OSM Datenformate für (Consumer-)Anwendungen

Der Weg zu verlustfreien Vektor-Tiles

FOSSGIS 2017 – Passau – 23.3.2017

- Dr. Arndt Brenschede -

Was für Anwendungen?

- Rendering — Karten-Darstellung
- Routing — Weg-Berechnung
- Guiding — Weg-Führung
- Geocoding — Adress-Suche
- reverse Geocoding — Adress-Bestimmung
- POI-Search — Orte von Interesse

… Travelling salesman, Erreichbarkeits-Analyse, Geo-Caching, Map-Matching, Transit-Routing, Indoor-Routing, Verkehrs-Simulation, maxspeed-warning, hazard-warning, Standort-Suche für Pokemons/Windkraft-Anlagen/Drohnen-Notlandeplätze/E-Auto-Ladesäulen...

Was für (Consumer-) Software ?

GPS-Handhelds

<Garmin>

Smartphone-Apps

Oruxmaps
c:geo
Locus Map
OsmAnd
Maps.me
Cruiser
MapFactor
Navit
Maps 3D Pro
Magic Earth
Naviki
Komoot

Basecamp

QMapShack

Route Converter

Cruiser

(Mapsforge-Tileserver)

(BRouter/Local)

Desktop Anwendungen

Mapnik

OSRM

Valhalla

Nominatim

(Overpass)

Backend / Server

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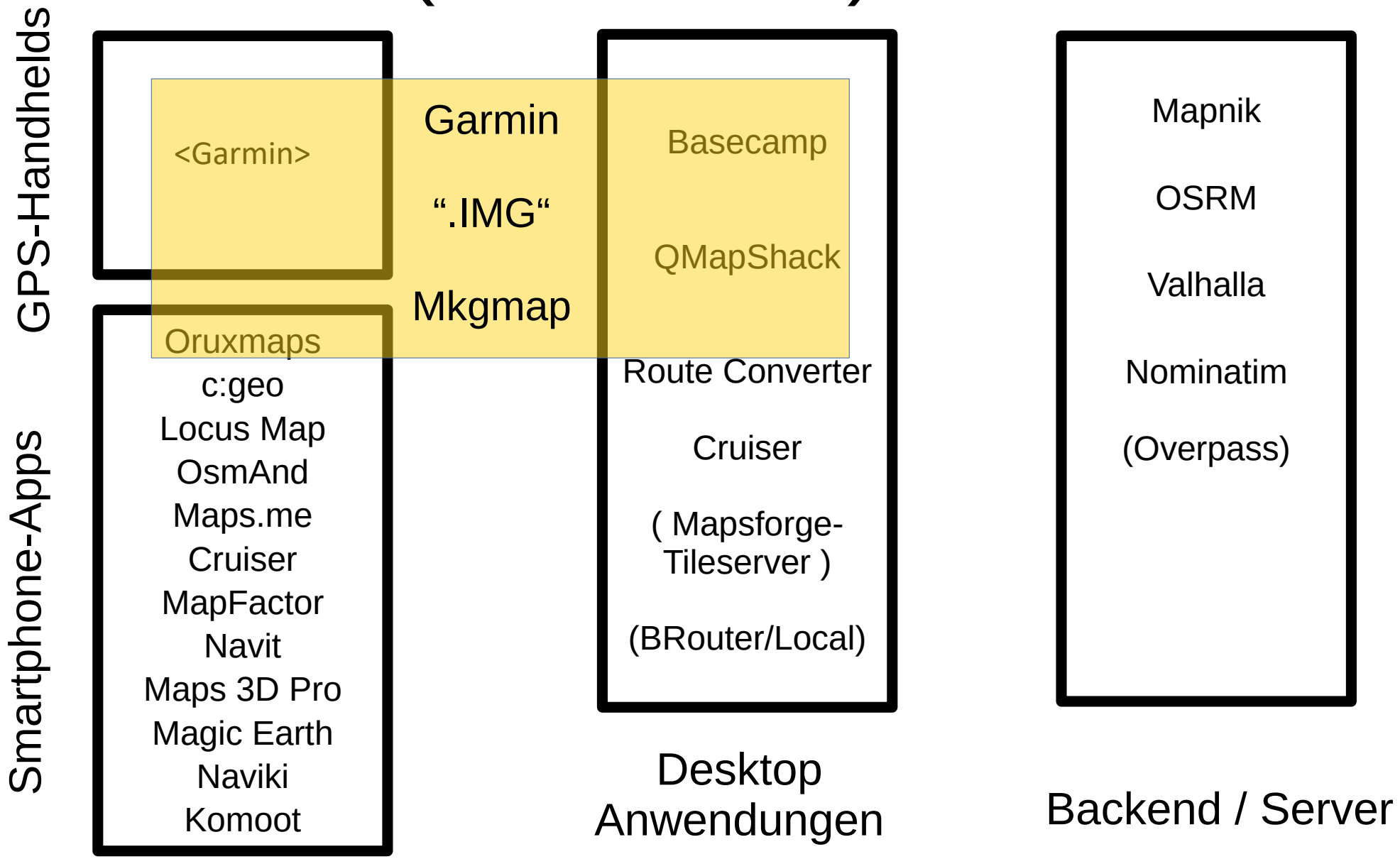

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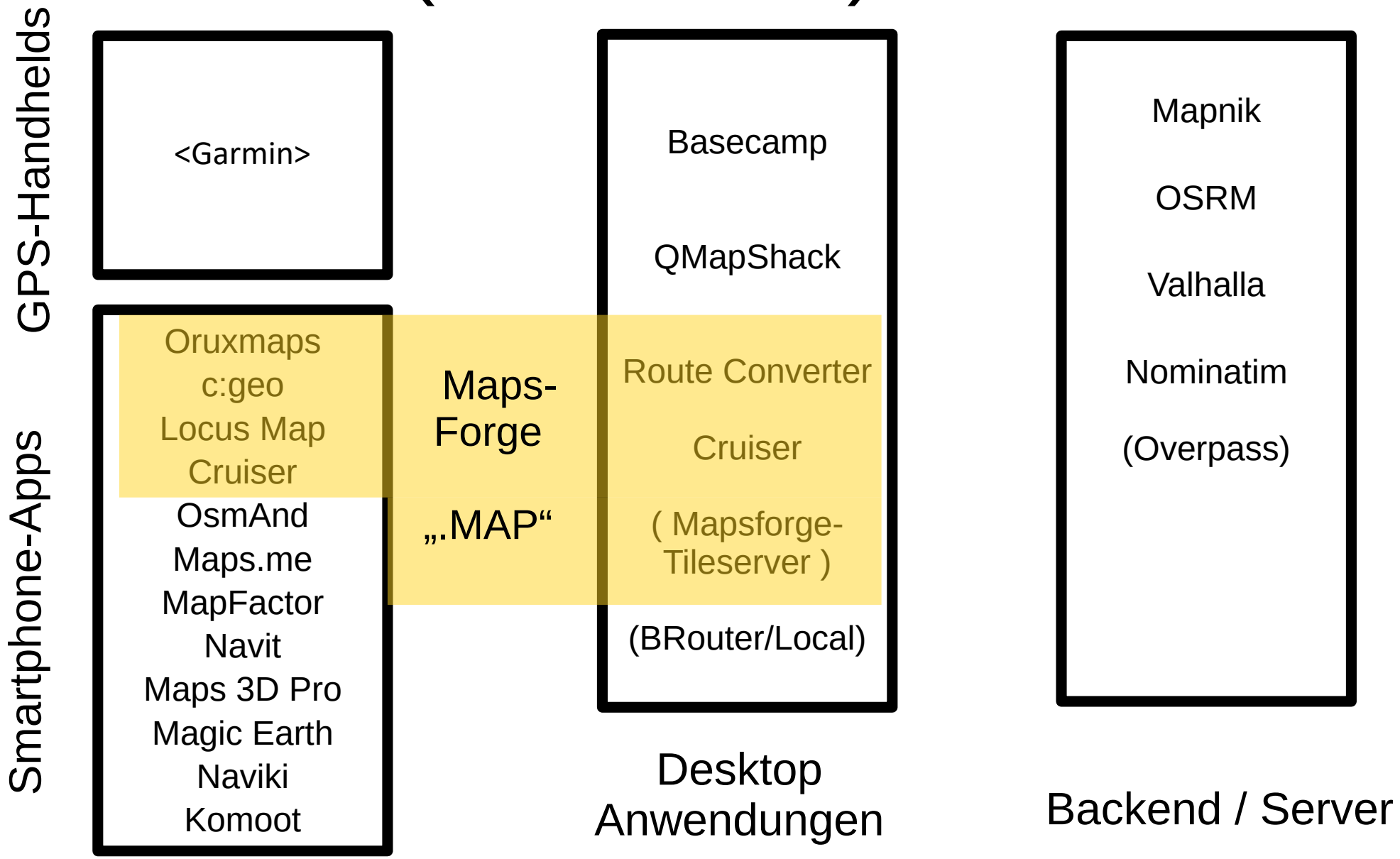

