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OpenGIS in action – Field-tested Web Map Services (WMS) and experiences with Web Feature Services (WFS)

Andreas FRITZSCHE & Markus SPRING

Dipl.-Ing. (FH) Eur.–Ing. Andreas FRITZSCHE Industrie- und Handelskammer für München und Oberbayern (IHK), Max-Joseph-Straße 2, D-80333 München, fritzsche@muenchen.ihk.de, http://www.muenchen.ihk.de

Dipl.-Ing. sc. agr. Markus Spring, Referat für Gesundheit und Umwelt der Landeshauptstadt München Bayerstraße 28a, D-80335 München; markus.spring@muenchen.de, http://www.rgu-muenchen.de

1 INTRODUCTION

The Open GIS Consortium (OGC) Web Map Service (WMS) allows for combined map images from different Web Map Services on the Internet. The Chamber of Industry and Commerce (IHK) for Munich and Upper Bavaria uses WMS in practice to reduce costs and work. The OGC Web Feature Service allows a client to retrieve geospatial data encoded in the Geography Markup Language (GML) from multiple Web Feature Services. The city of Munich, Department of Health and Environment (RGU) works on the implementation for their daily work. The usage of OGC-conformant Web Map Services (WMS) and Web Feature Service (WFS) will become the most important step in the development from a local to an integrated and distributed map service.

2 FIELD-TESTED WEB MAP SERVICES (WMS)

The IHK for Munich and Upper Bavaria, which represents the biggest among the 82 Chambers of Industry and Commerce in Germany attends to more than 280.000 companies. The IHK is a self-administering body under public law for any individual company of industry, trade and services. Every company in Germany is member of a Chamber of Industry and Commerce, except of crafts enterprises, professionals and agricultural enterprises. The Chamber of Industry and Commerce represents, democratically authorized, every particular industrial sector independent from the size of the enterprise. The main tasks are the representation of interests concerning economy, sovereign functions and assistance for companies. The IHK for Munich and Upper Bavaria uses a lot of different geo-relevant information for their work. Therefore GIS is an integrated module at the IHK Munich in three major services or websites.

- Site Information System Bavaria (SISBY)
- Network for Economic Developers in Upper Bavaria (Wirtschaftsförderer im Netz Oberbayern (W.I.N.))
- "Geoinfoservice" of the IHK Munich and Upper Bavaria

