Open Source Software in Daily Bavarian Cadastral Work – Practical Experience

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Key words: Open Source Software, GI standards, ISO, OGC, cadastre

SUMMARY

The Bavarian Administration for Surveying and Geoinformation (BVV) includes 73 cadastral offices all over Bavaria. The main tasks are the running of the new cadastral information system (ALKIS) as well as the data collecting (surveying) in the field. Since decades the BVV use modern technology to fulfill this tasks. With the implementation of ALKIS open source tools and software have been introduced mainly to reduce licensing cost for more than 2000 personal computer. The whole cadastral process uses Open Source Software and self-developed tools at the level of data capturing (measurements in the field with self developed software) as well as data storing (PostgresSQL, PostGIS) and data delivery via web services (UMN Web server). The following picture shows all corresponding components. However, right now there is no Open Source GIS software available in Germany fulfilling the requirements of such a complex system like the German cadastre. Therefore, 'just' some basic software and data base tools have been applied.
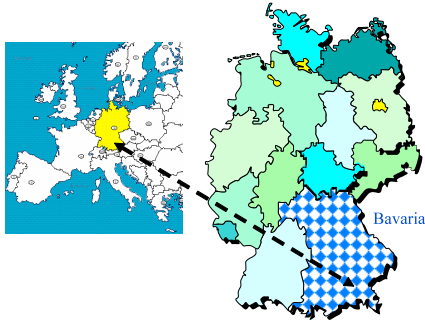
The paper will give an overview of the new cadastral system ALKIS and how the use of international GIS standards can support the use of Open Source Software. The advantages as well as limits and risks of using Open Source Software will be discussed based on the experiences in Bavaria.

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CADASTRAL SURVEYING IN BAVARIA – SOME STATISTICAL FACTS

Bavaria is one of the 16 states ("Länder") in Germany in central Europe. It is located in the southern part of Germany. Bavarian contains an area of some 70.000 square kilometer with around 11 Mio. inhabitants.
The cadastral register contains some 10 Mio parcels and 3.5 Mio buildings. Each year 55.000 parcels and 160.000 buildings are surveyed.

Traditionally, in Germany the cadastre is seperated from the real estate register that is running by the Minitsry of Justice. The establishment and maintenance of the cadastre in Germany lays in the responisbility of the Länder. Different Ministries are responsible for the cadastre, e.g. in Bavaria the Ministry of Finance. The cadastre describes all parcels of the area of the national territory. All information concerning boundaries, geometric extension, land use and location of parcels are determined in cadastral maps and cadastral registers. On the other hand the land register keeps information about ownership, leashold and other legal appointments. Land register and the cadastre depend on each other. So a exchange of information is urgently needed.

GENERAL CADASTRAL FRAMEWORK

Germany is a classic example of a country that takes great pride in it's highly accurate maps and cadastral data. In the last three decades several independent geoinformation systems has been developed in the field of cadastre and topographical mapping. Right now a redesign of the German digital cadastral information system ALK (Automated Real Estate Map) is under development. The new approach - called ALKIS (Official Cadastral Information System) - was launched in order to harmonize the structures of ALK and the topographic database ATKIS on the one hand and to integrate the cadastral map and the land titles into one single model which was usually separated for historical and technical reasons. Adding also the geodetic reference points (AFIS) almost all official data of the surveying and mapping agencies are defined in a common and harmonized data model, called the AAA data model (AFIS-ALKIS-ATKIS Data Model).

For that reason the Working Committee of the Surveying Authorities of the States (Länder) of the Fedaral Republic of Germany (AdV) has started developing a new conceptual data model based on international GIS standards which helps to fulfil this harmonization. That will bring the surveying and mapping agencies in Germany to a nation wide well defined data that can

be used as a baseline for many other thematic application schemas. For the inreasing efforts in building up a apatial data infrastructure the AAA data model can generally be used for standardization of these thematic data as well and could help to standardize the Geoinformation in Germany brick by brick.

While the data model is a common approach for all Länder in Germany, the corresponding transposition of this concept and the software development and implementation is up to the Länder. Except of Bavaria all Länder in Germany launched calls for tender in order to buy software solutions from specific GIS vendors.

The consequent use of GIS standards

There is a strong benefit of using international ISO standards for geographic information. ISO standards for geographic information provide methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations.

The standards AFIS, ALKIS and ATKIS of the AdV are described in the GeoInfoDok in a **conceptual** format on the basis of ISO 19109 Rules for Application Schema. This means specifically:

– Modelling in UML (Unified Modeling Language), stadardized interface using GML (Geographic Markup Language - ISO 19136)

– Compliance with the regulations of ISO 19103 for the use of UML

– Use of relevant ISO standards, e.g. 19107 (and therefore by implication ISO 19111), ISO 19115, ISO 19123

– Automated derivation and mapping of feature catalogues in accordance with ISO 19110.

An automated derivation of the data exchange interface for AFIS, AKIS and ATKIS objects, the NAS, completes this picture.

The application of ISO standards in any GIS (e.g. ALKIS) will help to:

– Increase the understanding and usage of geographic information

– Increase the availability, access, integration, and sharing of geographic information

– Promote the efficient, effective, and economic use of digital geographic information and associated hardware and software systems

– Contribute to a unified approach to addressing global ecological and humanitarian problems

– Allow any software developer to analyze the specific demands and to derive an implementation model out of the conceptual data model.

