



openGIS

Connecting and using open source GIS software

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2017-04-19 – openmod tutorial day – advanced topics – openGIS

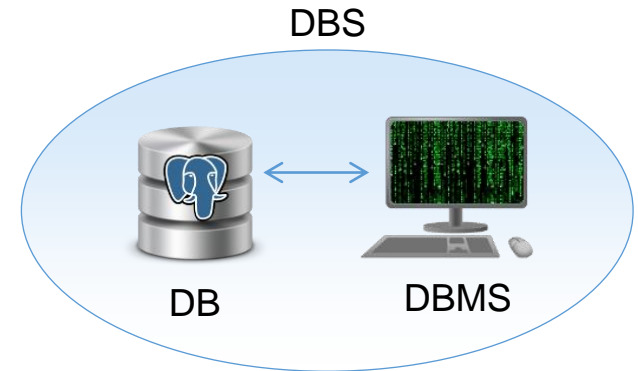
Agenda

- Database Introduction
 - Wording & Motivation
 - Relational database
 - Software
- GIS Introduction
 - Vector & Raster data
 - Projections & Coordinate Reference System (CRS)
- PostGIS
 - Create sample data
 - Common PostGIS functions
- Presenting
 - Print composer

openGIS - Database Introduction

Wording

- Database System (DBS)
- Database (DB)
- Database Management System (DBMS)
- Data Managment System (DMS)



Motivation

- Storing large data in an organised system
- Unlimited contributors and users
- Well defined user management
- Fast and efficient computer performance
- High robustness and safety
- Storage of metadata
- Including extensions (e.g. PostGIS for spatial data)
- Web access

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Relational Database Management System

- Database is structured by folders (schemas)
- Data organised in relations (tables or entity set)
 - Columns (attributes)
 - Tuples (rows or entities)
- Each table needs a unique key identifying each row (primary key)
- Data types (and length) of each attribute are defined
 - Numeric [integer, decimal(p,s)]
 - Character [varchar(n), char(n), text]
 - Date/Time [date, time, timestamp]
 - Geometry [Point, Line, Polygon]
 - ...
- Functions

server DB relation (table)

Daten editieren - PostgreSQL 9.4 (localhost:5432) postgres relation_terminology

	id [PK] integer	attribute1 character varying(20)	attribute2 real
1	1	cell_1	1.1
2	2	cell_2	2.2
3	3	cell_3	3.3
*		field (cell)	

attributes (column)

tuple (row)

primary key

3 Zeilen.

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server DB relation (table)

Daten editieren - PostgreSQL 9.4 (localhost:5432) - postgres - relation_terminology

Datei Bearbeiten Anzeigen Werkzeuge Hilfe

Keine Begrenzu

	id [PK] integer	attribute1 character varying(20)	attribute2 real
1	1	cell_1	1.1
2	2	cell_2	2.2
3	3	cell_3	3.3
*		field (cell)	

attributes (column)

} tuple (row)

