

Spatial data infrastructures in practice - Saxony's governmental forest organisation makes intensive use of Saxony's spatial data infrastructure inside their web GIS, FGIS-online -

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Abstract

The paper presents a more detailed view on the architecture and functionality of FGIS-online, the web map solution of Saxony's governmental forest organisation, Sachsenforst, and its integration inside the spatial data infrastructure of Saxony. Furthermore it gives an impression how spatial data infrastructures can help organisations dealing with Geo-Information to improve their workflows by providing their employees the necessary data.

Keywords: sdi in practice, forestry, Web GIS, sdi.suite, Saxony

1. Introduction

In 2005 the governmental forest organisation of Saxony, Sachsenforst, decided to start the development of a service-oriented Web GIS solution supporting its employees with needed relevant Geo-Information and functionality. The decision based on an intensive conceptual phase was mainly driven by the following targets:

- The solution must be available on every computer within the intranet and internet without previous installation (only a web browser is needed).
- Software and data can be maintained and updated on central servers.
- Data has to be kept always up-to-date by direct integration from the data provider, which reduces the efforts for maintenance of secondary stored foreign data.
- Functionality to search and integrate additional available data sets must be available.

2. The SDI of saxony

As a consequence of the European INSPIRE-Directive, the spatial data infrastructure of Saxony (SDI Sachsen) has evolved quickly. Due to a multitude of governmental and non-governmental initiatives, a rising number of state authorities, responsible for collecting and holding Geo-Data, publish their data in the form of web services according to OGC standards. Topographical maps, cadastral data, aerial photographs and a multitude of thematic data (e. g. protected areas, bridleways, forest biotops) are available through WMS services. Hence, Geo-Information can be shared inside the SDI by state authorities, citizens and commercial users by integrating services into public geoportals and intra-organisational GIS solutions (Bernard et. al., 2008).

Beside the use of WMS services also the implementation and integration of OGC catalogue services (CSW) inside Saxony's SDI increases.

For instance, published services are available into Saxony's central internet portals Sachsenatlas (for Geo-Data) and GeoMIS.Sachsen (for metadata).

Within the Free State of Saxony the exchange and sharing of geoinformation via Web Map Services (OGC WMS standard) works fine and with good performance. After initial problems arising by the new technology, map services are now a stable alternative to the physical exchange of datasets. They feed numerous Web-GIS solutions of the Public Administration, such as FGIS-online.

3. FGIS-online concept, implementation and functionality

The realization of FGIS-online based on a detailed concept addressing the necessary functionality and architecture. For the specification, the enterprise architecture framework of the Reference Model of Open Distributed Processing, RM-ODP (Putman and Boehm, 2000) was used to identify user needs, the desired architecture, required information and necessary technology.

To build up the planned service oriented web solution FGIS-online, Sachsenforst relies on available services of the spatial data infrastructure of Saxony (SDI Sachsen) and decided to make use of con terra's (a GIS solution company from Muenster, Germany) sdi.suite. The sdi.suite is a software framework providing necessary components for creating SDI's and service oriented web based GIS solutions.

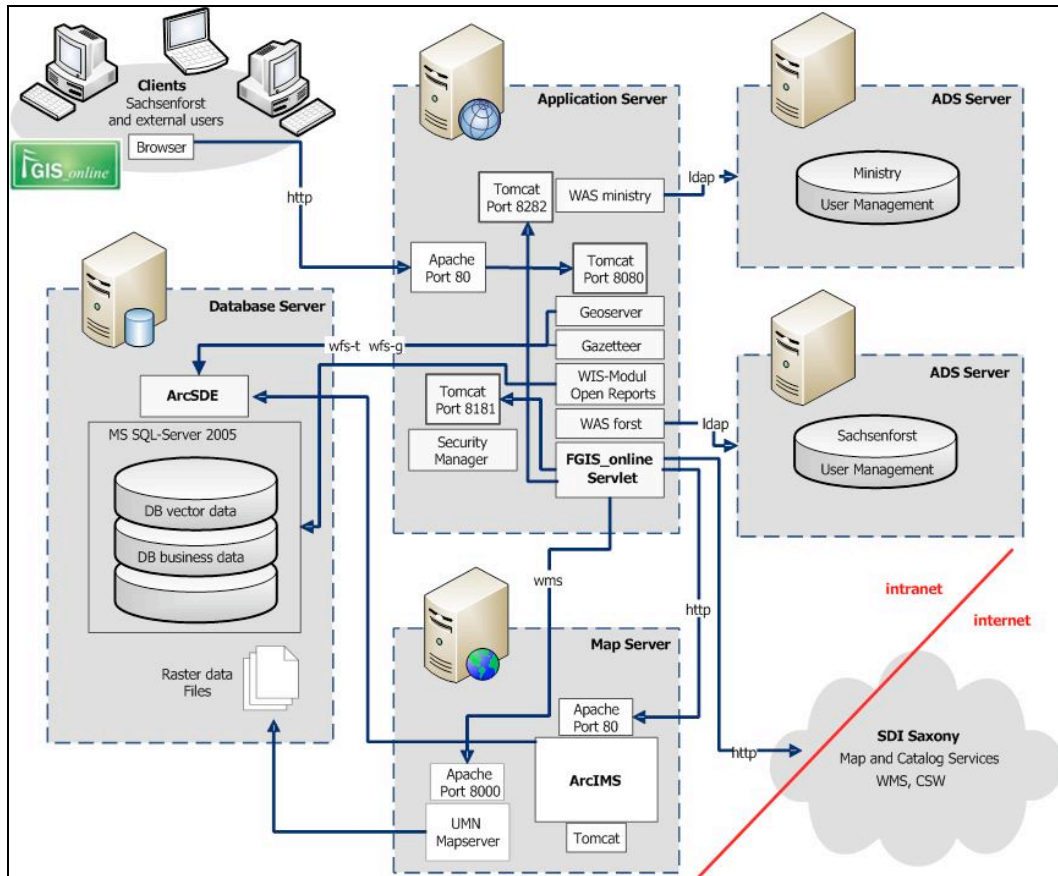
In 2006 FGIS-online started. Table 1 shows the different components FGIS-online consists of:

