



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**



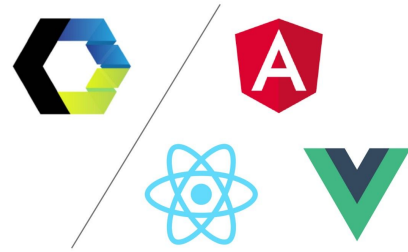
Open Source Geospatial Software



20+ years contributions



Geospatial Open Source Software stack



This Presentation



Why PostGIS

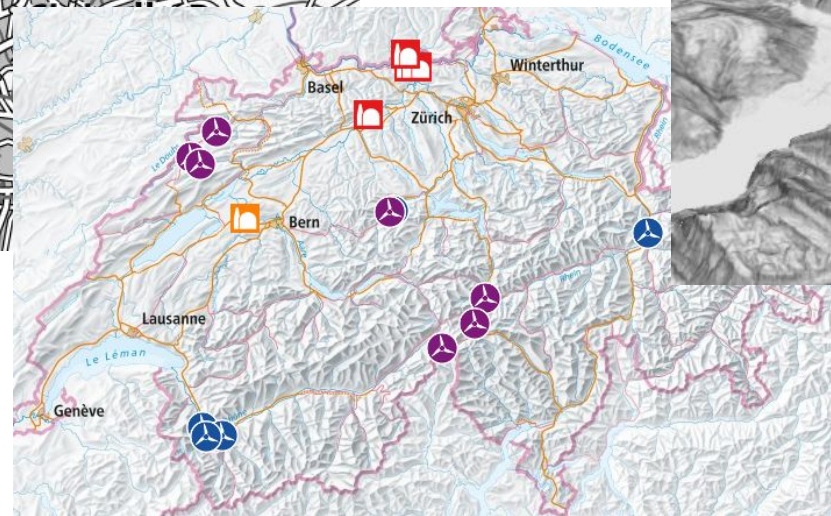
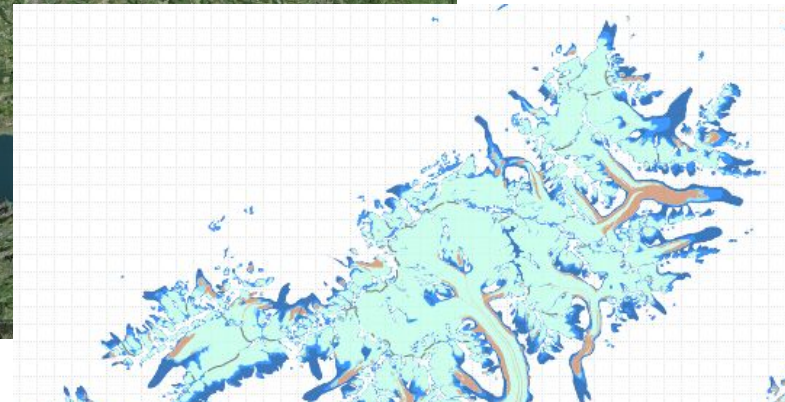
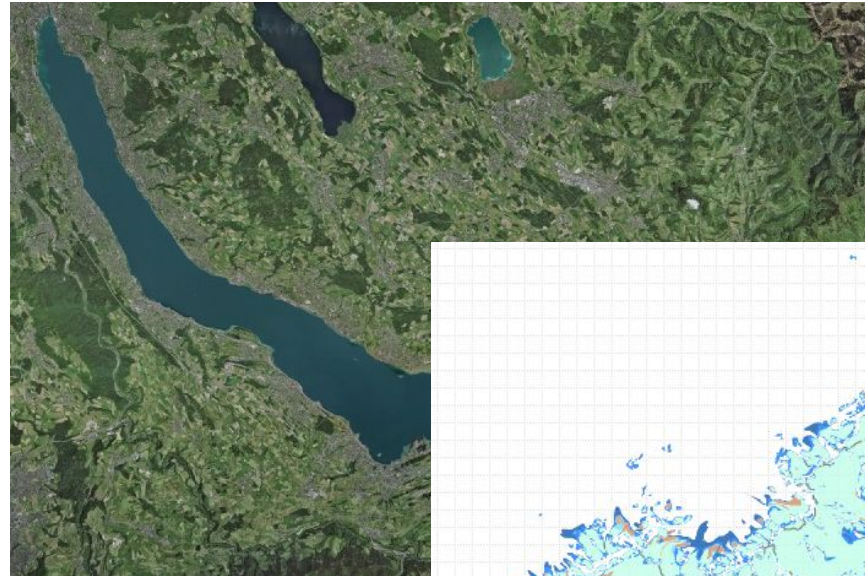


The Data Model

Harvesting the Data



What is geodata?



Any data with spatial information!

What is the format of geodata?



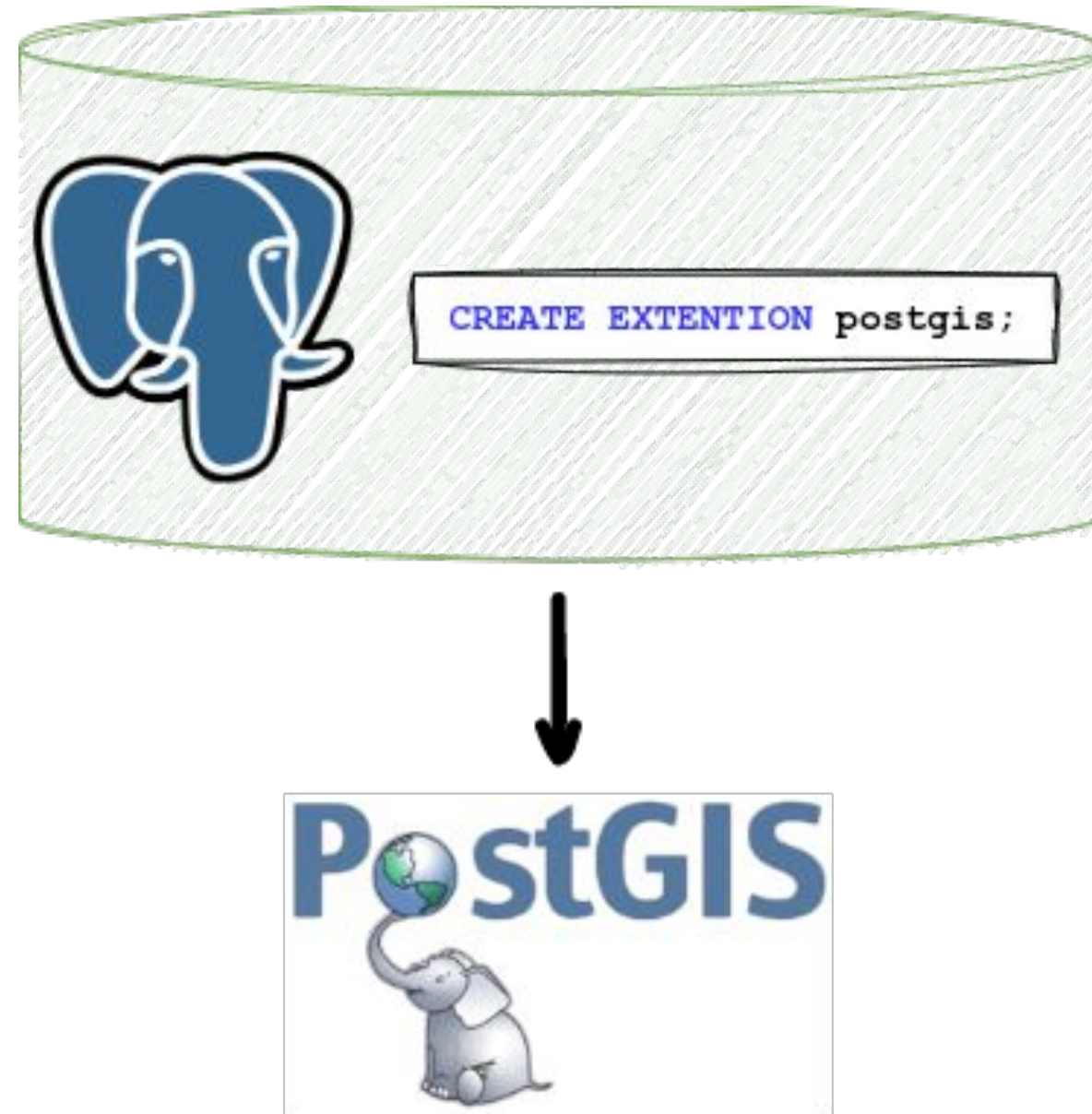
osm
GML
topojson
KML
GDB
geotiff
shp
GPX
jpg
NetCDF
GeoPackage
CSV





Why PostGIS

What is PostGIS?



PostGIS is a spatial database:

