

„Volunteered Geography“ für offene GI-Dienste – mobil und 3D



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Quo Vadis?



- Volunteered Geography & GDI-Technologien?

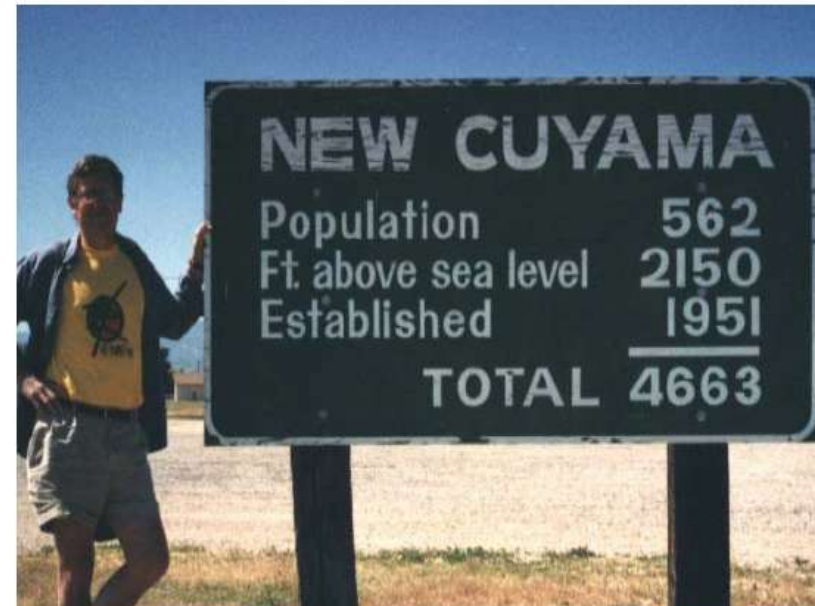
Bsp:

- Location based Services
- 3D Web Services

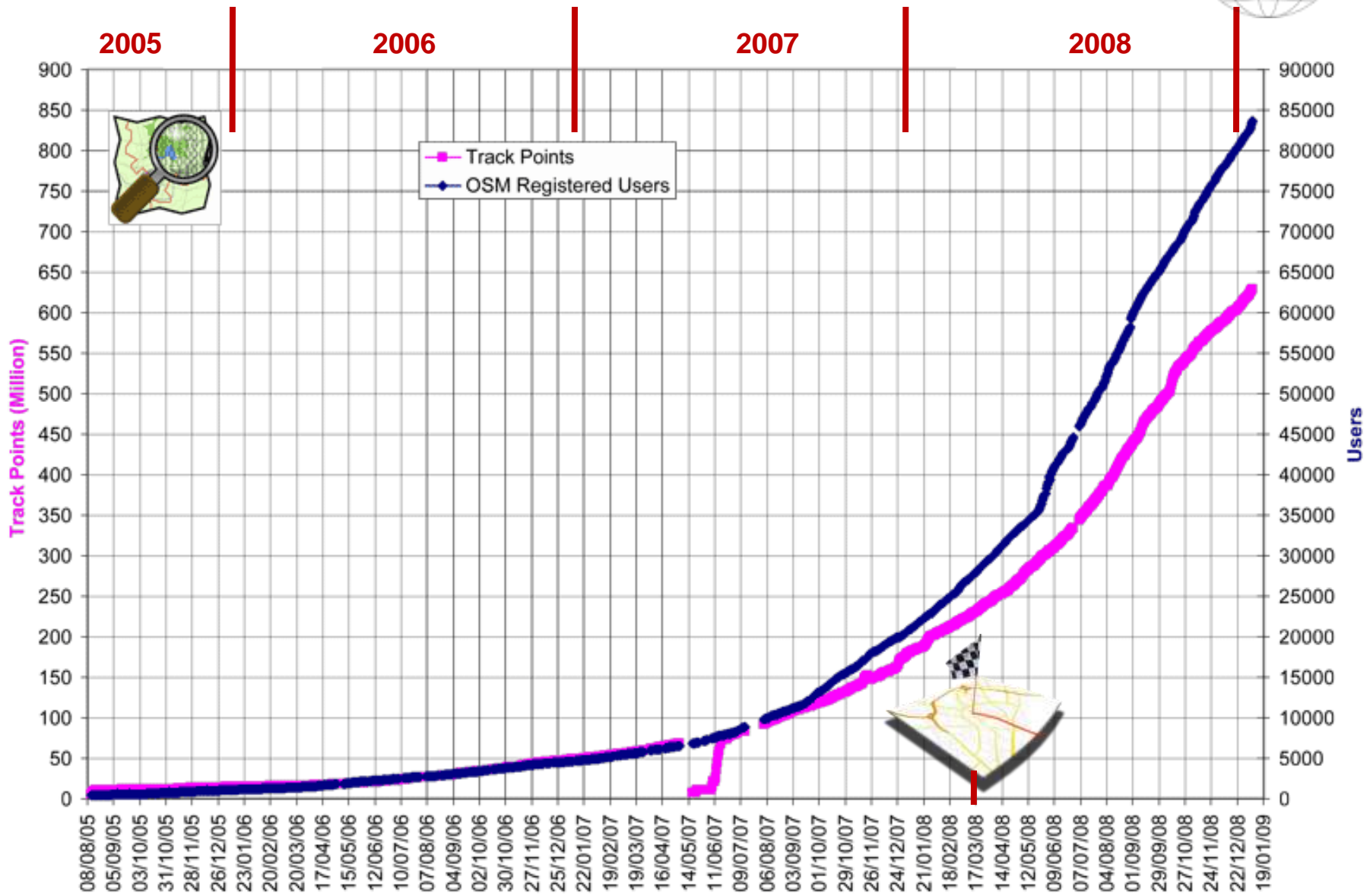


„Volunteered Geography“

- Example: Success of Wikipedia, Flickr et al.
 - Crowdsourcing, prosumer, community-based, collective intelligence...
- User-generated Geo-content
 - M.F. Goodchild (2007): Citizens as sensors: the world of *volunteered geography*.
GeoJournal 69(4): 211-221.
- OpenStreetMap (OSM)
 - Edit free map in a collaborative effort
 - Wiki-style



Growth of OpenStreetMap



Potential of Volunteered Geography



- 05/2008 TomTom buys Teleatlas – ~3 Billion Euro
- 07/2008 Nokia buys Navteq – 5,7 Billion Euro

OpenStreetMap & OpenLS = OpenRouteService



OpenRouteService.org

MAP&ROUTING HELP WIKI NEWS INFO&CONTACT

Routing with user-generated, collaboratively collected free geodata. This service is based on open standards by the Open Geospatial Consortium (OGC). Thanks to OpenStreetMap.org - please donate your geographic data to openstreetmap.org/!