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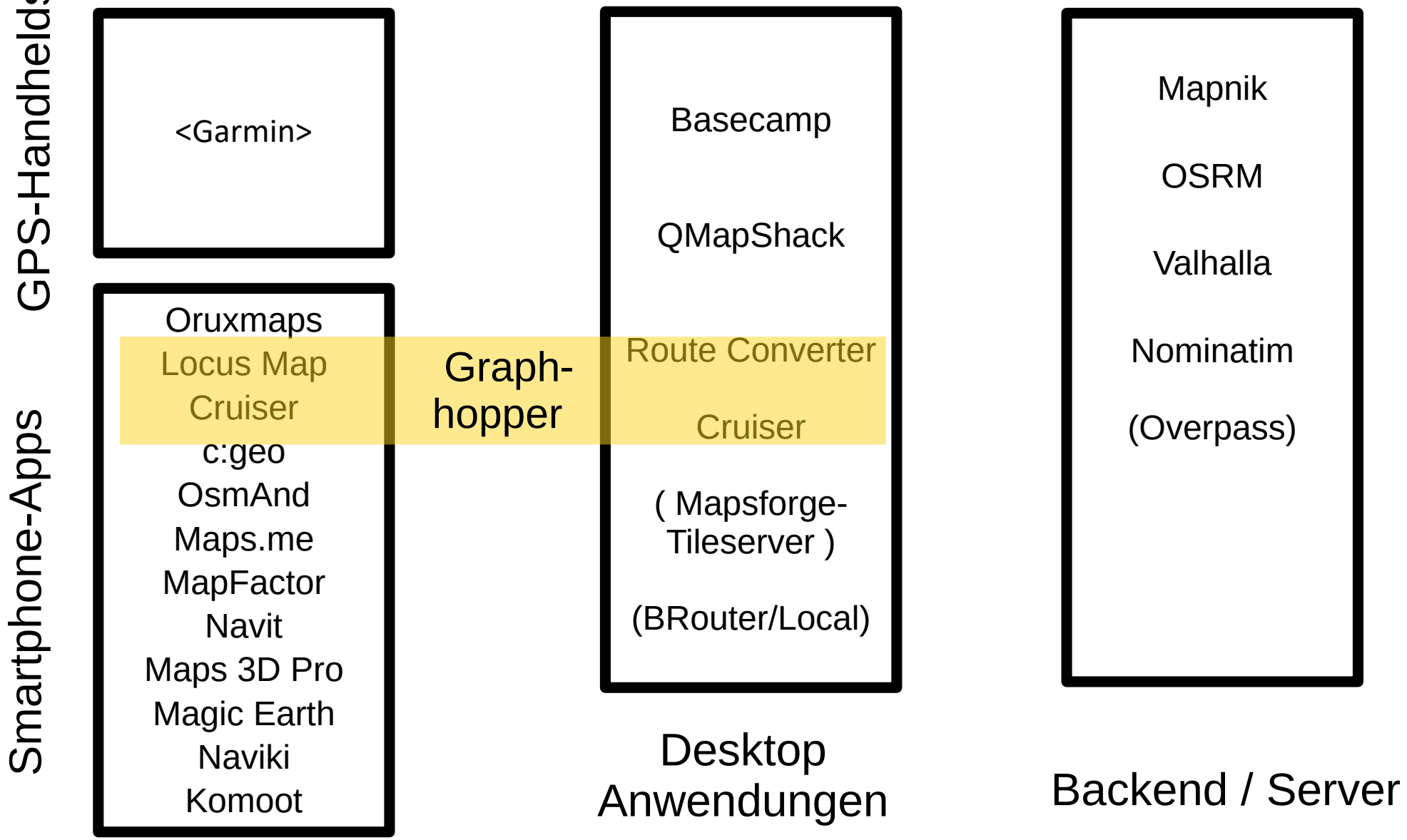

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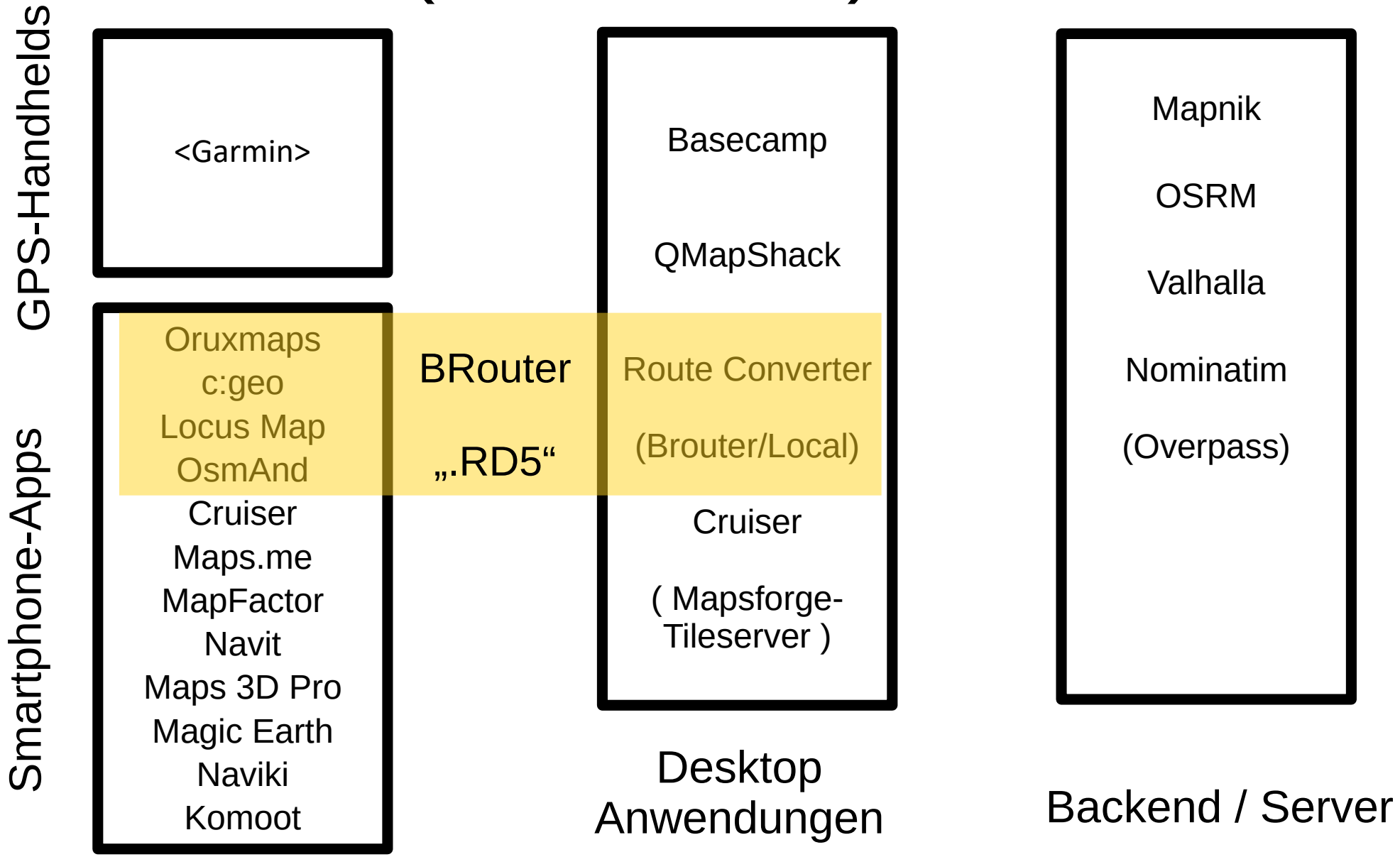

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Ausgewählte Supply-Chains für Vektor-Daten

(Zahlen bezogen auf Deutschland)

	Format	Download-Size (MB)	Resident-Size (MB)	Features	Update-Intervall (Wochen)	Extract-Schema	Extrakt-Überlapp
OSM-Extrakt (Geofabrik)	OSM.PBF	3000	3000	-	1	National	moderat
Mapsforge / Freizeitkarte	MAP	2800	3800	K	12	Gross-Regionen	gross
Mapsforge / OpenAndroMaps	MAP	2000	2900	K	4	National	moderat
BRouter	RD5	250 *	250 *	R	1	Quadrate	-
OsmAnd	OBF	3000	5400	K+R+A+P	4	Bundesländer	moderat
MapsMe	MWM	2500	2500	K+R+A+P	?	Klein-Regionen	-

(* deutscher Anteil, realer Quadrate-Download = 445 MB)