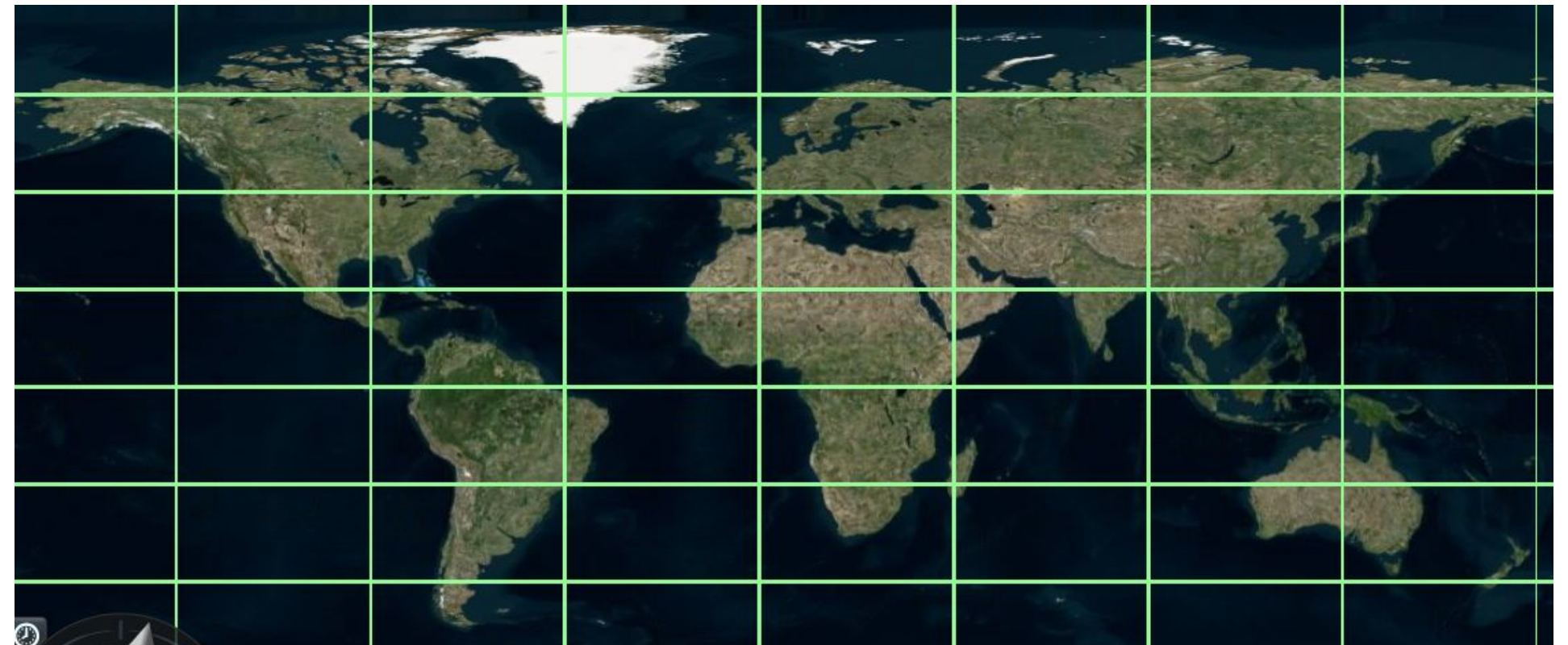
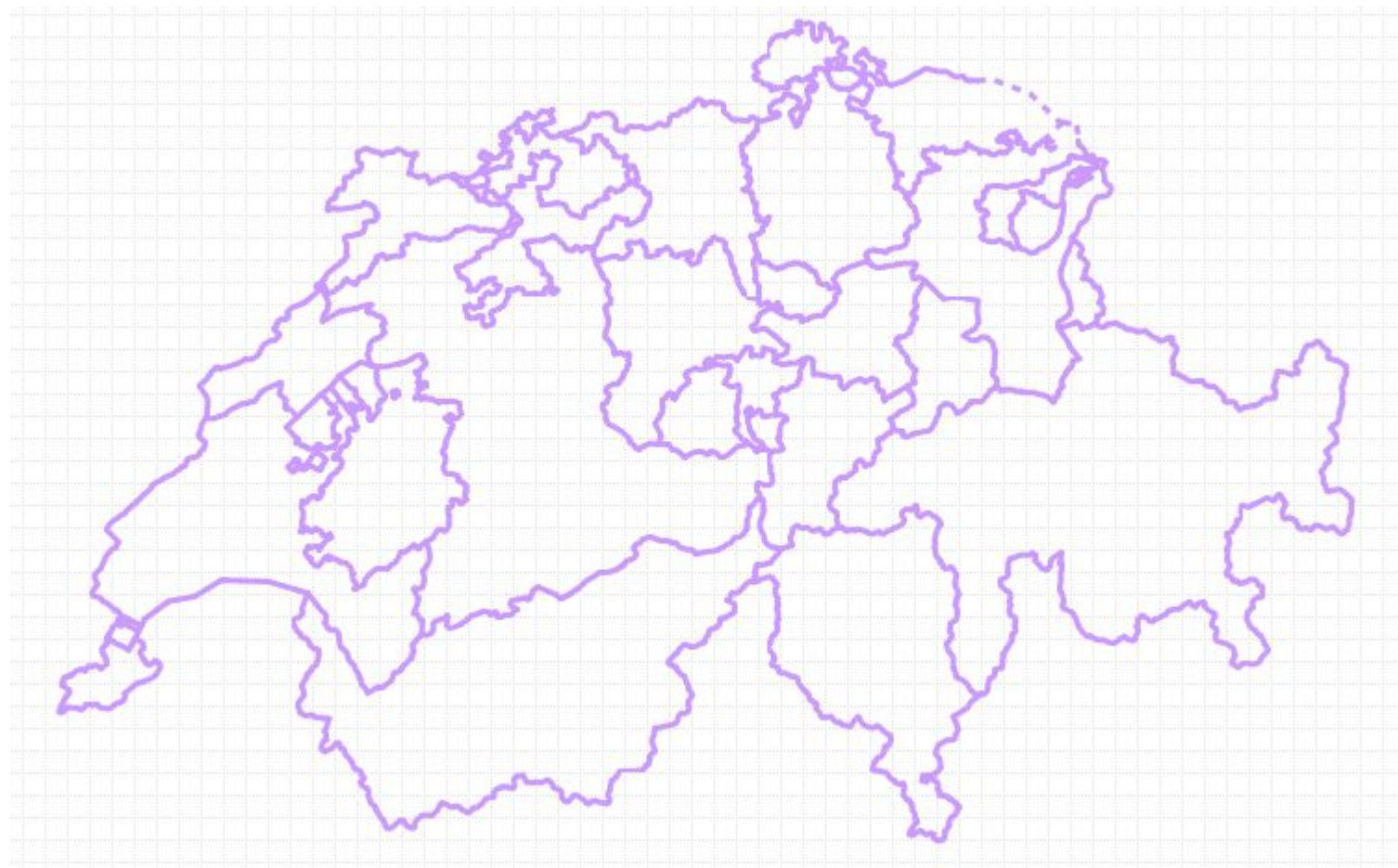
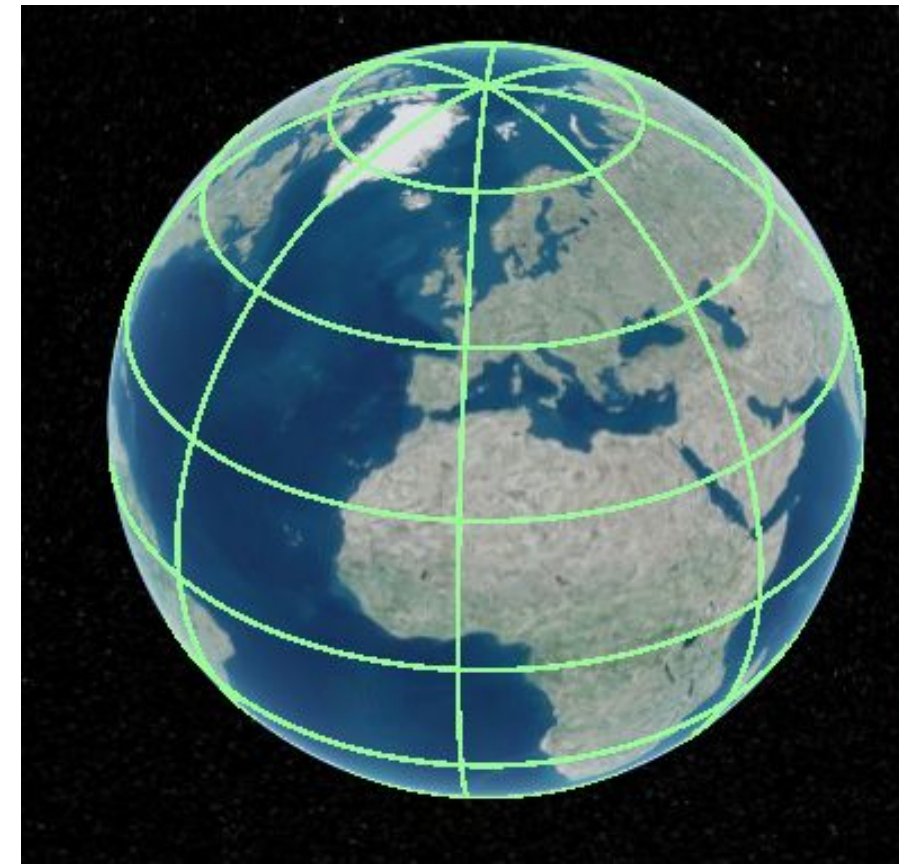
- Spatial data types
 - geometry (point, lines, polygons)
 - raster
- Spatial indexing
 - Optimised for spatially related data
- Spatial functions
 - ST_...

Data Types



Vector data

- geography
- geometry



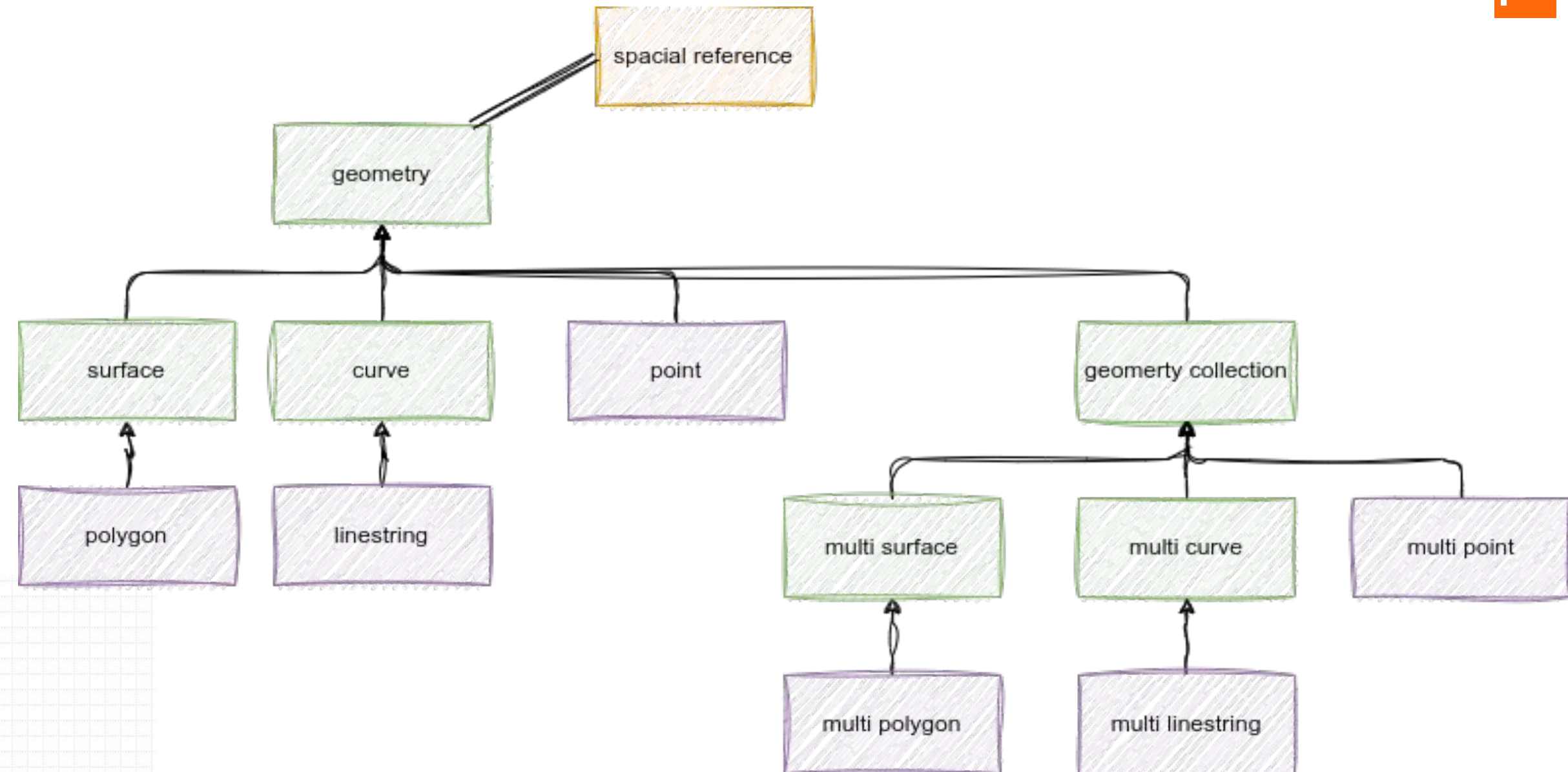
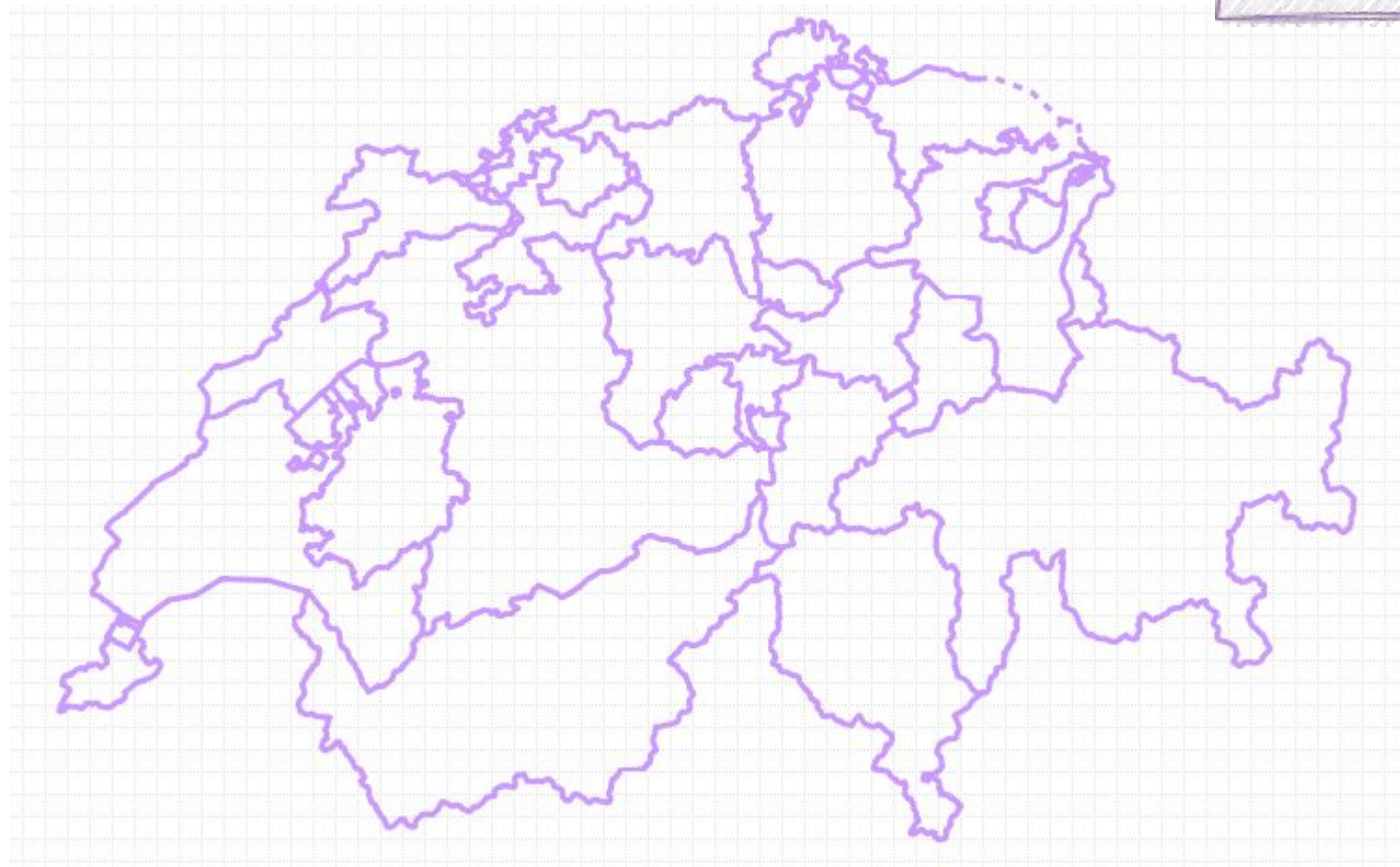
<https://sandcastle.cesium.com/>

