

## **Interoperable portal for web-based geospatial data and geoprocessing services**

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### **Abstract**

A research project “Interoperable portal for web-based geospatial data and geoprocessing services” has been started at the Technical University of Munich in co-operation with the government of the land Bavaria in the framework of “High-Tech-Offensive” by the state in 2000.

During the whole project standards and de-facto-standards of Open GIS Consortium (OGC) are taken into consideration, as interoperability initiatives of OGC have increased process of development and availability of products for access to overlayable maps.

The paper presents some first results and the following contents of the project:

- Definition of a web-based interoperable geoportal, which will provide direct access to geospatial data from different sources based upon the idea of distributed data storage.
- Interoperable technologies and interface requirements of a web-based portal: open access to superimposed map-like views and geospatial data as well as necessary sophisticated geoprocessing services.

In second part of the paper an example of using OGC Web Mapping Specifications is shown for a small local authority.

Furthermore, the paper addresses other topics that also play an important role in the project. To be mentioned are e.g. software development for presentation and analyses

of geospatial data, issues of e-commerce and web-based transmission for commercial transactions of geospatial data, implementation of web-based, user interfaces for navigation and access as well as services for refinement of geospatial data.

## **1. Introduction**

Many governmental agencies, research institutions and private enterprises acquire, store and manage valuable geospatial information for their own special applications. Except for base data like cadastral or topographic maps these data sources are scarcely brought to the market and used by other persons.

Often geospatial data is captured repeatedly, although it already exists elsewhere. This situation can be traced back to two major impediments of an efficient market for geospatial data.

- Firstly, potential data users cannot keep track of the choice of available data, as it is rather difficult to provide information about the existence, the content and quality of data (meta data).
- Secondly, users encounter additional difficulties because of heterogeneous data and the associated technologies. They must possess considerable expertise if they want to access data from varying sources and combine it for their own needs and applications. And once having purchased data from a certain data source, the user himself is in charge of updating his database.

## **2. Web-based geoportal**

In the internet there meanwhile is the possibility of improving this situation.

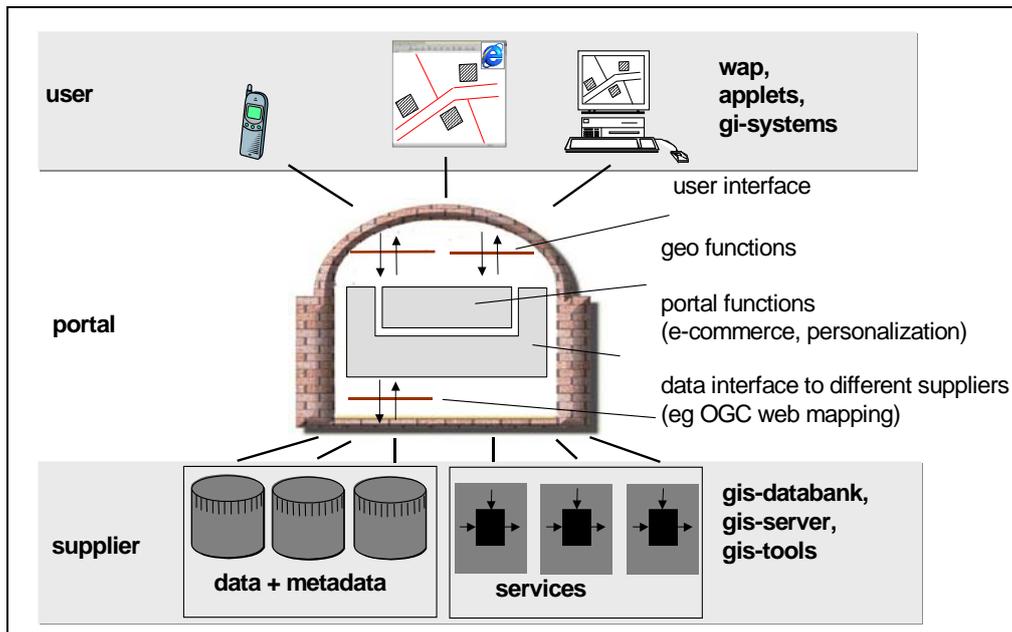
There can be found manifold initial stages and new terms, which must be considered technically as well as organizationally. "Portal" is one of the actual catchwords in the world wide web and is used for an especially designed access to wide networks in the figurative sense.

