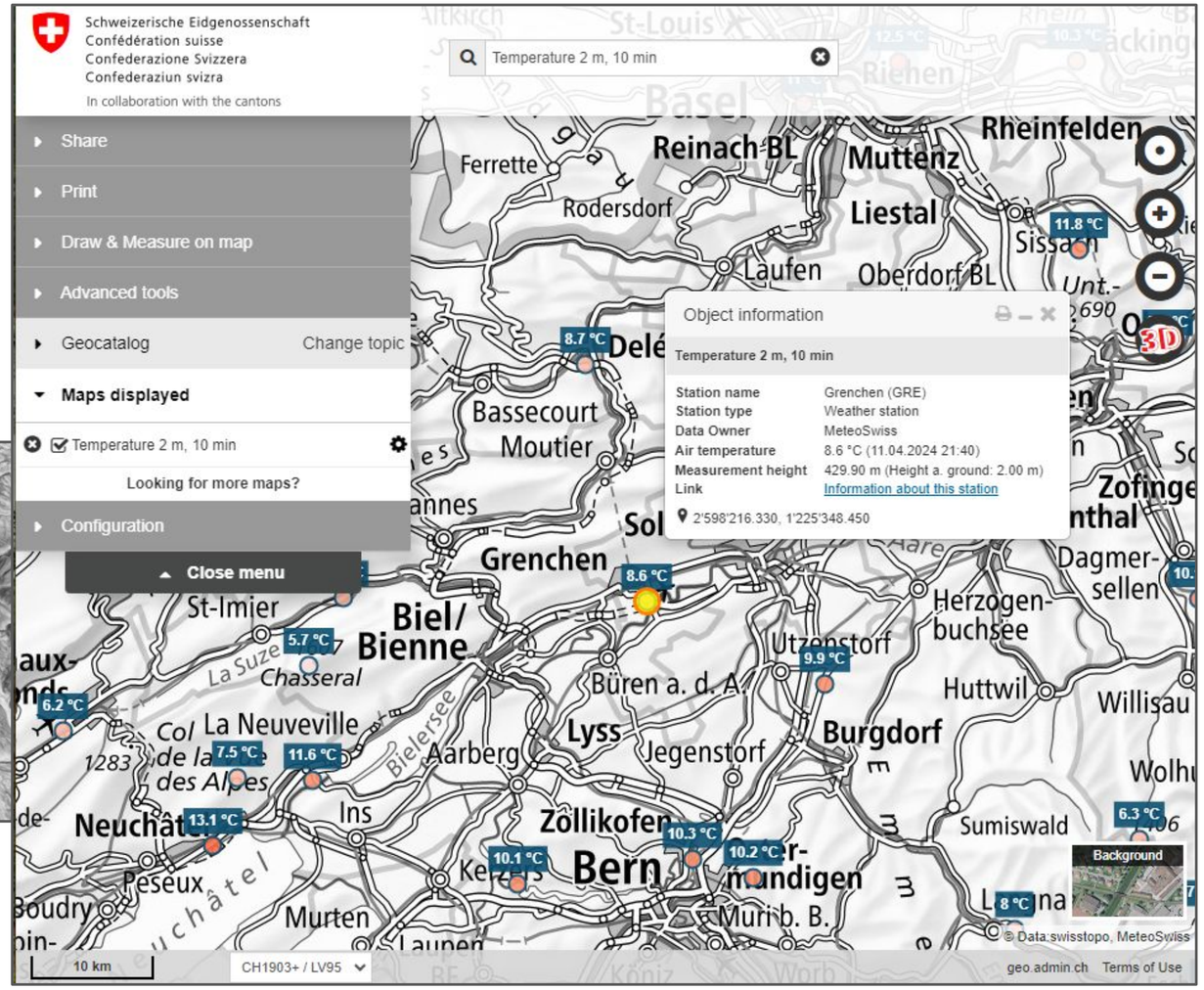
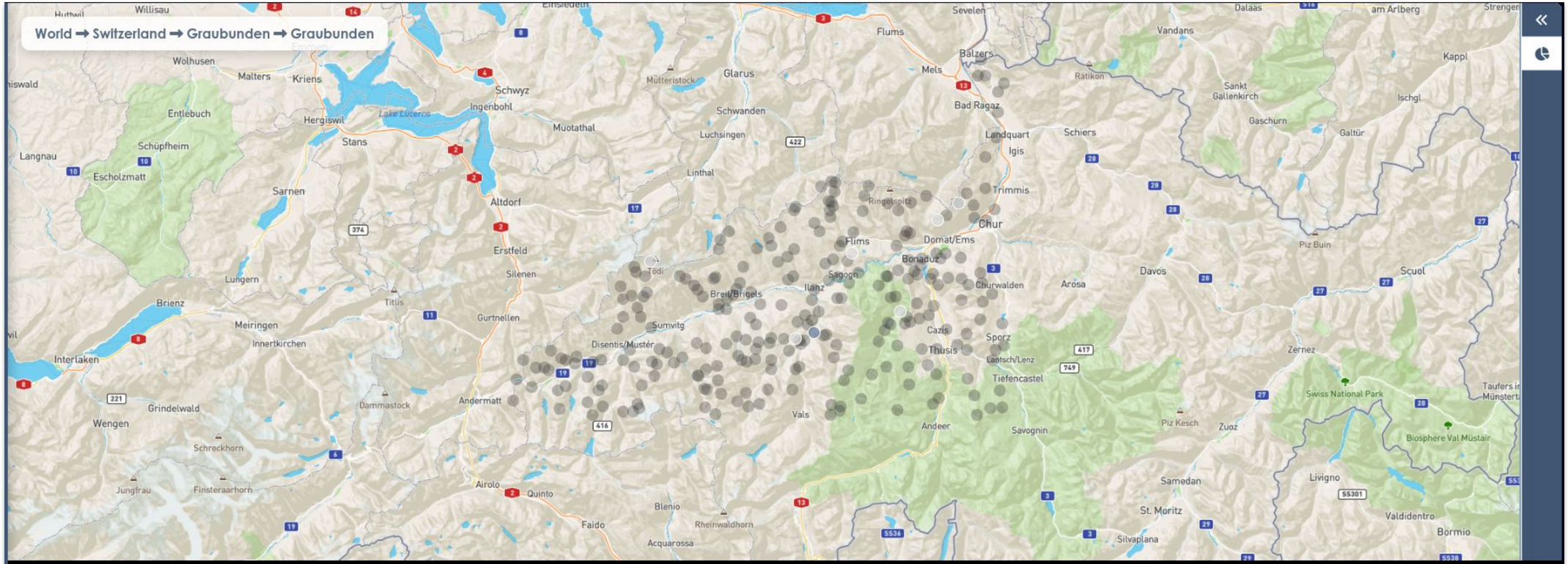