Search BETA

e.g. 'Bonn, Meckenheimer Allee'

Map Map Interaction [more](#)

Routing Pick Address-Search

Startpoint

Endpoint

[more options](#)

Search for Points of Interest (POI): [Directory Service](#)

Calculates reachable regions in given time: [Accessibility Analysis](#)

Route Summary

Total-Time: ~ P1 day(s) T9 hour(s) 20 minute(s)
Total-Distance: ~ 3397,5 km

Extras: [RouteLink](#)

Nr.	Route-Instruction	Distance
1.	Start ...	0 km
2.	Fahre geradeaus	1.0 km
3.	Fahre links	0.8 km
4.	Fahre halb rechts	0.0 km
5.	Fahre halb links	0.0 km
6.	Fahre rechts	30.5 km
7.	Fahre halb links	0.0 km
8.	Fahre halb links	0.0 km
9.	Fahre rechts	2.0 km
10.	Fahre halb rechts auf A 369	24.7 km

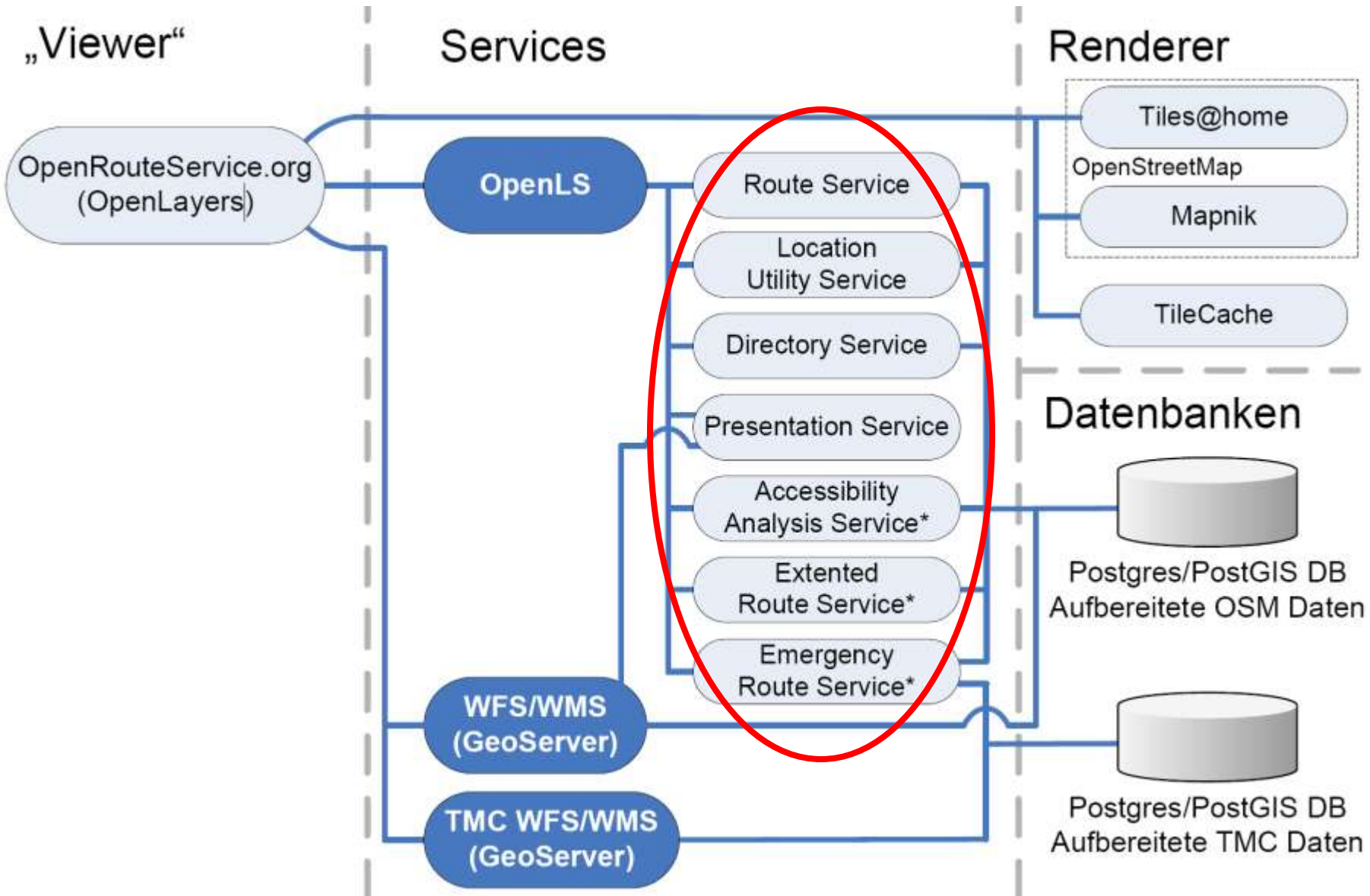


Scale = 1 : 14M

[Permalink](#)

16.29034, 50.88460

OpenRouteService Architecture



Erreichbarkeitsanalyse in OpenRouteService



OpenRouteService.org

Free OpenLS Route Service with Free OpenStreetMap Data

MAP&ROUTING HELP INFO NEWS EXAMPLES FREEOPENLS CONTACT

Routing with user-generated, collaboratively collected free geodata. This service is based on open standards by the Open Geospatial Consortium (OGC). Thanks to OpenStreetMap.org - please donate your geographic data to openstreetmap.org!

Map Map Interaction Get Information

Search

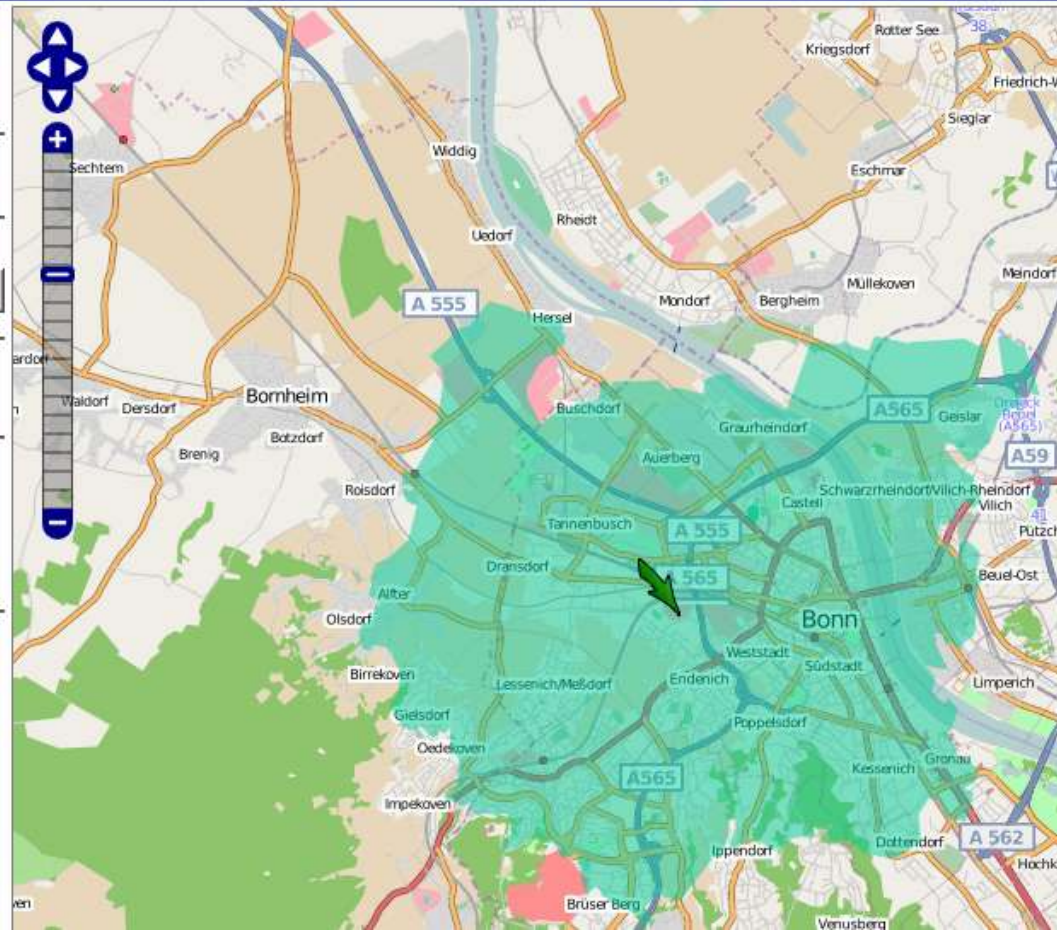
Accessibility Position Minutes

Routing Start End (Click on map to set Start/End!)

[Extended Routing Version](#) [Accessibility Analysis](#)

Result Accessibility Analysis

Time: 6 Minutes
Position: 7.0696111 50.7349901



3D geographic information on the Web



Today: proprietary virtual globes

- Google Earth / Microsoft Virtual Earth
- Nasa Worldwind... ..

Only Visualisation !