Therefor a geoportal in the internet is an interface between suppliers and users of geographical data. It can currently be seen as the furthest initial stage.

The fundamental characteristics of a geoportal are:

- A geoportal acts as a mediator between suppliers and users of geospatial data and relevant services. The portal itself does not store and integrate any geospatial data.
- A geoportal is based upon the idea of distributed data storage: Geospatial data obtained from distributed servers of governmental and commercial suppliers become available in the internet. Data remain at the place, where they have been originally stored, acquired and managed. That means in practice that users can always work with newest information without being in charge of updating their database.
- A geoportal enables usage of data in ordinary web browsers (viewing, automatic overlay) to users without using a Geographic Information System (GIS). More complex usage can be achieved by linking to offered services in the portal or with using an own GIS.

Illustration 1 shows components of a geoportal.



**Illustration 1: Components of a portal for geospatial data and geoprocessing services**

The portal should offer methods of e-commerce, which enables itself to administrate access privileges as well as users to buy and pay for data at a central place. So users should not be concerned with business processes of certain data providers.

The portal should also offer personalized access to certain user and user groups. That means, the user can arrange himself, what services he wants to use, in which form services are presented (eg arranged on website) and can determine further settings of several services. Requirement for personalization is the user identification via login and password.

Geo functions embedded in the portal should enable usage of geospatial information to those users, who have not yet thought about installation of GIS (eg usage via mobile phones)

The combination of different data sources of government and private enterprise opens up new markets and new fields of applications.

The more suppliers of geospatial data are reachable per geoportal, the more expectations of certain users can better and more flexibly be realized

Reversely the number of possible users and especially the broad field of user (from experts to arbitrary web surfers) and applications is going up.

Thereby further requirements for geoportals arise:

- Supply of information about geospatial data and their usage (meta data) for orientation and support
- Exchange of information between users (communities, news, tips, support)
- Supply of geoprocessing services in form for direct apply to offered data. These services should not be offered by the portal but by service providers to obtain a greater variety.

Comparable projects can be divided in clearinghouses (meta data information systems) without access to geospatial data, geospatial data server (access to geospatial data of a certain supplier, and geospatial data warehouses (access to stored replications from several suppliers) [Teege, 2000].

In the opposite to these mentioned projects, a geoportal has following advantages:

- distributed data storage with direct access to data of several suppliers
- actuality of data
- meta information system to search for data and services
- integration of business processes of data supplier
- personalization
- supply of geoprocessing services in the portal..

Positive effects come up to the market of geospatial data as well as to the market of GIS and geoprocessing services.

### **3. Interoperable web mapping**

Behind the term “interoperability” there is the idea to solve the problems when user want to work with heterogenous data from different data sources.

Instead of data storing after converting, transferring and integrating in the user system, the user should in need be able to access data sources of suppliers via internet without dependence on their GIS.

One solution is an independent Internet Map Server Interface (IMS) and a limited number of used data formats. OpenGIS Consortium (OGC) has taken this course with the Web Map Server (WMS) specification (<http://www.opengis.org/techno/specs/00-028.pdf>).

Since publication of specification in 2000-april most GIS producer have been worked to extend their IMS with this interface. First IMS capable of WMS are existing now. Also first clients capable of WMS are existing (partly of GIS producer and partly produced by another (eg Ionic Software <http://www.ionicsoft.com>).