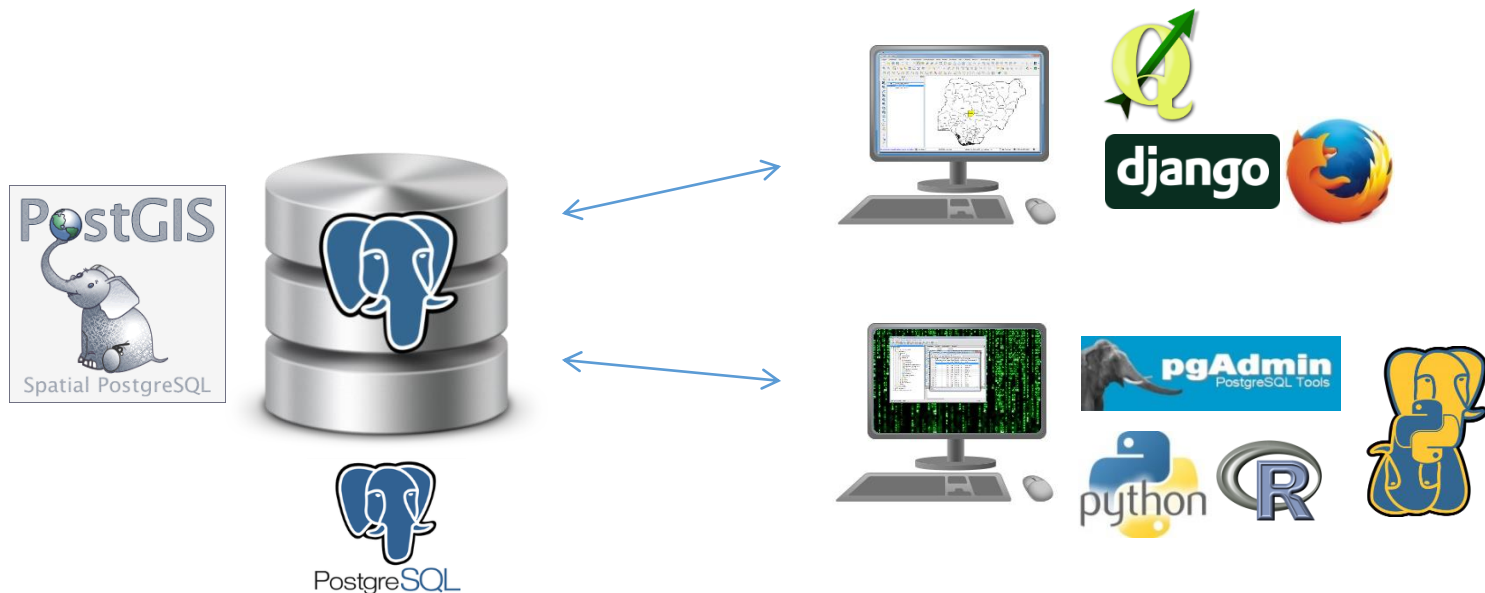
primary key

3 Zeilen.

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Software

- | | | |
|--------------|-------------------|-----------------|
| ▪ PostgreSQL | Local Server | Database |
| ▪ PostGIS | Spatial Extension | Database Add-On |
| ▪ pgAdmin | DBMS | Administration |
| ▪ QGIS | GIS | Maps |



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Database – Hands on – User Management

