



INNOVATIVE SOLUTIONS
BY OPEN SOURCE EXPERTS

Geodaten-Management mit PostGIS

Marion Baumgartner

About us



Marion Baumgartner

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

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**



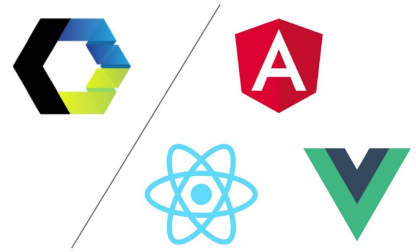
Open Source Geospatial Software



20+ years contributions



Geospatial Open Source Software stack



This Presentation



Why PostGIS

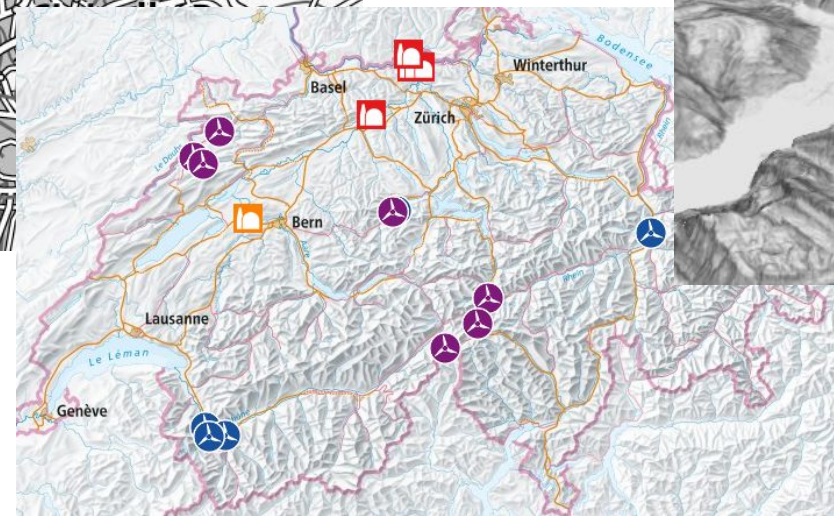
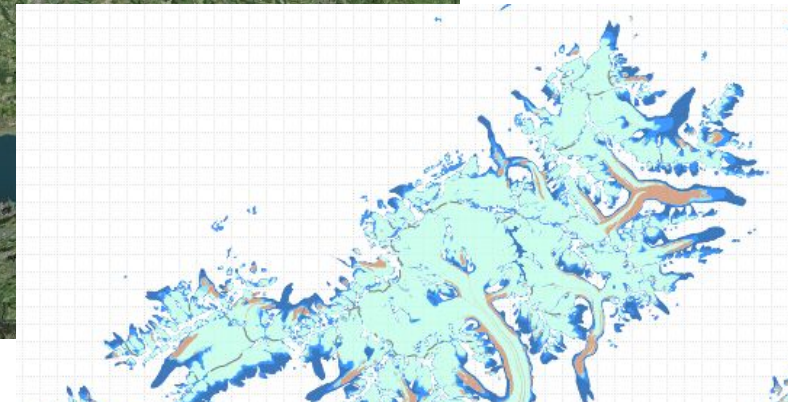
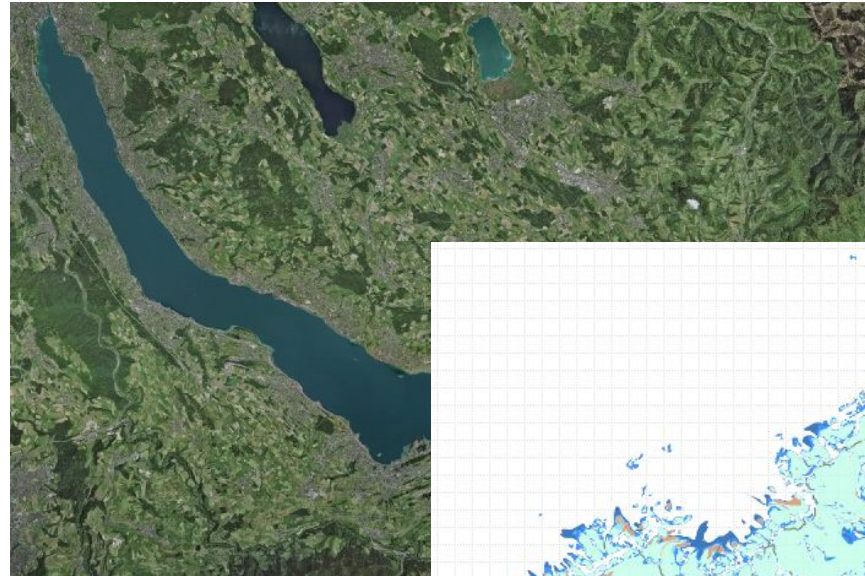


The Data Model

Harvesting the Data



What is geodata?



Any data with spatial information!

What is the format of geodata?



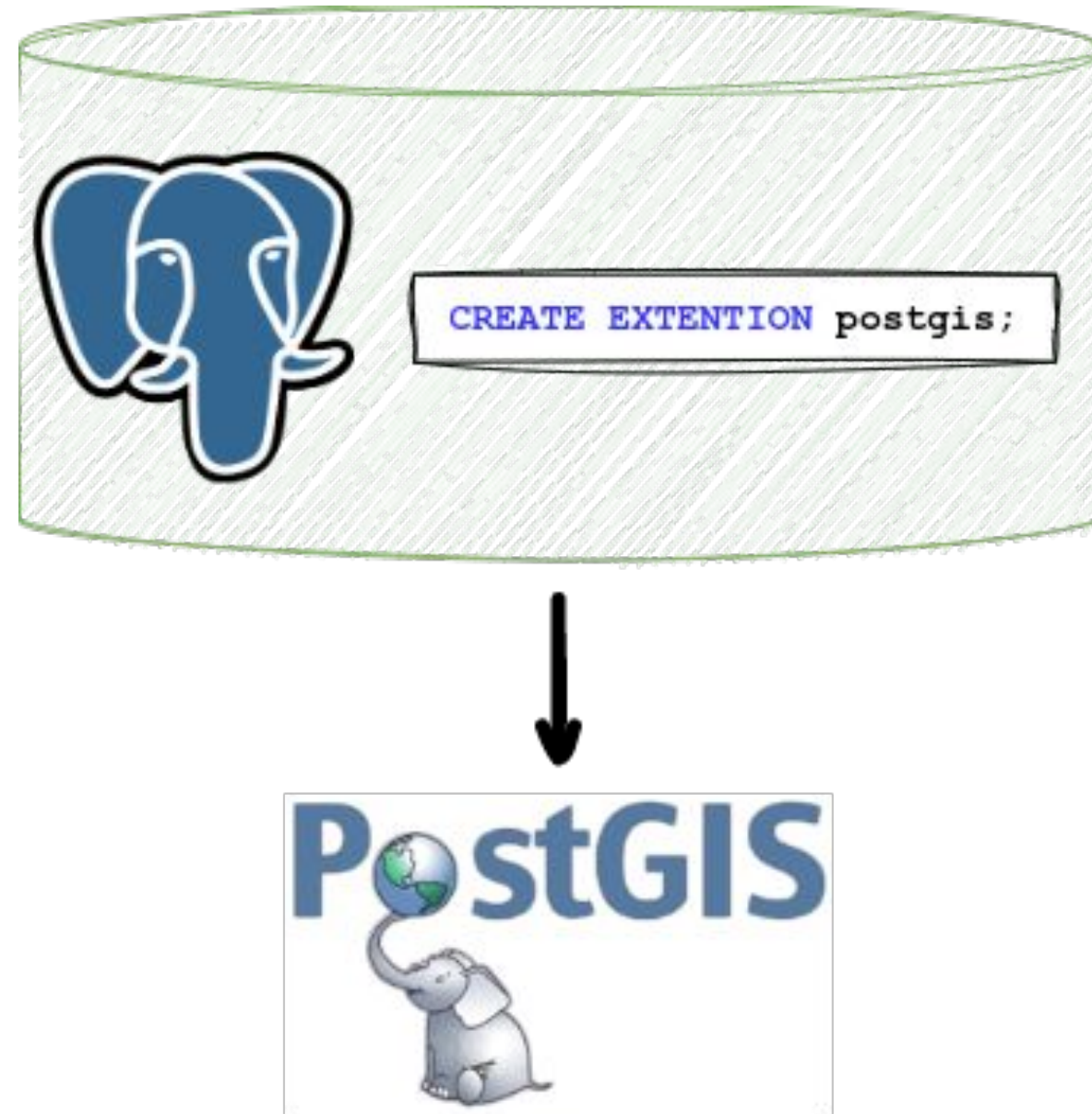
osm
GML
topojson
KML
GDB
shp
GeoPackage
GPX
geotiff
jpg
NetCDF
CSV





Why PostGIS

What is PostGIS?



PostGIS is a spatial database:

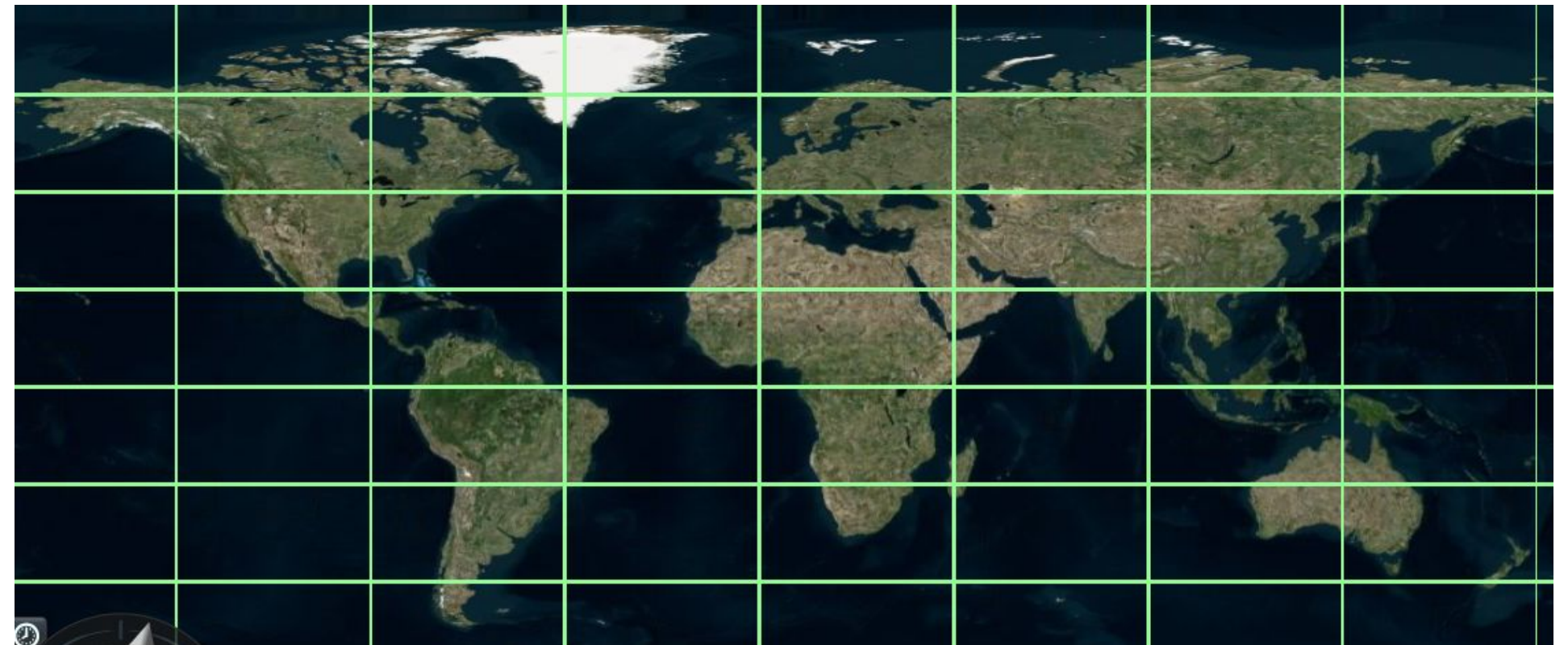
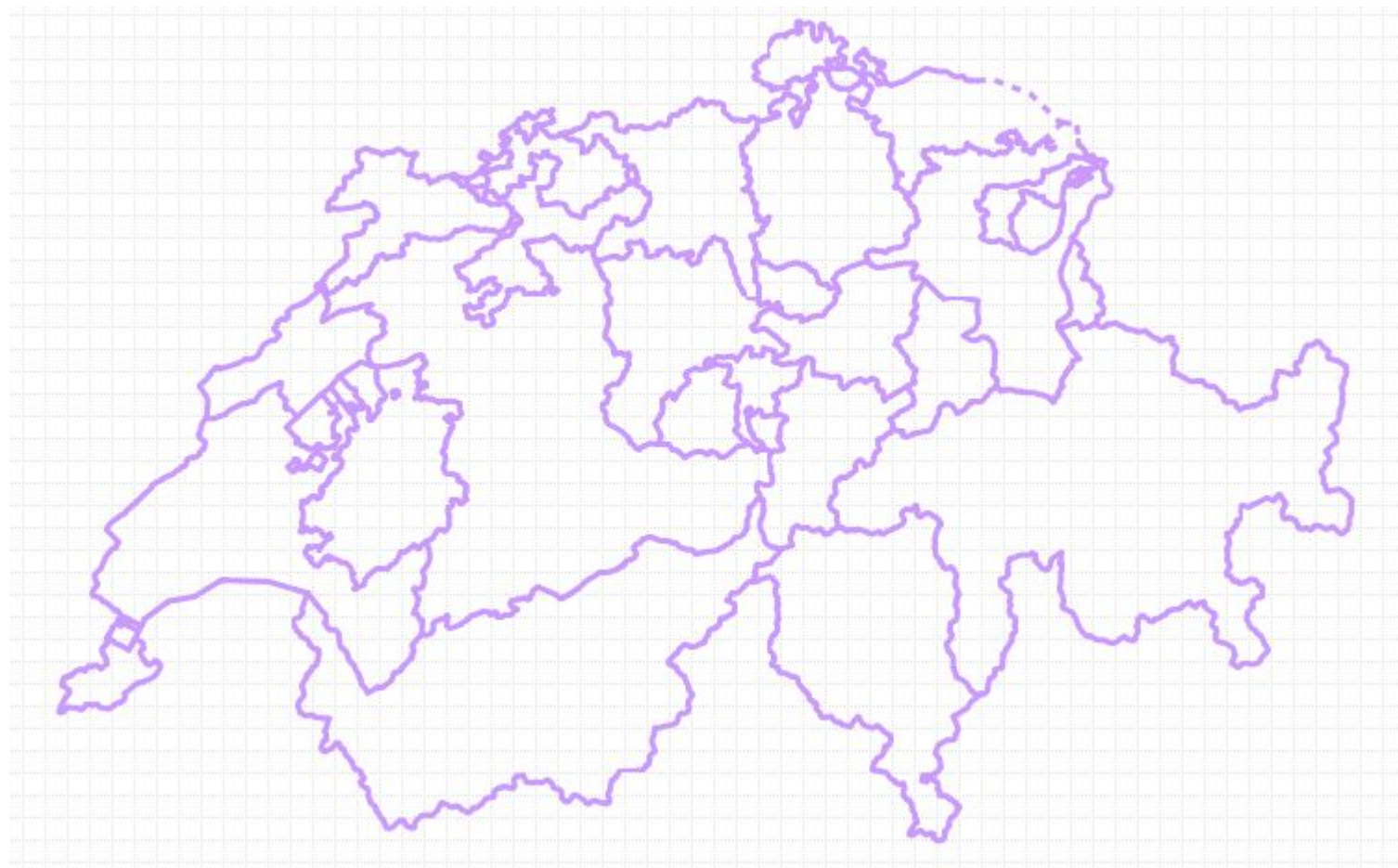
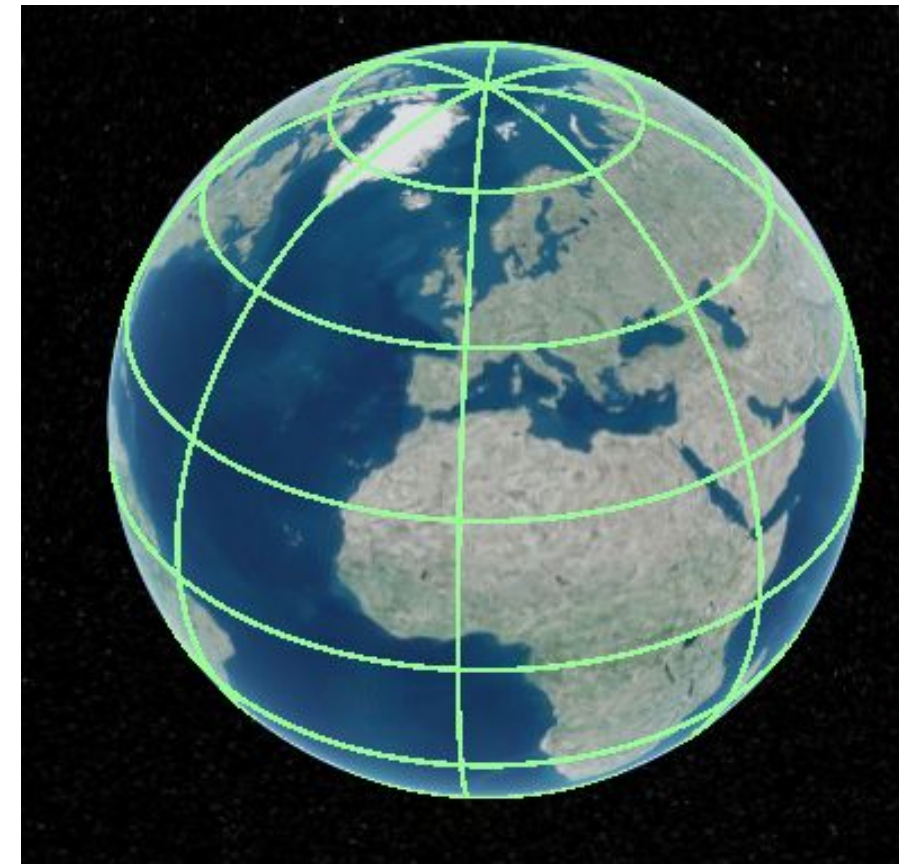
- Spatial data types
 - geometry (point, lines, polygons)
 - raster
- Spatial indexing
 - Optimised for spatially related data
- Spatial functions
 - ST_...

Data Types



Vector data

- geography
- geometry



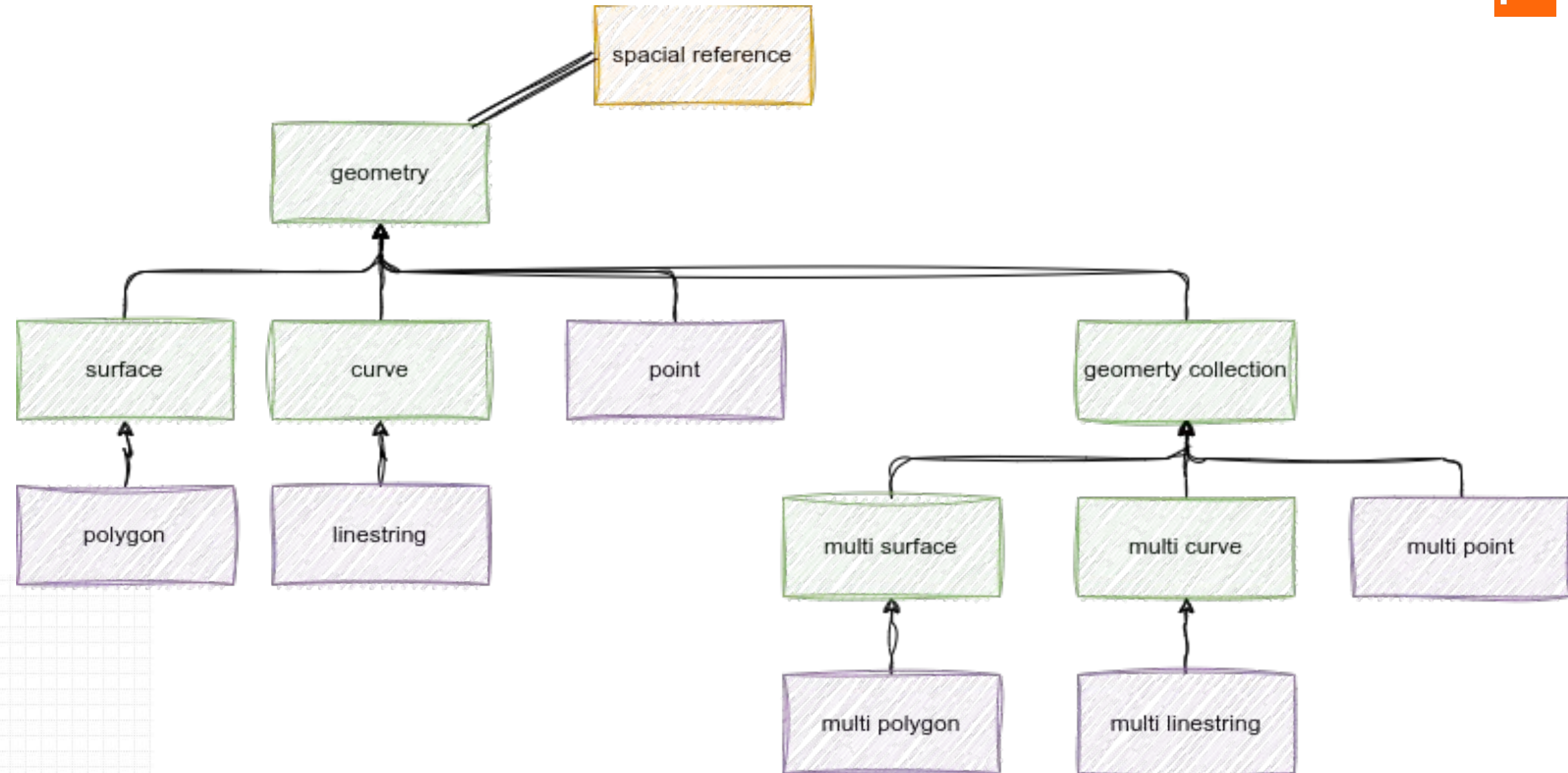
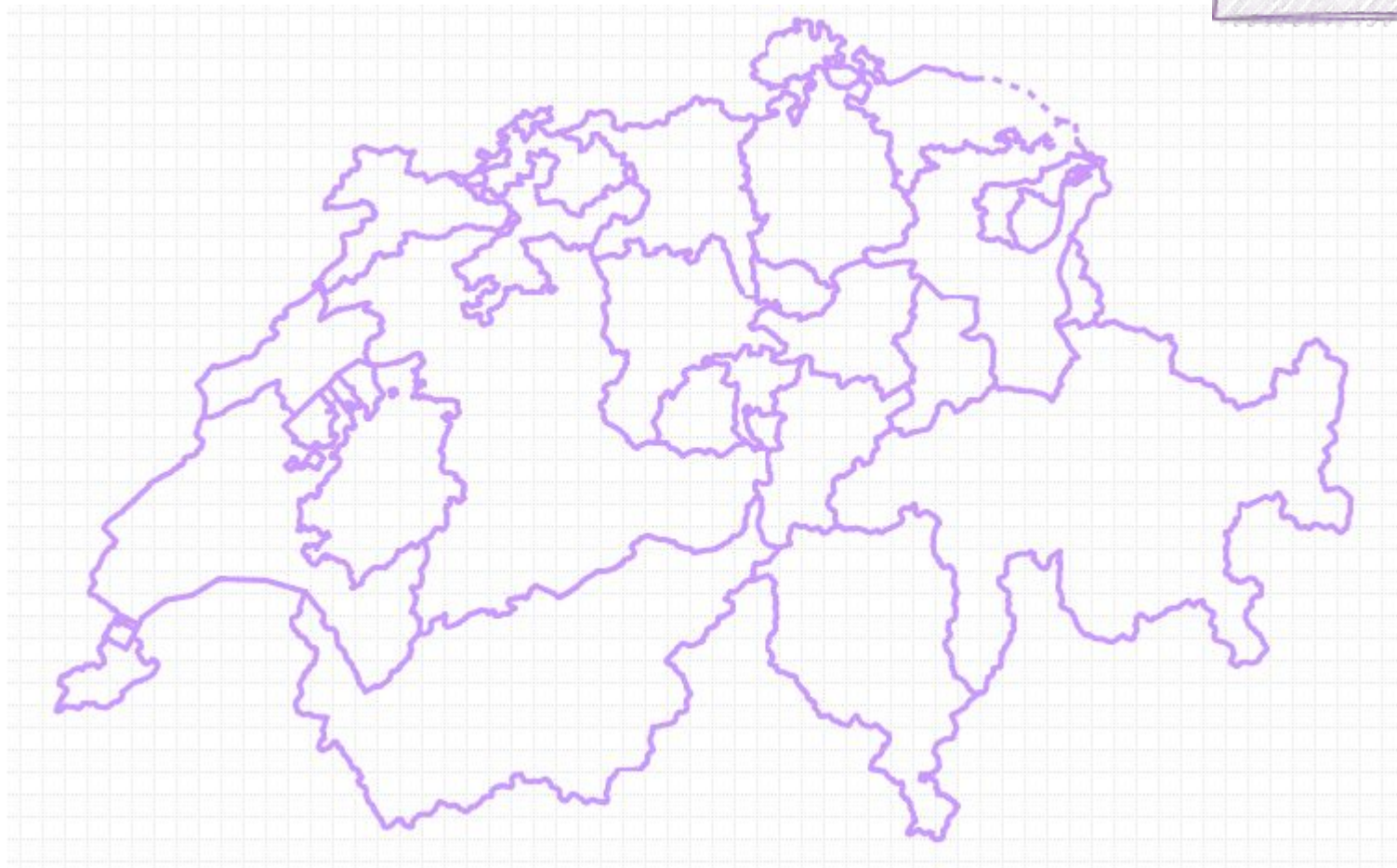
<https://sandcastle.cesium.com/>