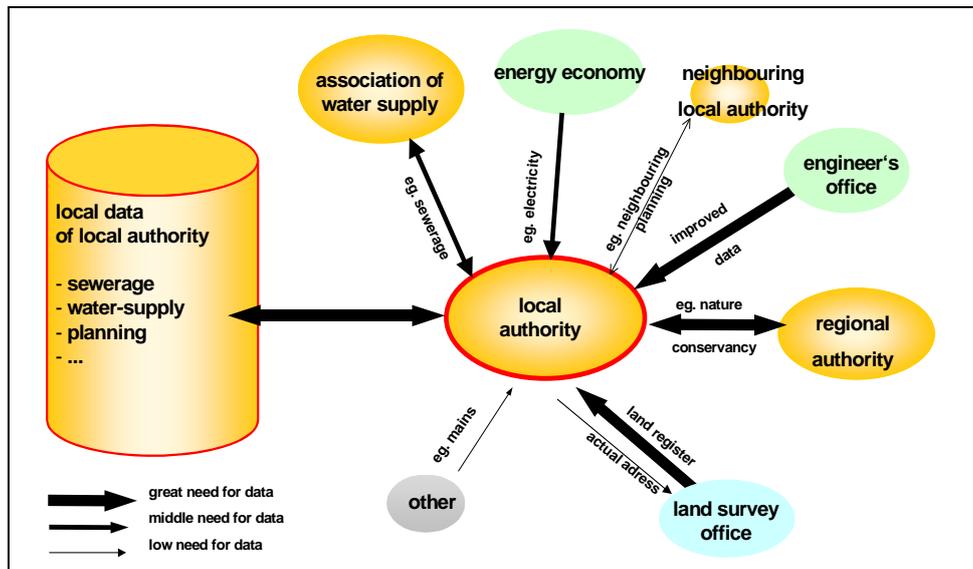
For development of the geoportal at Technical University of Munich international standards like OGC WMS specification have been considered, so there has been tested in a thesis (diploma) the realizing of a demonstrator based on WMS specification for small local governments in the land Bavaria.

A local authority should be able to work with local data but also it should be able to access different data bases in an ordinary web browser.

The results has been influenced by a comprehensible study of GIS market in the frame of the research project “geoportal” [Schilcher, Donaubaue, 2000].

The current study has shown, that eg a local authority in Bavaria needs different data from different sources: regional administration, associations of water supply, energy economy, neighbouring local authority and last but not least from engineer`s offices (illustration 3).

The local authority has to be prepared for the fact, that every certain data supplier uses a different system (GIS, CAD, other, ..) to acquire, store and manage data with different data structures, different cycle of updating and certainly with other data formats.