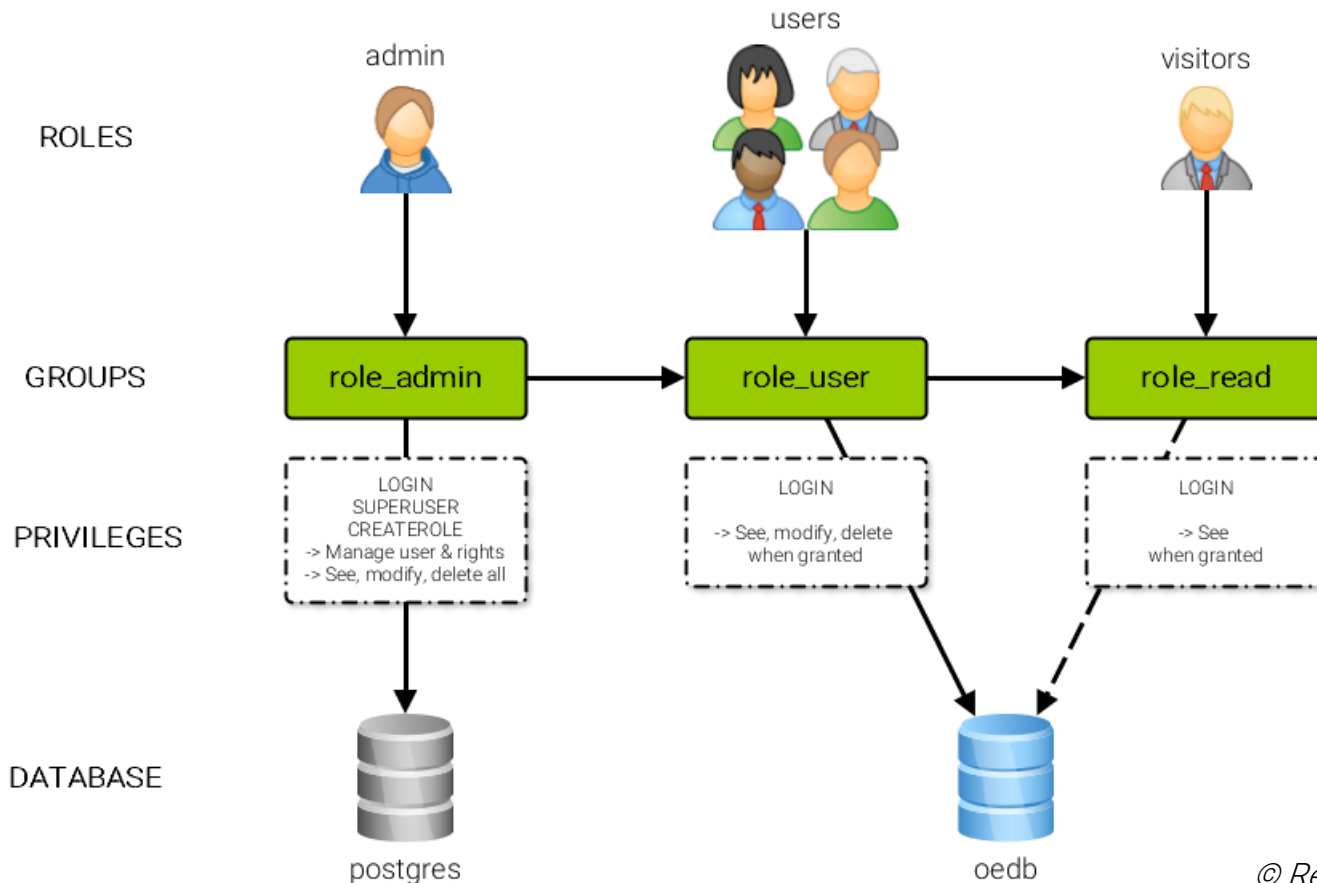
- Open **pgAdmin4**
- Connect to server **PostgreSQL 9.6** with user **postgres**
- View server properties

- Open **query tool** on database **postgres**
- Run script *user_management.sql*
- Refresh & view **Login/Group Roles**

- Run script *database_setup.sql* (on **postgres** & **oedb**)
- Refresh & view database structure (extensions, tables, functions)

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User management



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Database – Hands on – DB Setup

- Open second pgAdmin4
- Connect to server with user **qgis**
 - (Or disconnect from server; reconnect with user **qgis**)
- Run script *schema_setup.sql* on database **oedb**
- Refresh & view schema structure

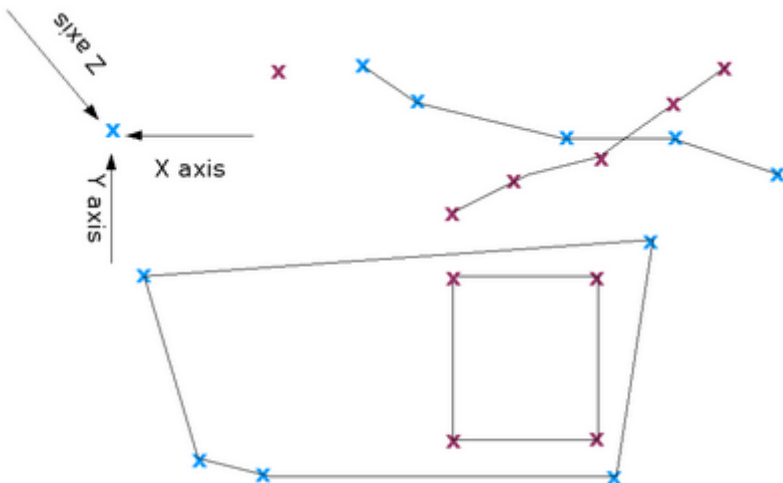
- Run script *function_scenariolog.sql*
- Refresh & tables
 - **model_draft.scenariolist**
 - **model_draft.scenariolog**