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The AdV has consequently adopted these objectives and decided to consider the ISO standards within the new AAA application schema as far as possible.

Open Source in the Surveying Administration in Bavaria

The Bavarian Administration for Surveying and Geoinformation uses Open Source Software and self-developed tools at the level of data capturing (measurements in the field with self developed software) as well as data storing (PostgresSQL, PostGIS) and data delivery via web services (UMN Web server). The following picture shows all corresponding components.
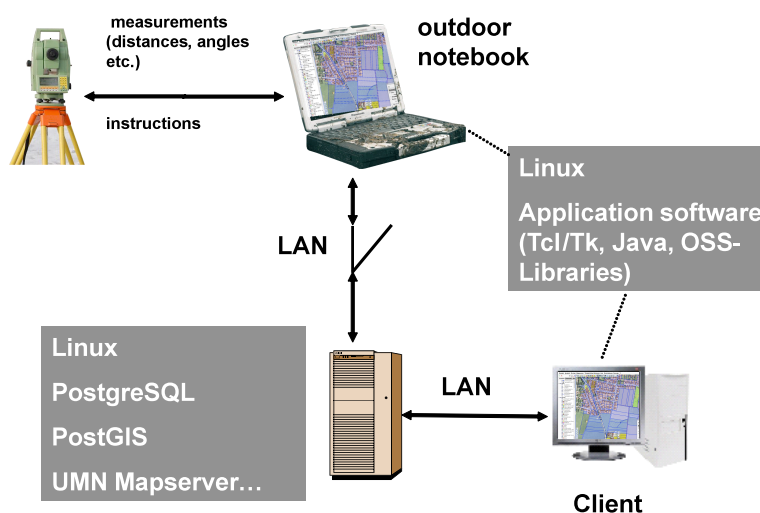
For integration the cadastral data in the national spatial data infrastructure several web services have been established also using Open Source Software. The customization for the requirements of the cadastral administration has been done by own developers.

Right now there is no Open Source GIS software available in Germany fulfilling the requirements of such a complex system like the German cadastre. Therefore, some basic software and data base tools have been applied, but an additional development of specific requirements is crucial for the implementation of practical solutions for the daily work. In Bavaria these developments are not done by contractors or software vendors, but by own software developers within the Bavarian Administration for Surveying and Geoinformation. After running Open Source software since many years, the main experiences for such a self-development in Bavaria are:

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- The policy strongly requests the public administration to implements Open Source Software as far as possible and to limit the increasing costs for licences and software maintenance.

- There are just low costs for licensing (the administration holds some 2500 personal computer for the employees).

- Customized solutions perfectly adjusted to the requirements and the demands of the people working with the software.

- Smooth integration into the business processes

- Homogenous ICT system environment (hardware and software) that allows low costs for maintenance, implementations and integration (e.g. the maintenance is don remotely; no ICT specialist are necessary at the local level in the cadastral offices)

- Independency from any software vendor

- Updating and bug fixing can be done very quickly and efficiently.

Open Source Experiences (advantages and risks)

In terms of **technology** the following positive experiences can be stated:

- Technical requirements (performance, stability etc.) are sufficiently fulfilled by Open Source Software products at least as the surveying administration is concerned.

- PostgreSQL is a powerful database for GIS purposes that is sufficient for cadastral applications

- System requirements are lower for open source products than for professional proprietary products

- Good maintainability

- Installations can be automated in an efficient way (from one location to 73 servers and 2500 clients without manual interaction)

- Fast reaction on changing frameworks (data model, data exchange interfaces etc.).

Regarding the **software** that has been developed with Open Source tools or based on Open Source solutions (e.g. PostGIS) the following conclusions have been drawn:

- Not-Open Source proprietary software solutions do not really meet the specific demands of a country and of specific workflows. A customization has to be done in any case.

- There is a demand for open source cadastral functions (no one should reinvent the wheel); maybe the LADM (Land Administration Domain Model) leads to a solution for that.

- Open Source solutions for web services (e.g. WMS, WFS) are modular components inter-operating on internet services that support the implementation of a spatial data

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infrastructure by improving the accessibility to cadastral information („web services for geo-enabling the world").

There are also **some limits and potential risks** by using Open Source products in the field of cadastre:

– Specific technical personnel is required with particular skills in the field of programming languages (Java etc.), DBMS, SDBMS (PostgreSQL), system, networks and implementation of ISO standards.

– By introducing a new system the most efforts have to be done in the field of data migration (to meet the rules of the data-model) and data acquisition -> in Bavaria the most labour-intensive and technical challenging task. The software development is not the most expensive component.

– The reputation of Open Source Software is not the very best. People assume that installation is difficult, the operation complicated and there is bad support. Even it has been proved that it is not the case in the Bavarian Administration for Surveying this prestige is still there.

However, even if there are also some potential risks and definitely a lot of things to be done before Open Source Software can be sufficiently implemented, the experiences in Bavaria are very positive. It has been shown that the implementation of Open Source applications is a reasonable approach in the field of cadastral administration.

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BIOGRAPHICAL NOTES

Markus Seifert is head of the project team "SDI Standards" that is modeling the conceptual schema of the AAA data model. Furthermore he represents the Bavarian Organization for surveying and cadastre in several national working groups concerning the standardization of public geospatial data. On behalf of the Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany (AdV) he is the head of the German delegation at ISO/TC 211 and CEN TC 287.

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