OGC working group: 3D Portrayal Services

- Web 3D Service (W3DS)
- Web Perspective View Service (WPVS)
- 3D Symbology Encoding

Integrated in SDI Framework !

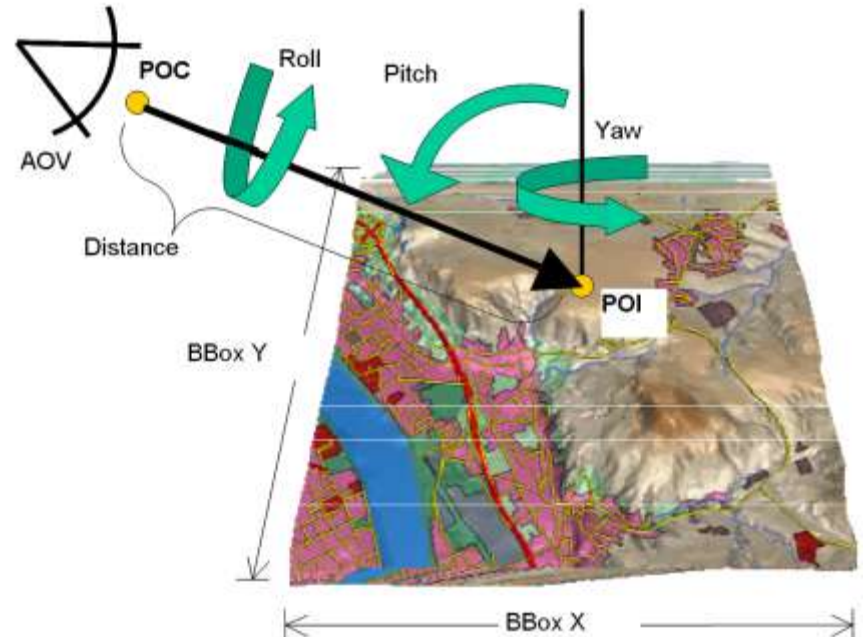


OGC Web 3D Service (W3DS)

draft



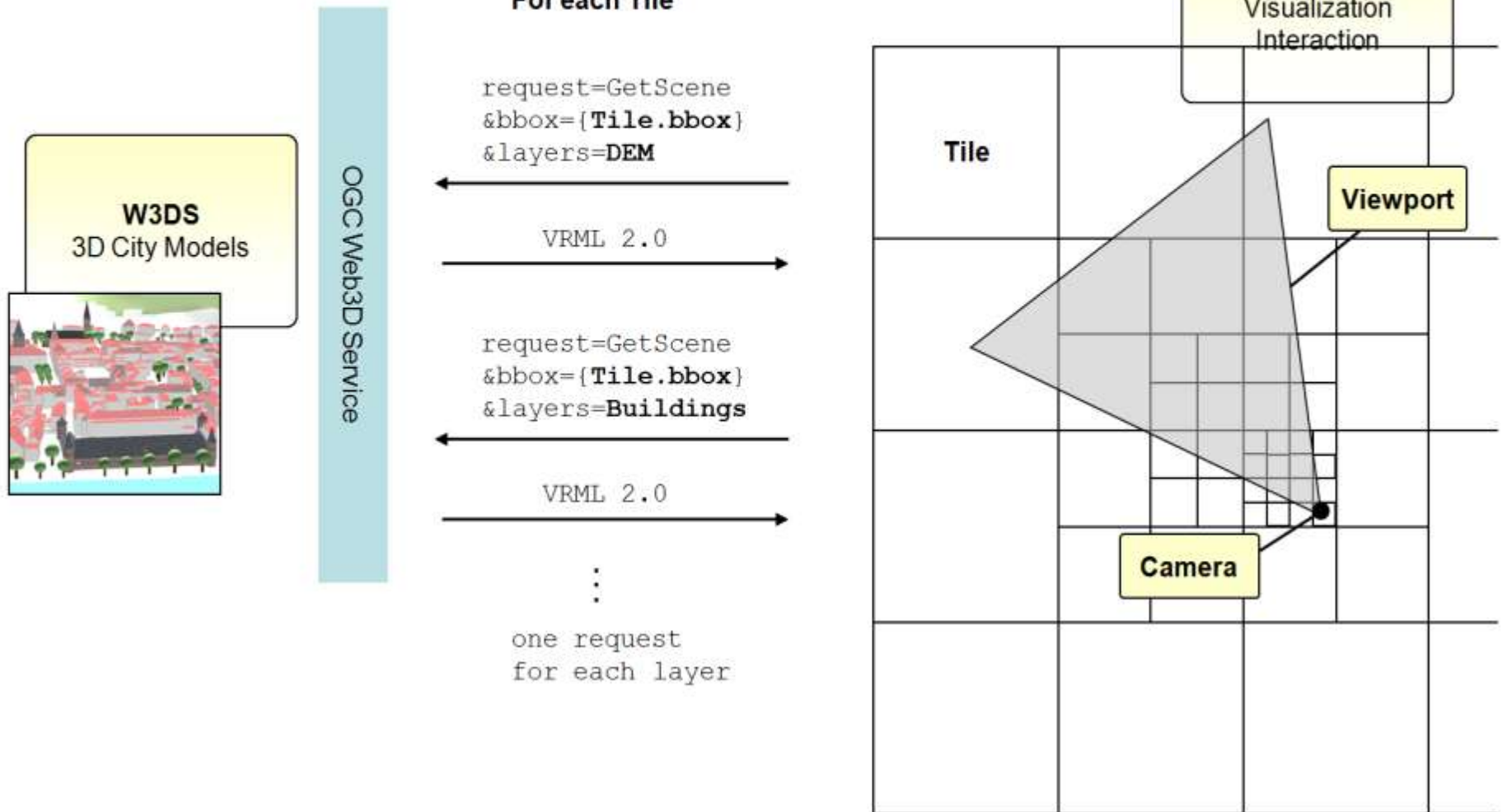
- delivers 3D scenes
 - display elements
 - VRML, KML, X3D
- imports 3D city models
 - OGC CityGML format
- interface similar to WMS
 - ~15 parameter..
 - 3D Symbology Encoding Draft
 - Including OGC Filter Encoding



- Realtime update/synchronisation with 2d cadastral database in bureau of surveying, Heidelberg through direct access to internal WFS



Support for streaming through tiling & view dependent level of detail (LOD)

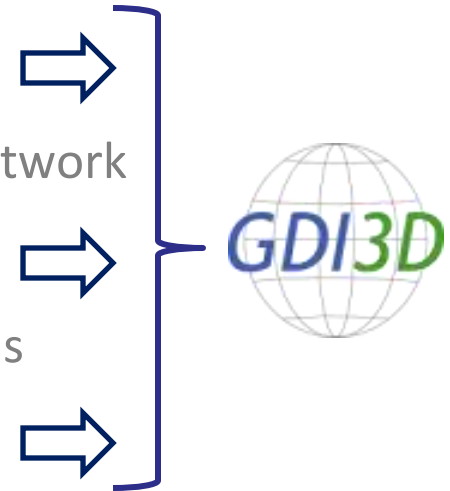


Location Based Services (LBS) in 3D!