- Run script *table_template.sql*

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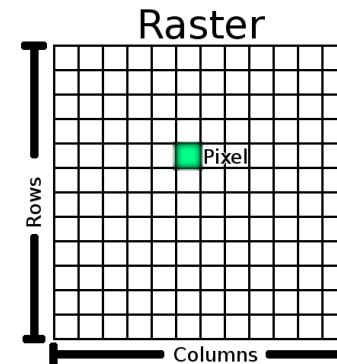
Vector data

- Point
- Line
- Polygon
 - Multipolygon
 - Polygon



Raster data

- Image with pixels

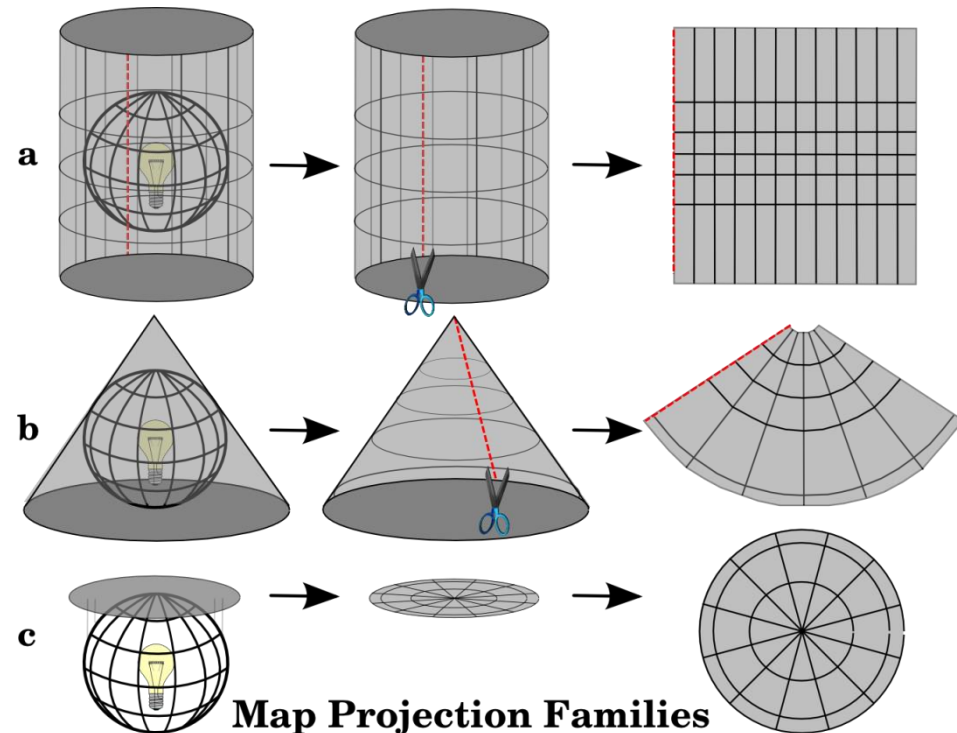


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Projections & Coordinate Reference System (CRS)