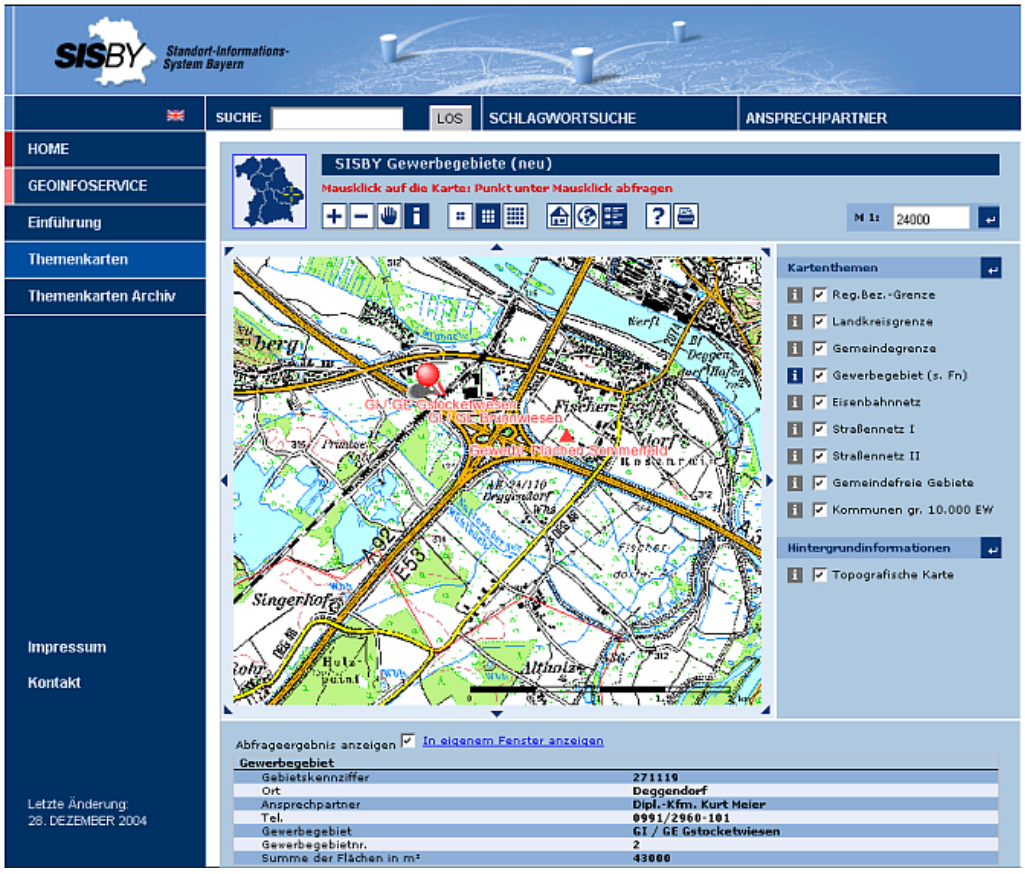


Figure 1: Internet-GIS-Viewer integrated in SISBY

For example (SISBY has already been marketing instrument of economic development for municipal industrial sites and properties in the Internet since 1997. SISBY consists according to the integrated IT- strategy of the IHK of five different modules: Database of

industrial estates/properties, database of communal statistic, database of contact persons, content management system (CMS) and GIS. The modules are exclusivley used via web technologies with different depth of information for the extern customer service in the Internet and intern workflow demands for the IHK staff.

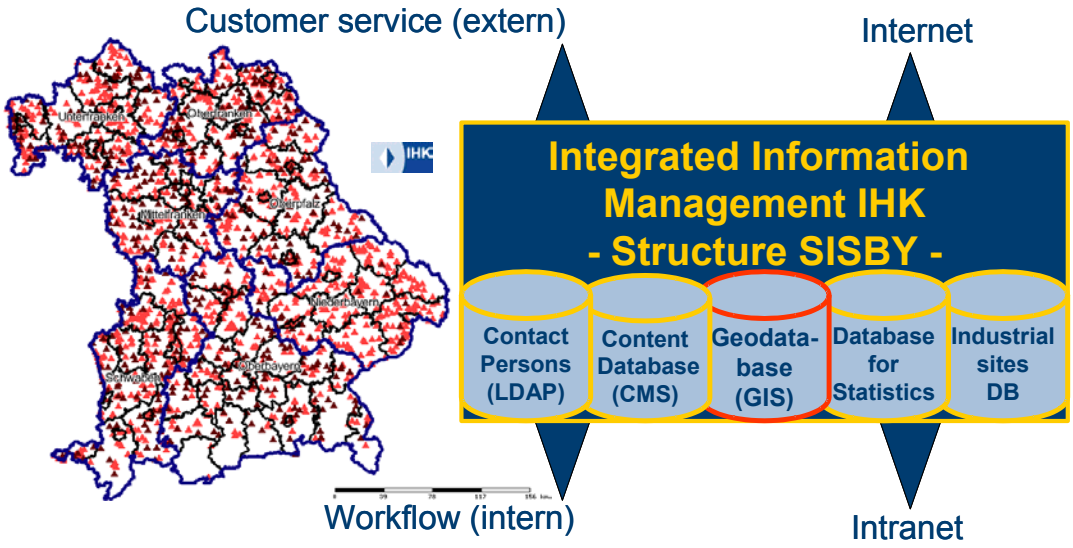


Figure 2: Schematised module model for SISBY

The offered geodata in SISBY with a purely web based Internet Map Service (IMS) covers the whole spatial extent of Bavaria (about 70.000 km²) with ATKIS 500.000 (Authoritative Topographic Cartographic Information system) a vector dataset with the basic transportation system, estate structure and the administrative subdivision. The TK 50.000 (topographical map) is also available in the application as a background layer consisting of more than 40.000 tiles. GIS in SISBY is designed multilingual and supports German and English at present.