Data Types



Vector data

- geography
- geometry



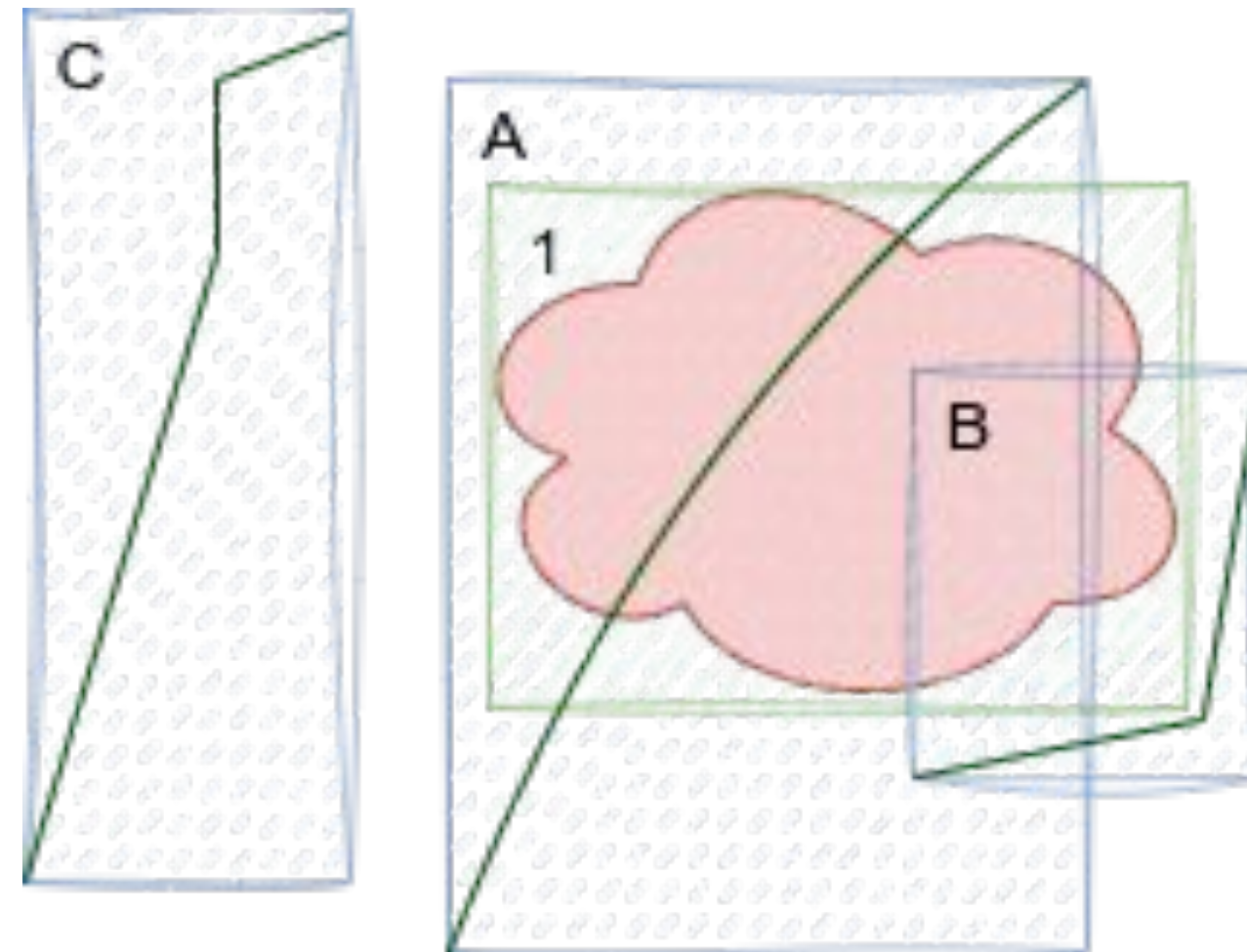
Data Types



Raster data



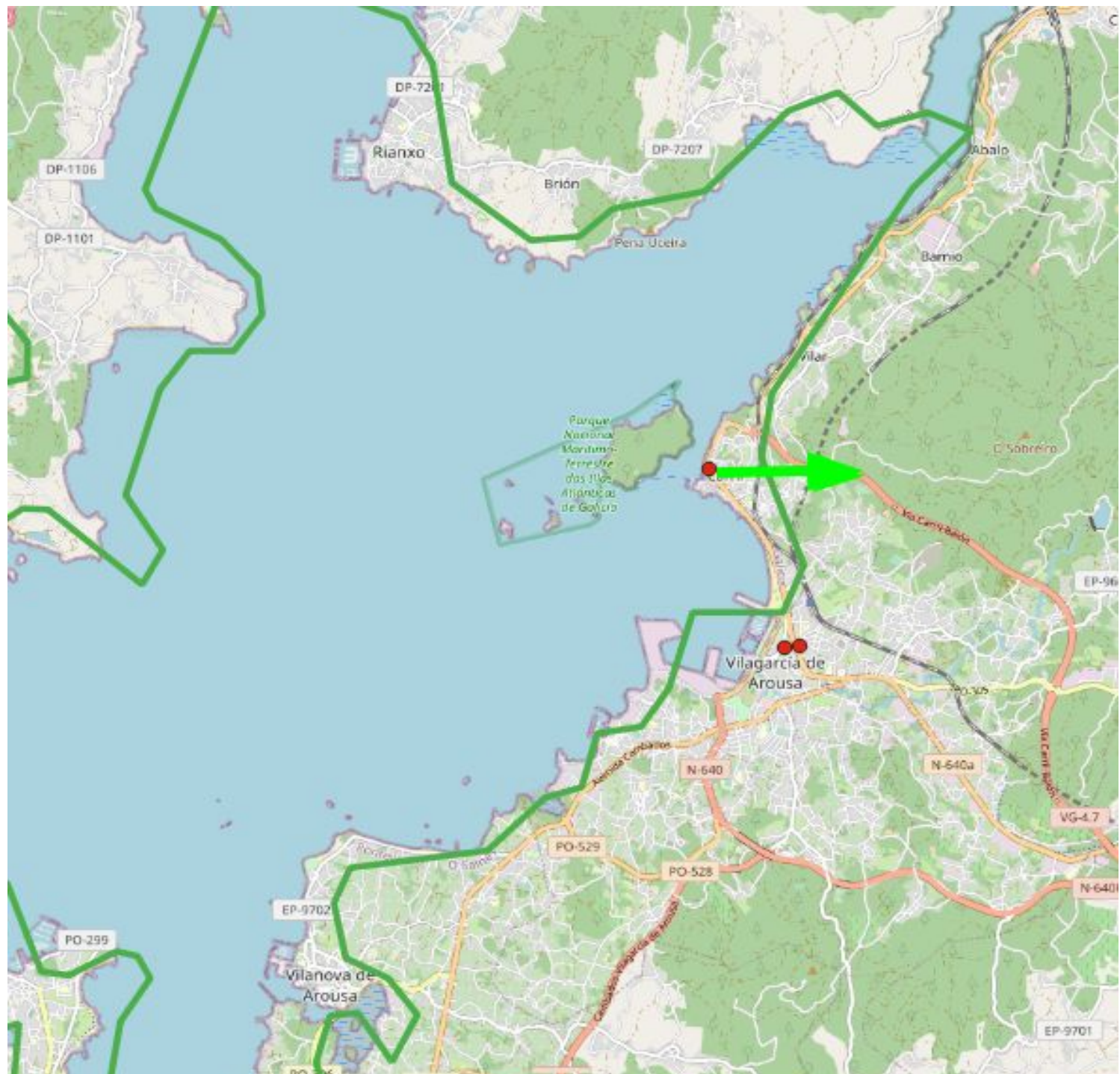
Spatial indexes



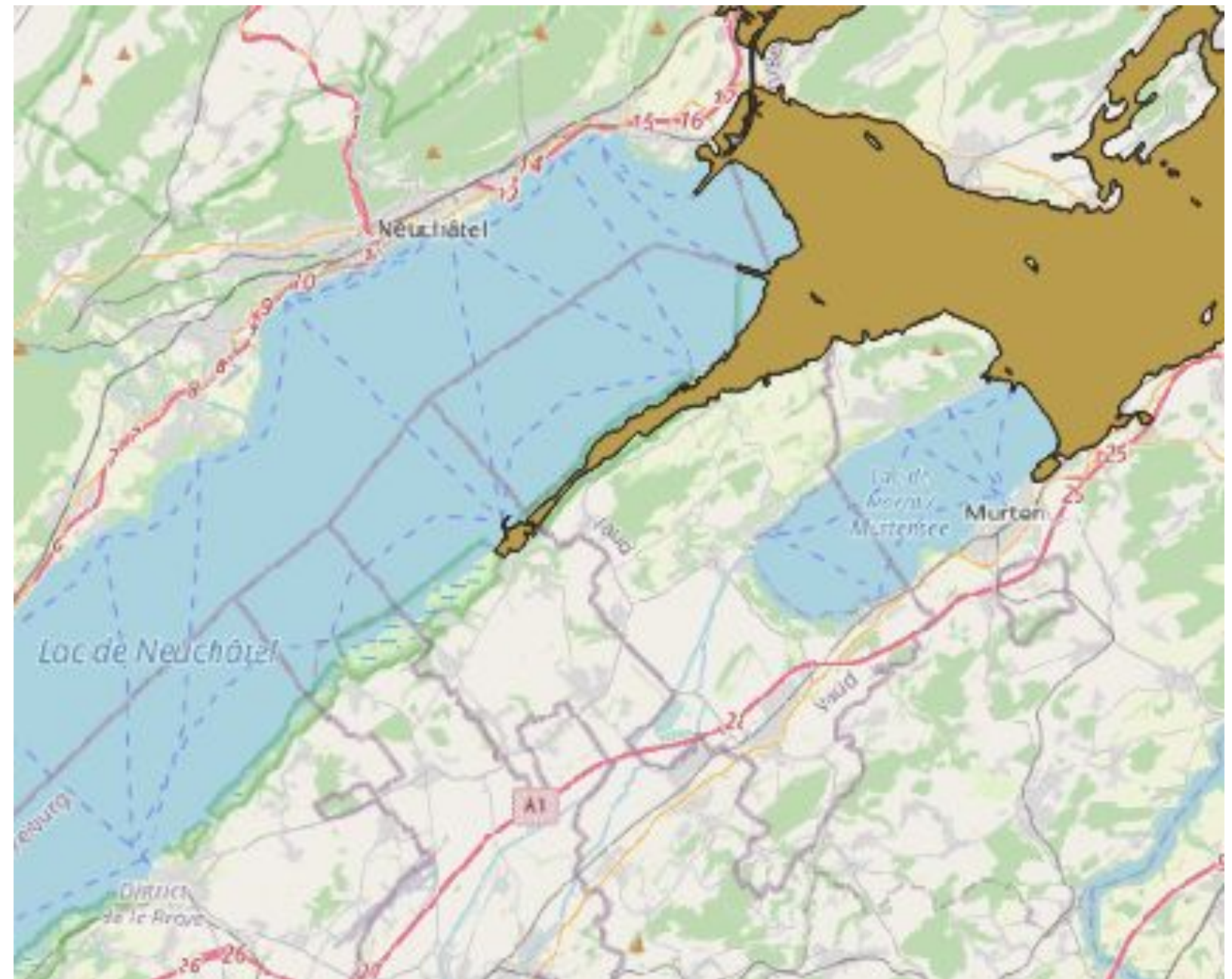
Spatial functions



`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/>