OpenGIS Location Services (OpenLS)

- Part 1 **Directory Service** spatial yellow pages
- Part 2 **Gateway Service** position from wireless network
- Part 3 **Location Utility Service** (reverse) geocoder
- Part 4 **Presentation Service** route maps with POIs
- Part 5 **Route Service** several options
- New **Tracking Service** track people & goods



Directory Service: Points of Interest



Map Map Interaction Get Information [Where am I?](#)

Search
e.g. 'Bonn Meckenheimer Allee' or Postalcode '53111'

POIs Position [m] Click on position in the map to search for Points of Interest, such as hotels, restaurants

Public Transport

Routing

- Group ...
- Amenity
- Public Transport**
- Shops
- Tourism
- Public Transport ...
- Bus Stop
- Bus Station
- Railway Station
- Tram Stop
- Subway Entrance
- Parking
- Amenity ...
- ATM / EC
- Bank
- Bureau de Change
- Biergarten
- Bus Station
- Cafe
- Cinema

Add region
Calculates

Number of

Am Botani
Position: 7
Poppelsdr
Position: 7
Haydnstra
Position: 7
Bachstraß
Position: 7
Kaufmann
Position: 7.084248° 50.728243°



OpenLS Route Service 3D



Automatic generation of 3D graph,; Usage of 3D route service through XNavigator

next: 3D Indoor Routing (airport disaster scenario)



XNavigator - http://www.gdi-3d.de

System Panels View Help

Layers:

- integrated_DEM
- Buildings
 - Styles:
 - default
 - UsabilityTest1
 - Sensor-LOD3
 - Cartographic-LOD1|2
 - LOD2
 - LOD1
 - LOD1|2_no_lod3
 - LOD1|2
 - fokus_50_150_250
 - Cartographic_LOD1

Search Routing Map

Street: Marstalltor
House No.: 4
ZIP: 69120
City: Heidelberg

Destination Pick

Street: Enheimer Landstraße
House No.: 32
ZIP: 69120
City: Heidelberg

Options

Language: Deutsch

Compute Route

Get Description Clear

Gehe halb links auf EG

Gehe rechts auf 2.OG

Gehe rechts auf 2.OG

Gehe halb links auf EG

Gehe rechts auf EG

Gehe links auf 2.OG

Ziel erreicht 2.OG

Gehe links auf EG

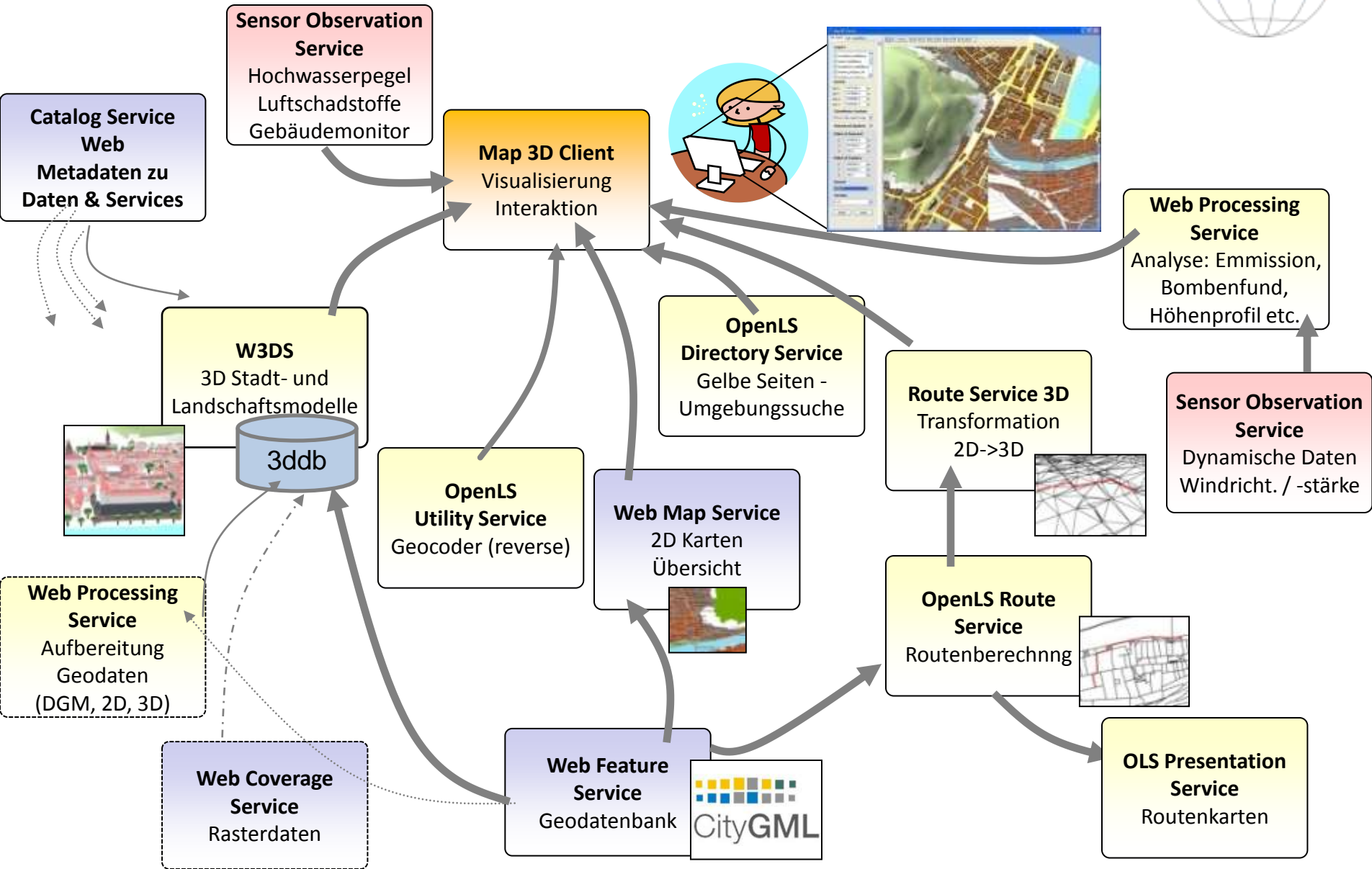
Gehe links auf Treppe zwischen EG und 1.OG

universität bonn
Geographie

immer besser

fps: 91.7
pos: 3478770.44 5474959.12
alt: 155.43

OGC Services Architecture of GDI-3D.de



From static to dynamic data in 3D SDI

- provide real-time sensor data in SDIs
- based on OGC Sensor Web Enablement (SWE)
- Web-based access and control of sensor networks
 - Example: integration of different sensors in 3D-SDI
 - Visualization in XNavigator



