OpenRouteService.org is three times "Open": Combining OpenSource, OpenLS and OpenStreetMaps

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1. Introduction

Open solutions are getting more and more momentum and support in the GI community. Nowadays we have very usable and stable open source libraries for handling, processing and visualizing spatial data. But Open Source is not the only trend, the other well known and often discussed issue within geoinformatics is the need for open standards, as specified by the *Open Geospatial Consortium* (OGC). Of course there are already open source frameworks that build on these standards such as deegree, 52°North or geoserver. Our software deals with a specific aspect of the OGCs specification: the *Open Location Services* (*OpenLS)* explained later, parts of which will be available as a new open source project at www.freeOpenLS.org in the foreseeable future.

But in addition to the already known combination of Open Source and open GI standards (OGC web services) recently with the appearance of the Web2.0, where anybody, i.e. non-specialist persons can contribute with their own data and software, also new relevant phenomena appeared concerning spatial data: People can contribute their own geodata in a collaborative attempt to build an open spatial dataset which resulted in the successfully OpenStreetMaps project (2007).

Therefore we can distinguish three aspects of openness:

- Open (GI) standards (OGC)
- Open source (GI) software
- Open (GI) data

We will introduce and discuss an example where all these three are combined in a new service that has been developed recently and is currently being extended and improved in order to meet real world requirements for a new online service. The most important application for street data and in the case of route planning we have only recently all three versions of openness combined in one new system which will soon be available at www.openrouteservice.org.

2. OpenRouteService.org

OpenRouteService.org uses free and open street data and map data from sources such as OpenStreetMaps.org and delivers route planning functionality through open standardized interfaces by the OGC. We have implemented a route service according to the OGC OpenLS Specification. It also will be made available as Open Source soon. Currently we are just setting up the website and

improving the performance of the service for larger number of users and higher volumes of data. The amount of data provided by OpenStreetMap is already huge and is still growing. As first example we selected the data for Germany, and we have here already more than 400.000 streets that need to be transformed into a topological graph structure that is read and processed by our service (see figure 1).

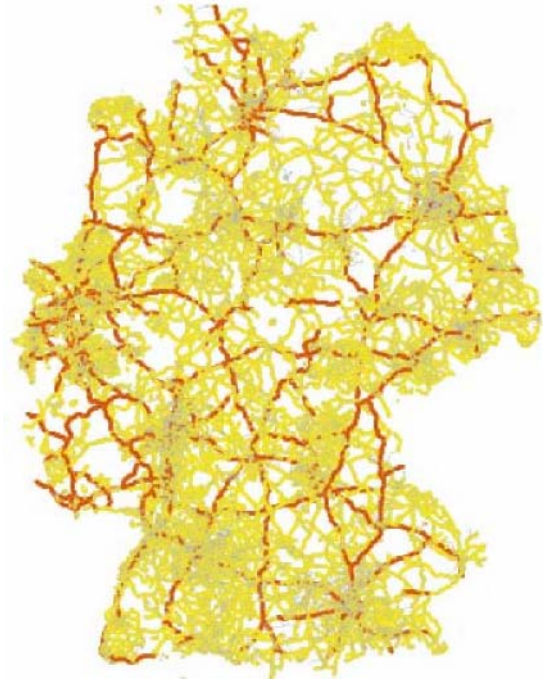

Figure 1. OpenStreetMap for Germany used in our OGC services (WMS, WFS, OpenLS RS)

OpenStreetMaps provides free editable and usable street data (Nelson et al 2006), but for several reason this data is not provided through a standardized specification, but through a specialized API and proprietary XML schema. This has reasons which will be discussed in the full paper. While OSM has reasons for using their own formats, we think that the data provided by OSM is too important to be left out in the current trend of setting up SDIs (spatial data infrastructures) based on open OGC standards realized as web services. Therefore we also loaded parts (current scenario is focussing on Germany so far) in OGC standards based services, like WFS (Web Feature Service,), WMS (Web Map Service) and most important our OGC OpenLS Route Service (RS) and make them available as such.

3.) Web 2.0 and standard based spatial data sharing

The Web 2.0 type of free geodata (Turner 2006, Gillavry 2006, Holone et al 2007,) usually does not come in open standards, but is integrated through the Google Maps API or as *Google Earth* (GE) kml-files. While GE is now OGC principal member and KML is likely to become an OGC standard soon, that data put into GE by web2.0 users is not integrated in an open SDI, but found and visualized through a proprietary software – the GE Viewer (which is also not free for commercial users). While it includes the capabilities to search for full text entries in the data, this cannot be compared to the standardized and structured way real metadata is handled through OGC catalogue services (CS-W).

An SDI based approach (technically speaking: the use of standardized *OGC web services* (OWS)) for sharing free spatial data has been proposed by Tschirner and Zipf (2005). But due to lack of resources www.geoxchange.org remained a prototype. We consider reactivating this and developing a new portal www.openGeoXchange.org. Integrating OpenStreetMap data into WFS and WMS, as we have done for OpenRouteService.org is a first step towards such an undertaking towards the integration of Open Spatial Data and Open GI Standards.

4. Standards for Routing and Location Based Services: OpenLS

OpenLS is the acronym for OpenGIS Location Services. Since 2000 this OGC initiative has been developing implementation specifications for standardizing services that are relevant for *Location Based Services* (LB S). The OpenLS service framework consists at the moment of five core services:

- The Direcory Service,
- Gateway Service
- Location Utility Service (Geocoder/Reverse Geocoder)
- Presentation Service
- Route Service

Only recently a 6th service has been standardized by the Location Services working group: the "Tracking Service" But is not considered a "core" service. Also just since winter 2007 a new version 1.2 of the OpenLS specification has been successfully adopted by the OGC.