What´s new? The interactive map "SISBY Commercial estates" integrates in practice the topographic map 1:50.000 (TK 50) of the Land Surveying Office Bavaria (BVV). The TK 50 is fully integrated into SISBY directly with the raster data from the server of the BVV. How does it work? The topographic map is integrated and displayed via the OGC-Geoservice (WMS). There is no difference for the user. Between the scale from 1:50.000 to 1:10.000 the TK 50 is displayed, just that it comes now automatically from the BVV. How was it up to now? Since 2002 the GIS in SISBY has contained already beside different thematic maps e.g. population, person employed, rates of trade taxes etc. the map of all industrial areas for Bavaria including the background layer for the TK 50. However in the past the IHK Munich had to maintain their geo base data, the topographic map by its own and got just one update once a year. Now the TK 50 is alway keeping uptodate by the BVV without any operating expense for the IHK.

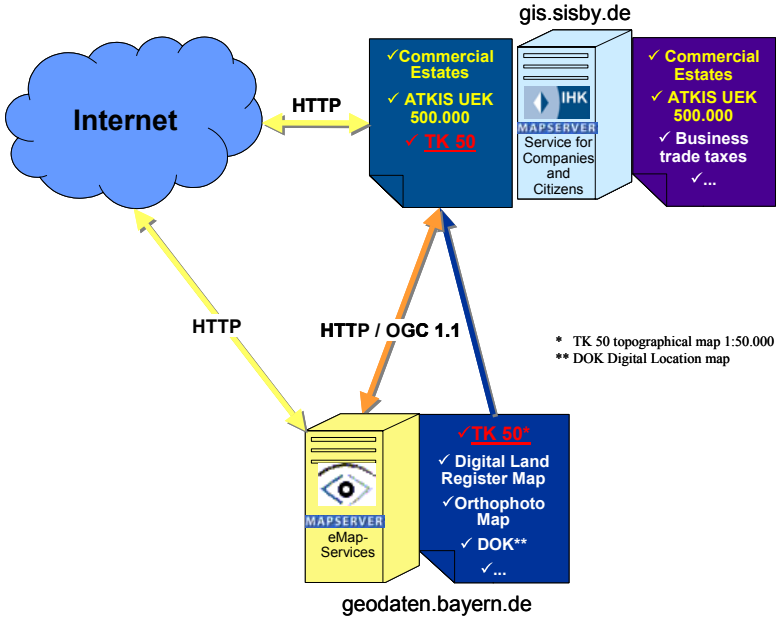


Figure 2: Schematic cascading mapserver enhancing geodata of the BVV with local layers in SISBY

What are the benefits? With this new geoservice the maintenance of the geo base data is outsourced to the specialists of the BVV and the geo base data can efficiently and economically be used in SISBY or in other map applications of the IHK. This practice in SISBY

shows exemplarily the eGovernment oriented strategy of interoperability by standardized technologies like OpenGIS. In the co-operation of IHK and BVV valuable practical experiences for the geo information economy were made. In the future standardized geoservices in map-applications by e.g. enterprises and in the administration can be simply and economically used. Under the view of eGovernment geo base data as well as official statistical data and official directory services should be offered centralized to prevent inefficient multiple data storage and support information exchange between authorities/suppliers in the future.