Data Types



Vector data

- geography
- geometry



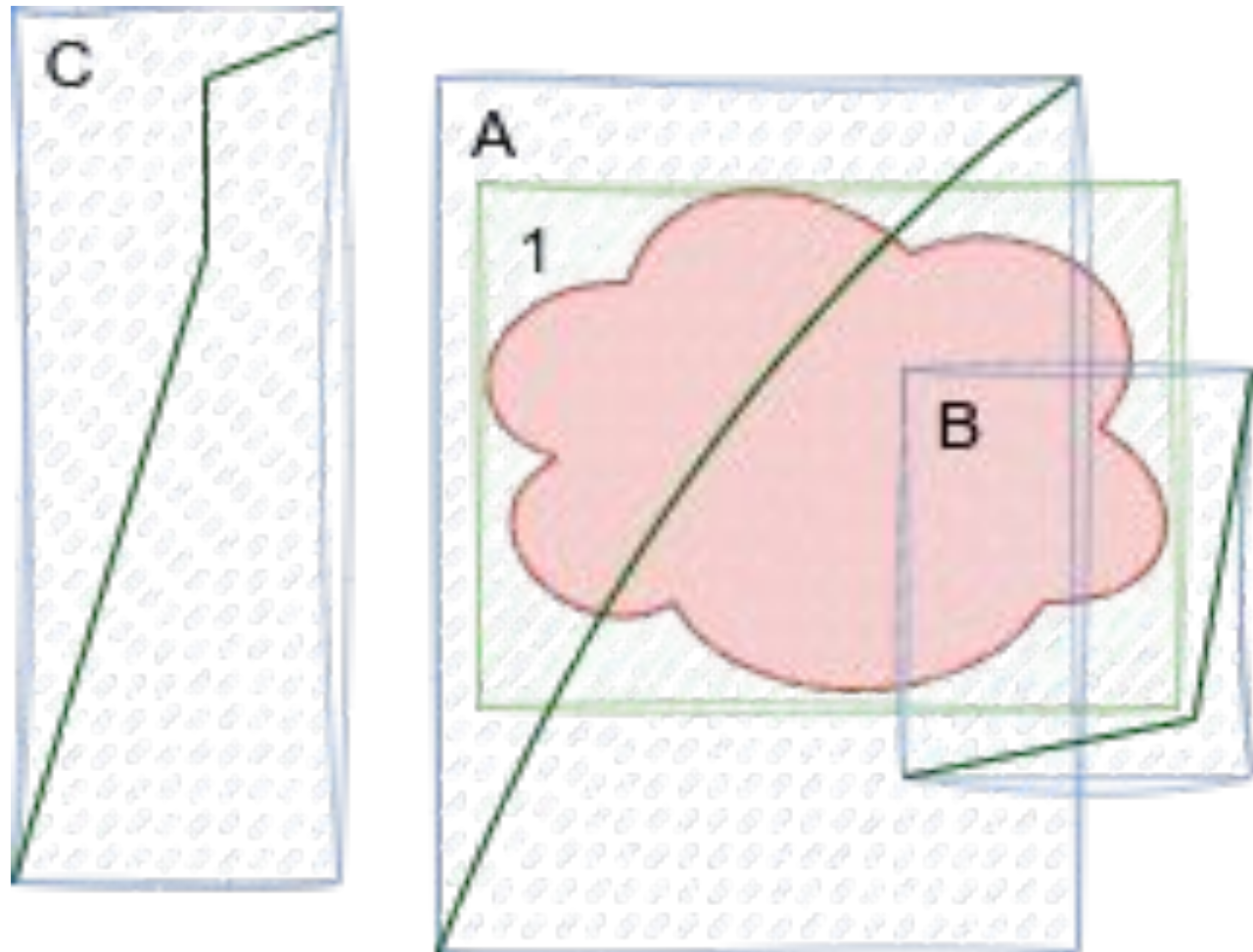
Data Types



Raster data



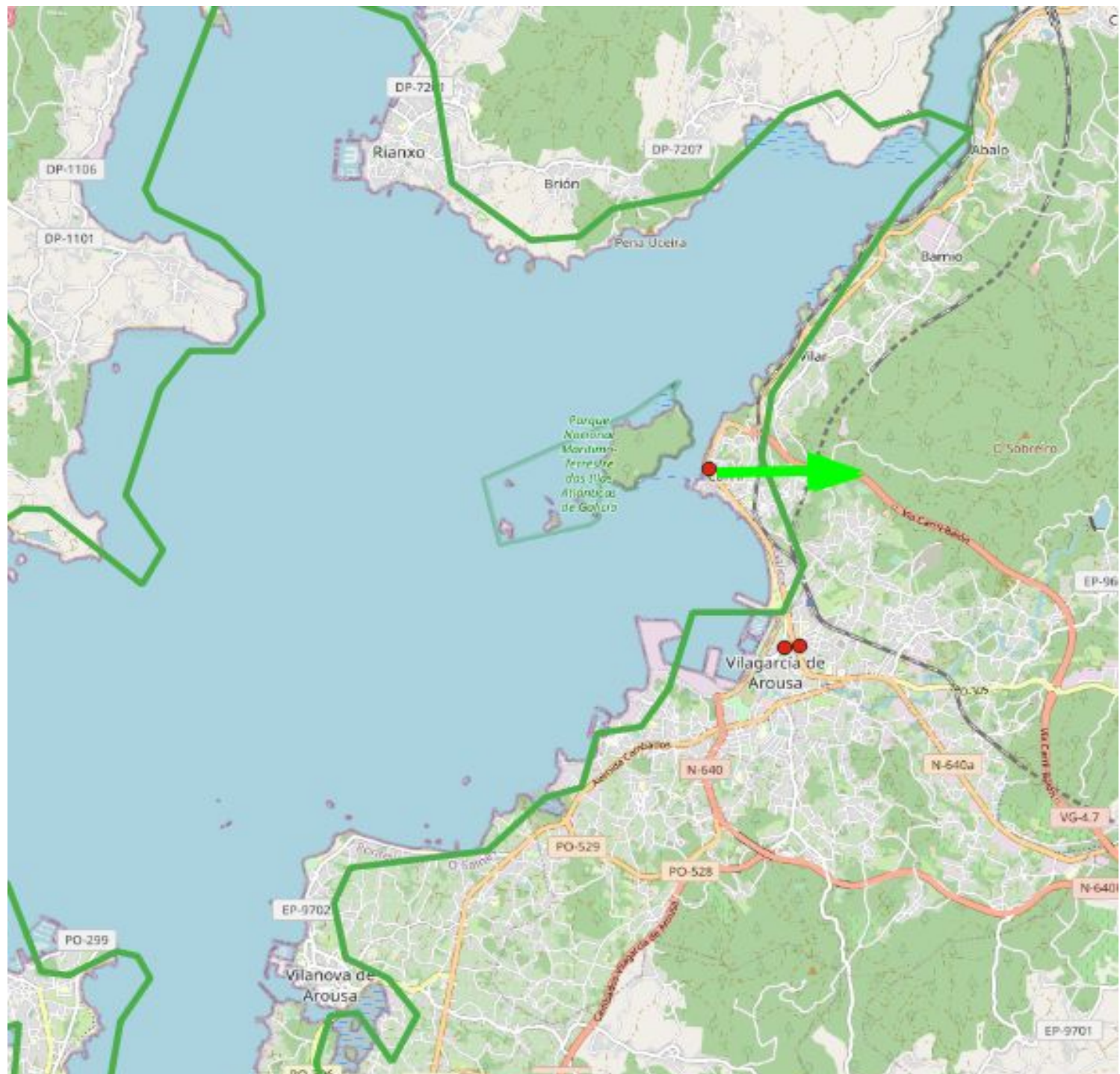
Spatial indexes



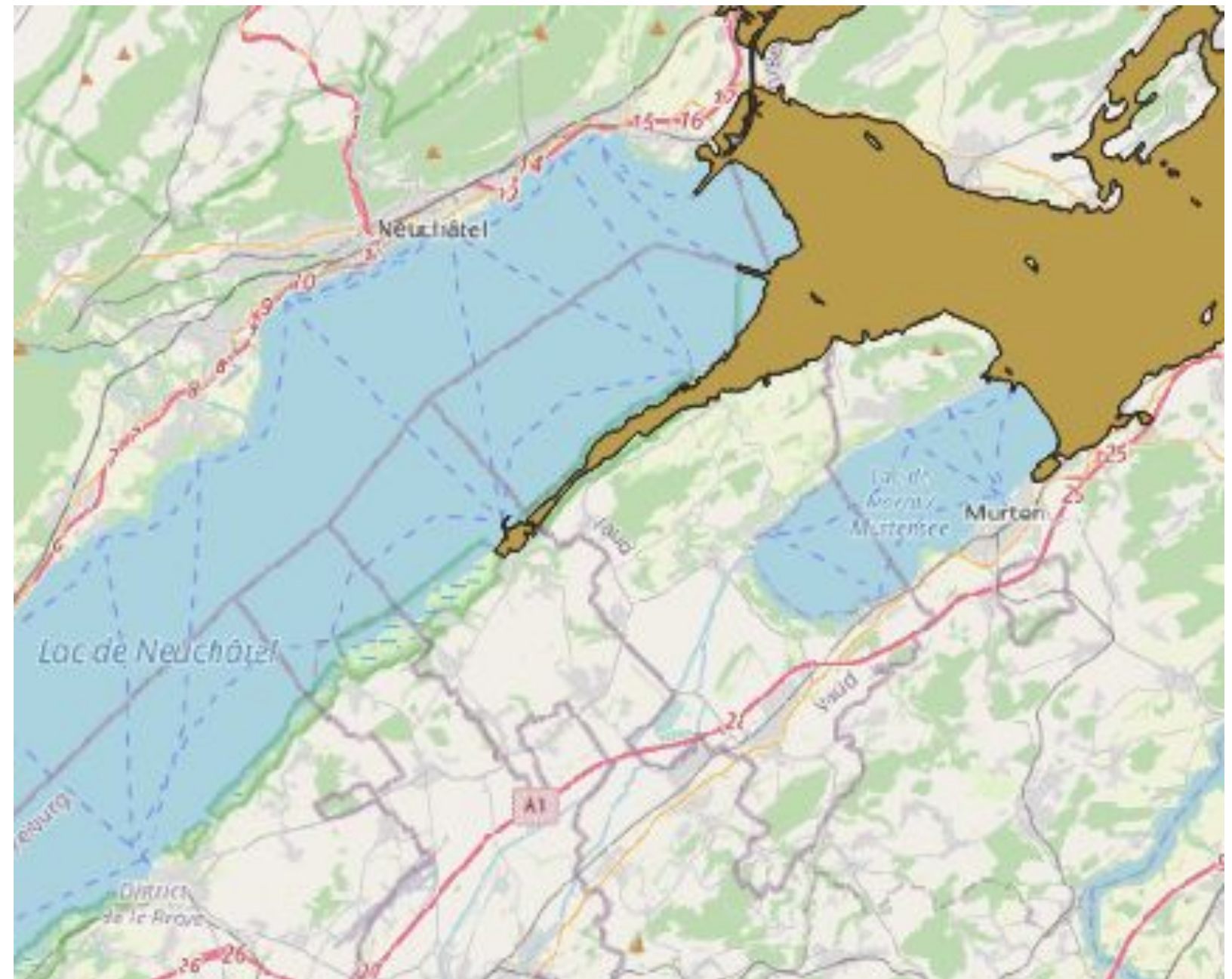
Spatial functions



`ST_Distance`(geometry A, geometry B)



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

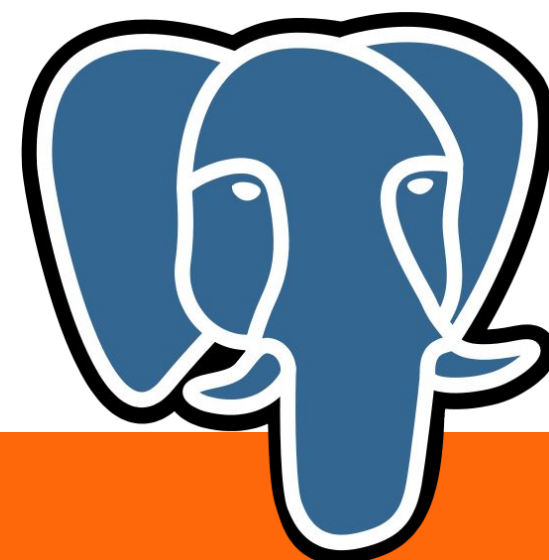


Why PostGIS?