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OSM Consumer Data	**xxx**	**1200**	**1200**	**K+R+A+P**	**1**	**Quadrate**	**-**
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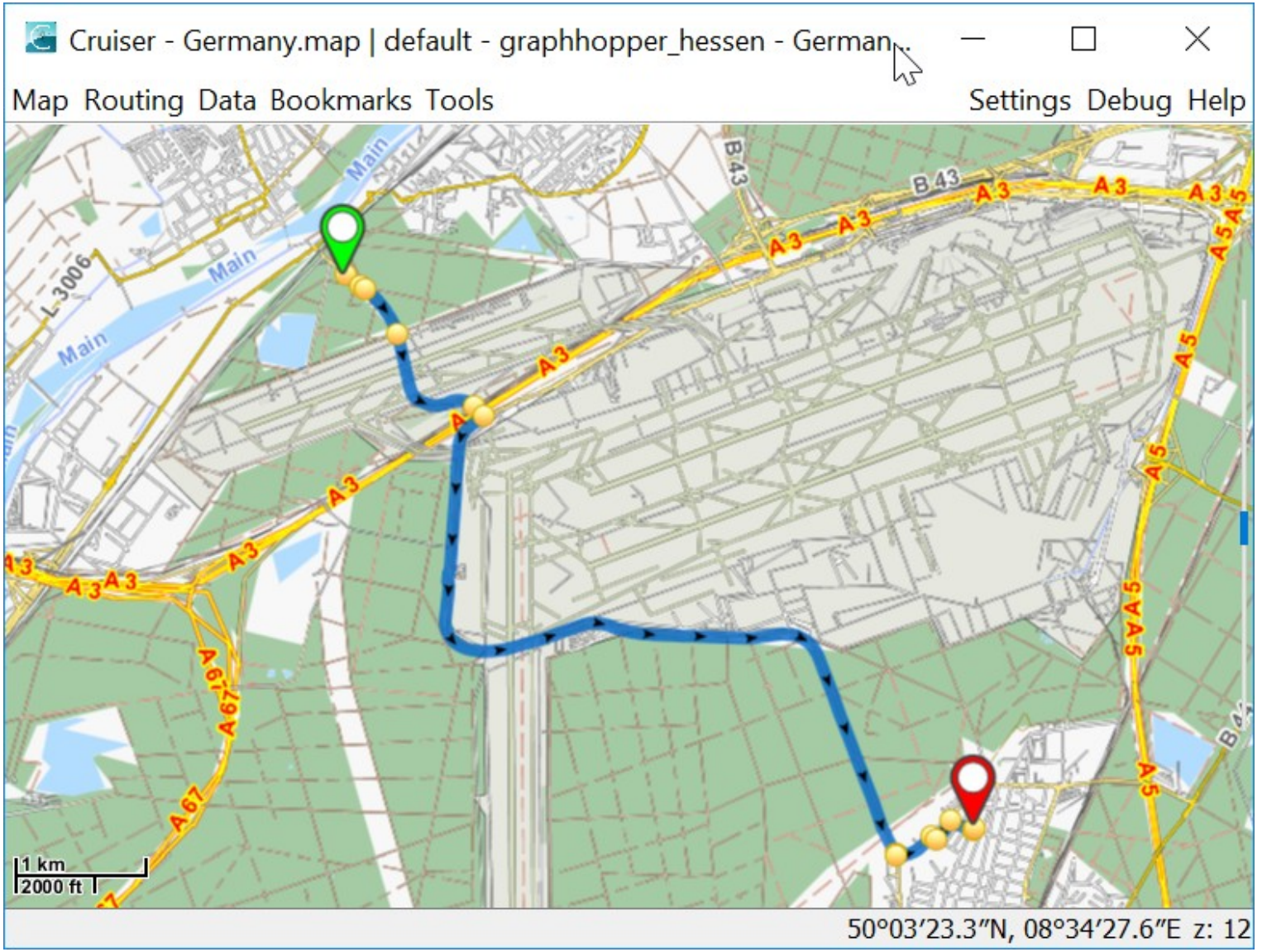
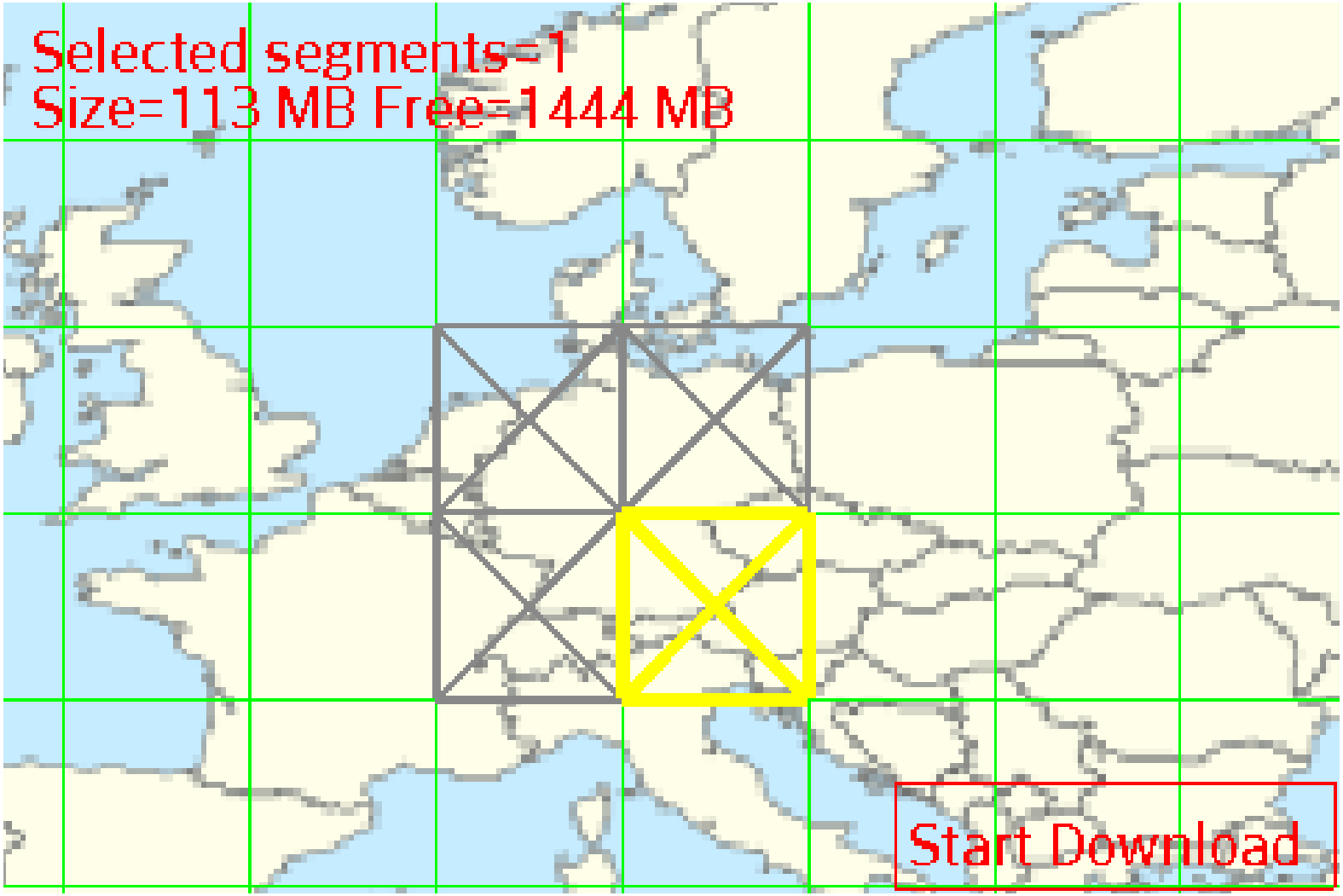
Offline-Desktop 1: Cruiser

Mapsforge + GraphHopper



BRouter Download Manager

(Android App)



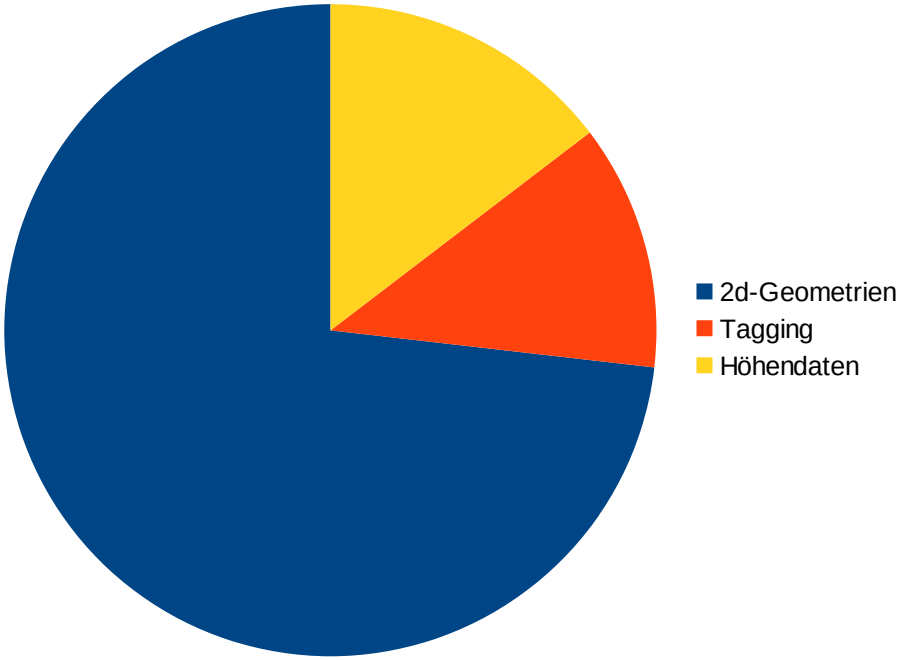
RD5 / Deutschland / Statistik

(per-tile statistical encoding)

- Nodes: 60 Mio / 260 Mio = 23 %

- Size: 250 MB / 3000 MB = 8,2% von „.osm.pbf“

- davon für die 2d-Geometrien = 180 MB (= 3 Bytes / Node)



Verlustfrei <--> Verlustarm

- **Technischer Metadaten des OSM-Datenmodells teilweise auch in „osm.pbf“:**

  technische Primärschlüssel (Node-ID, Way-ID, Relation-ID) zu jedem Objekt

  Version, Benutzer+Zeitstempel der letzten Änderung zu jedem Objekt

- **Technische Daten auch im Tagging: „**created_by“, „source“, ...

- **Koordinaten-Genauigkeit in OSM:** ca. 1 cm

--> Design-Entscheidungen im Proof-of-Concept:

- keine technischen Primärschlüssel und keine technischen Metadaten
- aber alle Tags (auch technische)
- internes Koordinatensystem = Merkator
- Koordinaten-Genauigkeit ca. 8 cm

Mapsforge Format Specification

- Ausschnitt -

Way data

bytes	optional	name	description
variable		number of way coordinate blocks	The amount of following way coordinate blocks as `VBE-U` *INT*. An amount larger than 1 indicates a multipolygon with the first block representing the outer way coordinates and the following blocks the inner way coordinates.
variable		way coordinate block	for each way coordinate block: • amount of way nodes of this way as `VBE-U` *INT* • geo coordinate difference to the top-left corner of the current tile as `VBE-S` *INT*, in the order lat-diff, lon-diff • geo coordinates of the remaining way nodes stored as differences to the previous way node in microdegrees as 2 × `VBE-S` *INT* in the order lat-diff, lon-diff using either single or double delta encoding (see below).