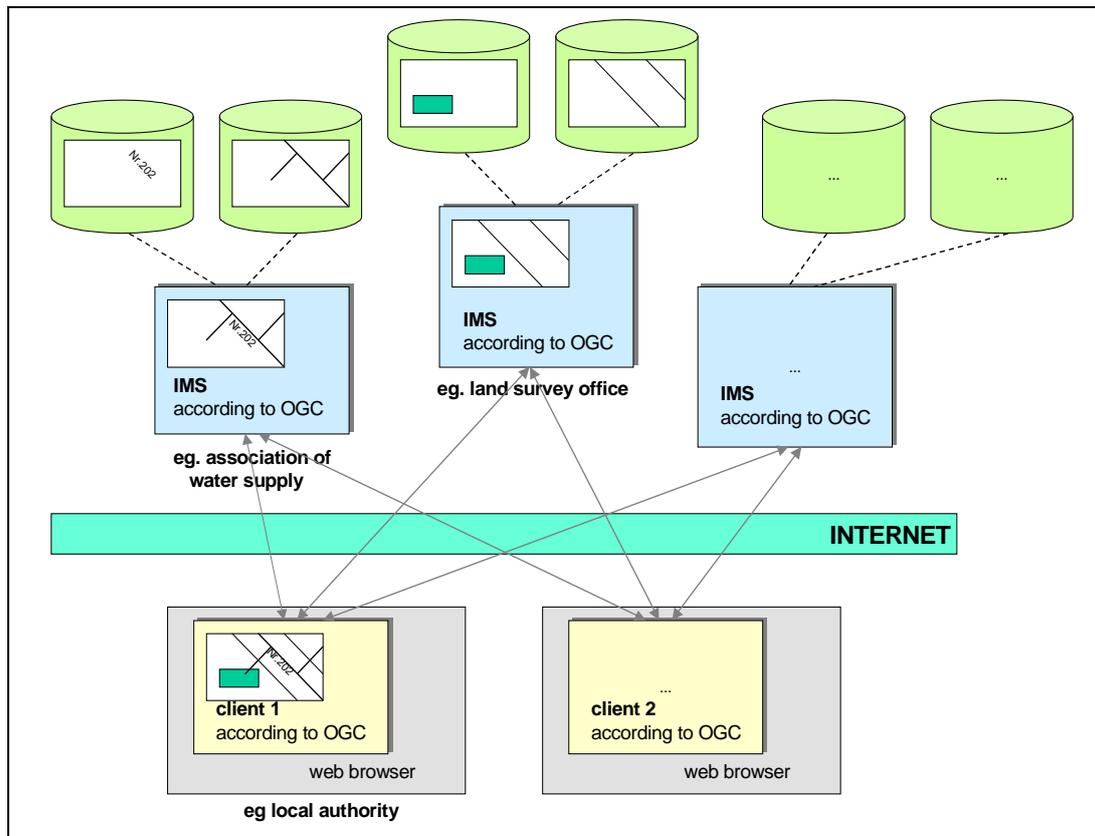


**Illustration 2: Need for transfer of geospatial data in local authority office [Schilcher, Donaubaue, 2000]**

The results of the study show, that also in small municipalities with less than 20000 inhabitants there is the need of exchange of geospatial data between different data suppliers. But only 20 % of local authorities are working with GIS because of too high costs for an own GIS and missing data availability [Schilcher, Donaubaue, 2000]. Costs mostly arises for data acquisition and management and for purchase and processing of software.

With an internet solution especially small local authorities are given the chance for using GIS functions combined with advantage of lower costs. With a standard web browser and access to the world wide web local authority is able to get different geospatial data and visualize them in digital maps.

The programmed front end of the thesis (diploma) is based on the Internet Suite of SICAD Geomatics and has been realized with HTML, JavaScript and PERL. Eg after input of an address or a number of cadastral area in a component client the user obtains different maps which can be overlaid. For the client is only needed an ordinary web browser like Microsoft Internet Explorer or Netscape Navigator. Client and several servers are communicating via interfaces according to OGC specifications (GetCapabilities, GetMap und GetFeatureInfo). The client is an applet which uses the available functions of a special server but also can access every server which is according to OGC standards. So different data of different suppliers (eg association of water supply and land survey office) can be transparently overlaid in one map (illustration 3).



**Illustration 3: Client-server communication with OGC interfaces**

The user is able to choose which offered layer of different servers he want to be shown. He can also starts queries for alphanumeric data and he can navigate (pan, zoom, distance measuring,..) in the selected part of map.

The demonstrator has given a first impression of possibilities for multiple usage of digital geospatial data via internet to the target group local authority.

#### 4. Conclusions

OGC has a central role in the development of international standards.

The results of the thesis (diploma) are based on the WMS standards of OGC and have made an important contribution to possibilities of the use of geographical data from available, heterogeneous GIS via Internet.

Even starting or small users in the GIS market can gain large advantage from the increase in value by overlay and combination of most different geospatial data sources as well as from the sunk costs of data storage and system supply.

Further technical requirement for interoperability in a geoportal is however similar to the WMS standard for the interoperable use of geo data, the availability of standardized interfaces between geoprocessing services.

At the present time there is still existing extensive research requirement in this field.

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