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



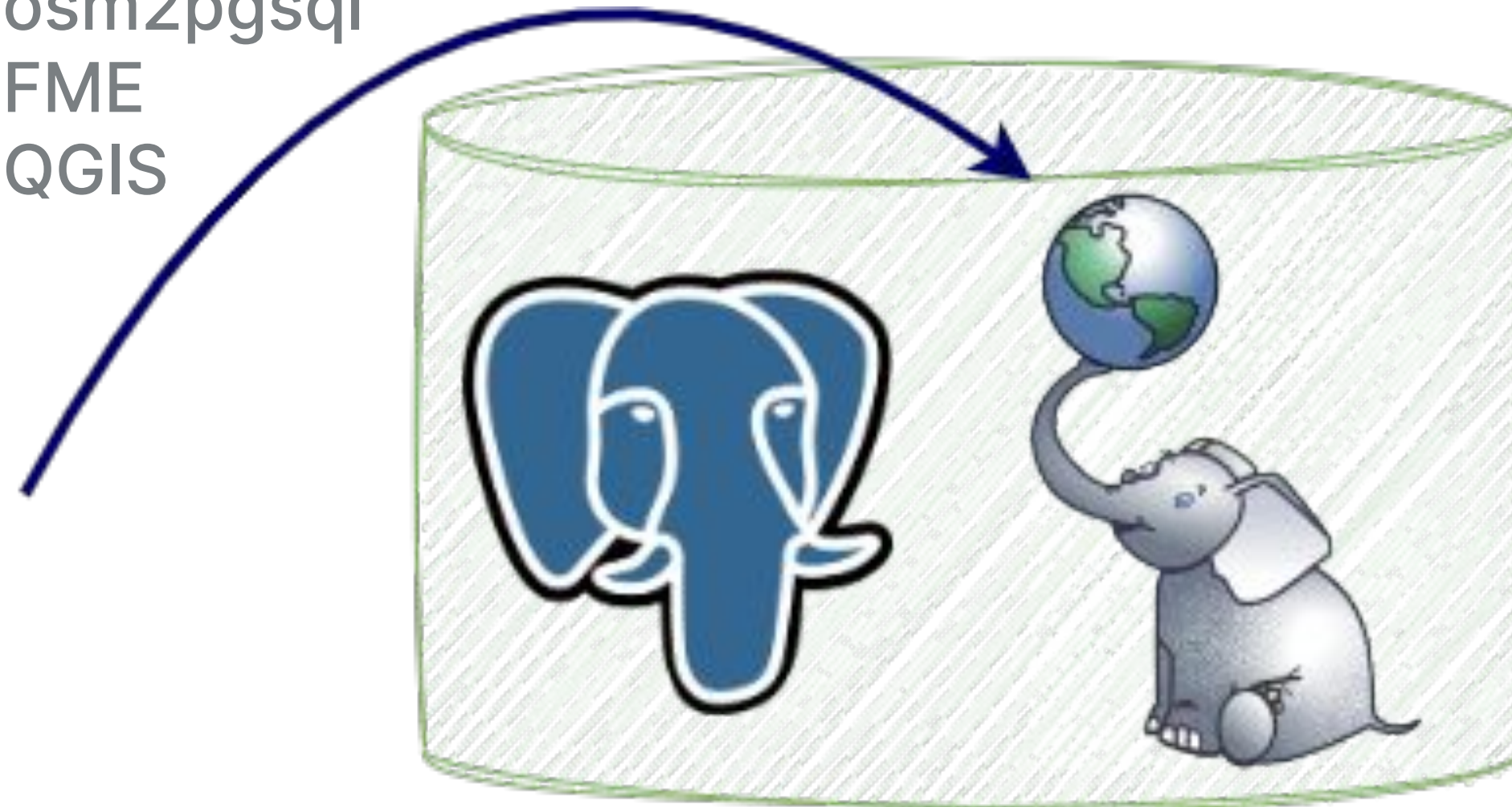


The Data Model

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

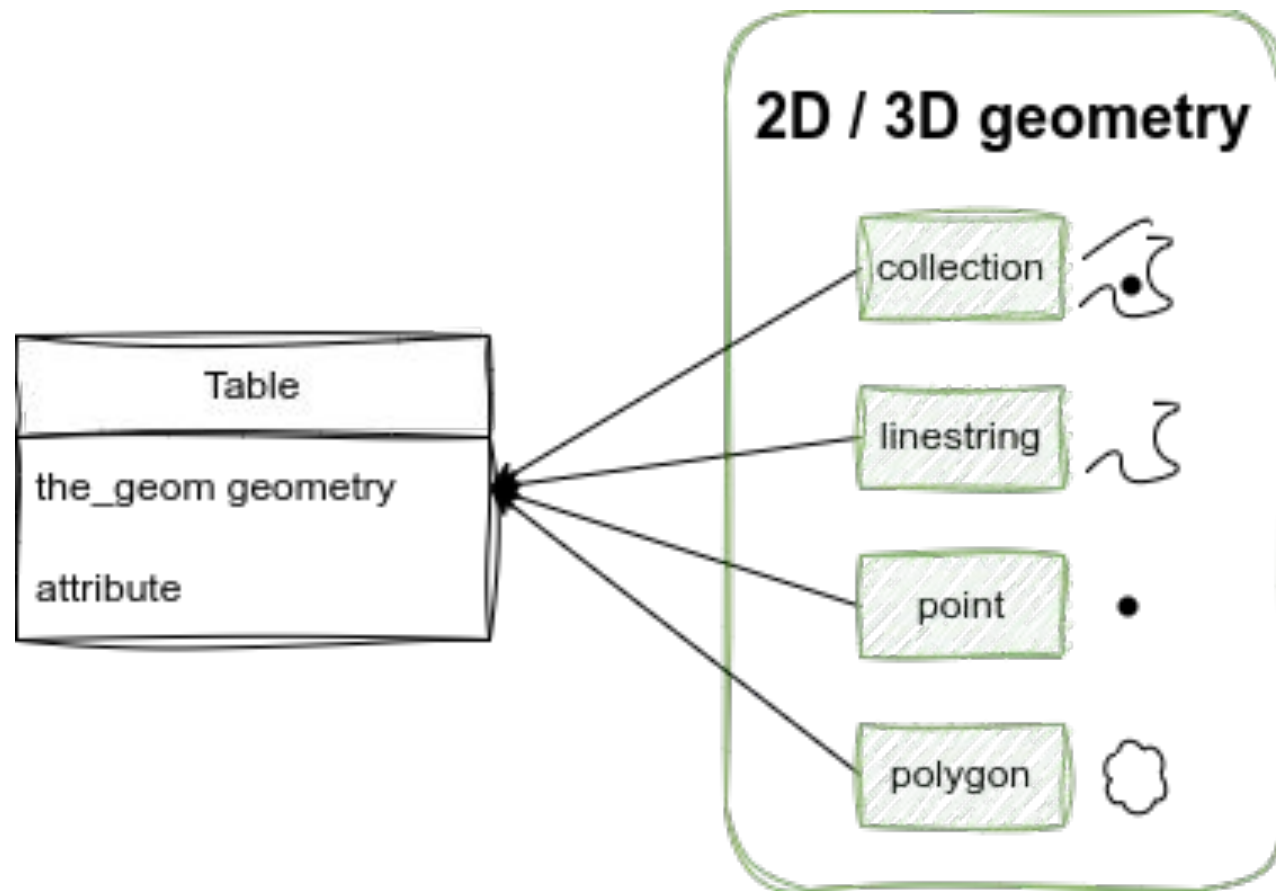
you are likely in trouble



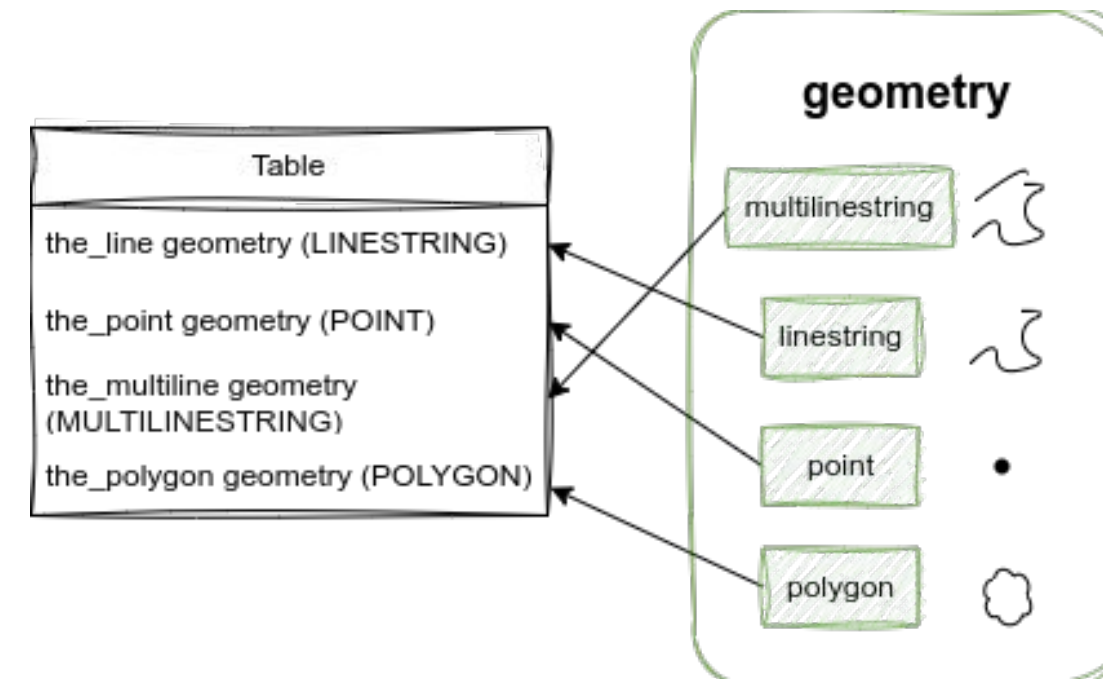
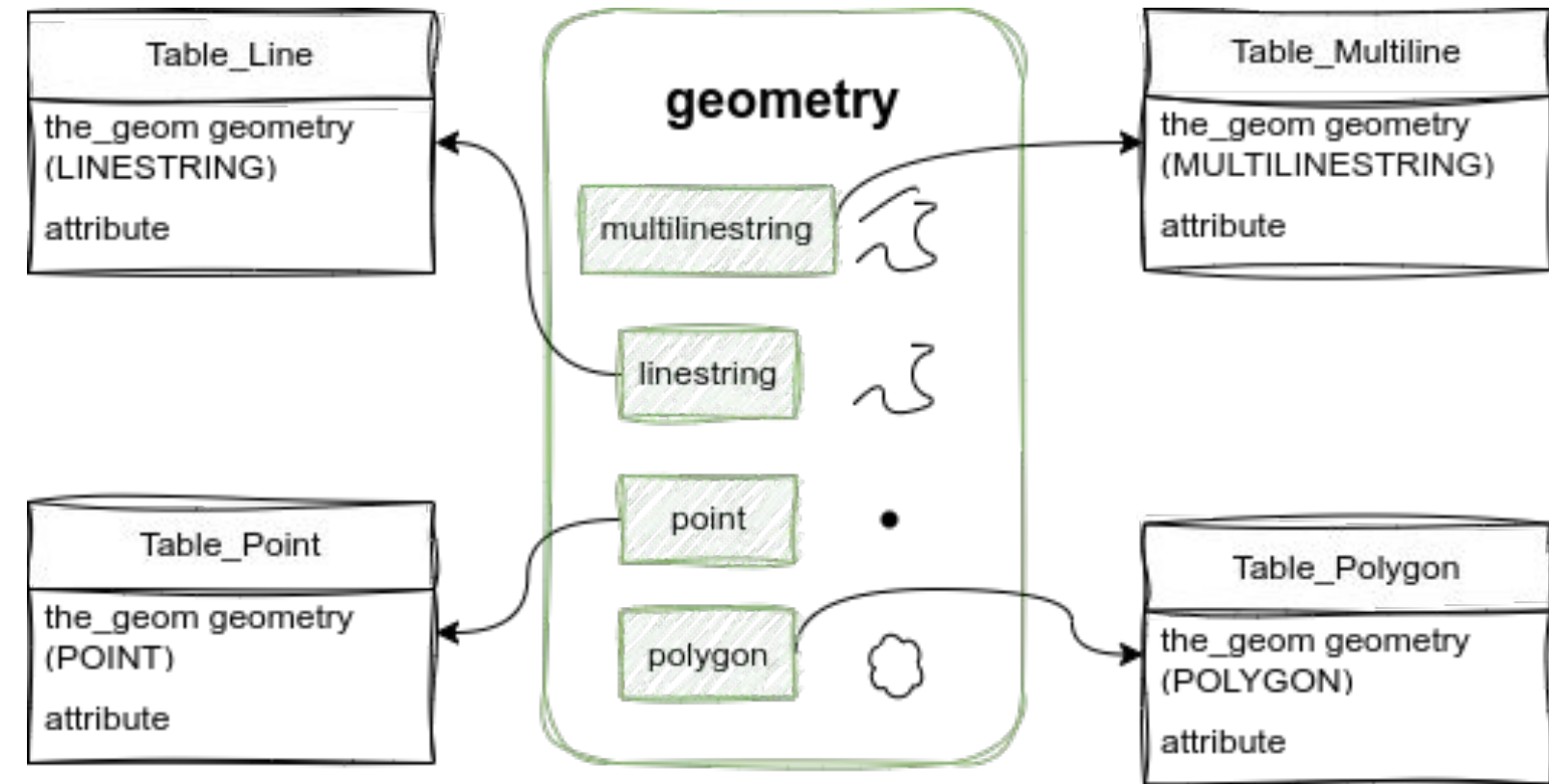
Geodata in a Table