Coordinates in a way data block are encoded in either 'single-delta' or 'double-delta' format according to the flag in the way properties. The encoder chooses the most efficient format on a way-by-way basis so most maps will contain examples of both types.

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~~Relationen~~

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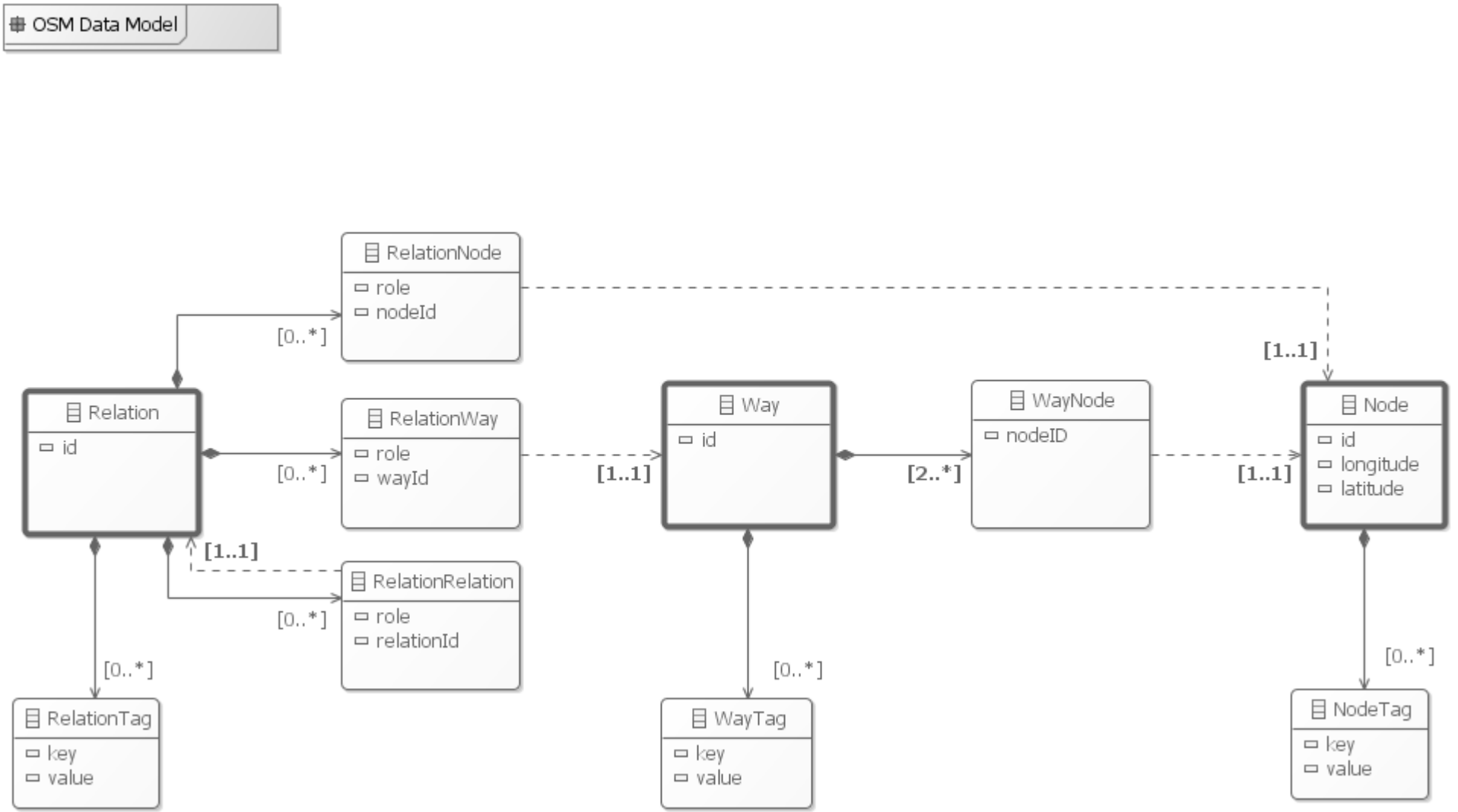
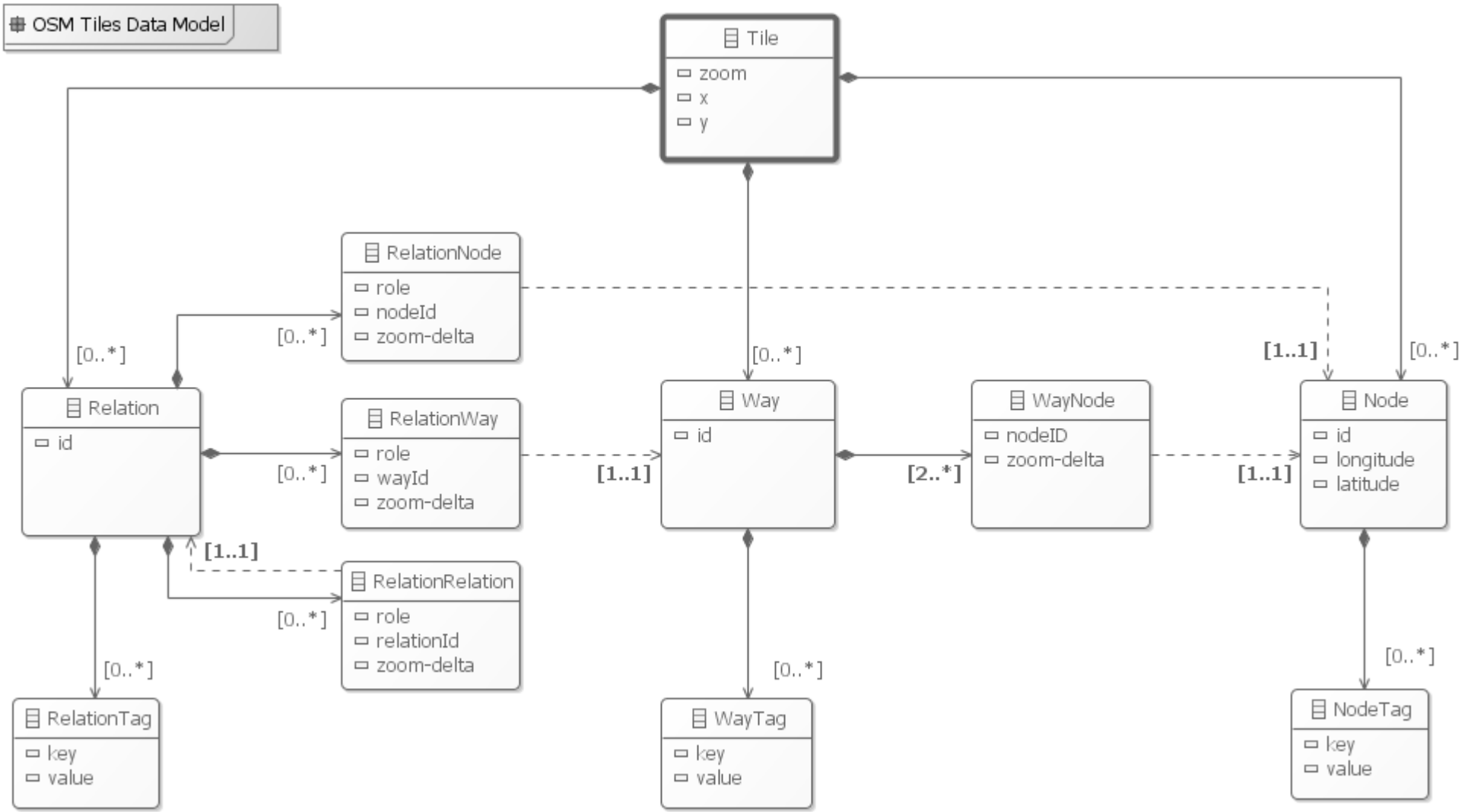
~~Knoten-Identität~~