Swisstopo: A large GDI





Aggregate Data with a Geospatial Relation

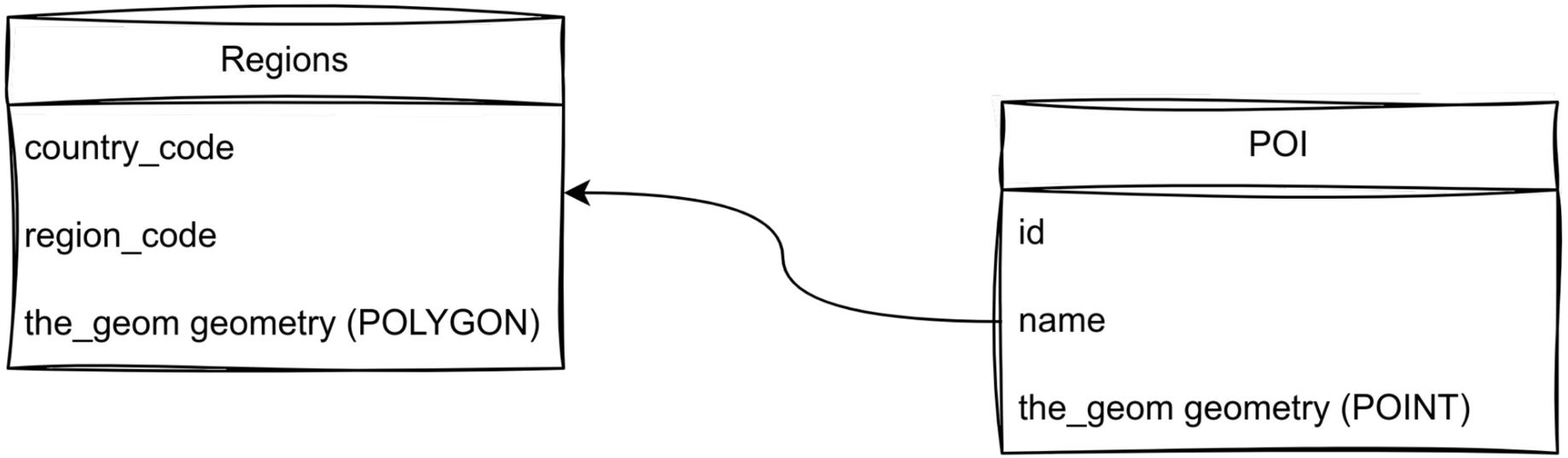


Outlet	ERP	GIS	Infrastructure	Other	Subscriptions	Total
Besnard et Fils	€2,490	€4,385	€223	€158	€4,292	€11,548
Martineau Guerin S.A.R.L.		€14,087		€600		€14,687
Meyer				€0		€0
Pinto Jourdan SARL				€0		€0
Raymond	€36,066	€61,190	€2,858	-€682	€28,743	€128,174
Schubert GbR	€35,256	€20,179	€11,307	€1,200	€149,137	€217,080
Ullrich Braun KG	€253,136	€575,992	€7,817	-€2,158	€201,008	€1,035,794