Heterogeneous

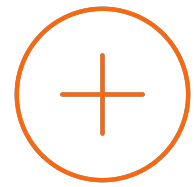
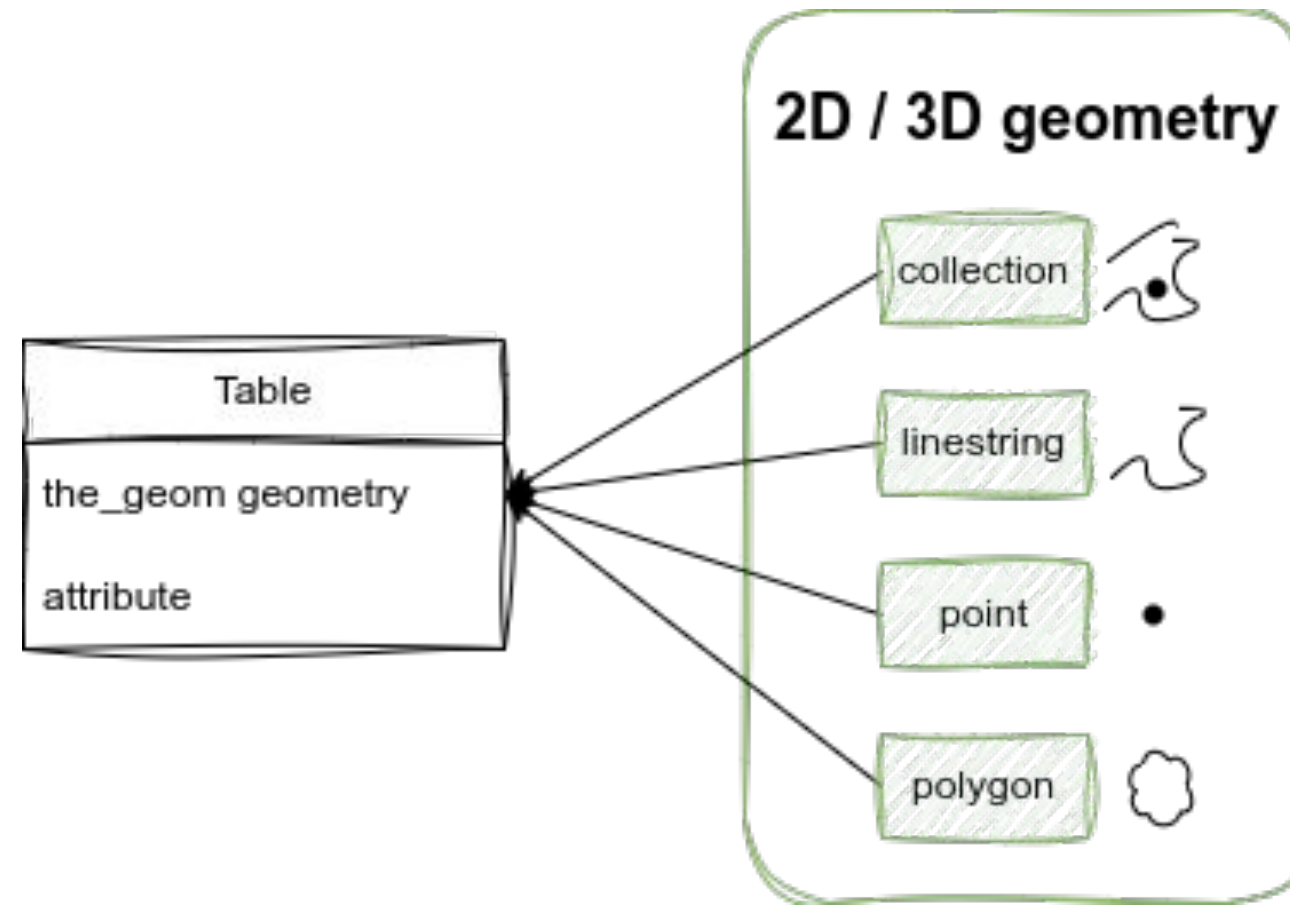


Homogeneous

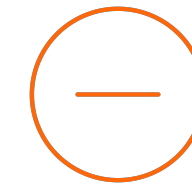


Heterogeneous

Pros & Cons

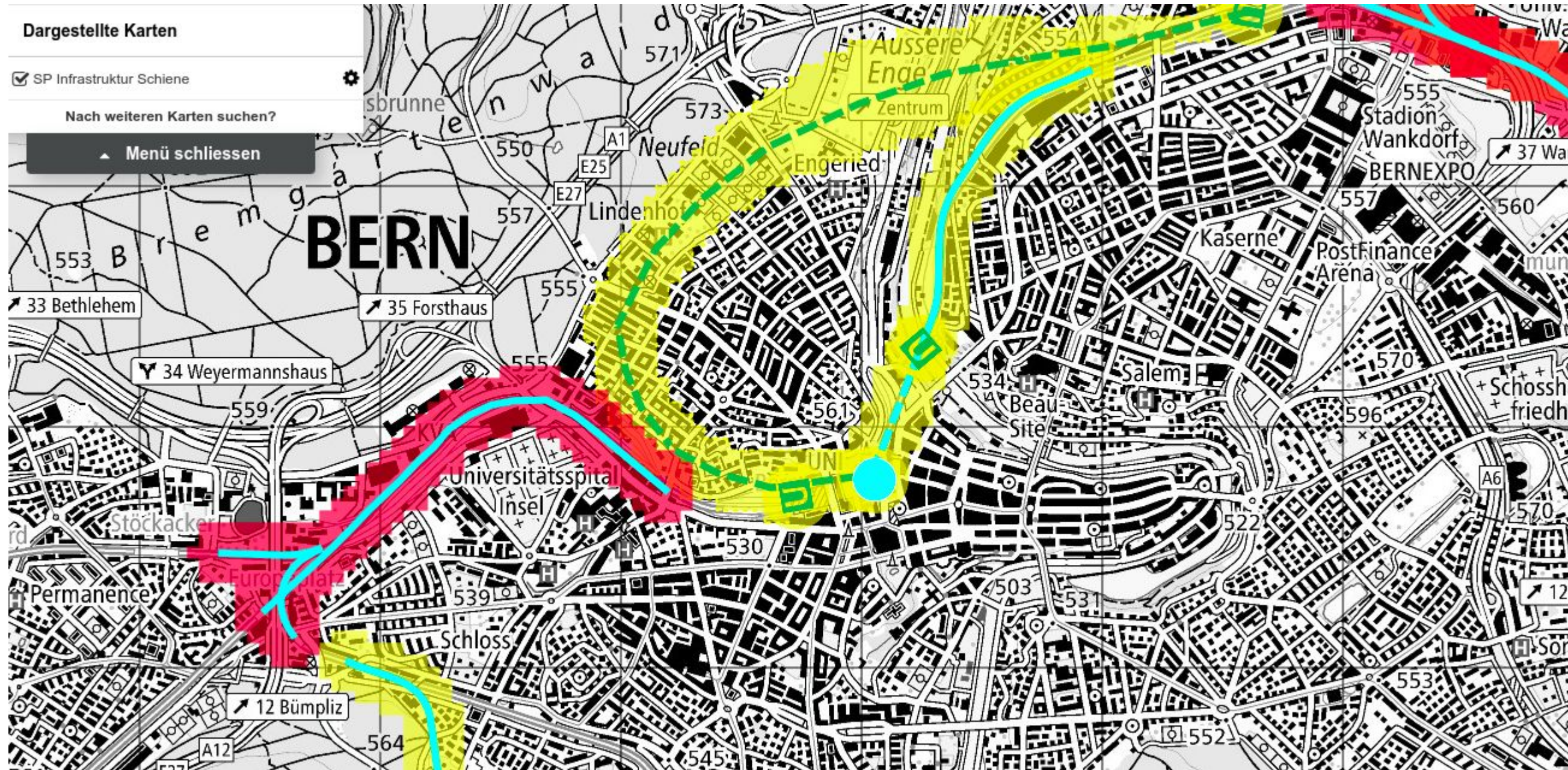


- Simple
 - query
 - model



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

Heterogeneous: Example



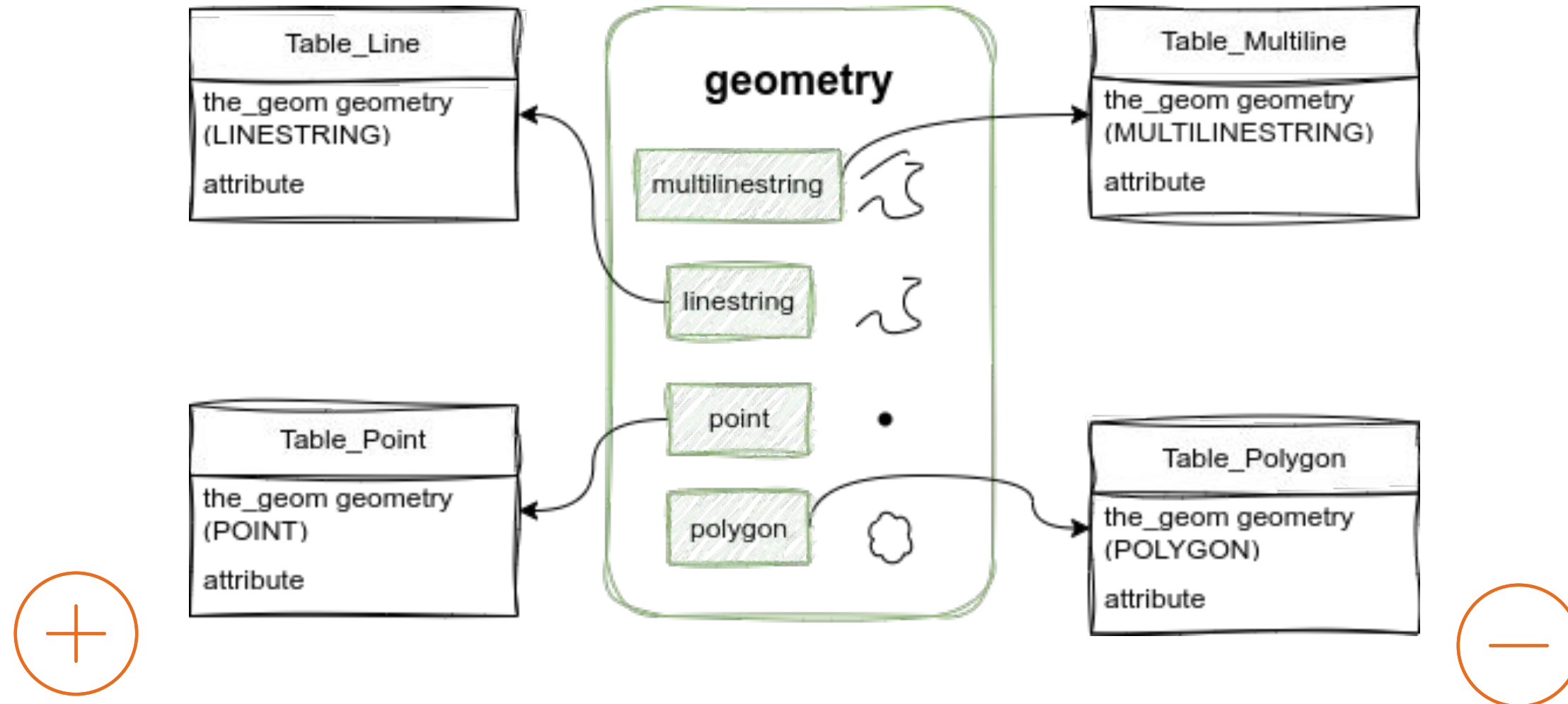
ST_GeometryType:

ST_MultiPolygon

ST_MultiPoint

ST_MultiLineString

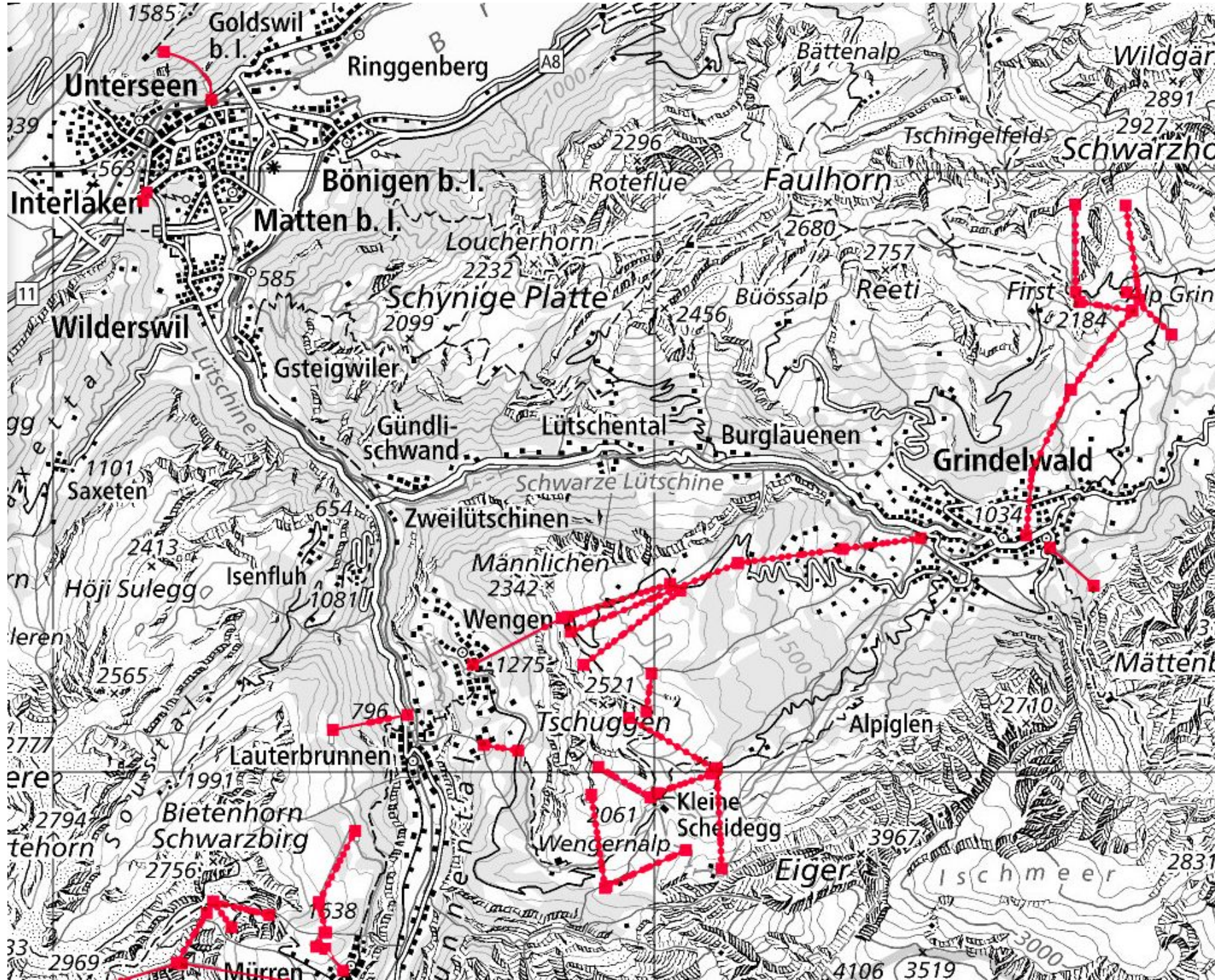
Homogeneous Pros & Cons



- 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

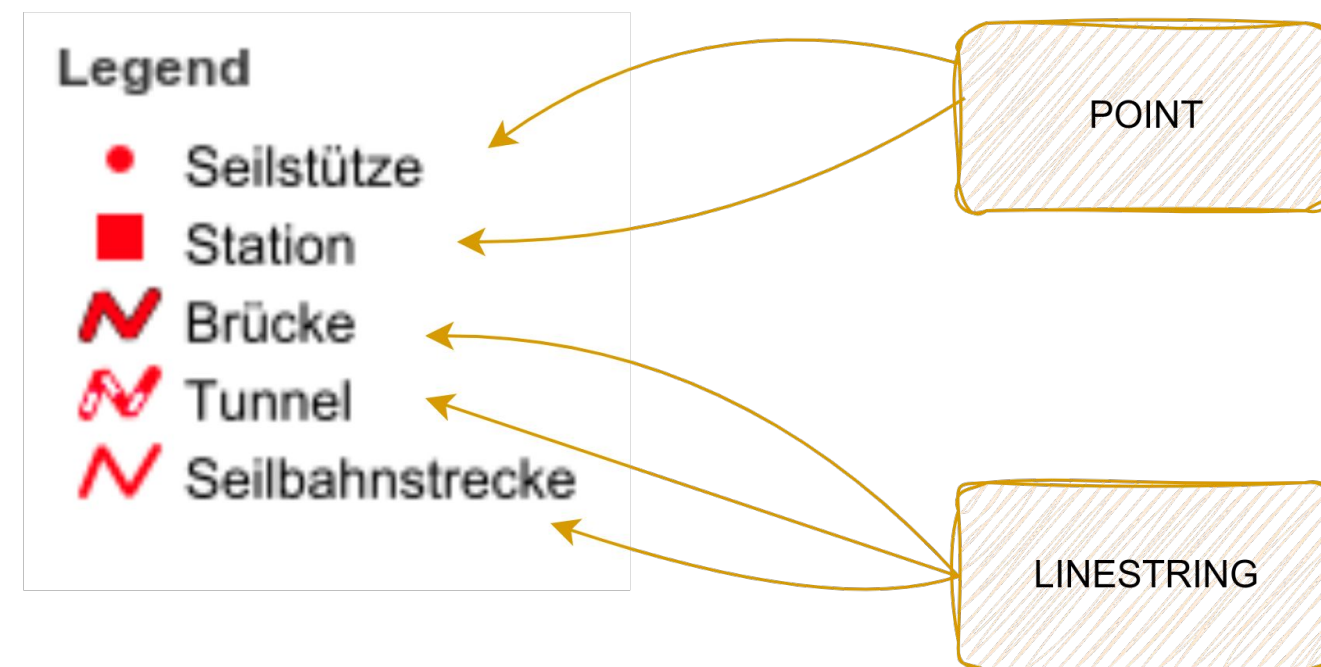


Table Inheritance

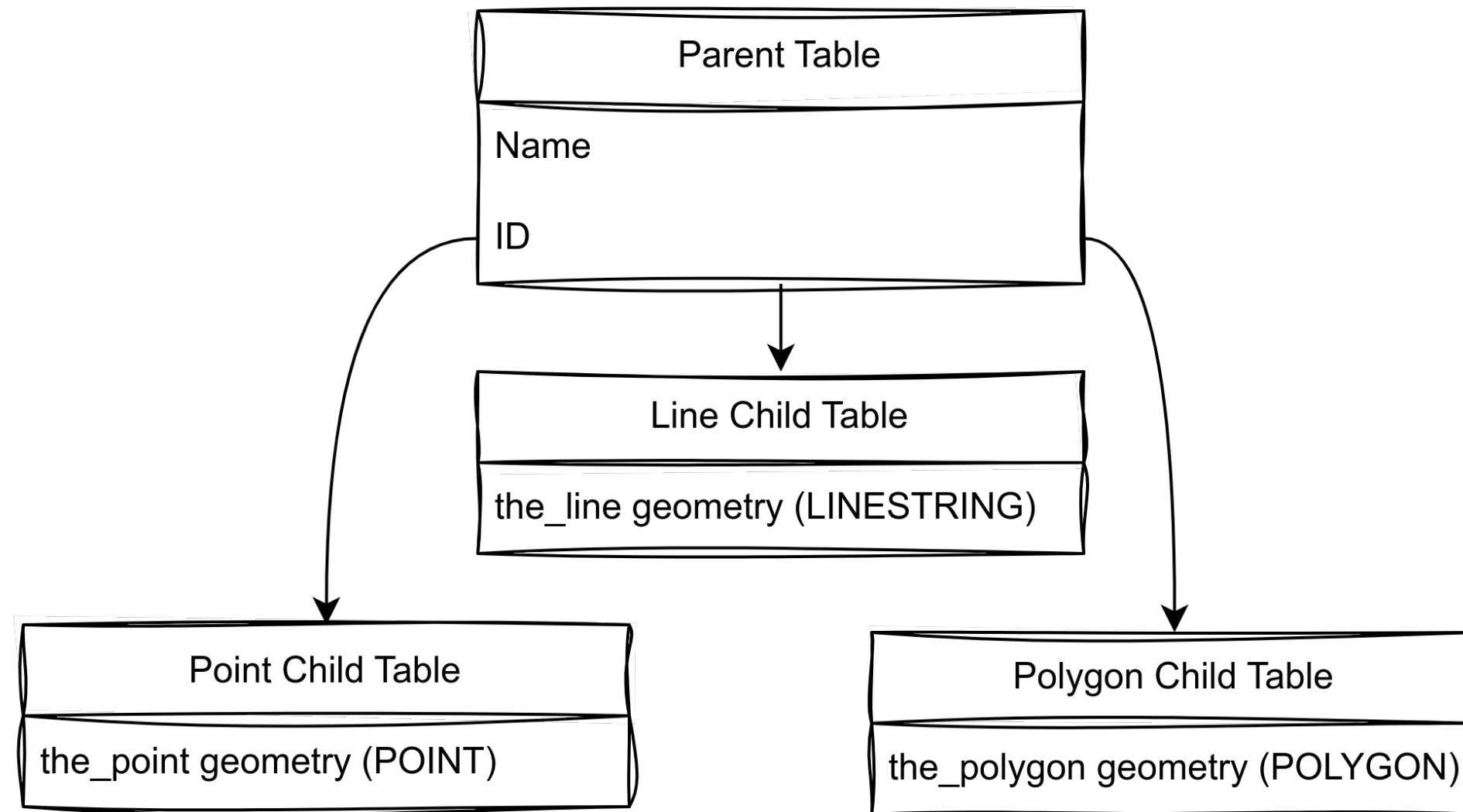
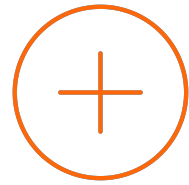
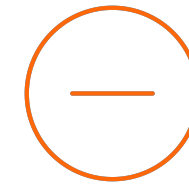