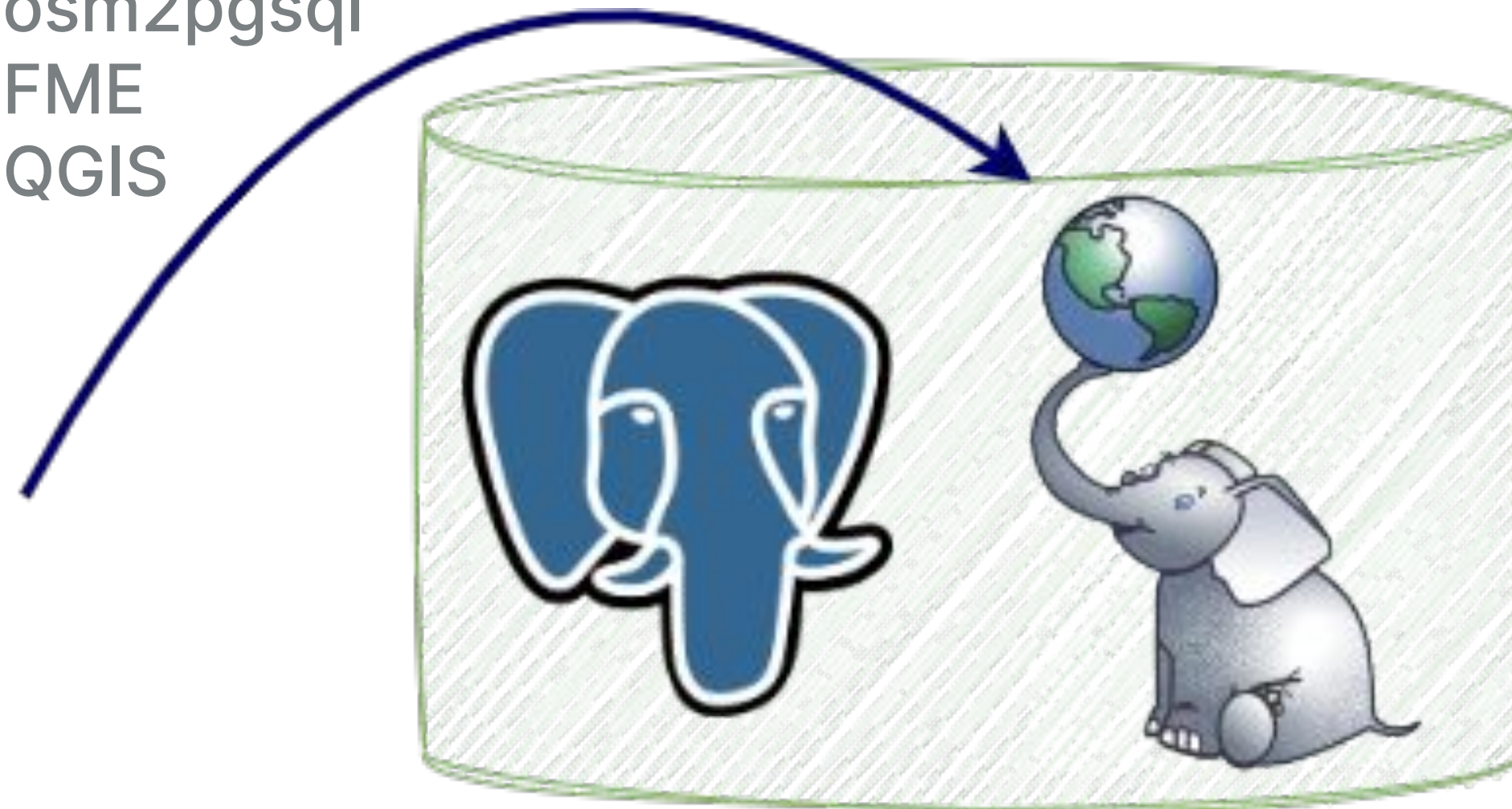


The Data Model

Filling data into a PostGIS DB



- GDAL
- shp2pgsql
- osm2pgsql
- FME
- QGIS



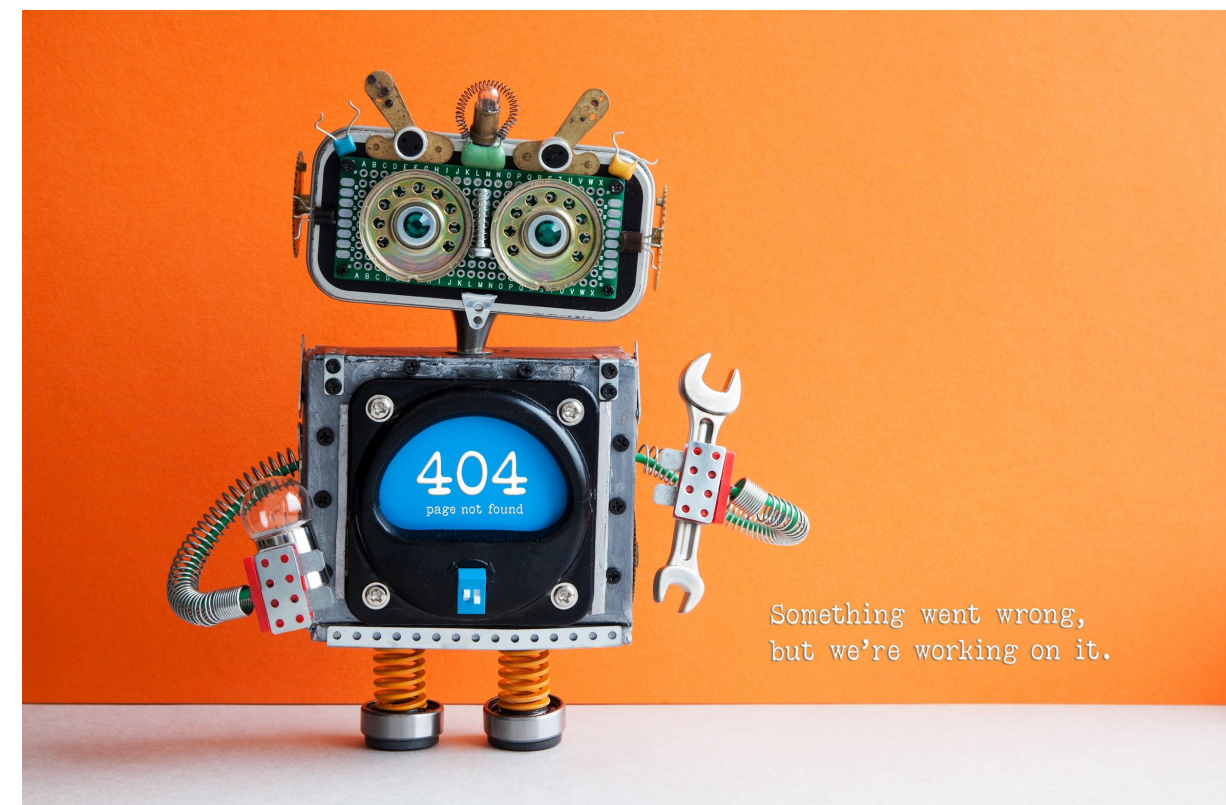
Geodata in a Table



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

- geography