A further service - the "Navigation Service" - has been in discussion since 2000, but has not yet reached a stable version. Therefore we only introduce shortly the five OpenLS core services and then focus on the route service and our implementation of this together with OSM data

The Route Service offers a broad range of possibilities, among them are several parameters hat determine the result, e.g.:

1. *RouteSummary* – gives meta information about the requested route, e.g.: overall distance, units, overall needed time etc.
2. *RouteGeometry* – requests the routes geometry (line string containing all waypoints of the route). It is possible to define a maximum number of waypoints. We have realised this generalisation using the Douglas-Peucker-Algorithm.
3. *RouteInstruction* – these are "step by step" driving instructions of the calculated route. We realized this for various languages (e.g. German, English, Italian, Swedish...).
4. *RouteMaps* – The calculated route is displayed on a route map. Amongst other possibilities an overview map as well as detailed maps of the start- and destination can be requested.

5. Applying the OpenLS Specification

So far we have implemented three of the original five core services (Location Utility Service, Presentation Service und Route Service) and two more (Directory Service and Tracking Service) are under development. In particular the Route Service has already been successfully used by some of our other projects (www.ok-gis.de, www.heidelberg-3d.de, www.rewob.de).This means that several specialized or extended versions have been developed as spin-offs of the OpenLS RS:

- *Emergency Route Service* (ERS) – The ERS considers actual avoid areas from a WFS (flooded or blocked roads or areas) automatically. Neis et al (2007)
- *Accessibility Analysis Service* (AAS) – The AAS calculates a polygon representing the area that is reachable within a certain time distance based on a street network around a given location. Neis and Zipf (2007)
- *Route Service 3D* (RS3D) – The RS3D maps the route geometry onto a digital elevation model (DEM). Neis et al. (2007)
- *Route Service with Landmarks and Focus Maps.* Neis et al (2007)
- *3D Route Service with Landmarks and 3D Focus Maps.* Neis et al (2008)

6. Discussion and outlook

Our OpenLS Route Service will be made available soon as open source at a new portal we are currently working on: www.FreeOpenLS.org. The further OpenLS services shall be added also in the future, but details on this have not yet been decided. So far we have successfully tested our service based on a modified version of the geotools Dikstra library with OSM data consisting of more than 800.000 street segments. But when we cover whole countries or even Europe the response time increases to several seconds, therefore we need to use a more sophisticated approach.

Of course there are a range of other route planning algorithms and according libraries available. We will test these and then decide which one will be used in future realizations of the route service in order to speed up response times. We just are in the process of conducting more research in this topic and will select or even improve an appropriate strategy as a result. This will be presented at the conference.

References

Coast S. (2007). *OpenStreetMap.* Workshop on Volunteered Geographic Information, December 13-14, 2007 http://www.ncgia.ucsb.edu/projects/vgi/

Heidelberg – 3D: www.heidelberg-3d.de / www.gdi-3d.de

Holone, H, G Misund, H Holmstedt (2007): *Users Are Doing It For Themselves: Pedestrian Navigation With User Generated Content.* In: The 2007 International Conference on Next Generation Mobile Applications, Services and Technologies, 2007. NGMAST '07. p 9 1-99

Gillavry, E. M. (2006): *Collaberative Mapping and GIS: An Alternative Geographic Information Framework.* In: Collaborative Geographic Information Systems.

Neis, P., A. Schilling, A. Zipf (2007): *3D Emergency Route Service (3D-ERS) based on OpenLS Specifications.* GI4DM07. 3rd Int. Symp. on Geoinfo. for Disaster Management. Toronto, Canada.

Neis, P., A. Zipf (2007): *A Web Accessibility Analysis Service based on the OpenLS Route Service.* AGILE 2007. Aalborg, Denmark.

Neis, P. and Zipf, A. (2008 in work, invited): *Generating 3D Focus Maps for the (mobile) Web - an interoperable approach.* In: International Journal of Location Based Services (JLBS).

Neis, P. and Zipf, A. (2007): *Realizing Focus Maps with Landmarks using OpenLS Services.* 4th International Symposium on LBS and Telecartography 2007. Hong Kong.

Nelson, A., A de Sherbinin, F Pozzi (2006): *Towards development of a high quality public domain global roads database.* Data Science Journal, V.5, November 2006- pp.223-265

OPENLS: OGC Open Location Services Version 1.1
http://www.opengeospatial.org/standards/olscore

Turner, A. (2006): Introduction to Neogeography.

www.FreeOpenLS.org

www.OpenRouteService.org

www.opengeocoder.org

Zipf, A., J. Basanow, P. Neis, S. Neubauer, A. Schilling (2007): *Towards 3D Spatial Data Infrastructures (3D-SDI) based on Open Standards - experiences, results and future issues.* In: "3D GeoInfo07". International Workshop on 3D Geo-Information. Delft, NETHERLANDS.

Zipf, A., Tschirner, S. (2005): *Finding GI-datasets that otherwise would have been lost - GeoXchange - a OGC standards-based SDI for sharing free geodata.* 2nd International Workshop on Geographic Information Retrieval (GIR 2005) Bremen, Germany. Springer.