Sensors in GDI-3D

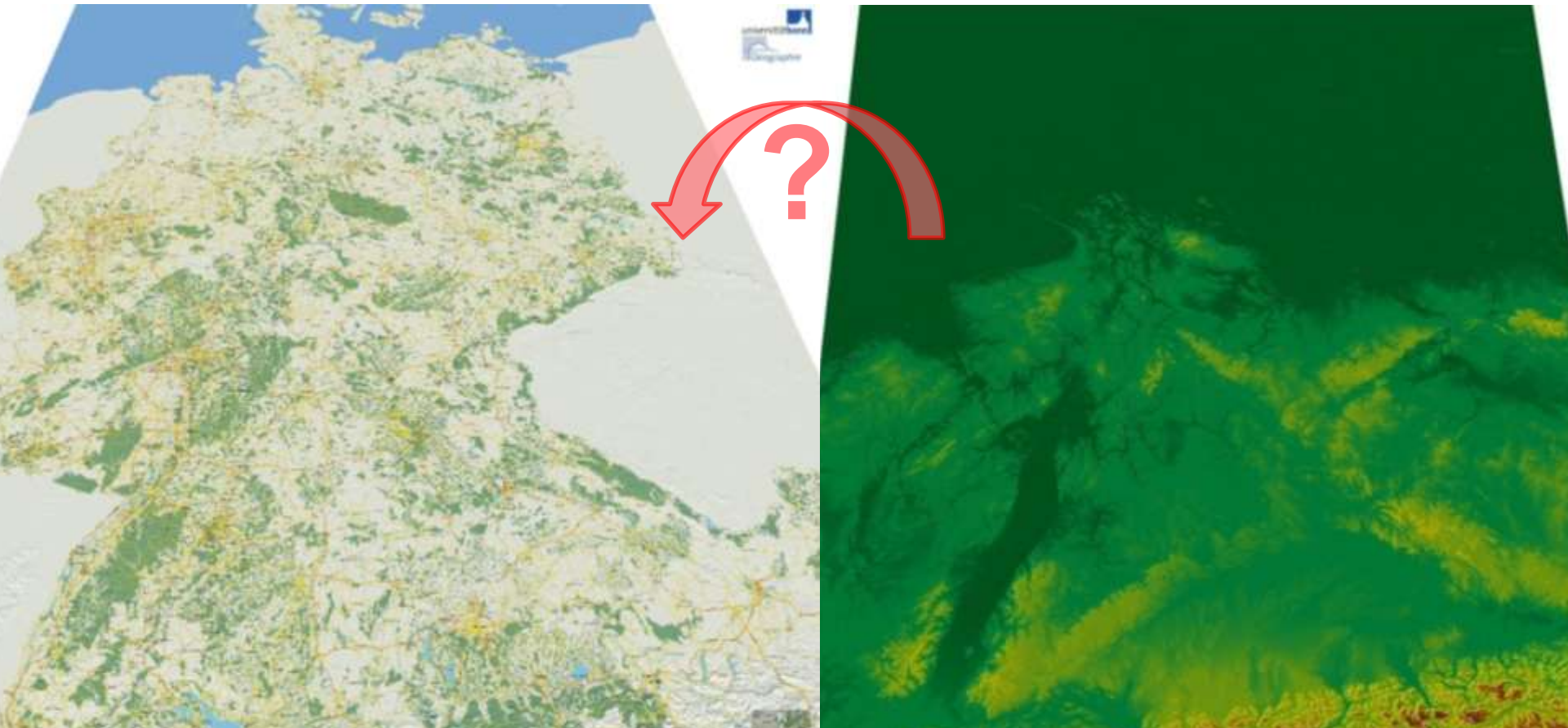


Sensors in GDI-3D building monitoring: smoke, locks



W3DS Germany 3D - elevation model?

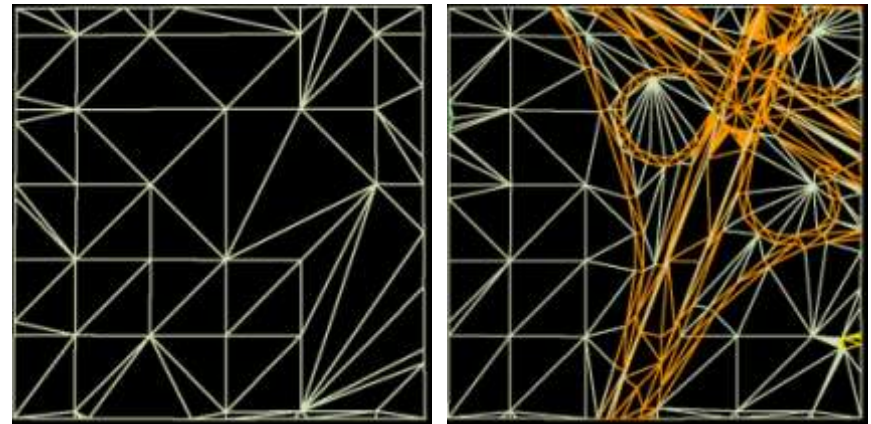
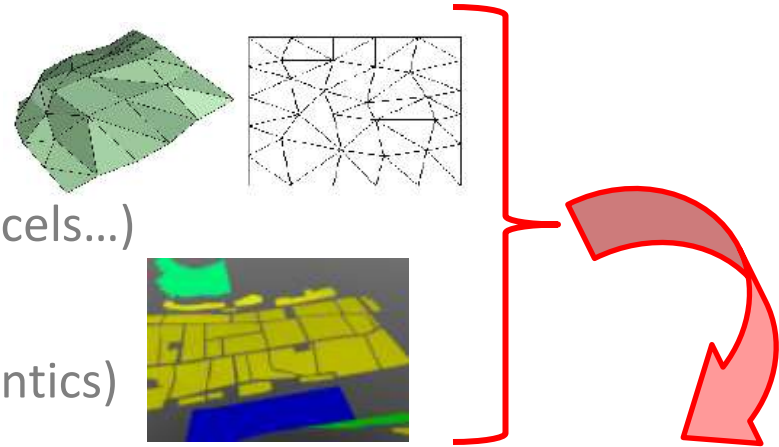
- DEM: SRTM, Shuttle Radar Topography Mission, 2000
 - resolution 90m (+-7m height accuracy in Germany) - FREE



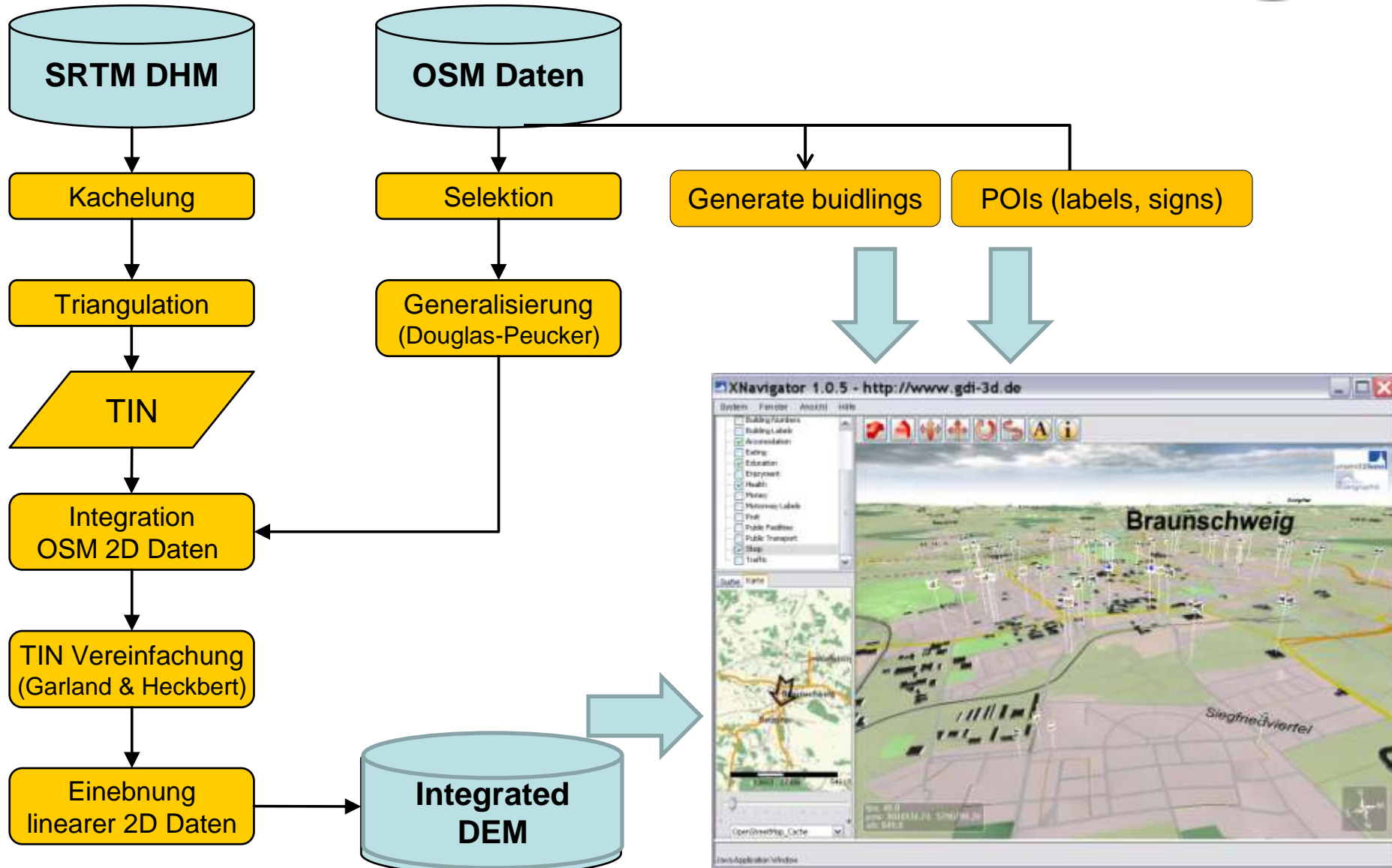
Generating 3D landscape models

Integrate heterogeneous data sources:

- 3D buildings (city model)
- digital elevation models (DEM)
 - **triangulated 3D points**
- Landuse (streets, water, forest, parcels...)
 - **2D vector data with landuse type**
 - aerial / satellite images (no semantics)
- other objects
 - trees, signs, street furniture
 - landmarks, POIS, ...