- geometry
- raster

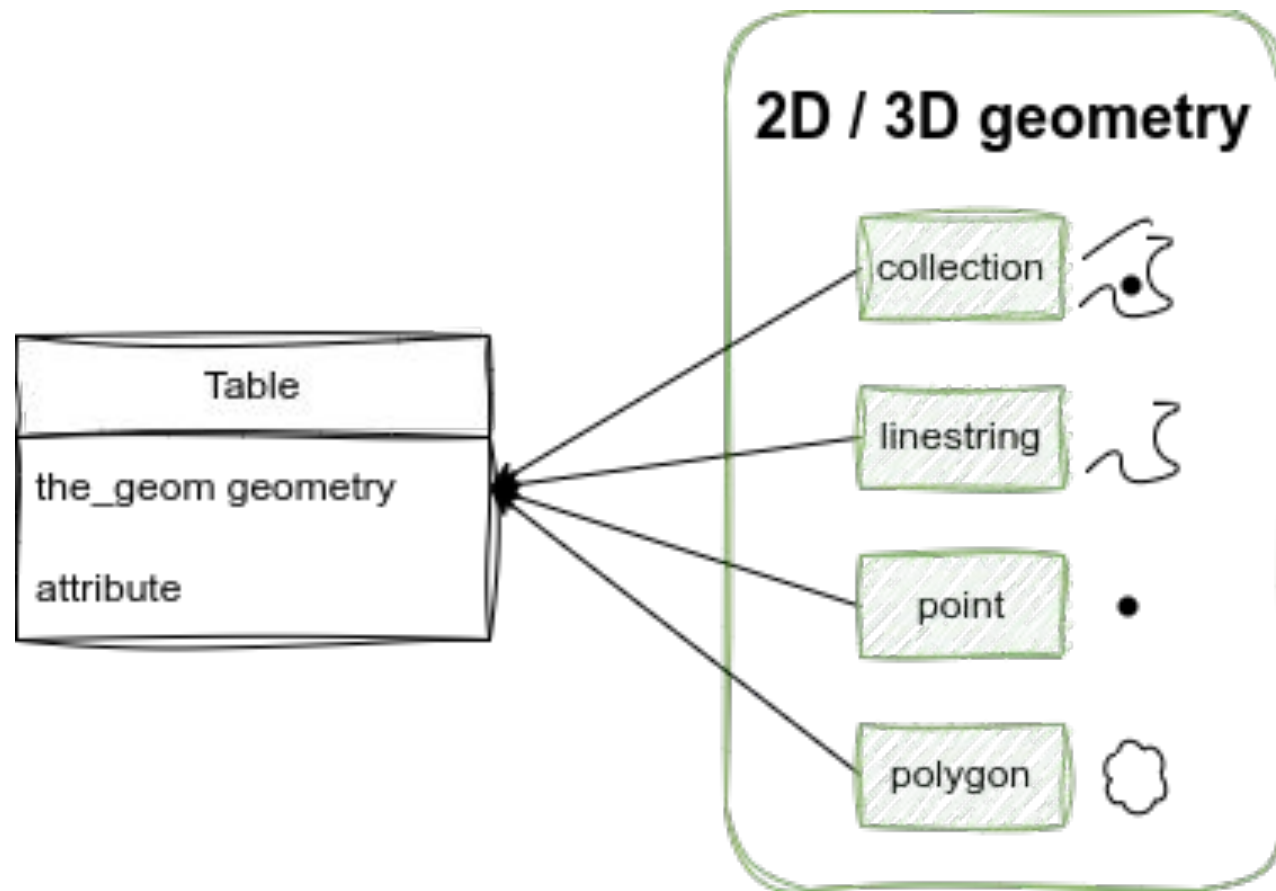
you are likely in trouble



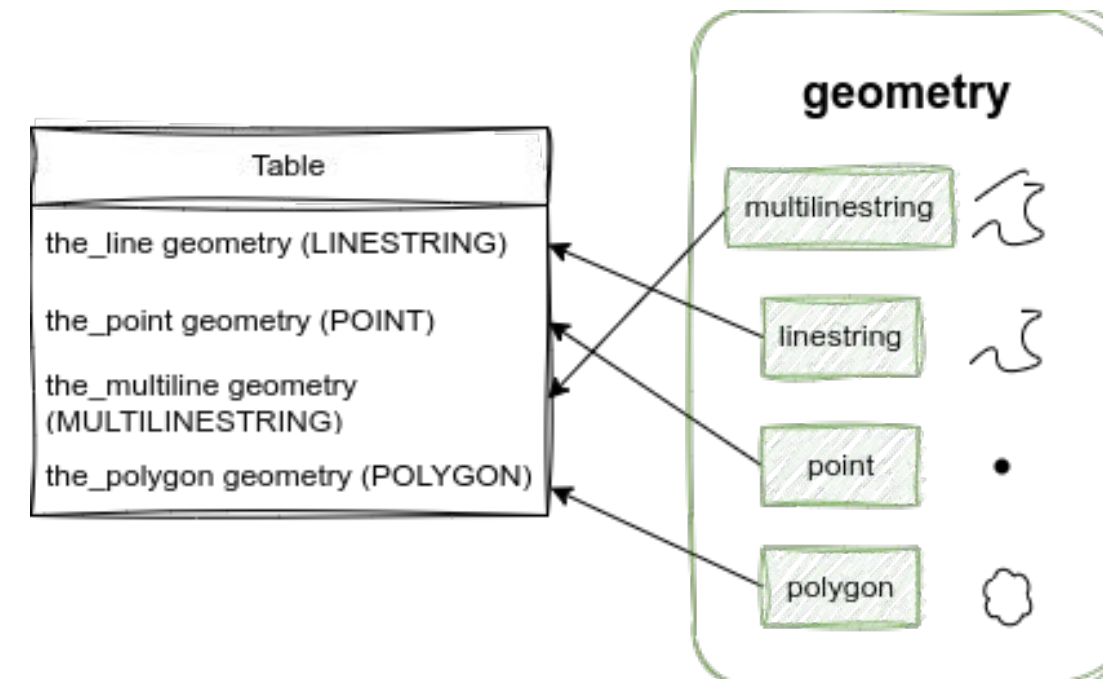
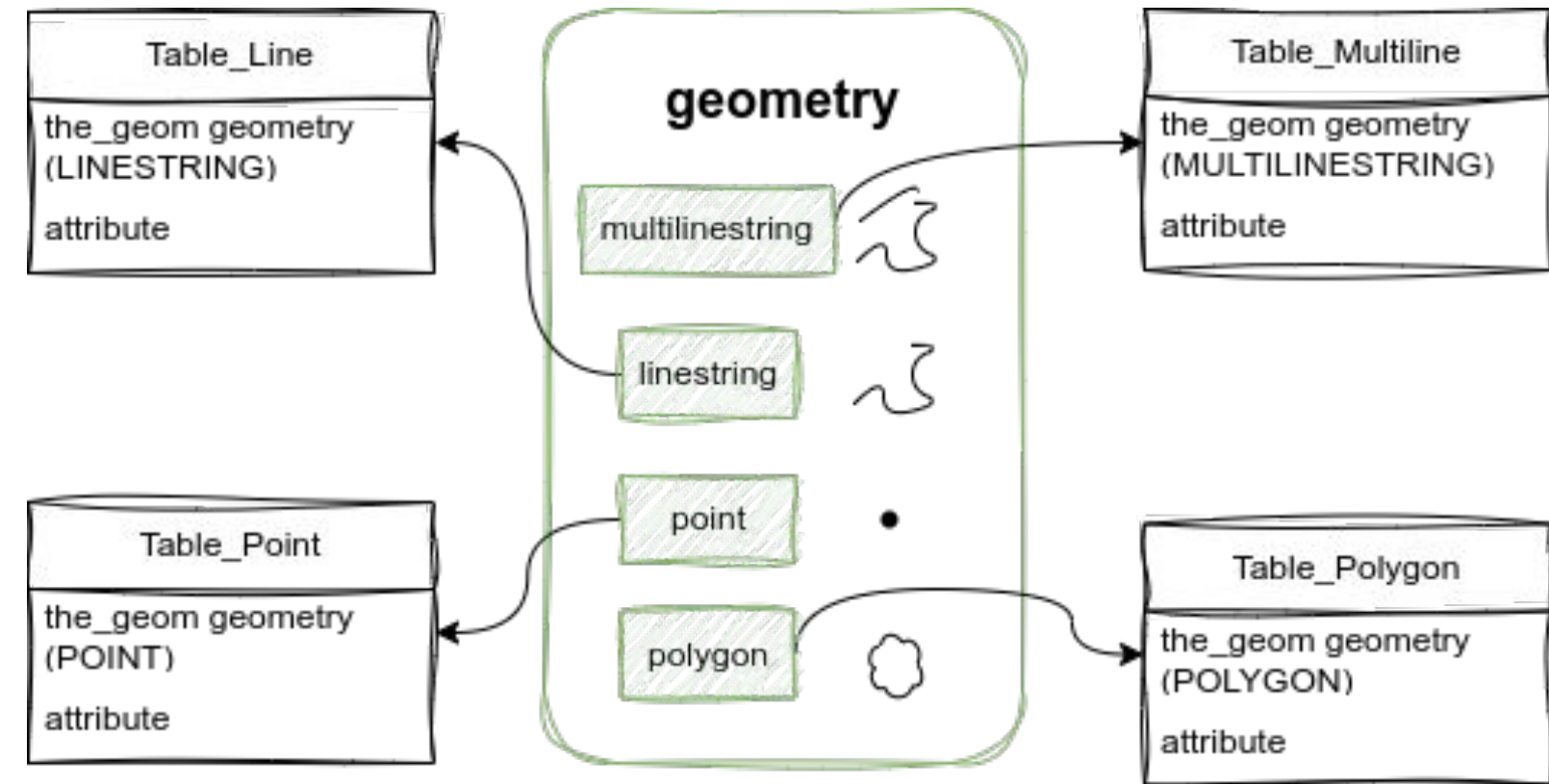
Geodata in a Table



Heterogeneous

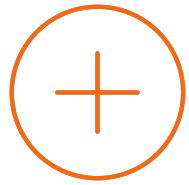
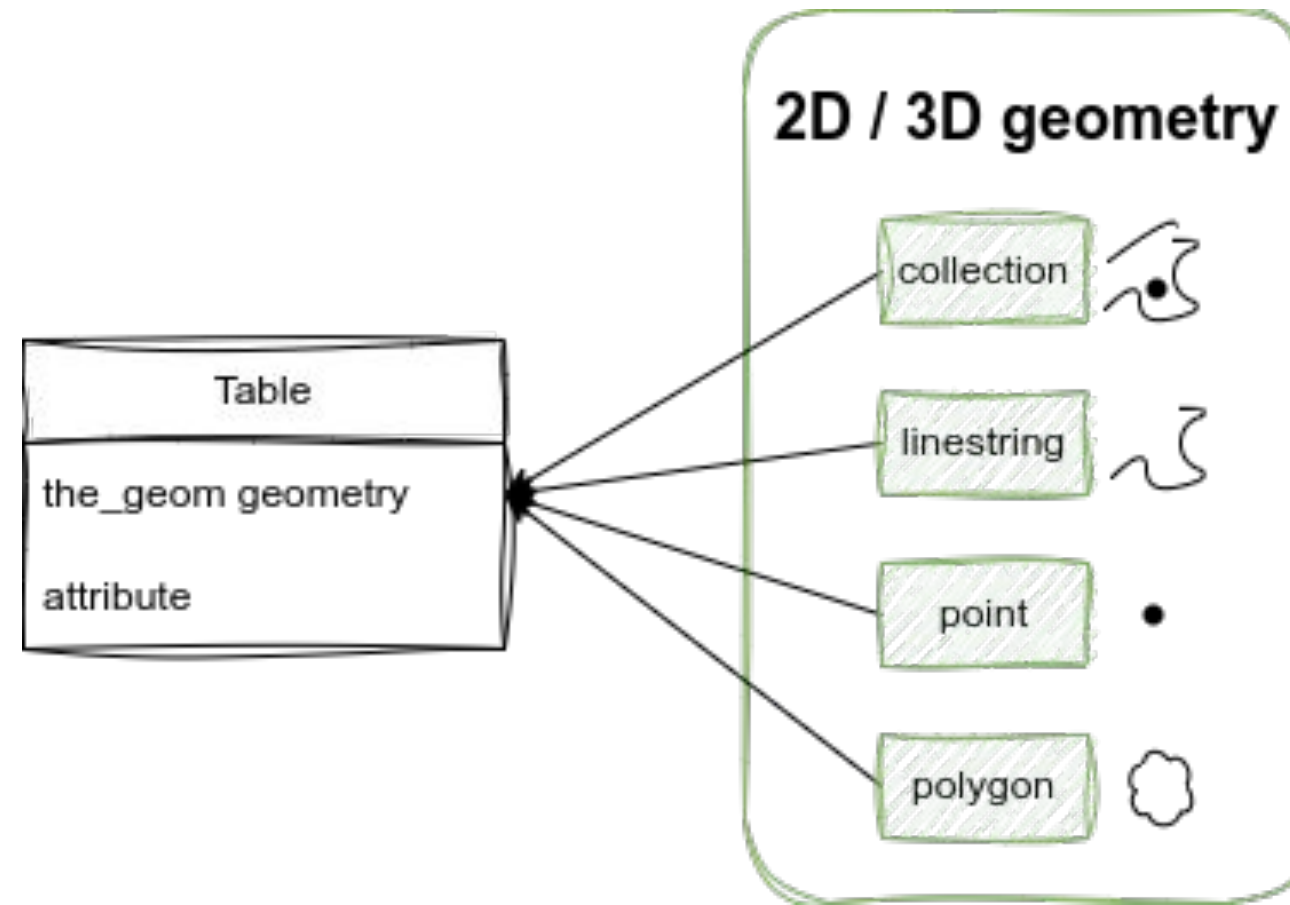