Table Inheritance

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

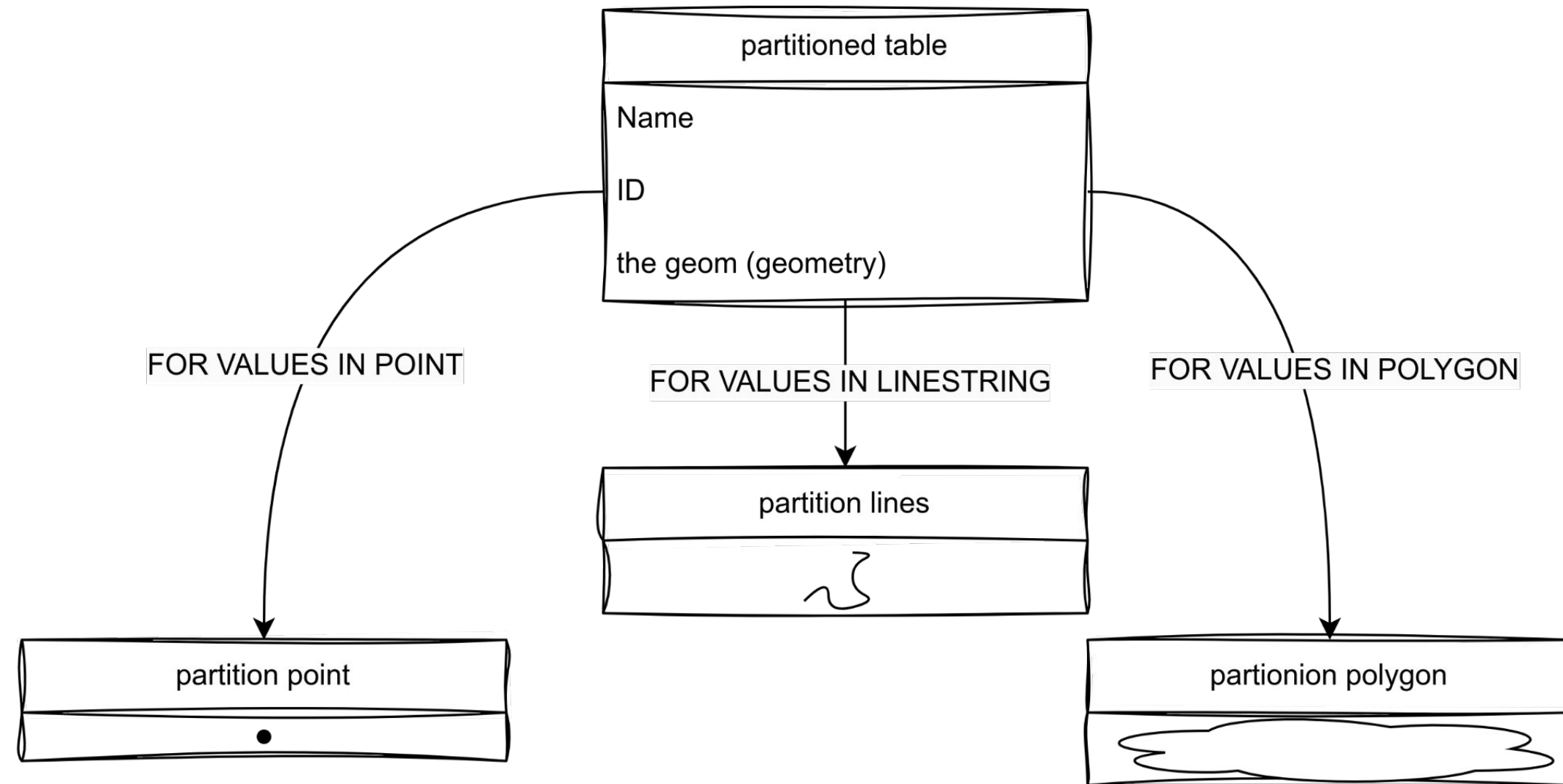
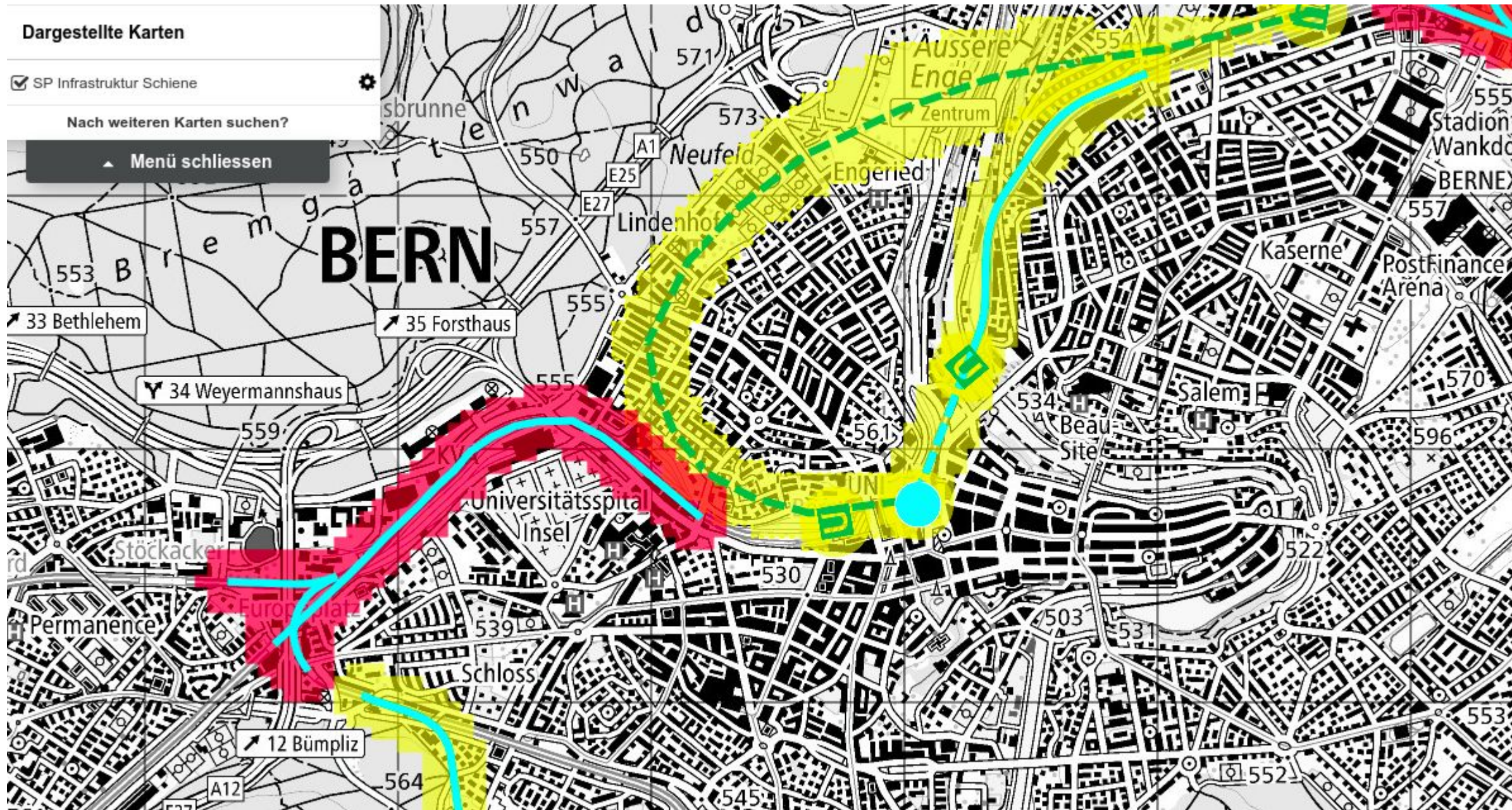


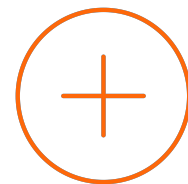
Table Partitioning: Example



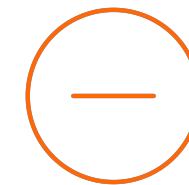
- partitioned_sis_pl_kraft
 - Columns
 - Constraints (2)
 - Indexes
 - Partitions (3)
 - part_line_sis
 - Constraints (3)
 - bgdi_geometry_valid_check_the_geom
 - enforce_dims_the_geom
 - line_sis_pl_kraft_pkey
 - Indexes
 - RLS Policies
 - Rules
 - Triggers
 - part_point_sis
 - RLS Policies
 - Rules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

Table Partitioning

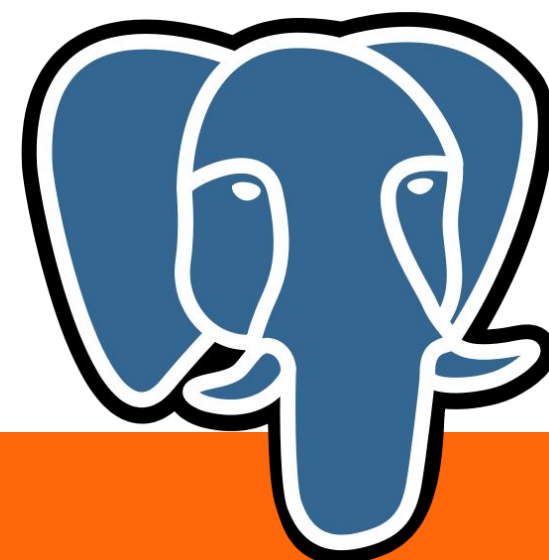
Pros & Cons



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

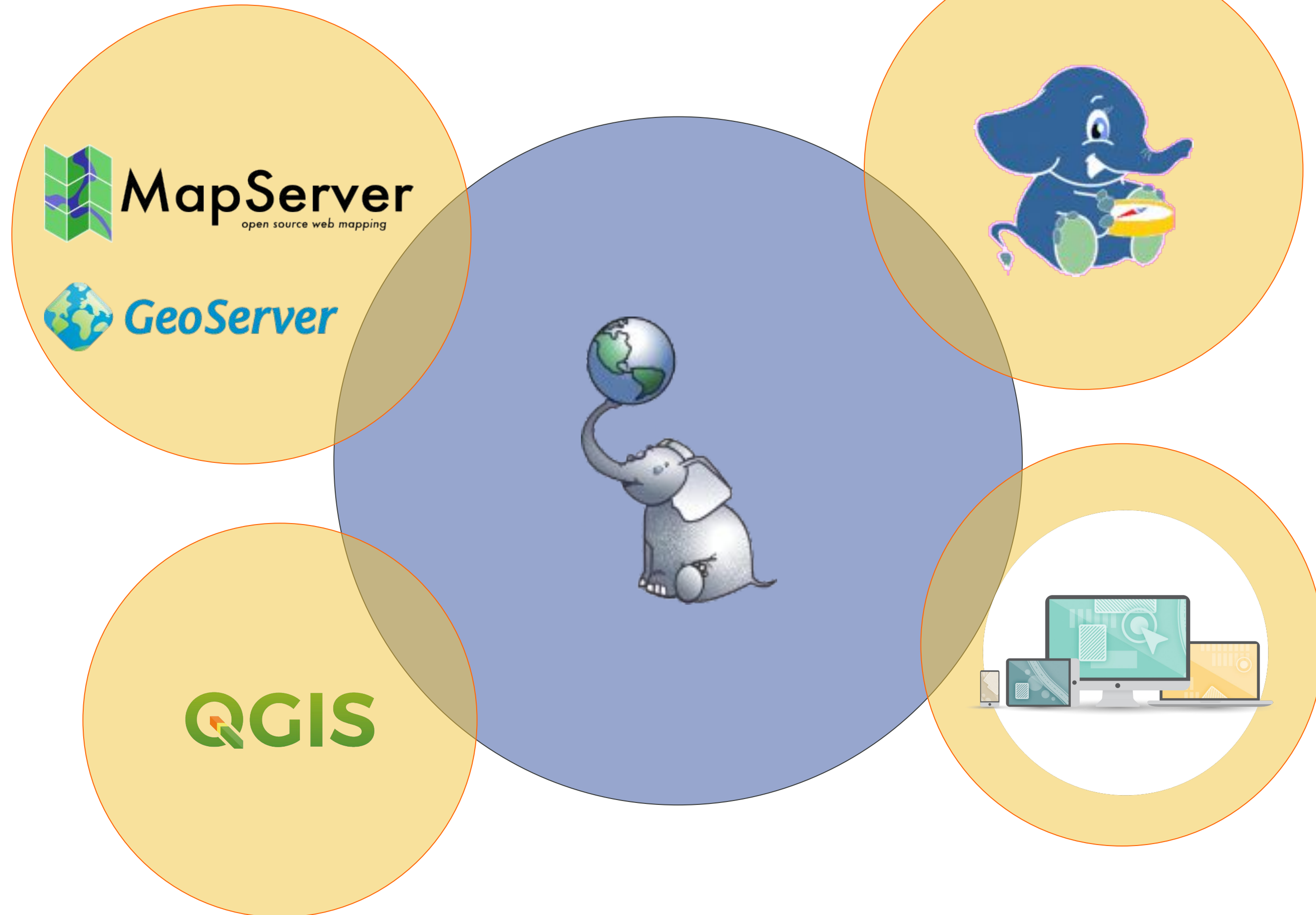


- Complex data model
- No additional columns in “sub-tables”
- better used with **huge** tables
- strategy/model needs to be predefined
- Partitioning keys are limited



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:
Try out test.map.geo.admin.ch Full screen Report problem Help Mobile version DE FR IT EN RM