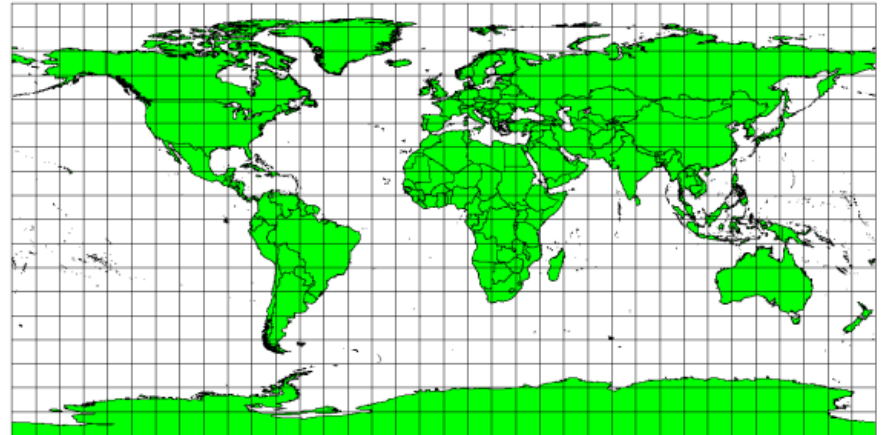
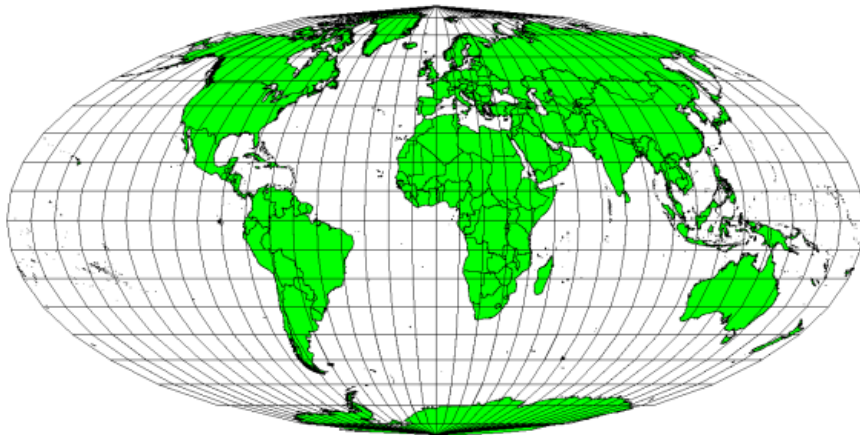
- Map projections portray the surface of the earth on a two-dimensional screen.
- There are, **global map projections** (WGS84) but most map projections are created and optimized to project smaller areas of the earth's surface.
- Map projections are never absolutely accurate representations of the spherical earth. They show distortions of **angular conformity, distance and area**.
- There are two different types of coordinate reference systems: **Geographic Coordinate Systems** and **Projected Coordinate Systems**.
- **On the Fly projection** is a functionality in GIS that allows us to overlay layers, even if they are projected in different coordinate reference systems.



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Projections & Coordinate Reference System (CRS)



The world in different projections. A Mollweide Equal Area projection left, a Plate Carree Equidistant Cylindrical projection on the right.

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QGIS – Hands on – Project setup

- Start QGIS
- Save project
- Activate **On the Fly** with WGS84 (EPSG:4326)
- Add PostGIS Layer
- Connect to oedb
- Open Database Manager
- Add `model_draft.template` (all!)
- Activate OpenLayer Plugin
- Add OSM layer
- Search your position and place objects

Neue PostGIS-Verbindung erzeugen

Verbindungsinformationen

Name: local_oedb

Dienst:

Host: localhost

Port: 5433

Datenbank: oedb

SSL-Modus: abschalten

Authentifizierung | Konfigurationen






Benutzername: qgis ☒ Speichern

Passwort: ☒ Speichern

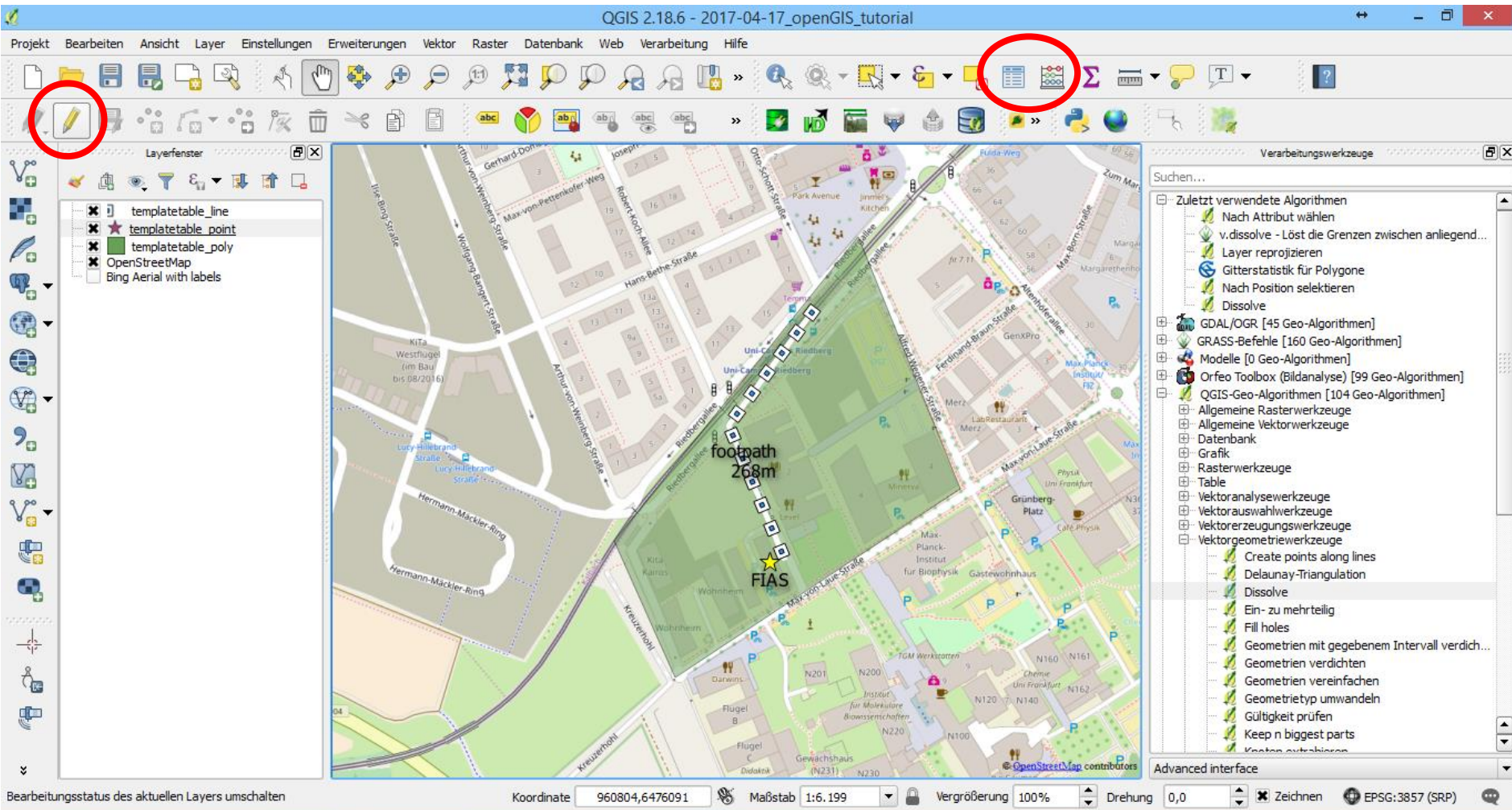
Verbindung testen

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QGIS – Hands on – Create and manipulate data

- Start editing mode 
- Create one point, one line, one polygon   
- Fill in **version** and **name**
- Open **attribute table** 
- Use field calculator to calculate **lat** (\$x) and **lon** (\$y)
- Create new column **value** with decimal double
- Calculate **length** of the line (\$length)
- Display the **name** and the **value** in meter of the line
("name" || '\n' || round("length",0) || 'm')

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PostGIS

- Basic SQL
- Geographic functions
 - Transformation
 - Intersections
 - Buffer

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PostGIS – Hands on – Calculate capacities per municipality

- Load shapefile into QGIS
- Import layer into database
- Run script *make_data.sql*
- Load *model_draft.powerplant* into QGIS
- Run script *postgis_functions.sql*
- Display results in QGIS

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Presenting

- Make a nice map with the print composer
- Include
 - Key
 - North arrow
 - Scale

Contact & License

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