Homogeneous

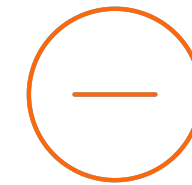


Heterogeneous

Pros & Cons

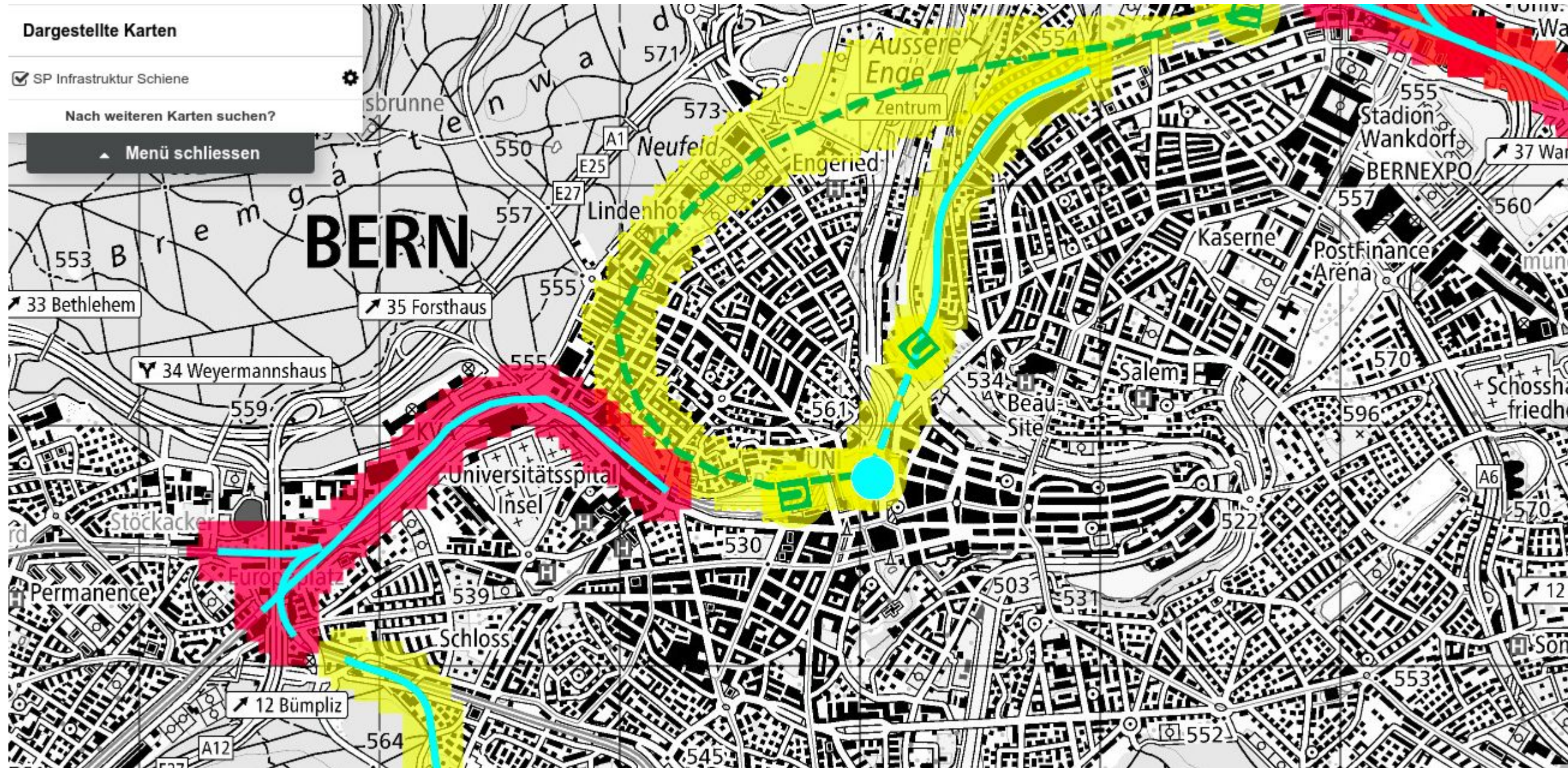


- Simple
 - query
 - model



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

Heterogeneous: Example



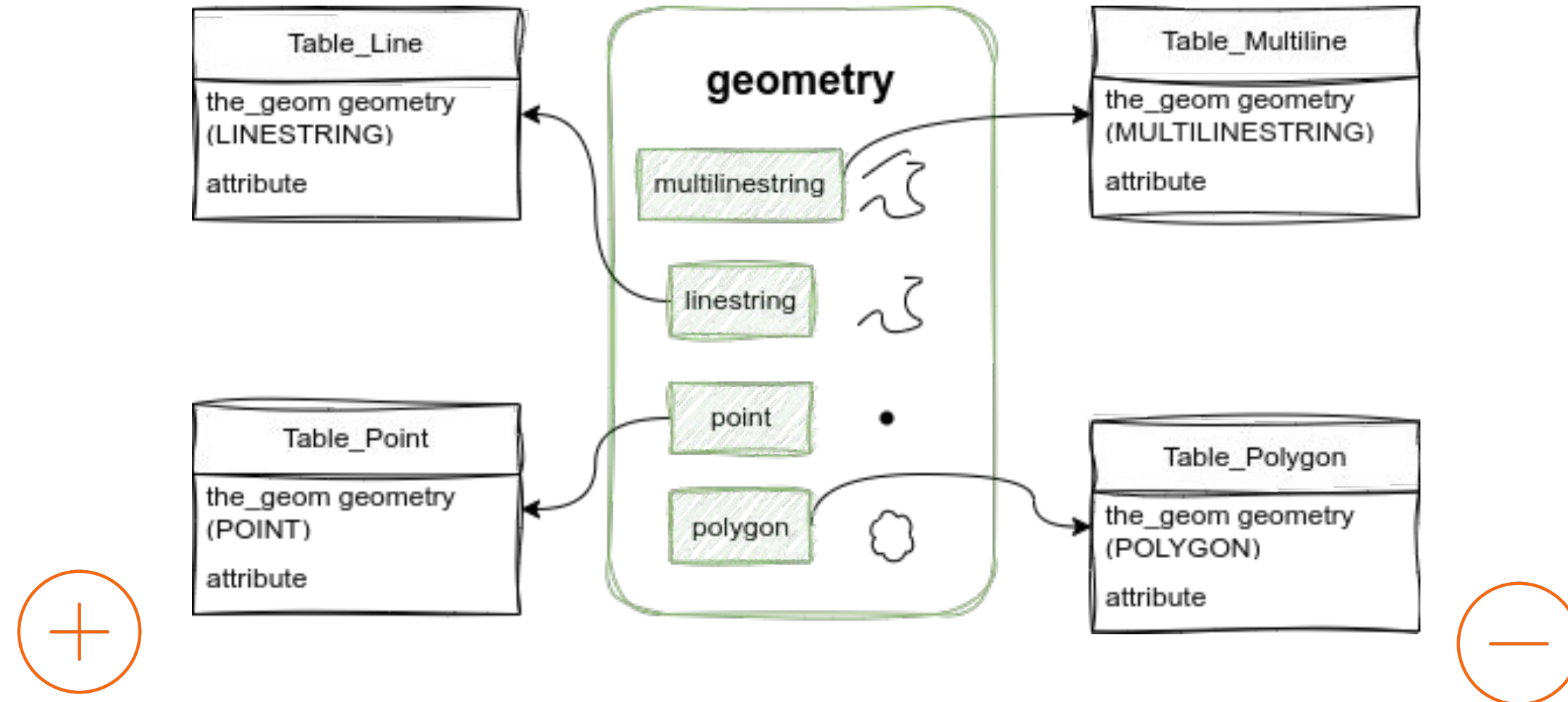
ST_GeometryType:

ST_MultiPolygon

ST_MultiPoint

ST_MultiLineString

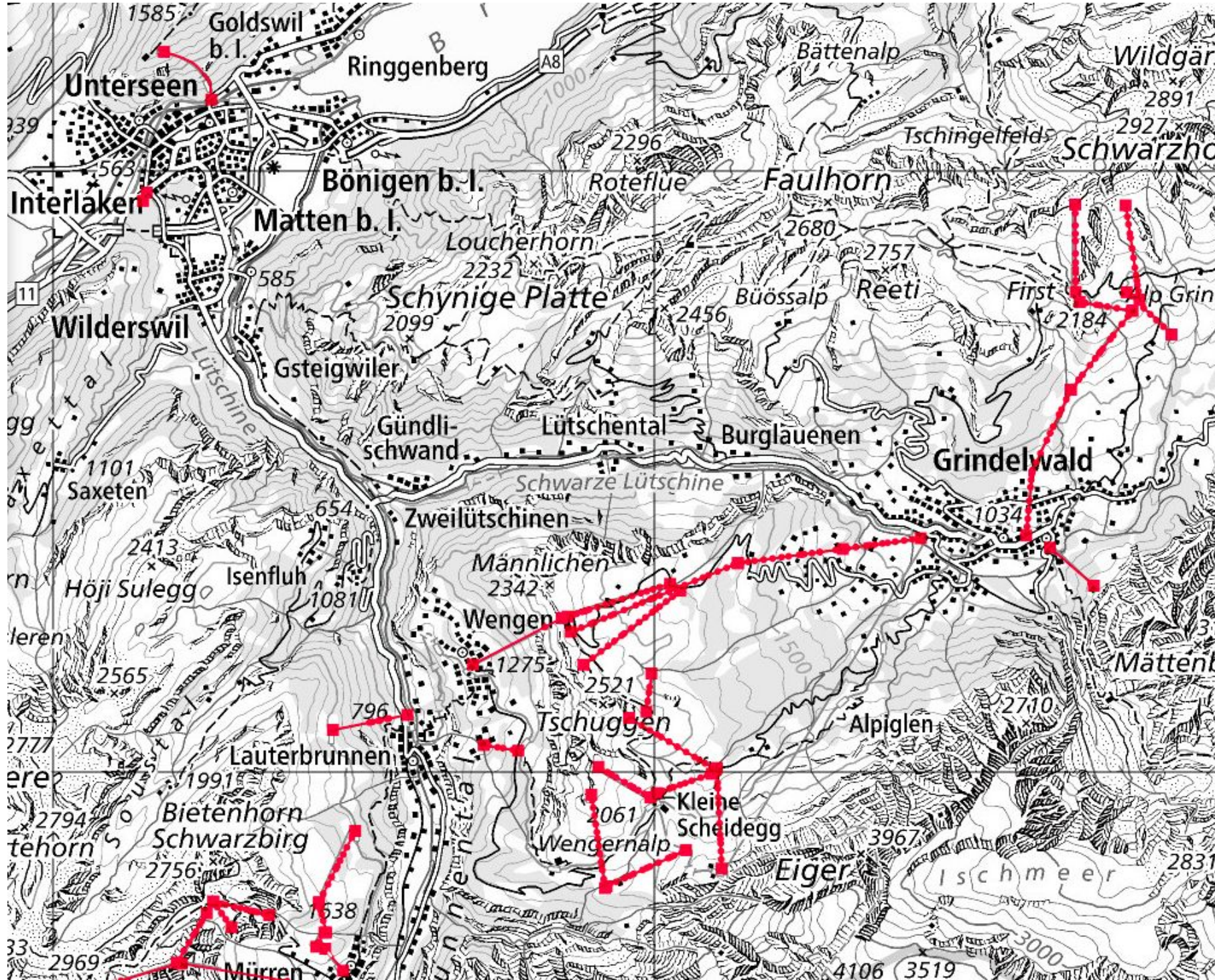
Homogeneous Pros & Cons



- 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

Legend

● Seilstütze

■ Station

~ Brücke

~ Tunnel

~ Seilbahnstrecke

POINT

LINestring

Table Inheritance

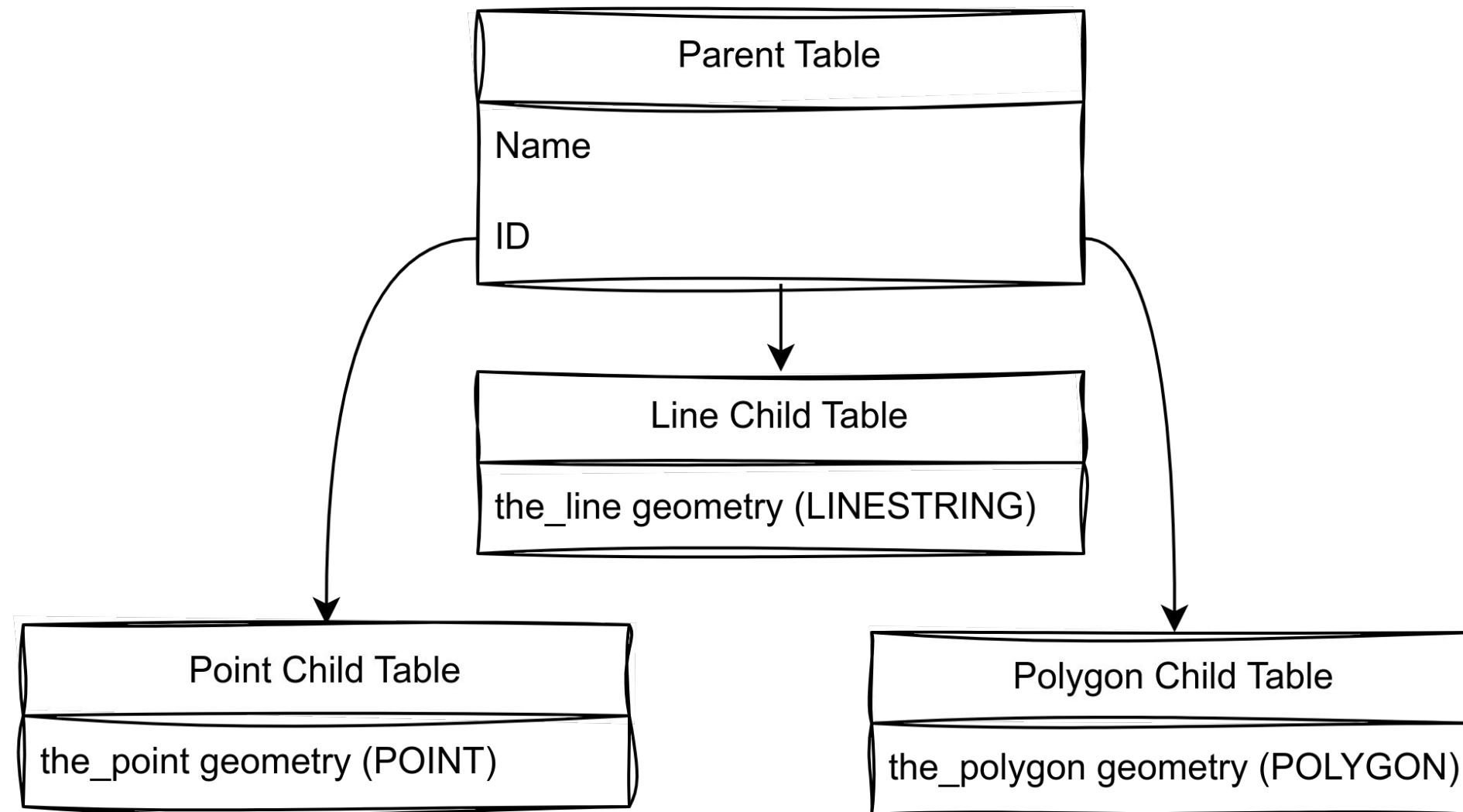
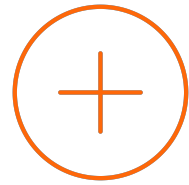
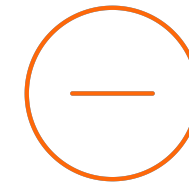