OSM Datenmodell



OSM Datenmodell mit Kachelstruktur



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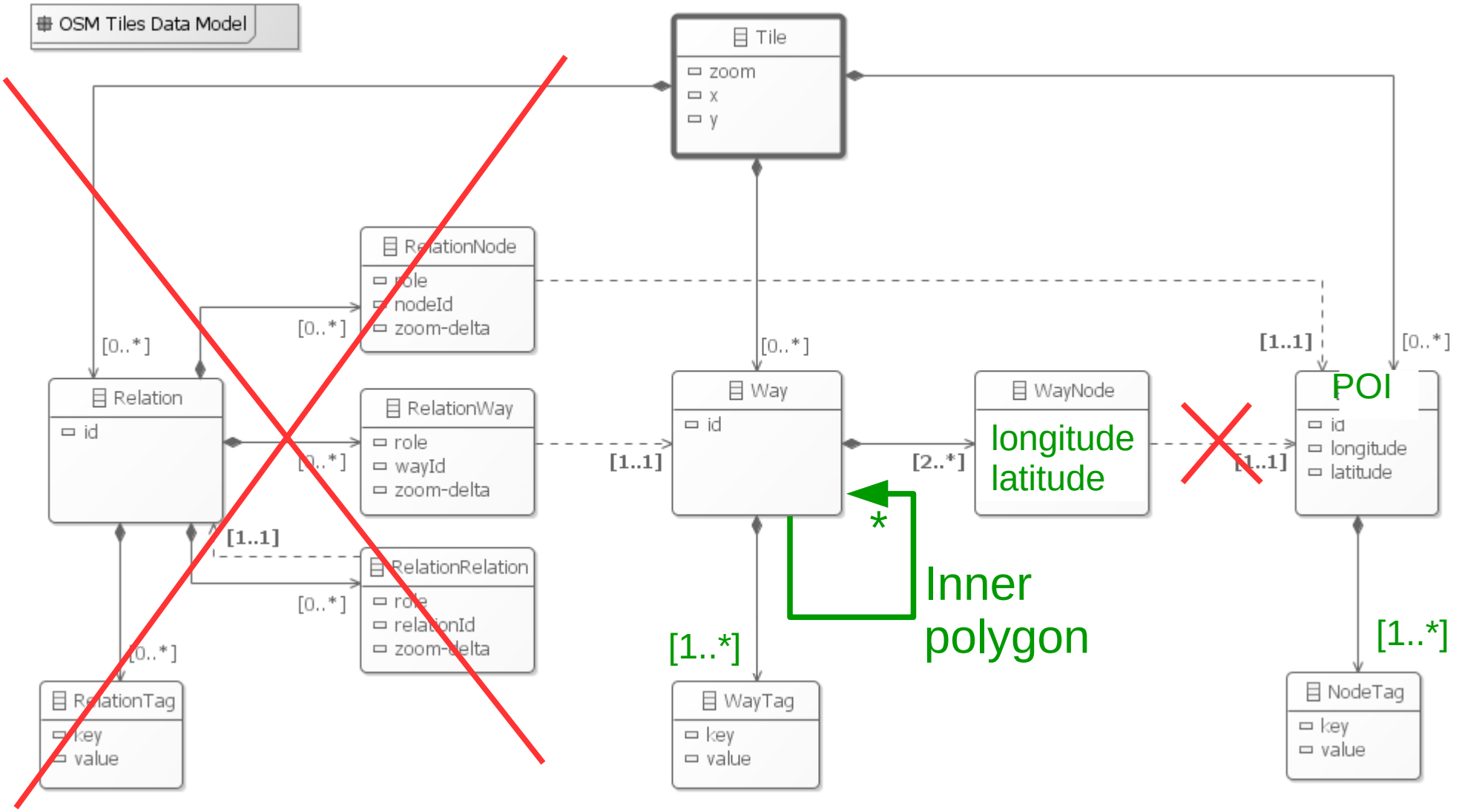

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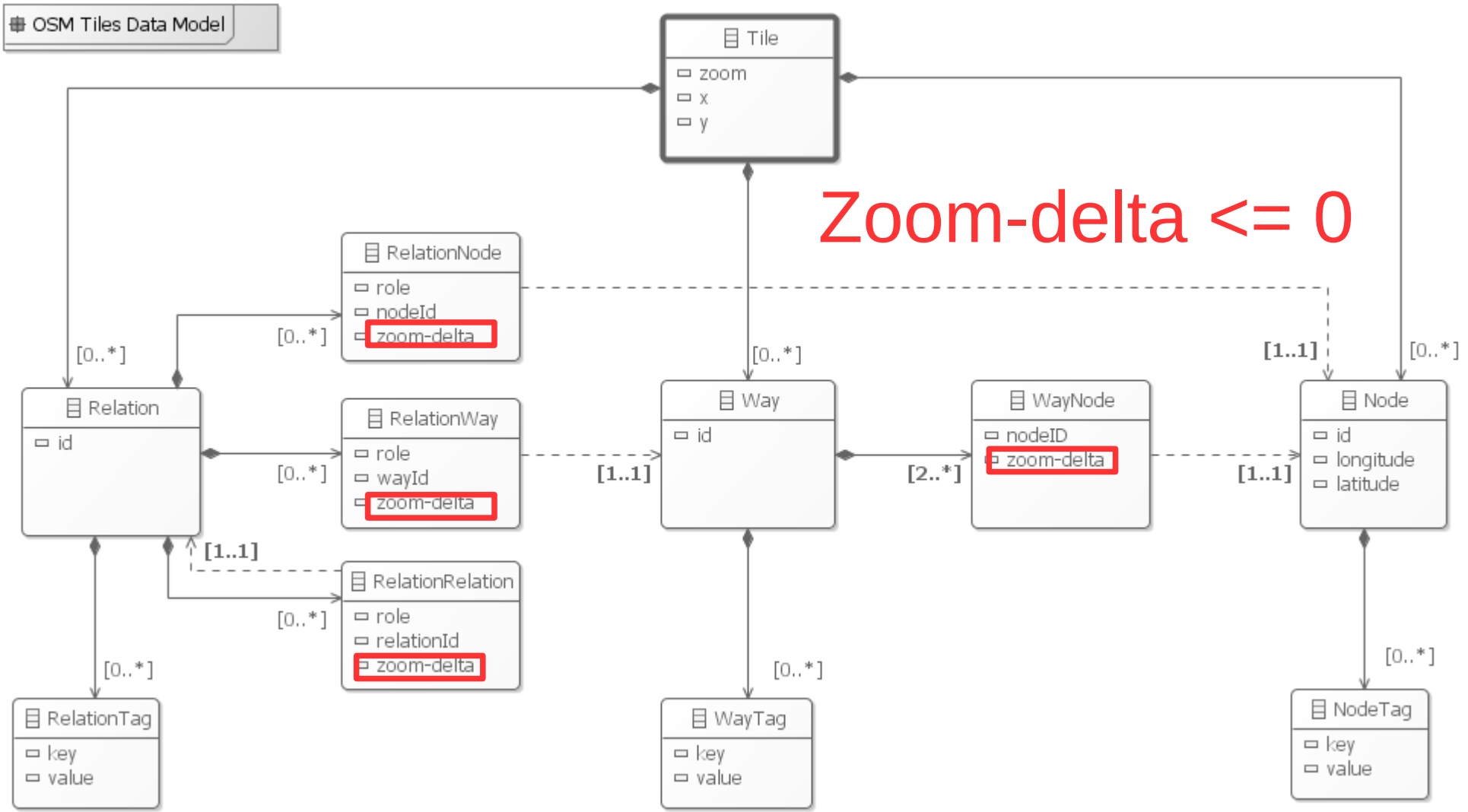
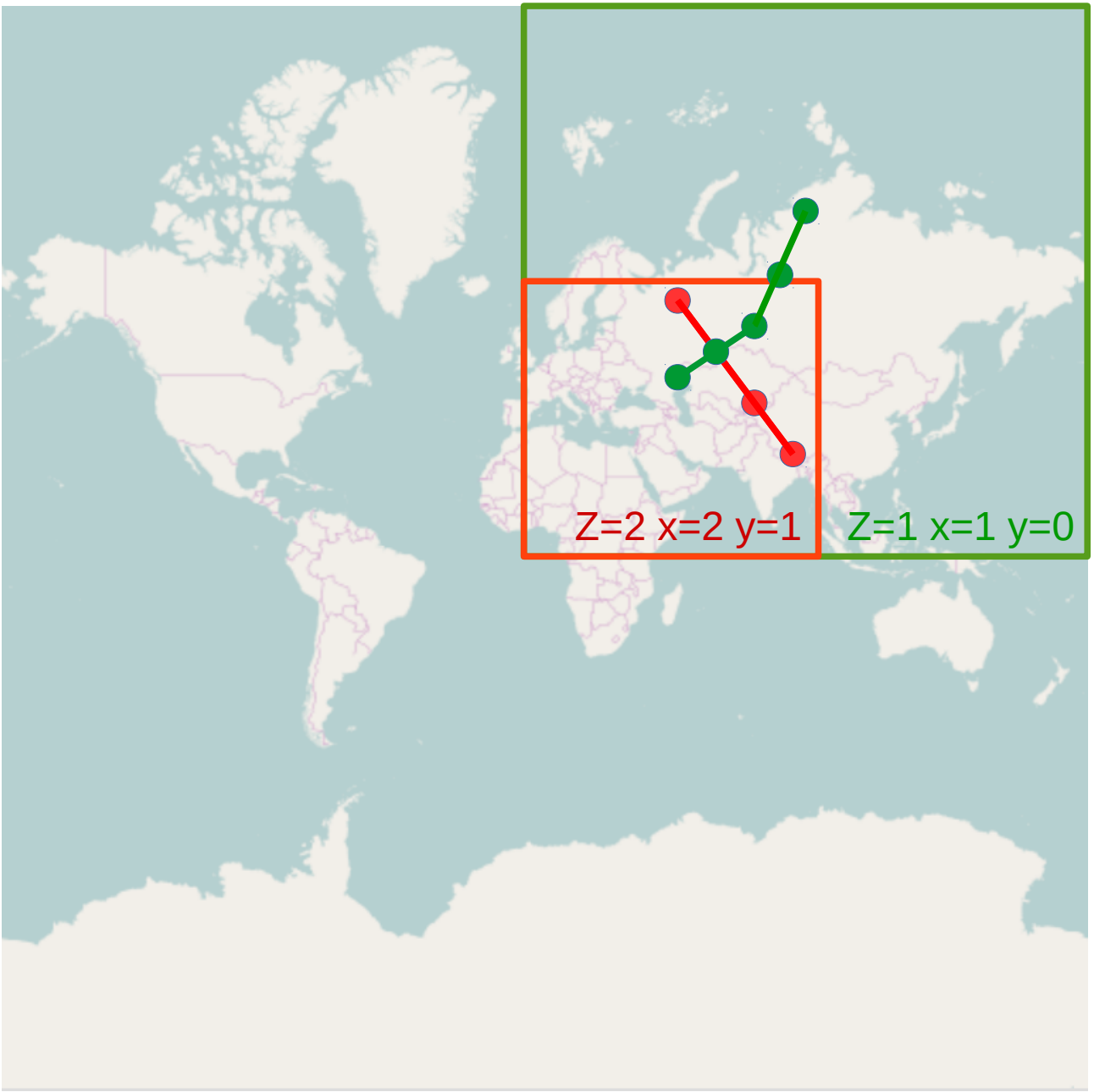
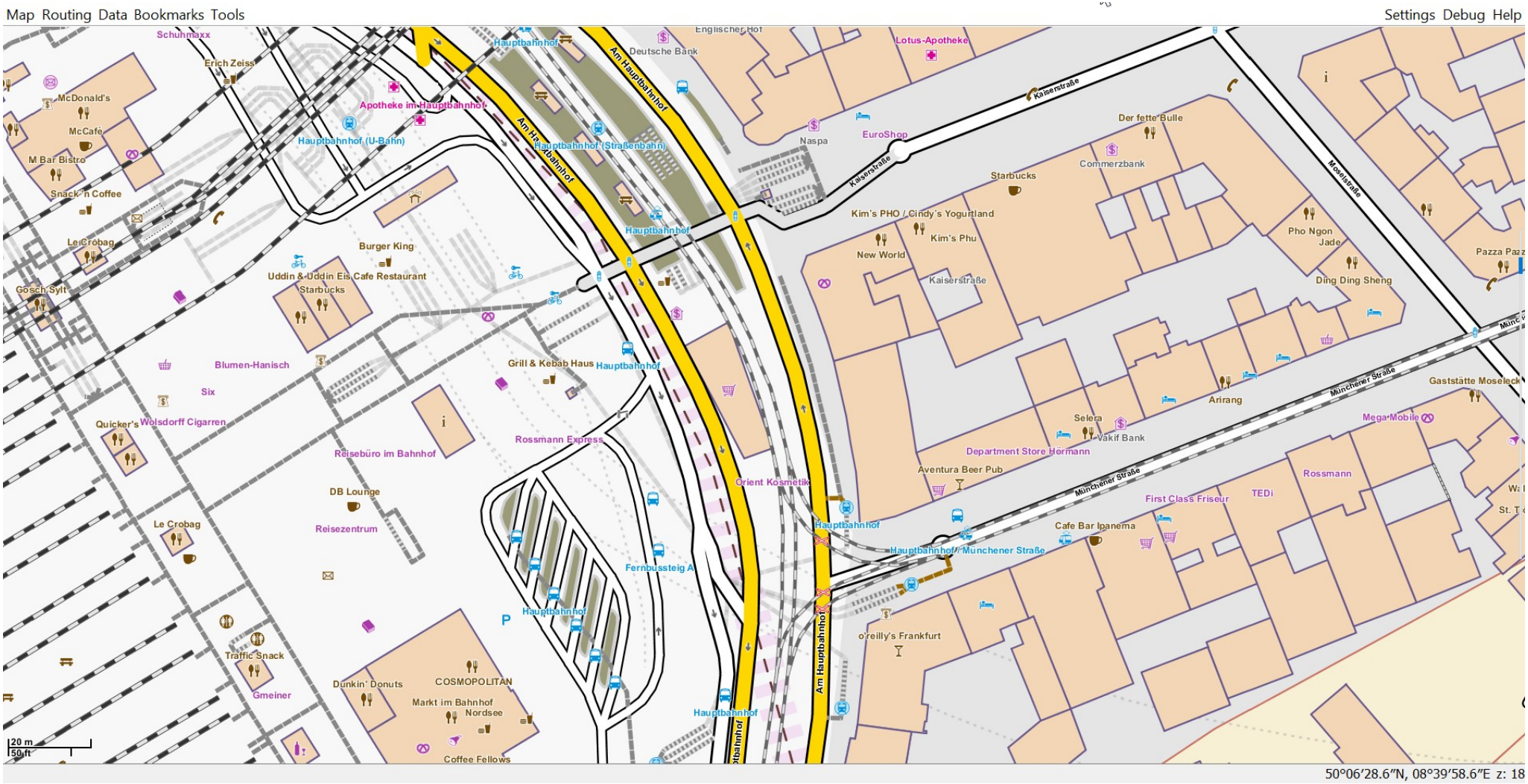