+ OpenStreetMap boundary data

Aggregate Data with a Geospatial Relation

- Access data and styling through OpenLayers
- Homogeneous tables



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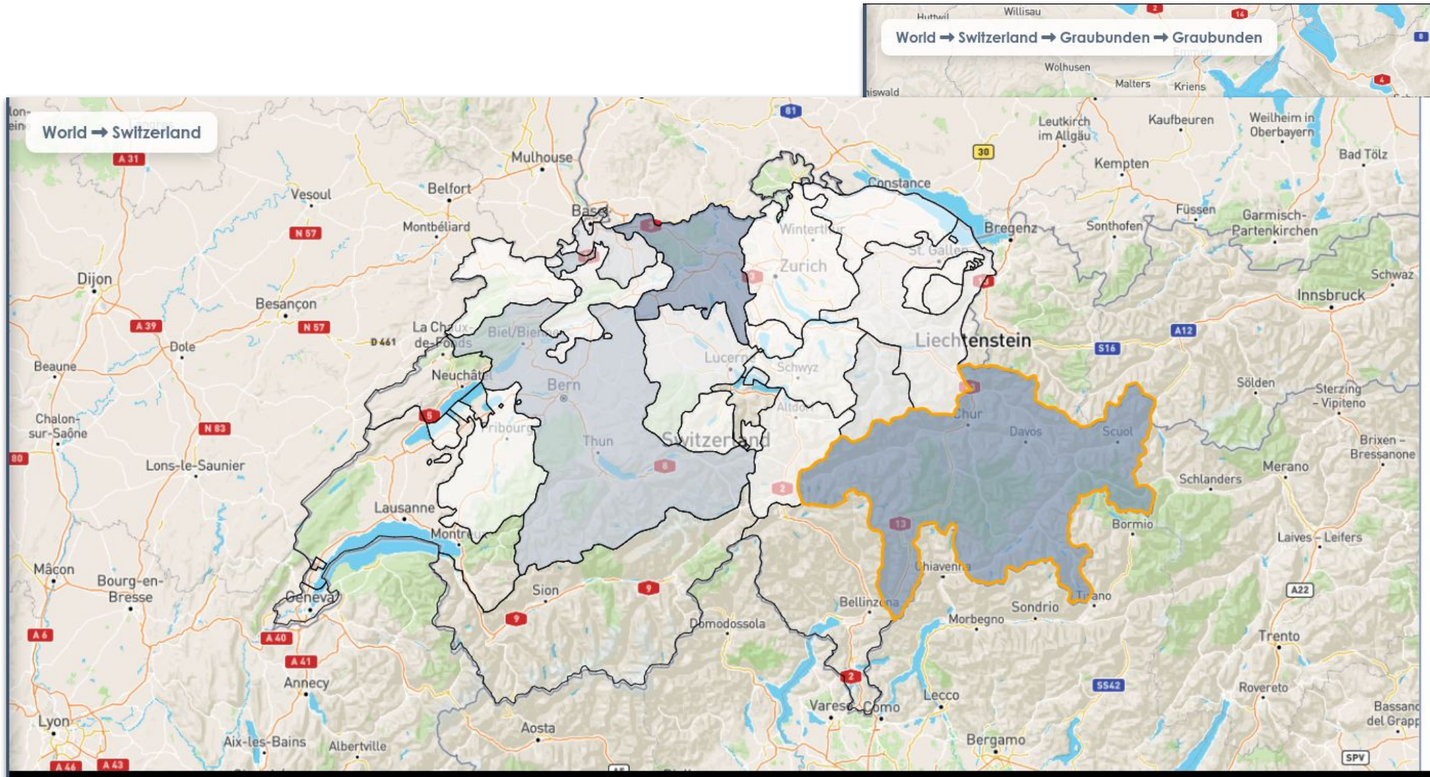
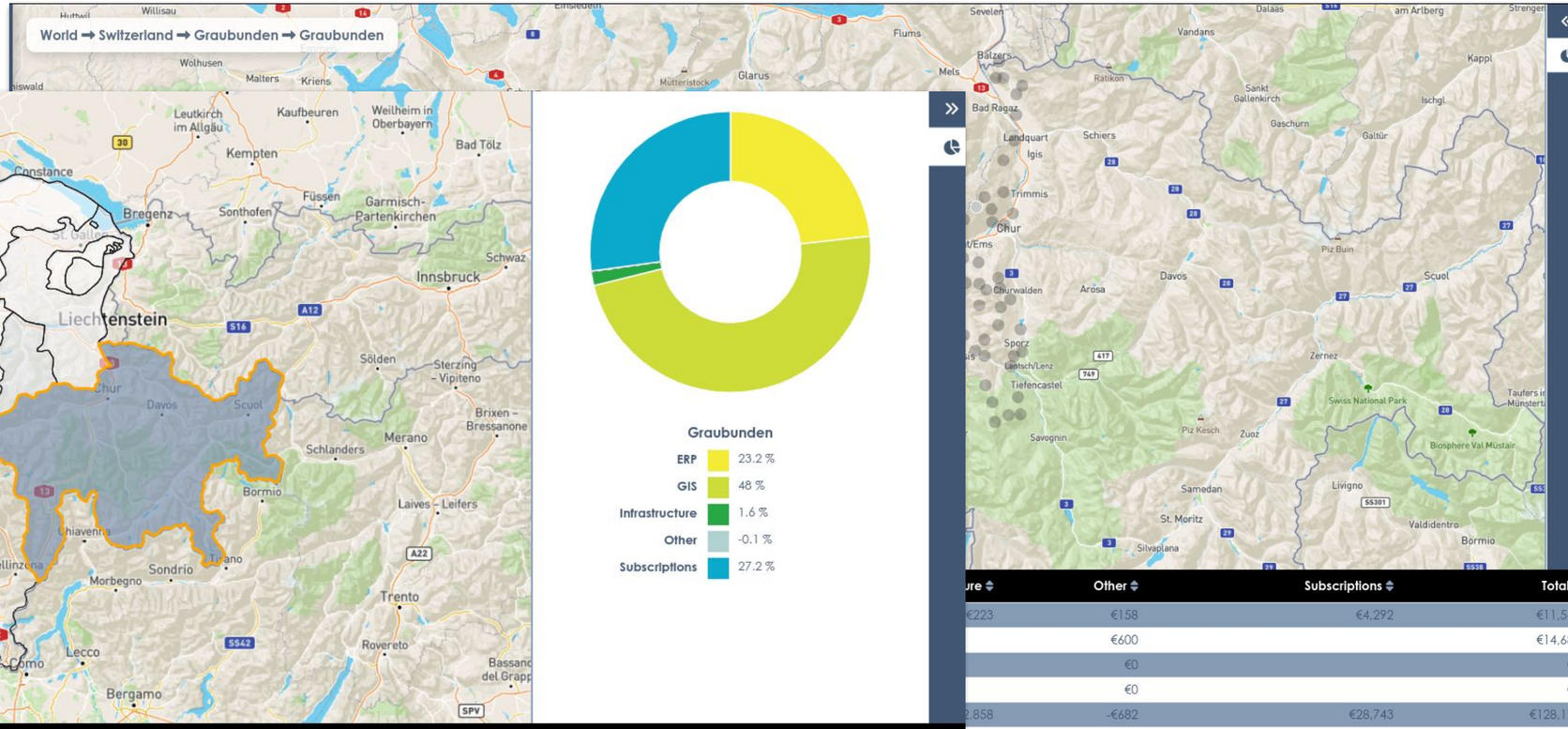
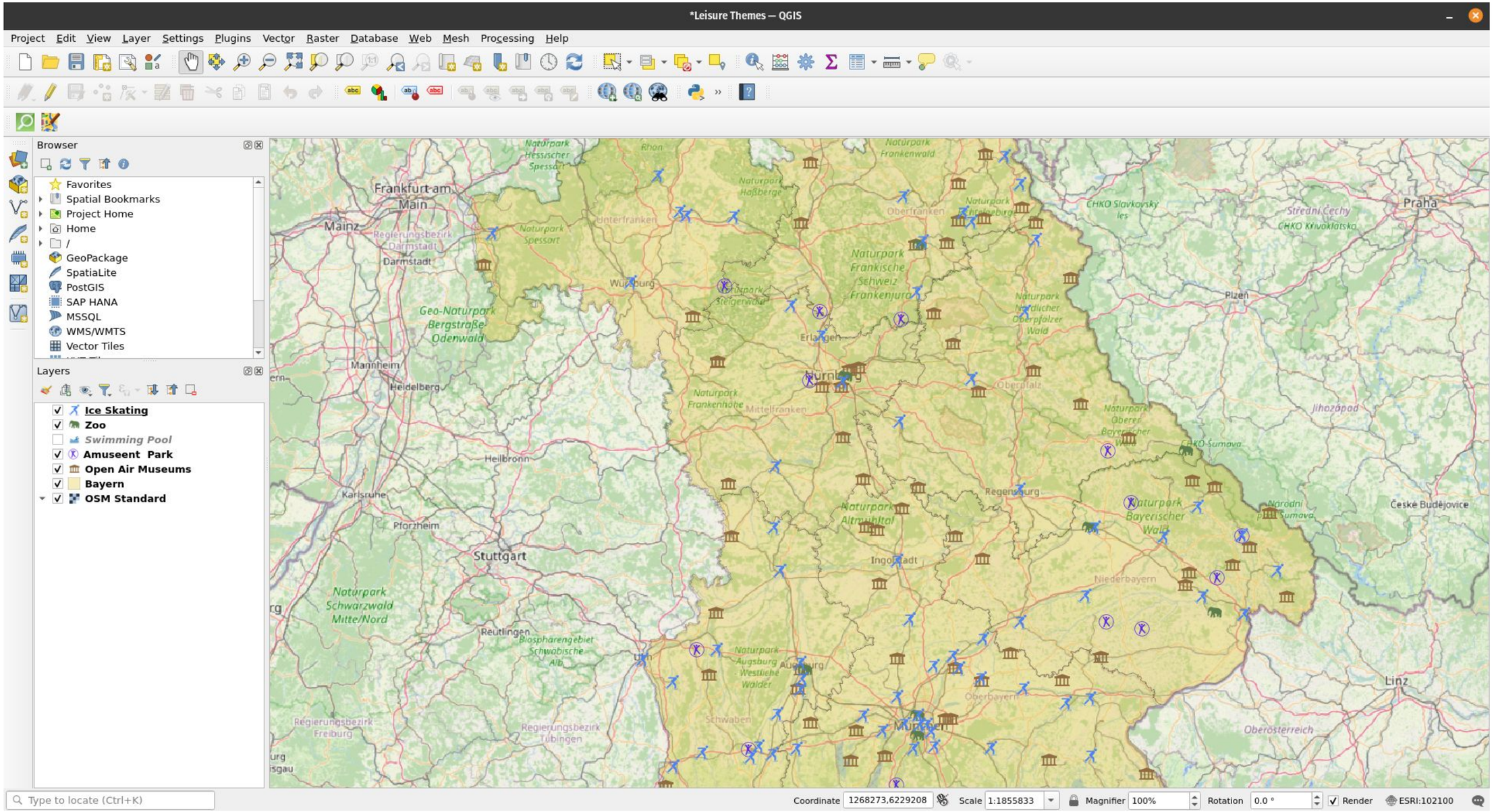