Table Inheritance

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

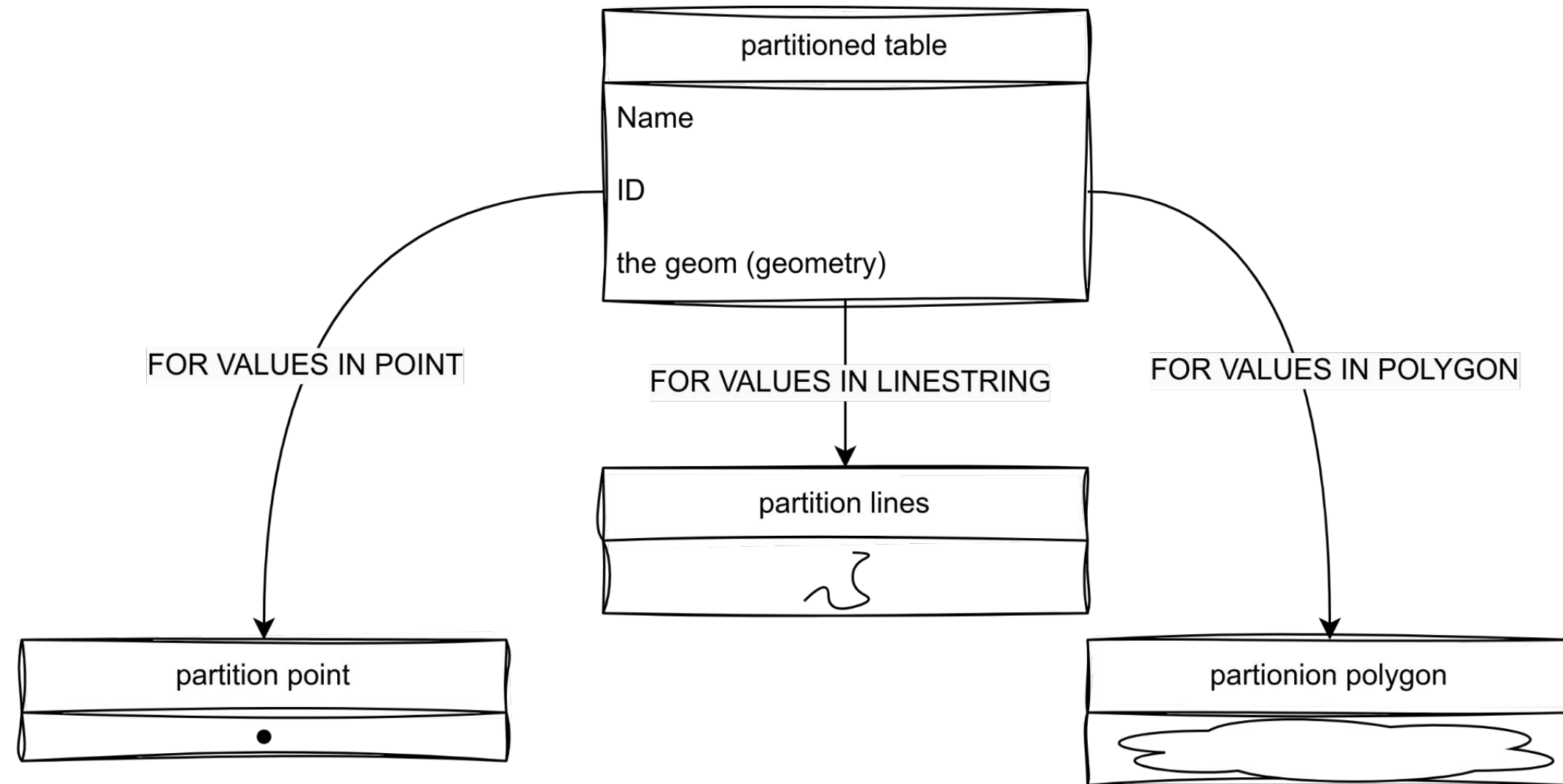
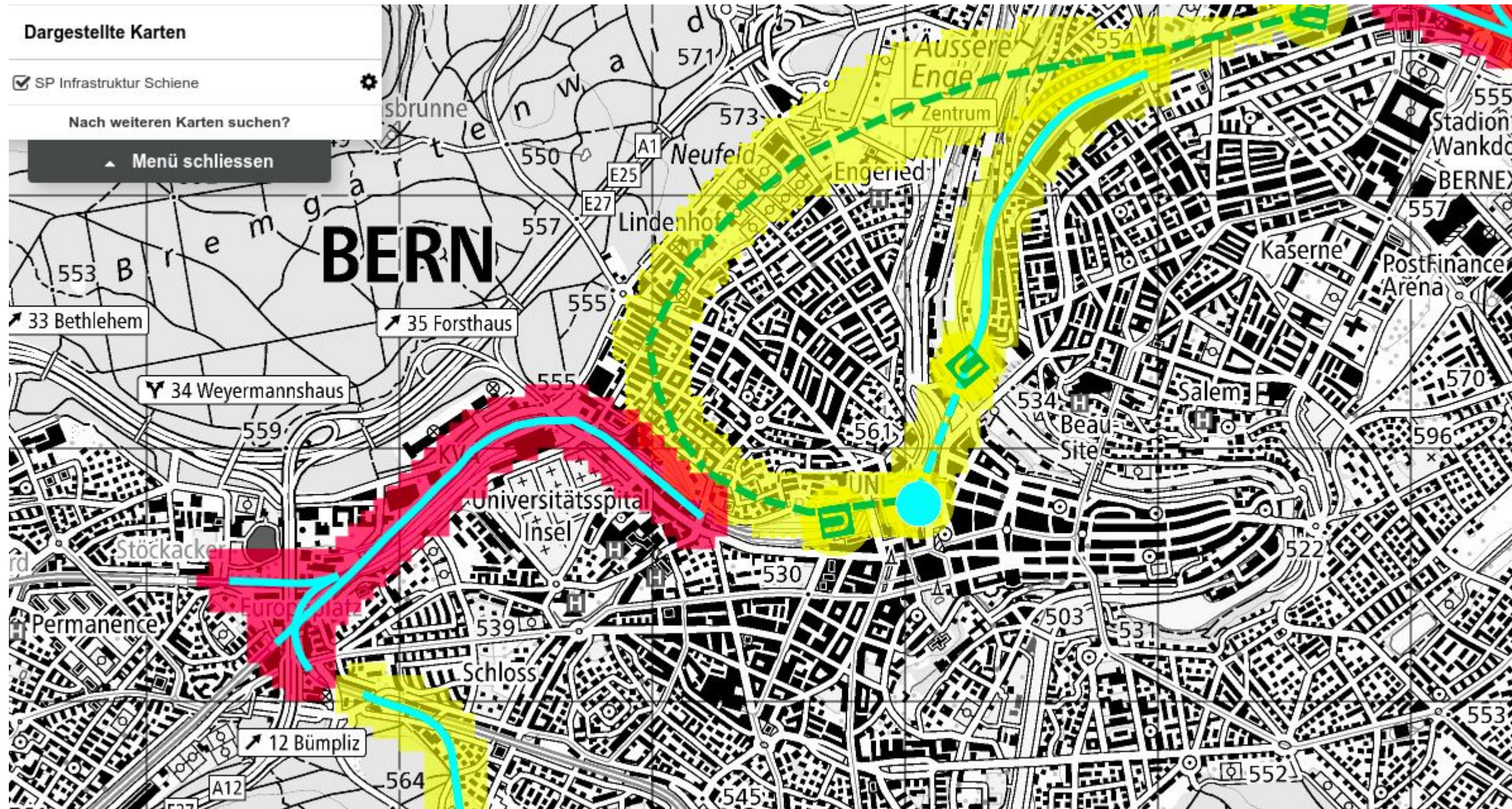


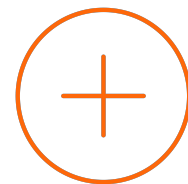
Table Partitioning: Example



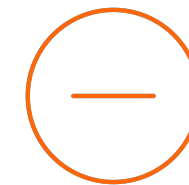
- partitioned_sis_pl_kraft
 - Columns
 - Constraints (2)
 - Indexes
 - Partitions (3)
 - part_line_sis
 - Constraints (3)
 - bgdi_geometry_valid_check_the_geom
 - enforce_dims_the_geom
 - line_sis_pl_kraft_pkey
 - Indexes
 - RLS Policies
 - Rules
 - Triggers
 - part_point_sis
 - RLS Policies
 - Rules
 - Triggers
 - part_poly_sis
 - RLS Policies
 - Rules
 - Triggers

Table Partitioning

Pros & Cons



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

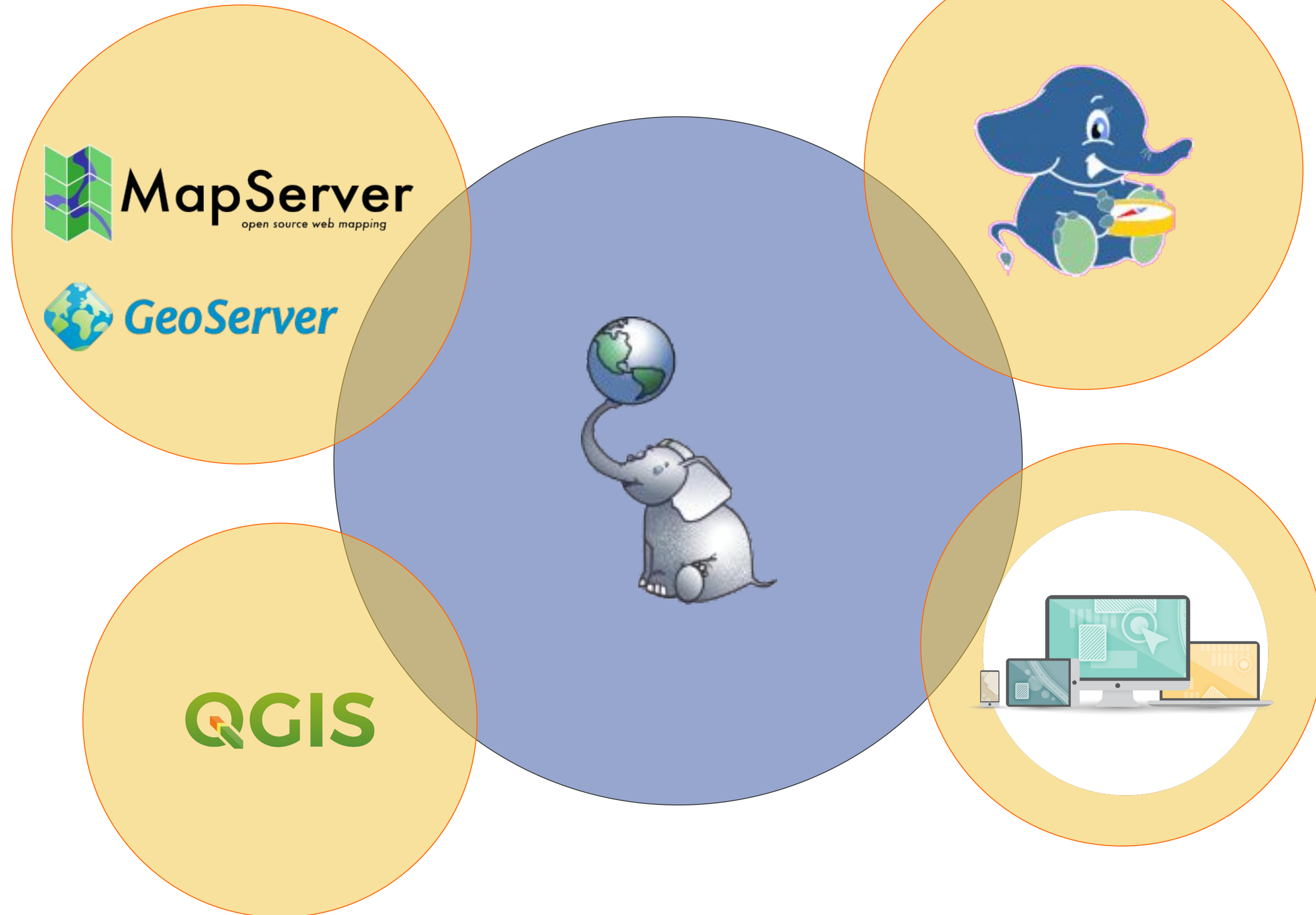


- Complex data model
- No additional columns in “sub-tables”
- better used with **huge** tables
- strategy/model needs to be predefined
- Partitioning keys are limited



Harvesting the Data

Make use of the data



Swisstopo: A large GDI



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
In collaboration with the cantons

Search for a place or add a map:
Search for addresses, parcels or maps

Try out [test.map.geo.admin.ch](#) Full screen Report problem Help Mobile version DE FR IT EN RM

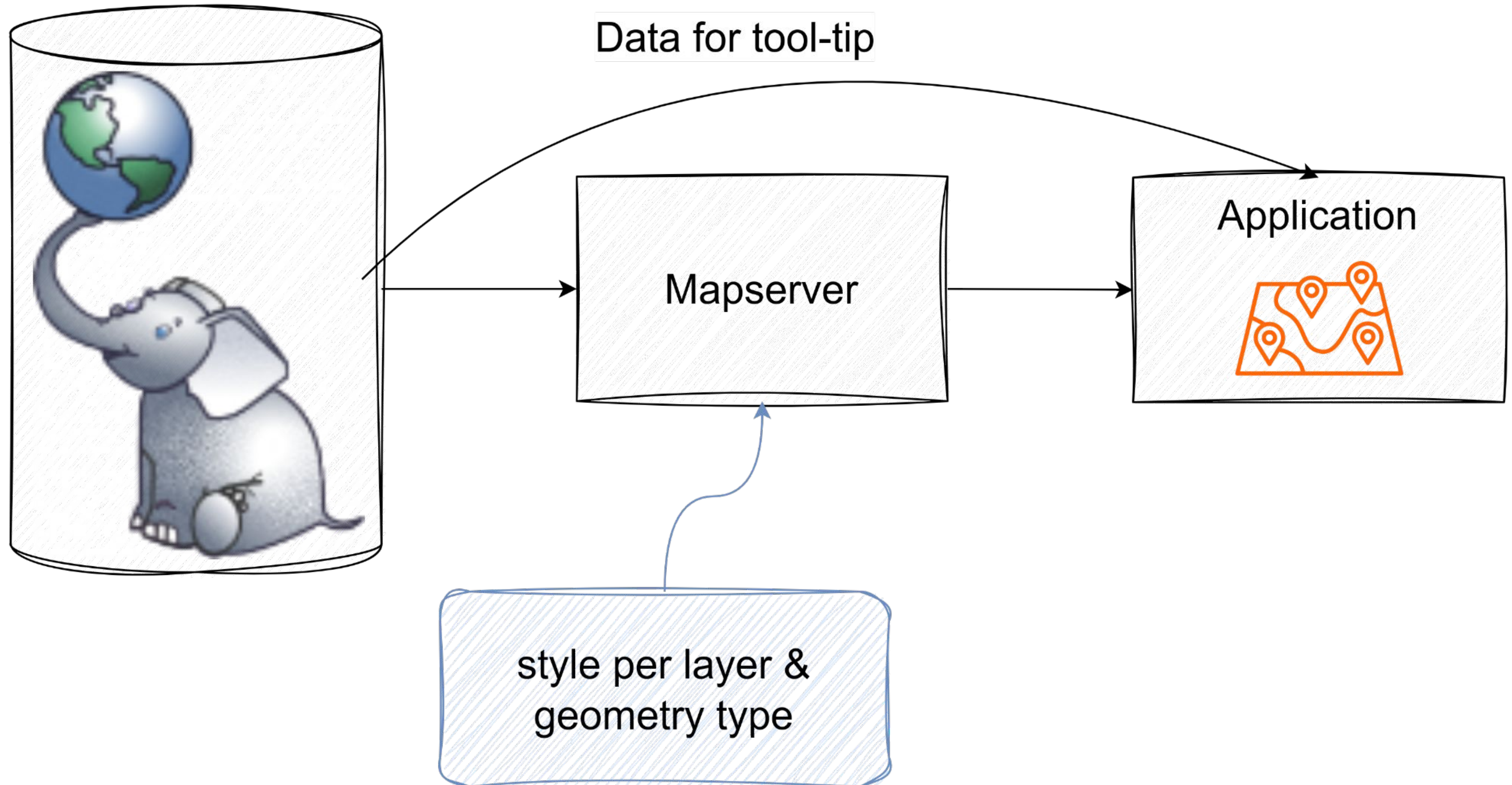
- Share
- Print
- Draw & Measure on map
- Advanced tools
- Geocatalog Change topic
- Maps displayed
 - Cableways with a federal licence
 - Closures Hiking trails
 - Hiking trails
 - Journey through time - Maps 1864