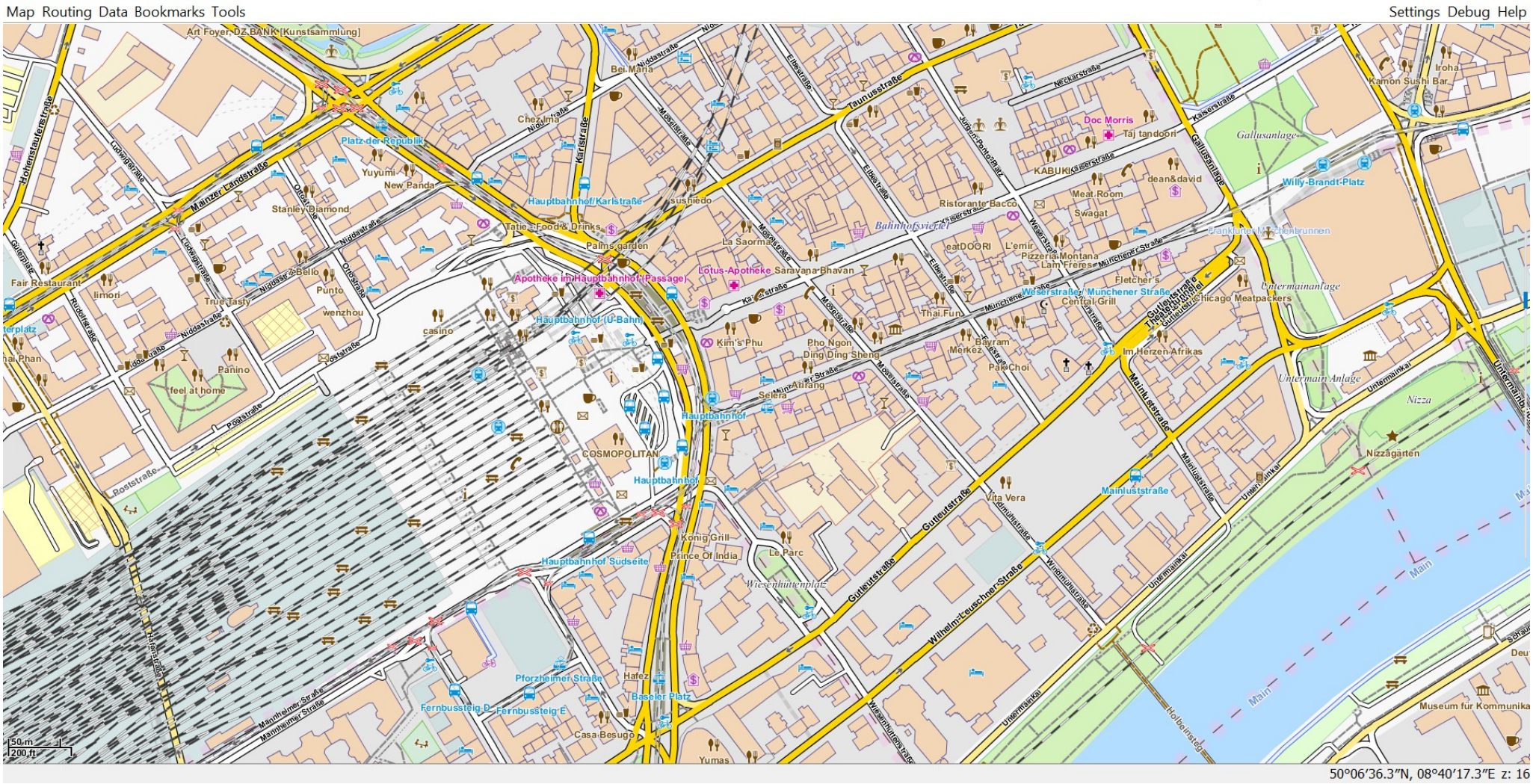
Beispiel: Weg in z=2 hat Knoten in z=1



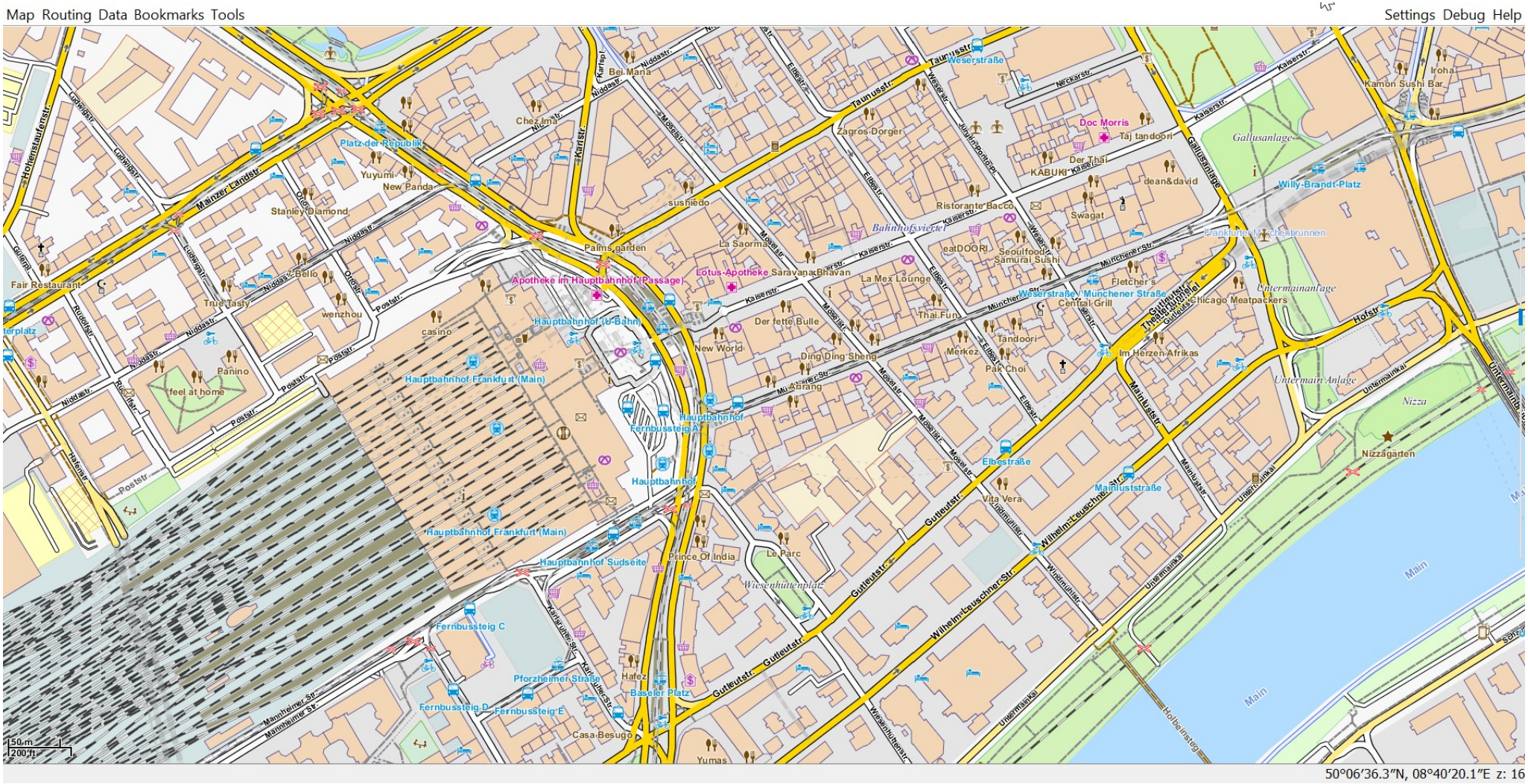
POC-Daten in Mapsfporge/Cruiser: Zoom 18