Region	ERP	GIS	Infrastructure	Other	Subscriptions	Total
Aargau	€214,333	€526,586	€49,056	€1,134	€533,980	€1,325,089
Appenzell Ausser-rhoden				€0		€0
Appenzell Inner-rhoden	€5,071	€6,383	€177	€0	€3,438	€15,068
Basel-landschaft	€60,784	€74,909	€14,107	€4,327	€174,303	€328,430
Bern	€140,097	€269,857	€11,771	€8,497	€224,359	€654,580
Fribourg	€2,962	€7,233	€1,038	€0	€8,703	€19,936
Glarus	€46,112	€75,455	€5,204	€431	€94,079	€221,281
Graubunden	€326,949	€675,832	€22,205	-€883	€383,179	€1,407,283
Jura	€1,079			-€1,079		€0

ure	Other	Subscriptions	Total
€223	€158	€4,292	€11,548
	€600		€14,687
	€0		€0
	€0		€0
858	-€682	€28,743	€128,174
307	€1,200	€149,137	€217,080
817	-€2,158	€201,008	€1,035,794

Data Analysis with Desktop Tools



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BY OPEN SOURCE EXPERTS

Thanks for your attention.

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https://github.com/camptocamp

https://www.camptocamp.com

Literature References

- PostGIS in Action by Regina O. Obe, Leo S. Hus
- https://postgis.net/docs
- https://www.postgis.net/workshops/postgis-intro/
- https://map.geo.admin.ch/
- https://www.swisstopo.admin.ch/de/swisstopo-in-zahlen


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