Looking for more maps?
Close menu

© Data: swisstopo
geo.admin.ch Terms of Use

50 km CH1903+ / LV95

Swisstopo: A large GDI



Swisstopo: A large GDI



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Confederazione Svizzera
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In collaboration with the cantons

Temperature 2 m, 10 min

- Share
- Print
- Draw & Measure on map
- Advanced tools
- Geocatalog [Change topic](#)
- Maps displayed
 - Temperature 2 m, 10 min
 - [Looking for more maps?](#)
- Configuration

Object information

Temperature 2 m, 10 min

Station name	Grenchen (GRE)
Station type	Weather station
Data Owner	MeteoSwiss
Air temperature	8.6 °C (11.04.2024 21:40)
Measurement height	429.90 m (Height a. ground: 2.00 m)
Link	Information about this station

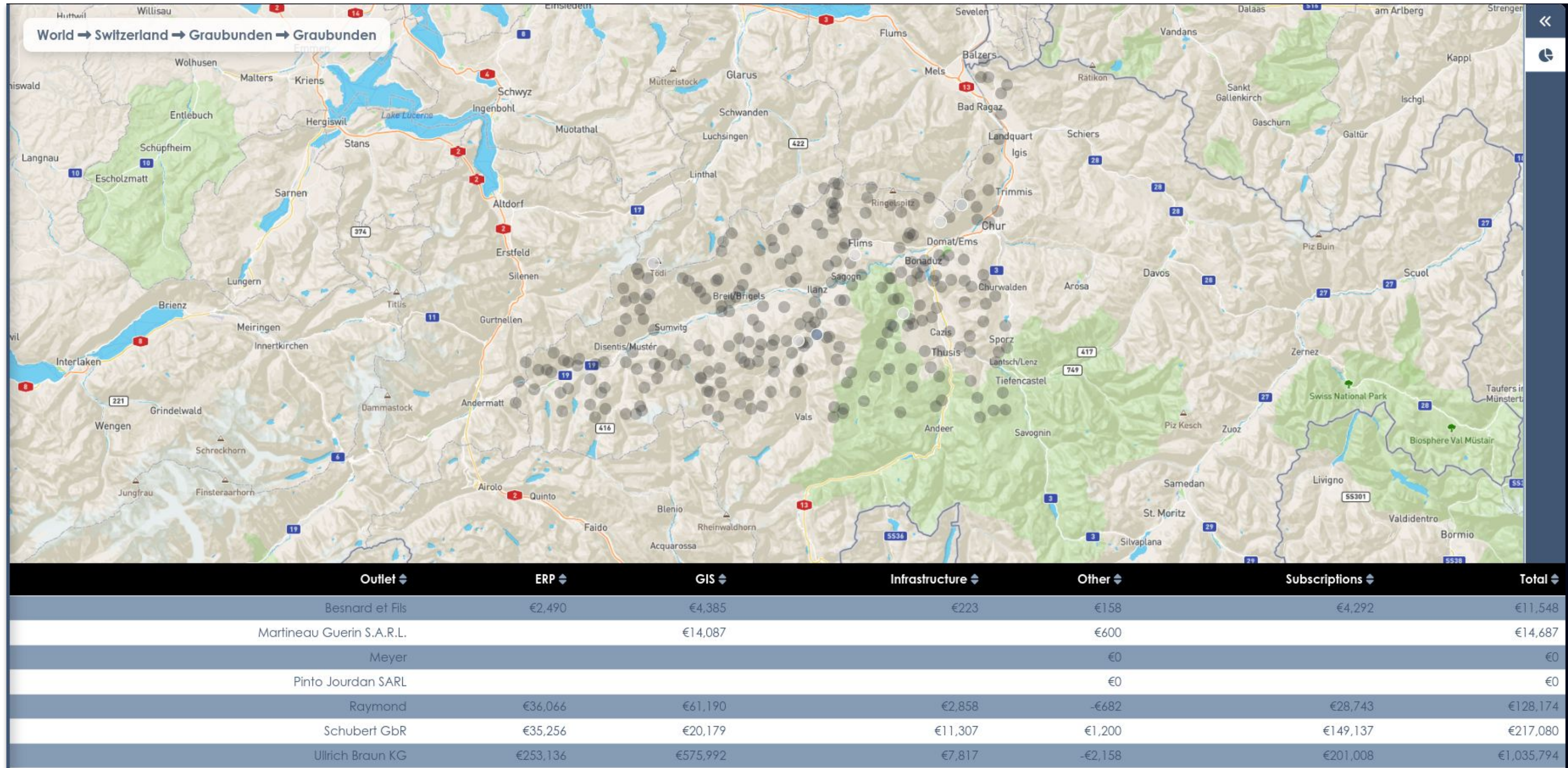
2'598'216.330, 1'225'348.450

Close menu

10 km CH1903+ / LV95

© Data: swisstopo, MeteoSwiss
geo.admin.ch Terms of Use

Aggregate Data with a Geospatial Relation

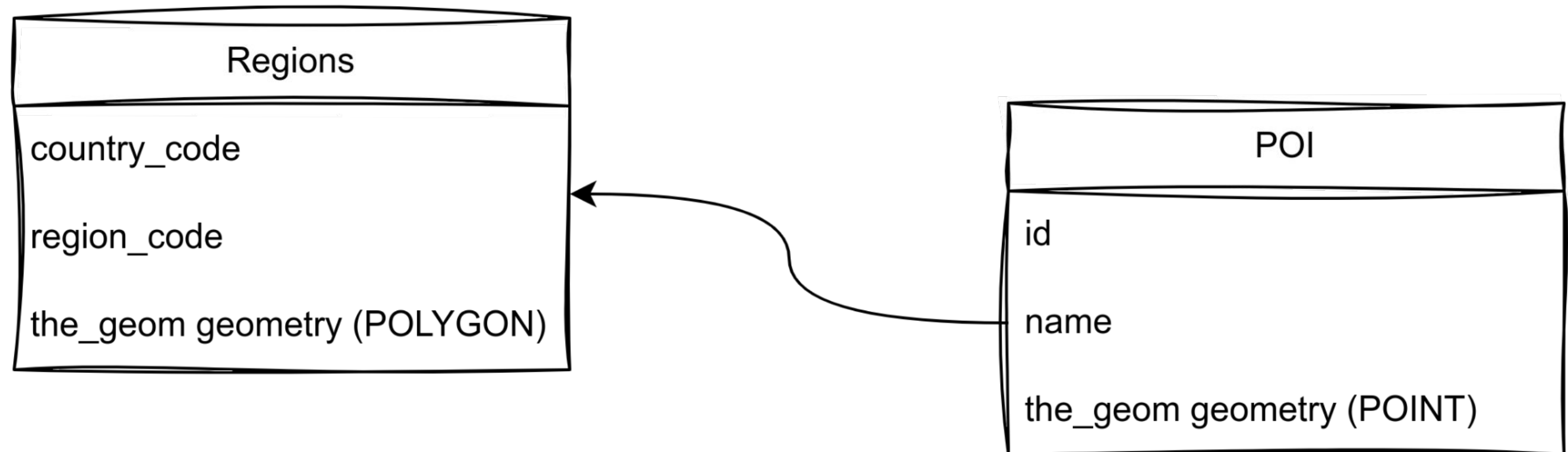


+ OpenStreetMap boundary data

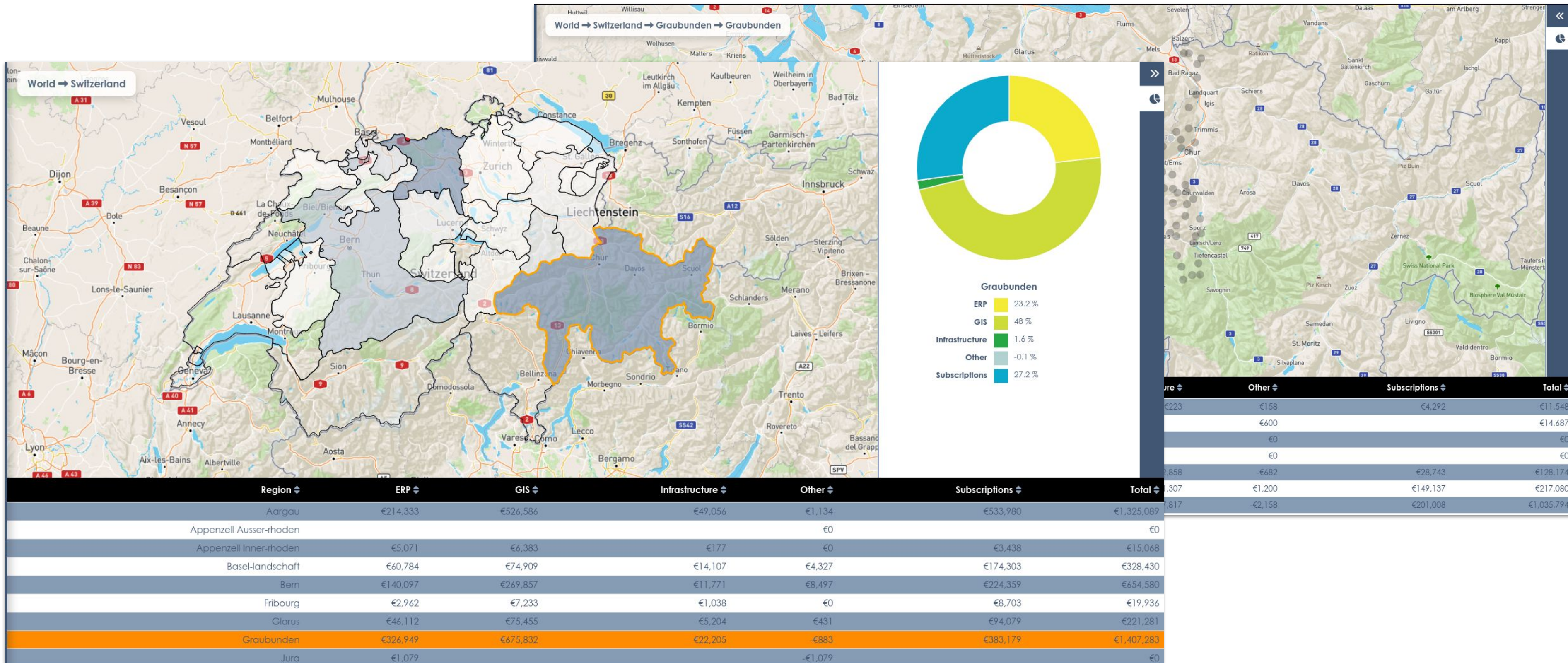
Aggregate Data with a Geospatial Relation



- Access data and styling through  OpenLayers
- Homogeneous tables



Aggregate Data with a Geospatial Relation



Data Analysis with Desktop Tools



The screenshot displays the QGIS desktop application window titled '*Leisure Themes - QGIS'. The interface includes a menu bar (Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, Processing, Help) and a toolbar with various GIS tools. On the left, the 'Browser' panel shows a file tree with folders like 'Favorites', 'Spatial Bookmarks', 'Project Home', and 'Home'. Below it, the 'Layers' panel lists several layers with checkboxes: 'Ice Skating', 'Zoo', 'Swimming Pool', 'Amusement Park', 'Open Air Museums', 'Bayern', and 'OSM Standard'. The main map area shows a topographic map of Germany with numerous blue 'X' markers and brown building icons overlaid on the terrain. The status bar at the bottom indicates the current coordinate (1268273,6229208), scale (1:1855833), magnifier (100%), rotation (0.0°), and render status.

Thanks for your attention.



<https://github.com/camptocamp>



<https://www.camptocamp.com>

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marion.baumgartner@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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