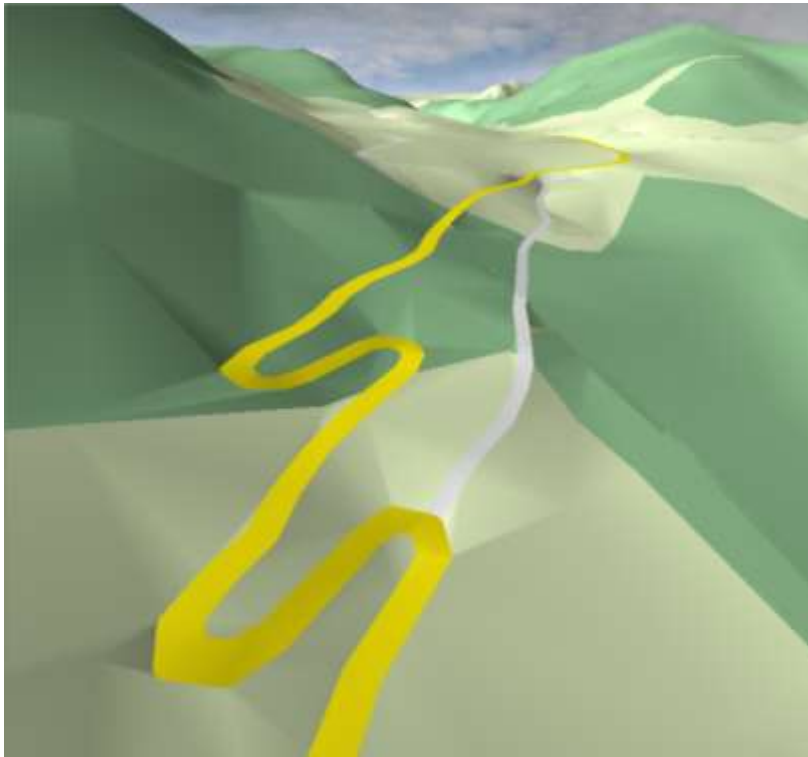


Integrating OSM 2D landuse & SRTM DEM



Smoothed streets in 90meter DEM

- Improved visualization despite coarse DEM



OSM-3D.org Germany



XNavigator 1.0.5 - <http://www.gdi-3d.de>

System Fenster Ansicht Hilfe

Ebenen:

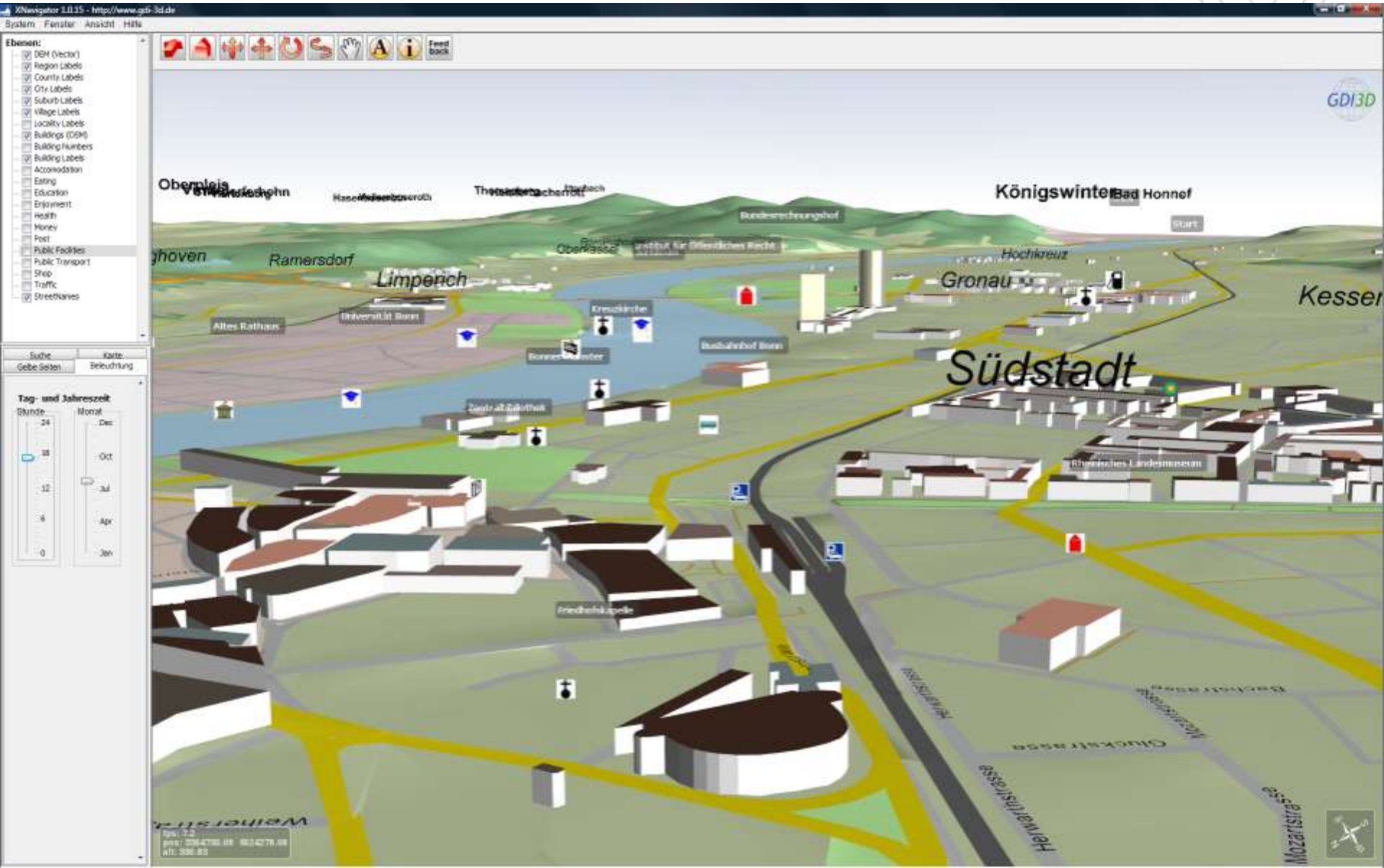
- DEM (Vector)
- City Labels
- Village Labels
- Suburb Labels
- Buildings (OSM)
- Building Numbers
- Building Labels
- Accomodation
- Eating
- Education
- Enjoyment
- Health
- Money
- Motorway Labels
- Post
- Public Facilities
- Public Transport
- Shop
- Traffic



fps: 70.9
pos: 3567442.51 5932320.92
alt: 718.0



OSM-3D.org Germany



OSM-3D.org Germany



OSM-3D.org Germany



OSM-3D.org Germany





1st lessons learned

- Both 3D & Location Services scale to large regions
 - Europe Map Service, (Reverse) Geocoder, Directory Service, Route Service, WFS
 - Germany W3DS, (3D Route Service), SOS, WPS (www.osm-3d.de)
 - NRW W3DS with >6 Mio LOD 1 buildings (www.nrw-3d.de)
- Preprocessing on computer cluster required
 - ~1300 CPU hours DEM processing OSM3D Germany
 - ~ 100 Mio files generated OSM3D Germany DEM (28 GB in DB)
 - ~300 CPU hours processing buildings NRW3D
 - > 1000 CPU hours DEM for 3D route graph Germany
- Frequent updates remain a challenge
 - GRID-Computing
 - need for high automation, fault tolerance and improved algorithms