Search for addresses, parcels or maps

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

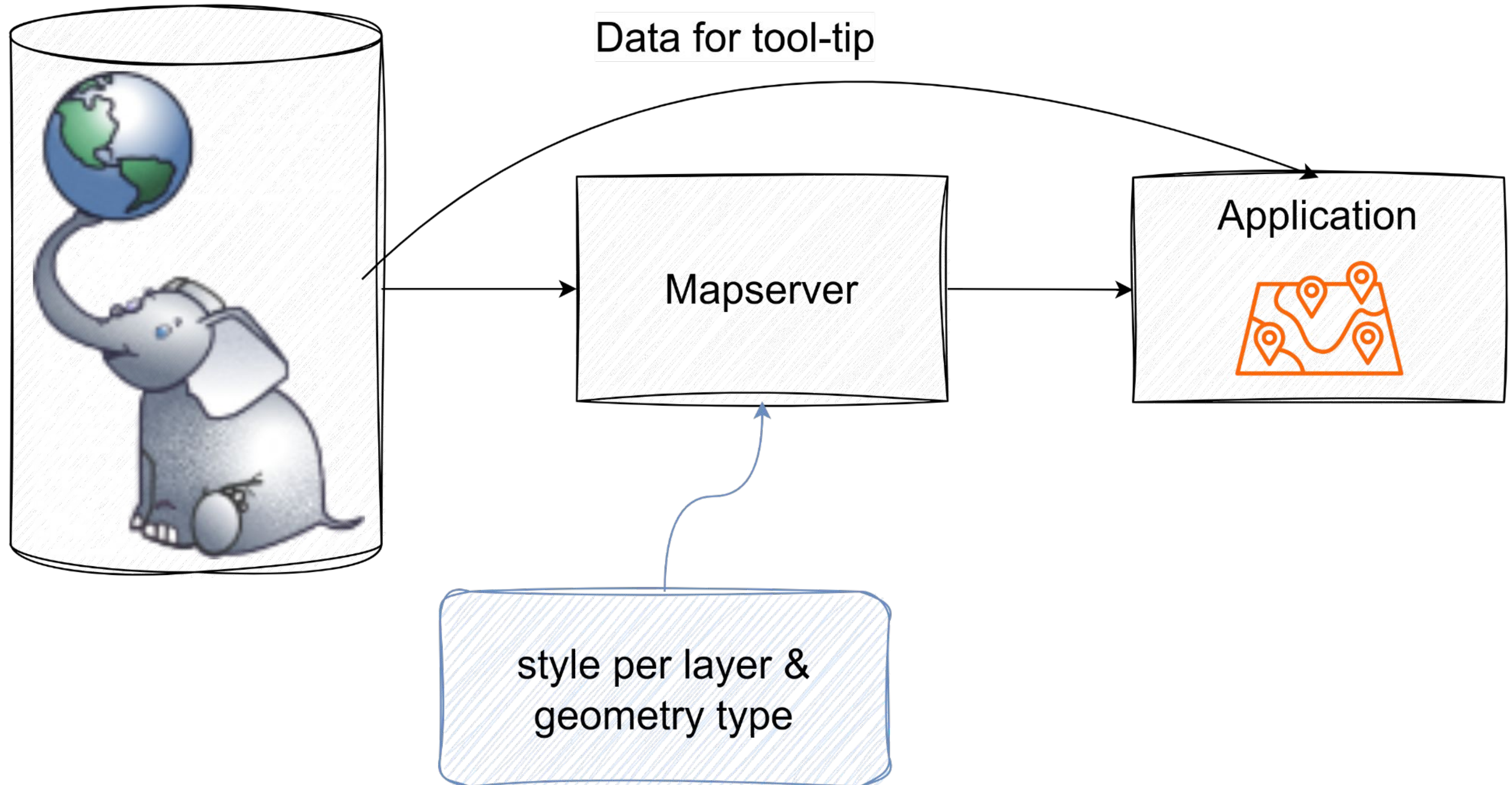
Looking for more maps?
Close menu

Background

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

50 km CH1903+ / LV95

Swisstopo: A large GDI



Swisstopo: A large GDI

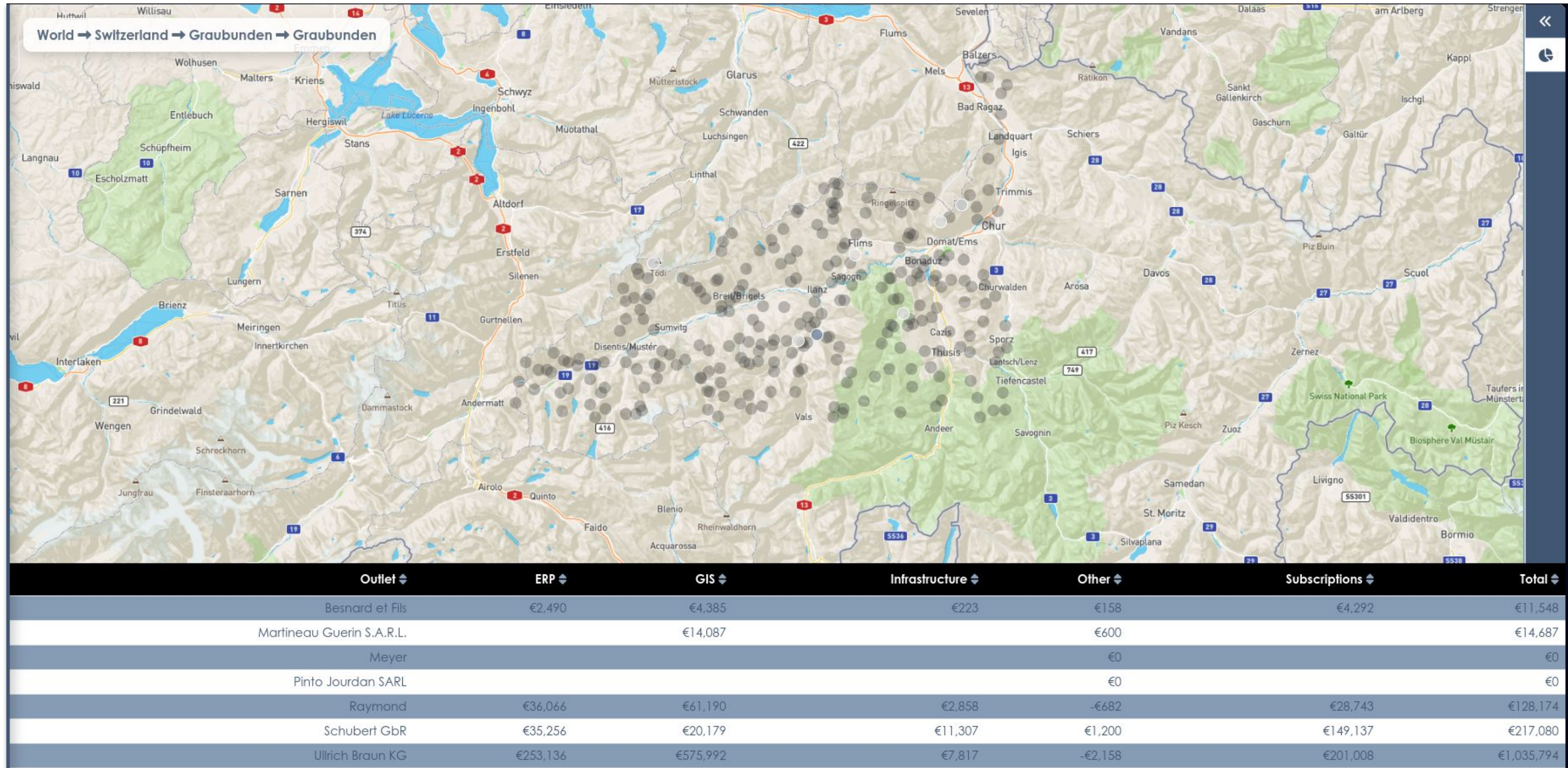


The main image shows the Swisstopo web application interface. At the top, it displays the Swiss flag and the text: 'Schweizerische Eidgenossenschaft', 'Confédération suisse', 'Confederazione Svizzera', 'Confederaziun svizra', and 'In collaboration with the cantons'. A search bar contains 'Temperature 2 m, 10 min'. A sidebar menu on the left includes options like 'Share', 'Print', 'Draw & Measure on map', 'Advanced tools', 'Geocatalog', and 'Maps displayed'. The 'Maps displayed' section shows 'Temperature 2 m, 10 min' is selected. An 'Object information' popup is open over a weather station marker, displaying the following data:

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	

The main map area shows a topographic map of the Grenchen region with various weather station markers and their current temperatures (e.g., 8.7 °C, 8.6 °C, 9.9 °C, 10.3 °C, 10.2 °C, 10.1 °C, 11.6 °C, 7.5 °C, 13.1 °C, 6.2 °C, 5.7 °C, 11.8 °C, 6.3 °C). A 'Close menu' button is visible over the map. At the bottom, there is a scale bar (10 km) and a coordinate system selector (CH1903+ / LV95).

Aggregate Data with a Geospatial Relation

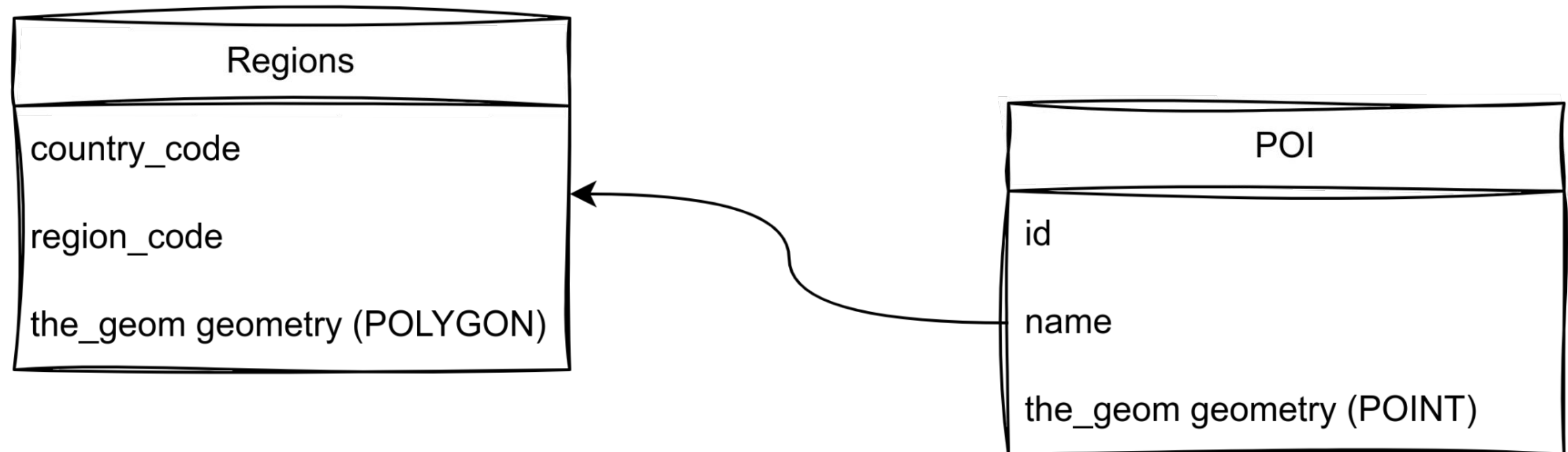


+ OpenStreetMap boundary data

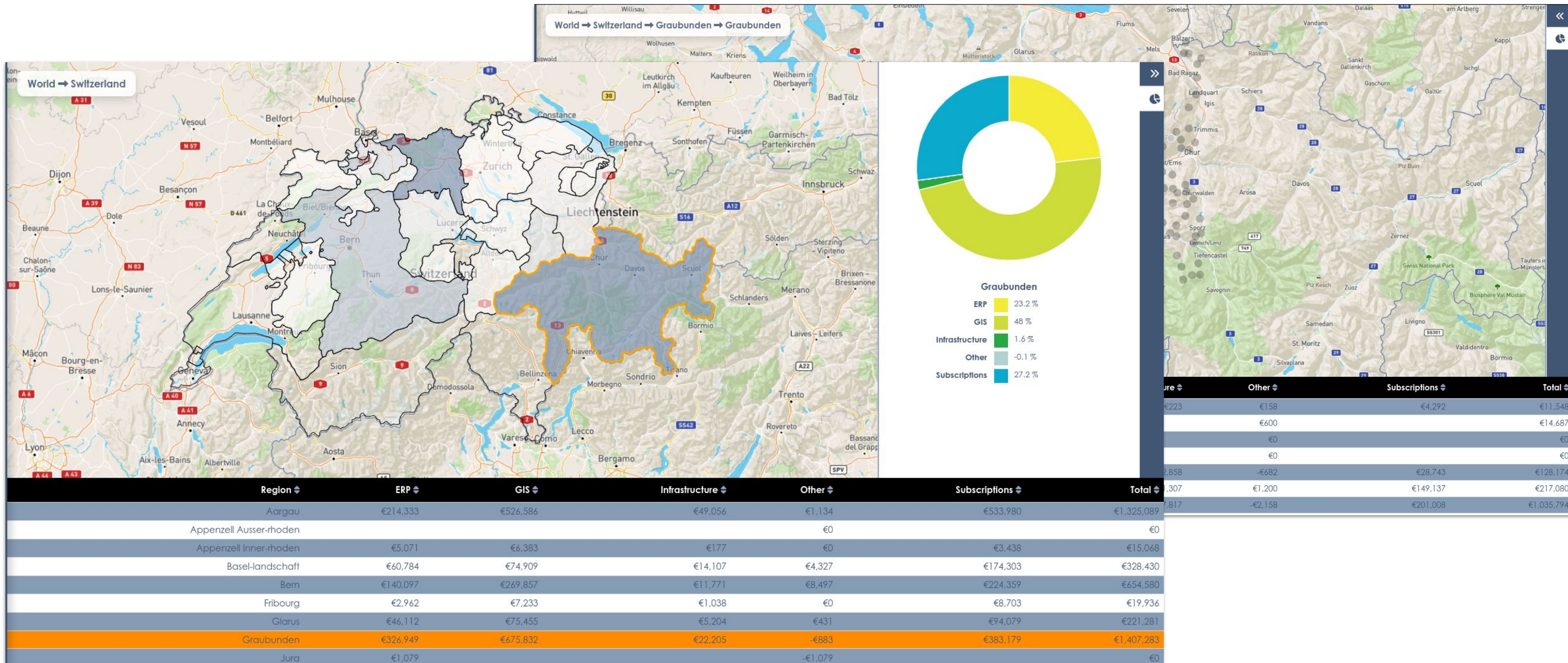
Aggregate Data with a Geospatial Relation



- 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 interface. At the top, the title bar reads '*Leisure Themes - QGIS'. Below it is a menu bar with options: Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, Processing, and Help. A toolbar with various icons for map navigation and analysis is located below the menu bar. On the left side, there are two panels: 'Browser' and 'Layers'. The 'Browser' panel shows a tree view of project files and data sources, including Favorites, Spatial Bookmarks, Project Home, Home, and various data providers like GeoPackage, SpatiaLite, PostGIS, SAP HANA, MSSQL, WMS/WMTS, and Vector Tiles. The 'Layers' panel shows a list of active 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 Central Europe, with various leisure-themed markers overlaid. These markers include blue 'X' symbols for Ice Skating, green elephant icons for Zoos, blue swimming pool icons for Swimming Pools, red 'X' symbols for Amusement Parks, brown museum icons for Open Air Museums, and a yellow area for Bayern. The map also shows natural parks and regions like 'Naturpark Hessischer Spessart', 'Naturpark Franconian Jura', and 'Naturpark Bayerischer Wald'. At the bottom of the window, there is a status bar with a search field 'Type to locate (Ctrl+K)', a coordinate field showing '1268273,6229208', a scale of '1:1855833', a magnifier set to '100%', a rotation of '0.0 °', and a 'Render' button.

Thanks for your attention.



<https://github.com/camptocamp>



<https://www.camptocamp.com>

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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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