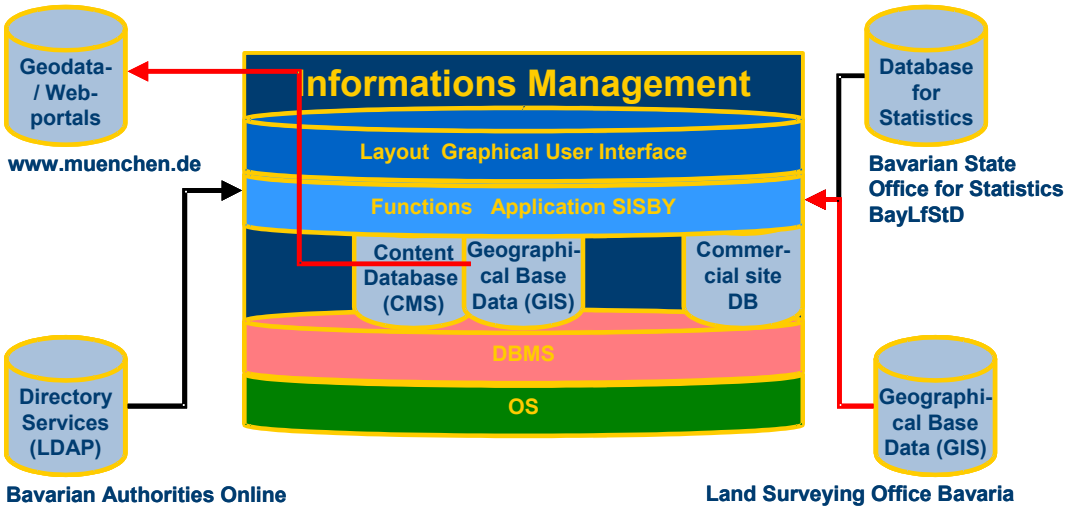


Figure 2: Schematic of future „eGovernment“ model for SISBY

3 EXPERIENCES WITH WEB FEATURE SERVICES (WFS)

The Department of Health and Environment (RGU) as part of the administration of the City of Munich is responsible for environment protection and planning as well as running the public health system with 5 municipal hospitals. The initial paper based environment atlas formed the starting point for the now internet based map services. These are used for internal information and quality control systems as well as public information. In the environment atlas over 100 maps of environmental themes are shown, health reporting adds another 15 maps, tendency growing. Within the European Union funded project MILES (Managing Information for Local Environment in Sri Lanka) the OpenGIS infrastructure will be adapted for the building of an environment and information system for Sri Lankan municipalities.

WMS services already prove their suitability for simplification of internet map services integrating map images from different services, but they need additional service types when it comes to delivery of location based alphanumeric data. For this purpose, the RGU uses the OGC Web Feature Services standard. Unsimilar to Web map services, which offer transformed imagery from raster and vector data, Web Feature Services operate on vector based data sources only. Delivering the query results in XML format through the HTTP protocol, their Geographic Markup Language named XML dialect transports the coordinate data along with the alphanumeric feature data.

3.1 The Price

As the basis for the internet map services of both the RGU and the IHK is the University of Minnesota's (UMN) mapserver, the WMS server/client as well as the WFS server/client features only have to be activated at compile time. WFS requires no additional libraries to the standard WMS services.

The map specification files have to be enhanced by some WFS specific lines, which do not impede their normal use as normal mapfiles:

```
File  Edit  Options  Buffers  Tools  Help
# MAPTITLE "Lärmminderungsplan Stand 11/2002"
MAP
  ...
  NAME       "laerm112002"

  PROJECTION
    "init=epsg:31468"                          ### wfs/wms required
  END

WEB
  ...
  METADATA
    wfs_title "Lärmminderungsplan Stand 11/2002"  ### wfs required

LAYER
  NAME 10
  METADATA
    wfs_title "Lärmminderungsplan Stand 11/2002"  ### wfs required
  END
  DUMP TRUE                                    ### wfs required
  PROJECTION
    "init=epsg:31468"                          ### wfs required
  END
  ...
END # map
-0:**  laerm.map        (Mapfile-Generic)--L24--C5--All----------
```

The presence of a WFS for a certain map can be checked with a http request in standard OGC „getcapabilities“ format:

http://maps.local/maps/laerm112002?SERVICE=WFS&VERSION=1.0.0&REQUEST=getcapabilities

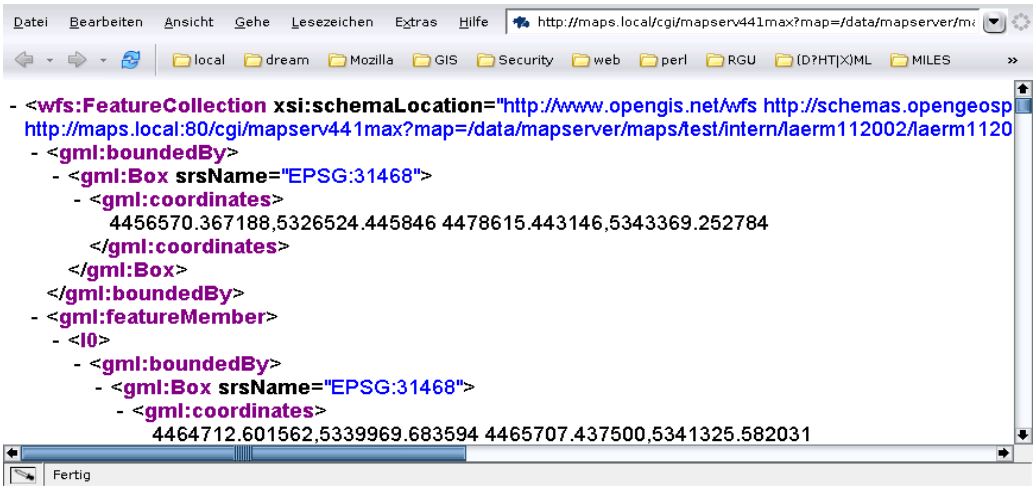
The actual call for data is done through a “GetFeature” call:

http://maps.local/maps/laerm112002?SERVICE=wfs&VERSION=1.0.0&REQUEST=GetFeature&TYPENAME=l0

Precondition for a call like this is, that the apache webserver's alias feature is used to implement a shortcut notation for the usual lengthy mapserver call.

3.2 Architecture

The getfeature-request returns data in GML format:



As today's browsers css (and more so xsl) capabilities are very limited, this returned data has to be reformatted on the server. The multi-tier architecture of RGU's and IHK's internet map service allows the additional implementation of a reformatting layer. PERL as the standard programming language for the application meanwhile has enough built-in XML features to make this task easy. In the final application, the user will see no difference between a native call for alphanumeric data and results retrieved through a WFS service call.

3.3 Security

OGC's implementation of WMS and WFS services would allow to set up 'fat clients', which retrieve native WMS results in image format as well as the GML data of WFS calls. The mapbender application (http://www.mapbender.org) is an example for this technique.

Unfortunately, in the current situation security of the data has high priority when publishing internet services. WFS return the coordinates of the data as well as the alphanumeric feature data, thus opening the door for anybody to save the raw data.

The current implementation of OGC's WFS in mapserver do not allow for access restrictions on the WFS level itself. Therefore security mechanisms have to be implemented to prevent the drain of the geographic data.

The RGU currently is checking two ways of achieving this:

- a filter chain in the apache webserver, where the UMN mapserver is used as a XML data source. It's output then is processed with XSLT spreadsheets, which, for example, just remove all vector data.
- Postprocessing of the results in the application to re-format the results before embedding ad presenting them to the users

The first technique would allow to publish WFS sources for other servers or clients. However, great attention has to be put on limiting the cpu load of those calls, as a request could easily cover the whole area of bavaria on several layers, resulting in gigabytes of data to be transferred.

The second technique is easier to implement and adapt, however it requires tight access control mechanisms on the WFS side to allow only requests from trusted clients.

4 CONCLUSIONS

The internet map services of RGU and IHK have proven their stability over years. WMS eases the cost as well as the maintenance burdens. WFS will add the necessary information level for intra-administration use, but requires more effort on the application side as XML on the browser side is far from beeing usable in a vendor independent way.

Administration itself unfortunately is quite slow in adapting WFS, the security issues adding their grain of salt to the difficulties. The openness and simplicity of OGC's WFS standard however gives the chances to many implementors to add this feature to their application and leaves room to use already present filtering and access control mechanisms in the most appropriate way for each implementation

The architecture of the internet map service of RGU and IHK has proven its flexibility when it comes to the integration of both WMS and WFS services with local maps. Sticking to the current way of server-preprocessing allows to maintain the high level of operating system and browser independence of this service.

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7 LINKS

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Digitaler Umweltatlas München, Referat für Gesundheit und Umwelt (RGU), Landeshauptstadt München, http://www.muenchen.de/referat/rgu/umweltdaten/index_html.php
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Digital Chart of the world: http://www.maproom.psu.edu/dcw
Land Surveying Office Bavaria (BVV): www.geodaten.bayern.de
Mapserver of the university of Minnesota: http://mapserver.gis.umn.edu
PostgreSQL Database: http://www.postgresql.org
PERL in the apache -Webserver: http://perl.apache.org
PERL programming language: http://www.perl.com
Site-Information-System Bavaria (SISBY): http://www.sisby.de
Mapbender: http://www.mapbender.org