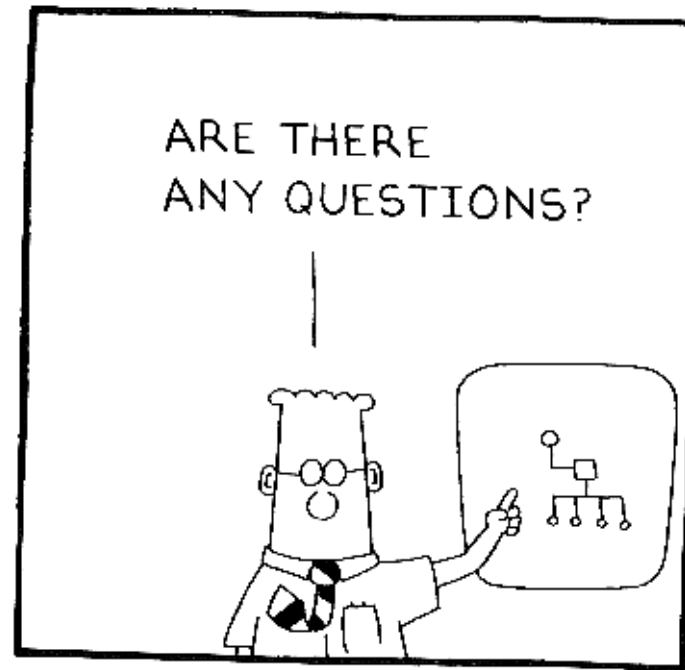
Summary & Outlook



- OGC services allow for non-trivial applications
 - need for control over the DEM for high quality data integration
 - one step towards Web-based 3D GIS
 - Integrate new (dynamic) data sources and analysis tools
- Search for best compromise between generalization (low data volume) & visual appearance
 - Improve visualization, usability, empirical user tests
- Potential of user generated geo-content (mass market)
 - Not all maps will be Google Maps in the future ;-)



Thank you very much!



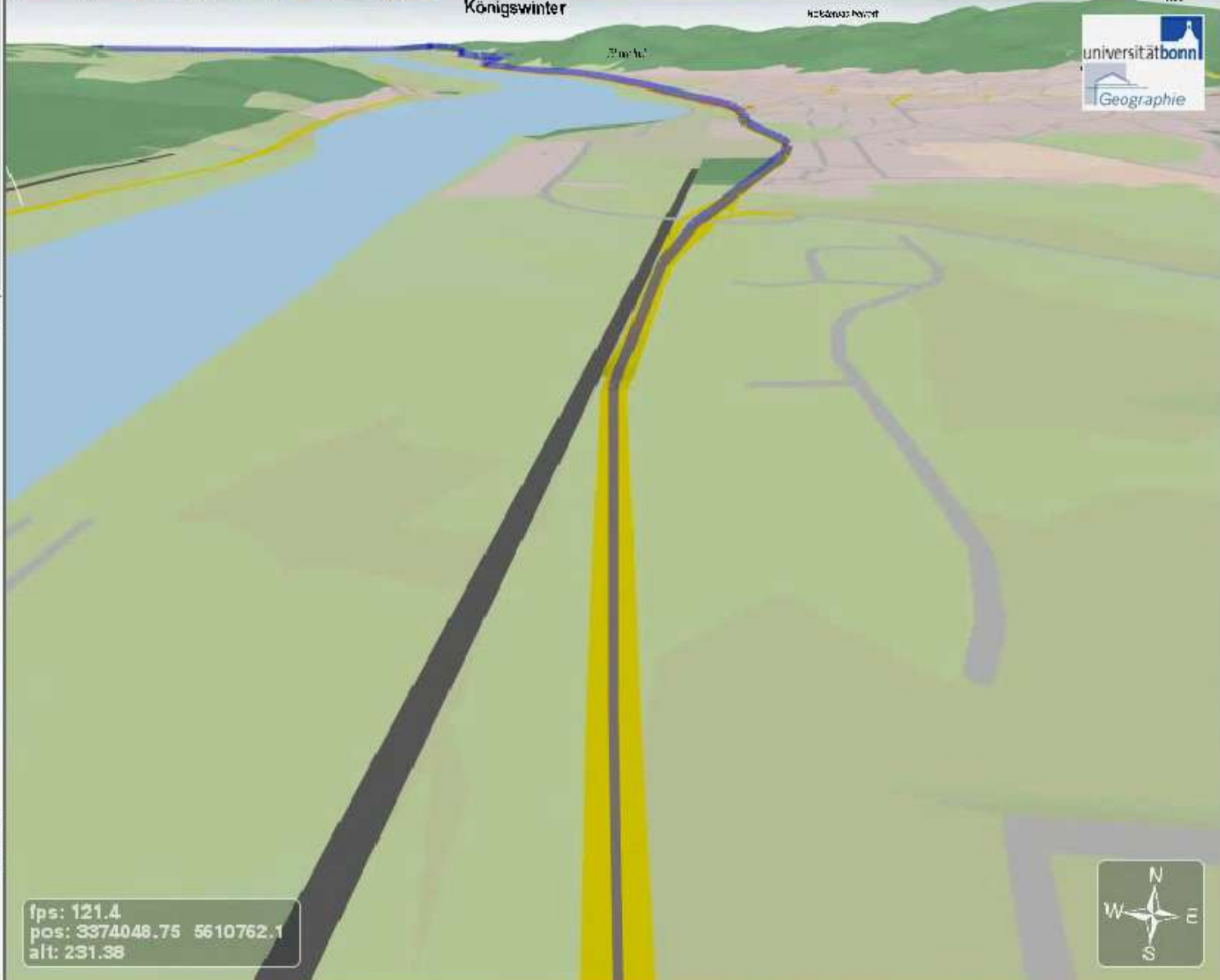
- <http://www.gdi-3d.de>
- <http://Www.osm-3d.de>
- <http://www.nrw-3d.de>
- <http://www.openRouteService.org>
- <http://www.mona3d.de>
- <http://www.gdi-grid.de>
- <http://www.ok-gis.de>
- <http://www.hgis-germany.de>
- <http://www.sutren-3d.de>
- <http://www.3dgismarkt.de>
- <http://www.ubigis.org>

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- Buildings
- Building Labels
- Building Numbers
- Accomodation
- Eating
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- Health
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- Post
- Public Facilities
- Public Transport
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- Traffic




Suche Route Karte



OpenStreetMap

fps: 121.4
pos: 3374048.75 5610762.1
alt: 231.38





- Ebenen:**
- DEM
 - Buildings
 - City Labels
 - Village Labels
 - Suburb Labels
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 - Traffic
 - Accomodation
 - Building Numbers



Suche Route Karte

Adresse suchen

Straße

Nr.