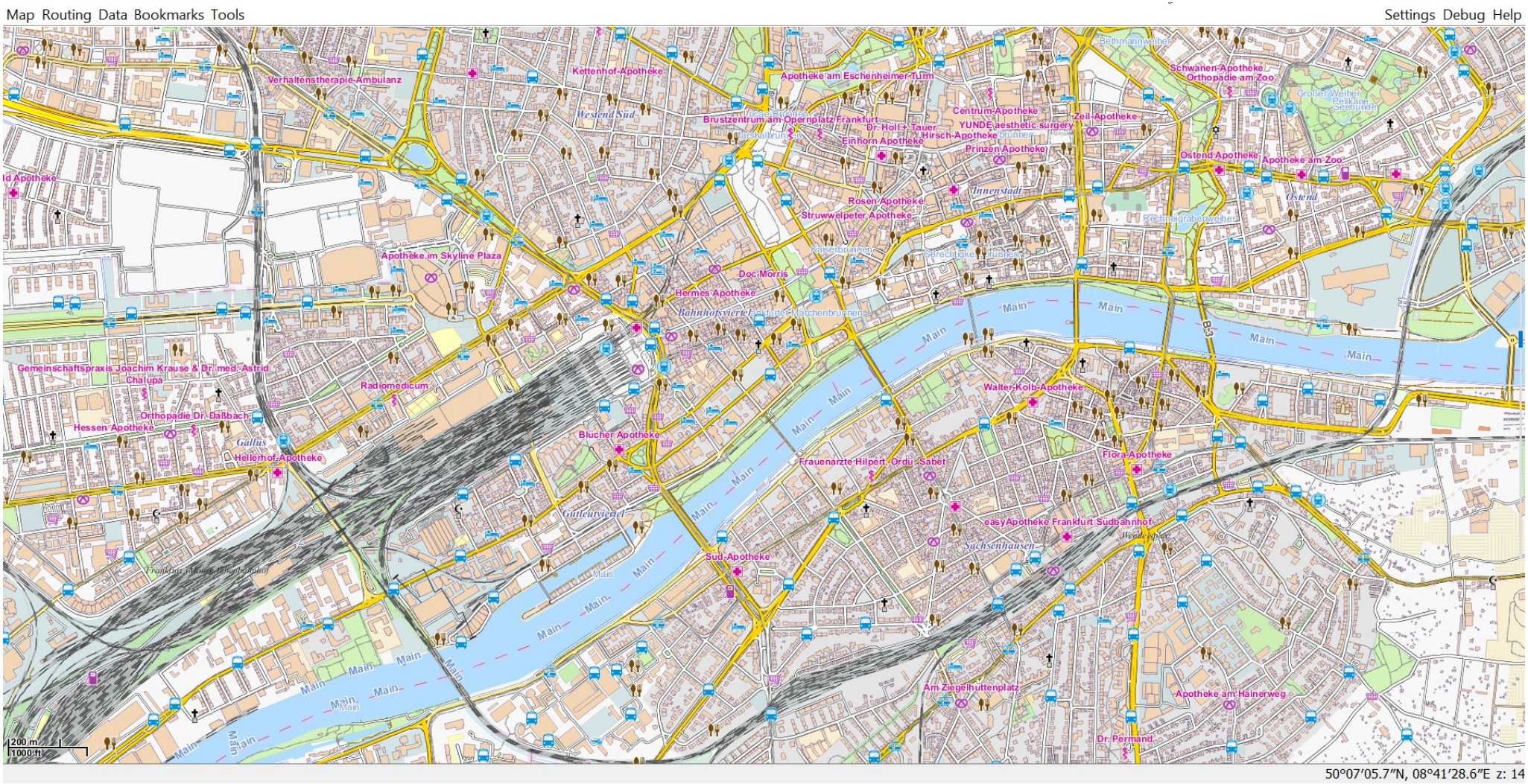
POC-Daten in Mapsforge/Cruiser: Zoom 16



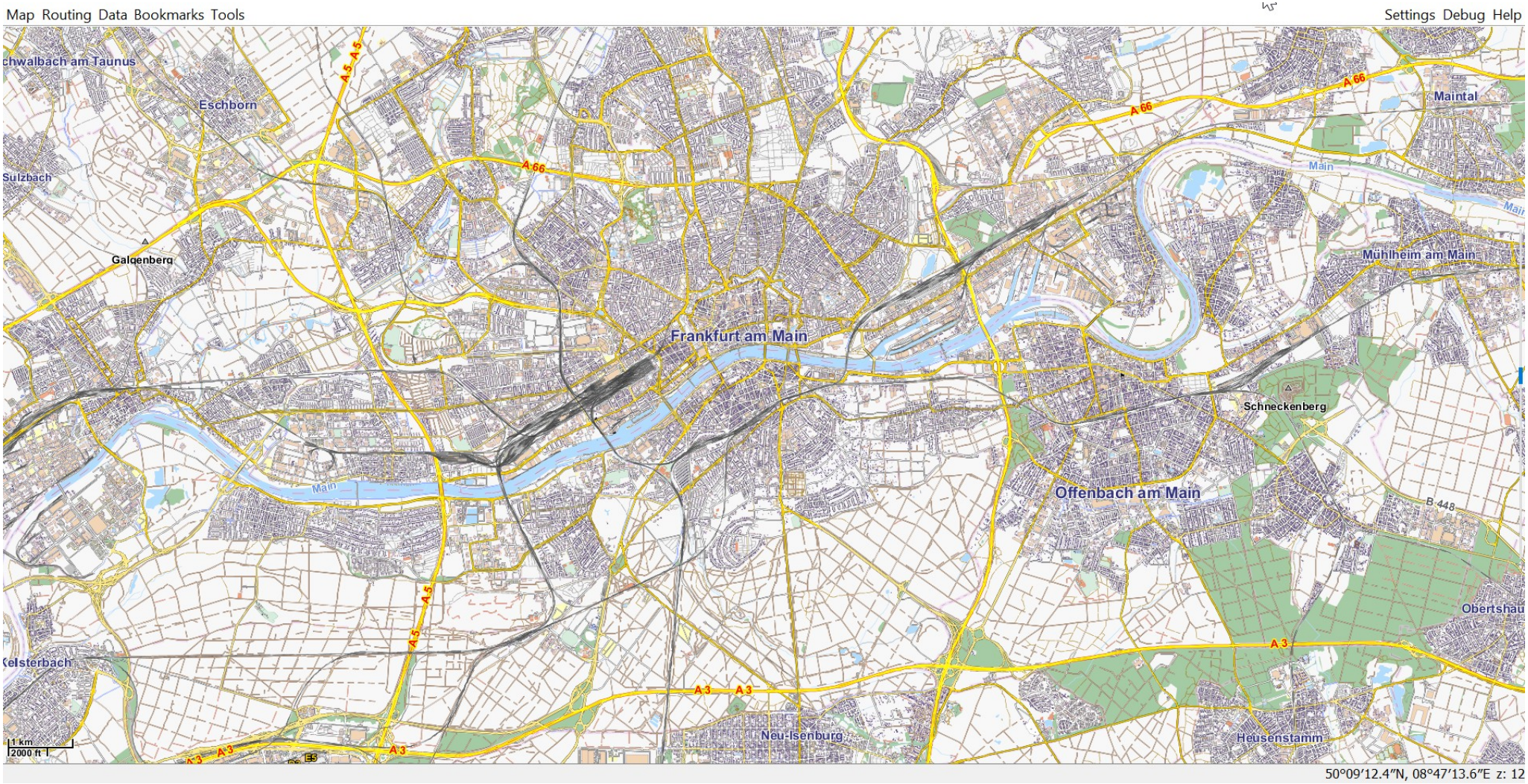
Mapsforge in Mapsfporge/Cruiser: Zoom 16