PLZ

Stadt

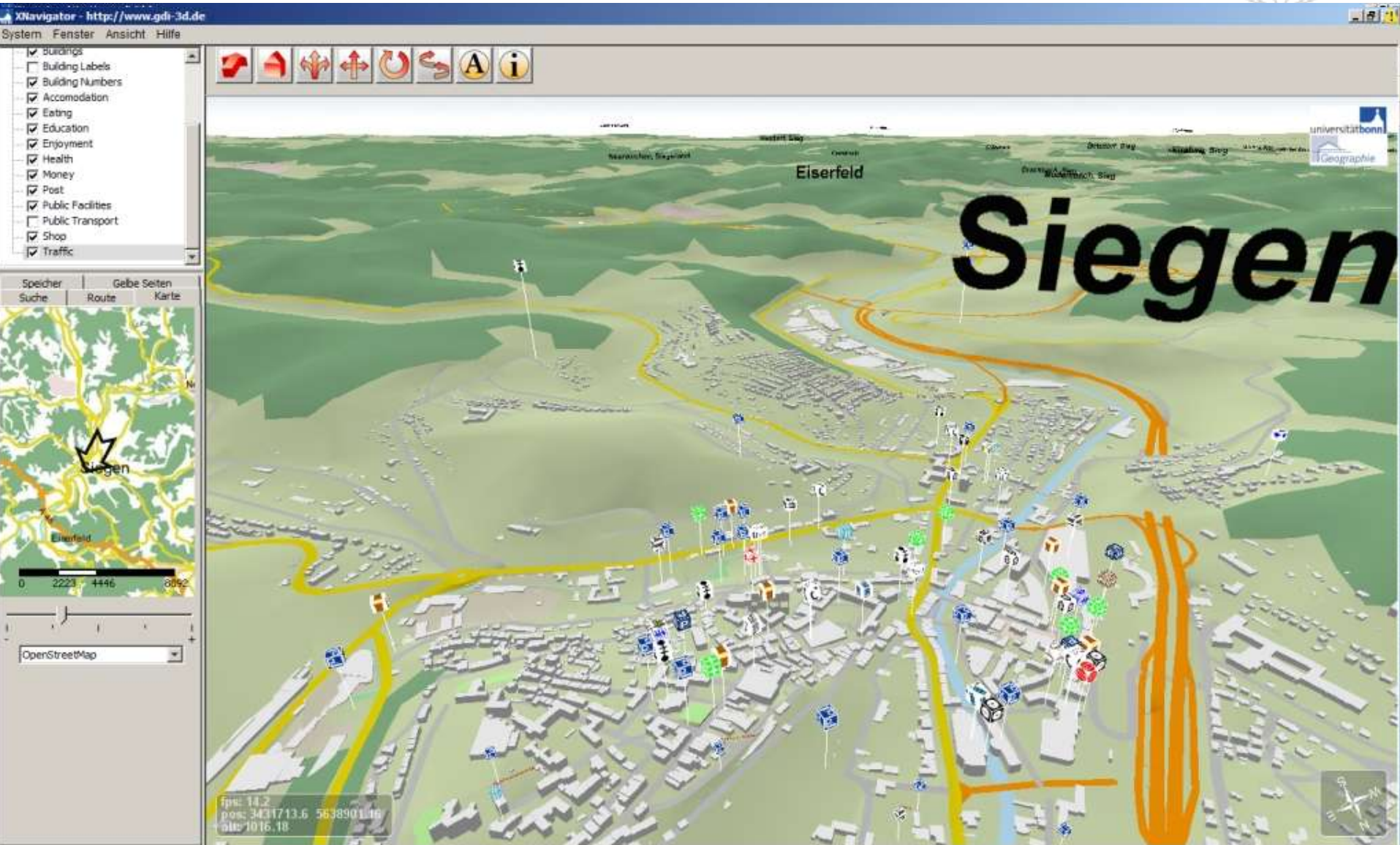
Land

Suchen

fps: 2.8
pos: 3476932.0 5476927.37
alt: 370.15



NRW-3D in GDI-3D



NRW-3D in GDI-3D > 6 mio buildings LOD1



System Fenster Ansicht Hilfe

Ebenen:

- DEM
- City Labels
- Village Labels
- Suburb Labels
- Motorway Labels
- Buildings
- Building Labels
- Building Numbers
- Accomodation
- Eating
- Education
- Enjoyment
- Health

Beleuchtung Sensordaten Speicher
Suche Route Karte Gelbe Seiten

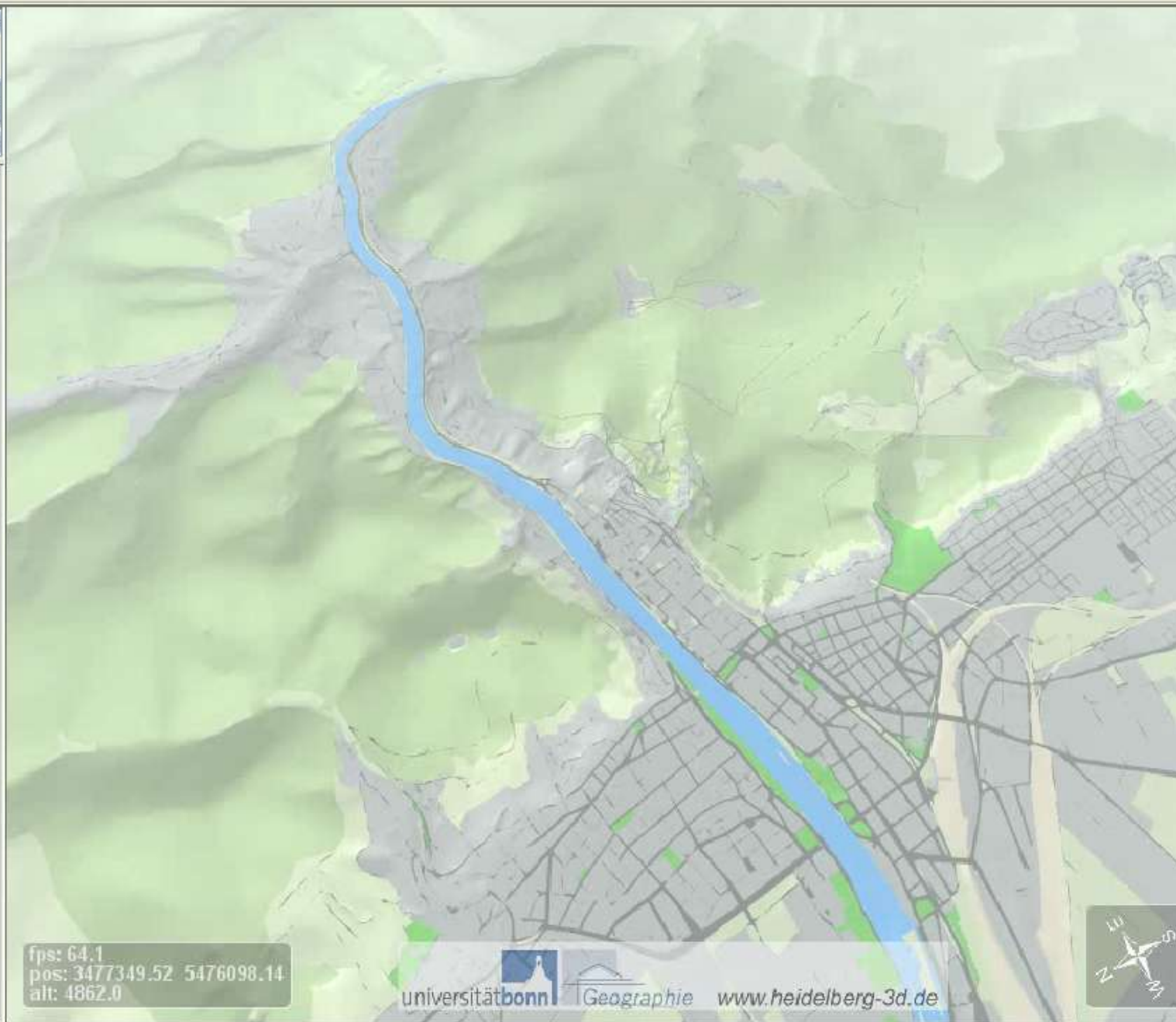
Düsseldorf
Mönchengladbach
Grevenbroich
Köln

0 11237 22474 44949

fps: 49.0
pos: 3359447.71 5653799.58
alt: 245.92

universität bonn
Geographie

- Buildings LOD 2
- Trees
- Parking Meters
- Traffic
- Street Names
- Labels



fps: 64.1
pos: 3477349.52 5476098.14
alt: 4862.0



Generalisation results of integrated DEM

LOD 500
1699 KB



LOD 1000
552 KB



LOD 8000
102 KB



LOD 16000
43 KB



Example: area of 3600 * 3600 meter (Heidelberg); file size in kilobyte