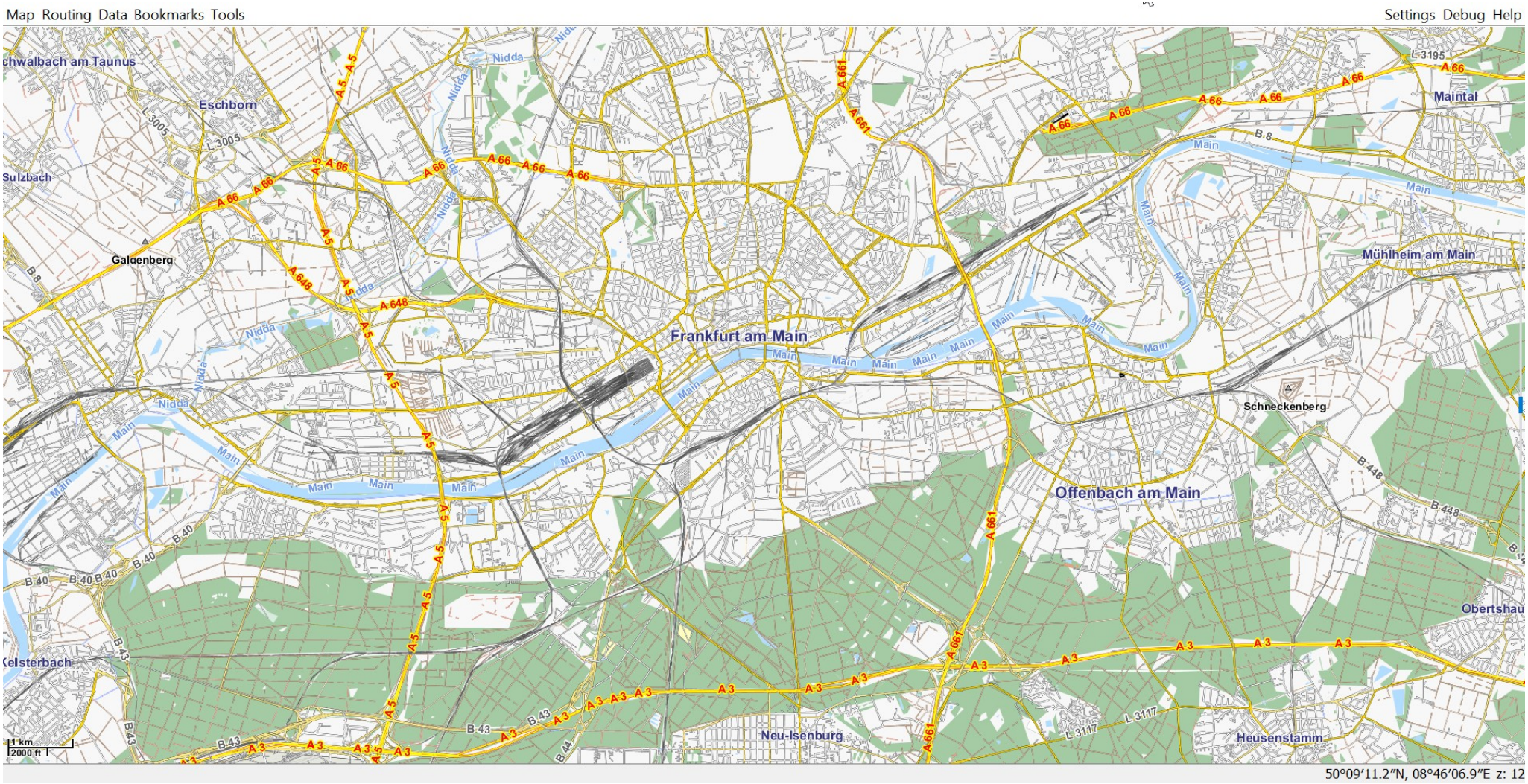
POC-Daten in Mapsfporge/Cruiser: Zoom 14



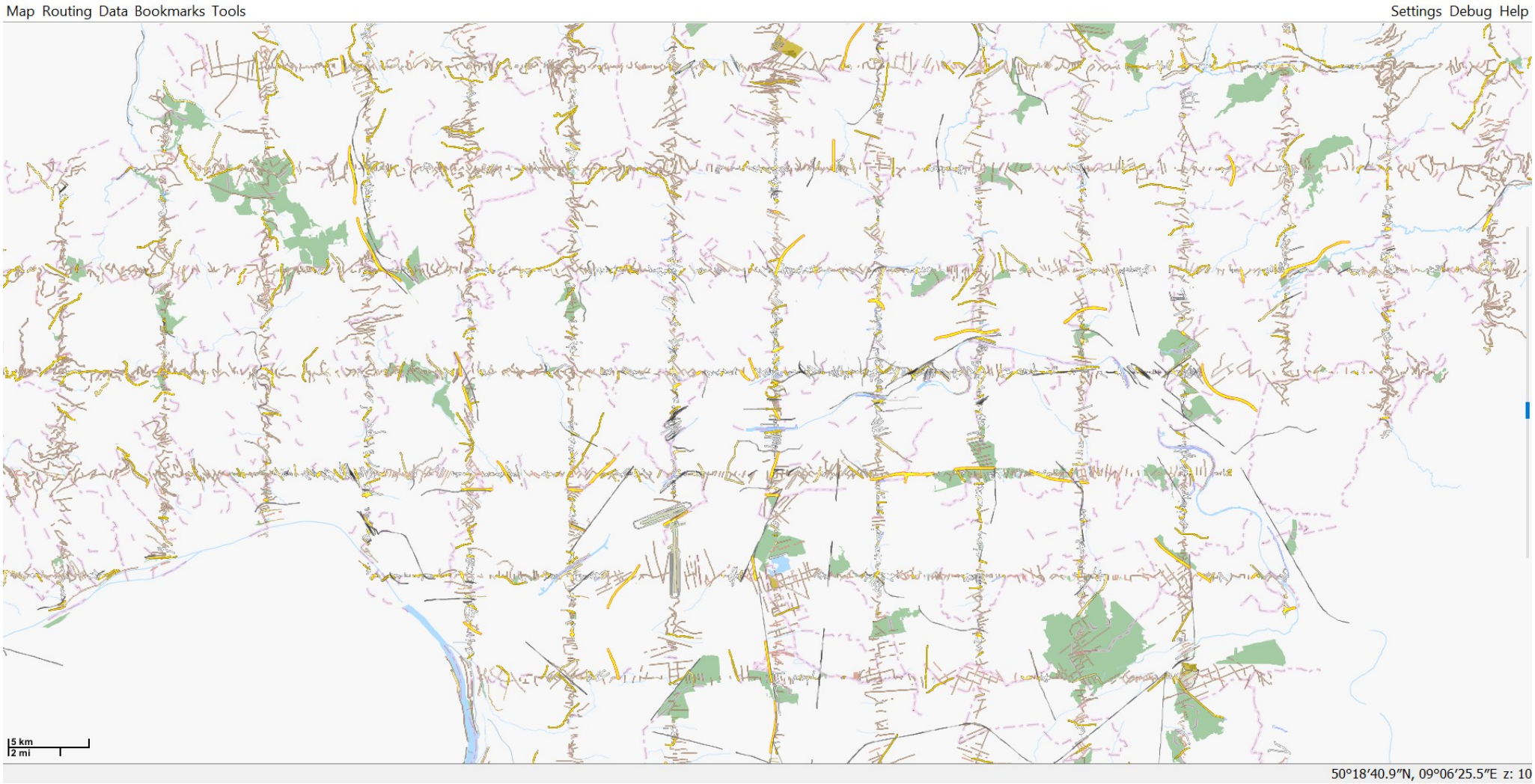
POC-Daten in Mapsforge/Cruiser: Zoom 12



Mapsforge in Mapsfporge/Cruiser: Zoom 12



POC-Daten in Mapsforge/Cruiser: Zoom 10



Ziel

standardisierte Data-Supply Chain für anwendungs-unabhängige Vektordaten

… inkl. Höhendaten (als Raster)

… Datenvolumen <= 40% von osm.pbf

… dokumentiertes Datenformat (keine API !)

anwendungsspezifische Features nur bei hohem Leidensdruck (Coastline?)

planeten-taugliche Kachel-Mühle mit moderatem Resourcen-Bedarf

Milestones

vollständige Mapsforge-Demo

Proof-of-concept Geocoding

BRouter Decoder Demo

Fazit

Universelle, kompakte, verlustarme OSM-Vektor-Tiles funktionieren!

Daten-Format-Zoo im Consumer-Bereich ist Innovations-Hemmnis

Integration im Consumer-Bereich entscheidender Erfolgsfaktor