Table 1: Overview of the FGIS-online components

Component	Description
Web Map Client	Web Client providing the user with the necessary Geo-Information and Functionality including data capturing, easy map production and providing access to the Catalogue e.g.
Catalogue Client	Web Client providing the user with access to Metadata including the possibility to use distributed catalogues
Web Feature Service (WFS-T)	OGC conform WFS-T (1.0.0) Service provided via GeoServer allowing the user to <ul style="list-style-type: none"> - Create a new feature instance - Delete a feature instance - Update a feature instance - Get or query features based on spatial and non-spatial constraints
Web Map Services (WMS)	OGC conform WMS (1.1.1 and 1.3.0) provided via ESRI's ArcIMS and UMN MapServer including the external available WMS in the SDI of Saxony
Gazetteer Services (WFS-G)	WFS-Gazetteer Service provided via Geoserver to improve map navigation to geo-objects
Catalogue-Services (CSW)	OGC conform CSW (2.0) provided via con terra's terra catalog (GeoMIS.Forst)
ADS Service	AAA Service based on the internal ADS user management provided via 52°N WSS (Web Security Service) and WAS (Web Authentication Service)
Report-Service	Report Service based on Jasper and OpenReports providing reports with further information of forest stands e.g. by using the Forest database
Geo-Database	Microsoft SQL-Server Database combined with ESRI's ArcSDE, holding the necessary Geo-Data.
Forest Database	Two SQL-Server Databases holding further information about the different forest stands like tree species and soil conditions.

Figure 1 shows the current architecture of FGIS-online.

Figure 1: current architecture of FGIS-online



FGIS-online provides the user with the following main functionality:

- Integration of the central AAA (Authentication, Authorization, Accounting) System

The user management inside the IT-Infrastructure of Sachsenforst is based on a Microsoft Active Directory System, ADS. By using the available security components of the 52°North Initiative for Geospatial Open Source Software GmbH from Münster, Germany, web authentication service, WAS, and web security service, WSS (May and Drewnak, 2006), the ADS integration was built for the realized map Client relying on LDAP the Lightweight Directory Access Protocol. Due to this, users can connect to FGIS-online by using their normal password and user name. Furthermore it is possible to restrict access to certain services based on defined areas or attributes.

Beside this it was necessary to provide external user's access to FGIS-online. This was realized by using the securityManager of the sdi.suite, which is based on the 52°North WSS and WAS and allows the administrators to give access to users, which are not listed inside the ADS.

- Searching for Geo-Information inside distributed Meta-Information Systems

The SDI of Saxony provides extensive Meta-Information about available services and data via a catalogue service. Inside FGIS-online it is possible to use the Meta-Information from the Catalogue of Saxony's SDI combined with the internal Meta-Information System.

- Integration and use of different data services

The FGIS-online Client can integrate and work with the following Geo-Data services:

- WMS (Web Map Service)
- WFS (Web Feature Service)
- ESRI's ArcIMS
- ESRI's AGS (Map Service)

- Central configurable hierarchical gazetteer

FGIS-online has integrated different gazetteers based on WFS – Gazetteer (WFS-G). For instance users can navigate to cadastral areas by using the cadastral gazetteer and filling in or choosing from drop down lists the necessary hierarchical information like county and district.

- Drawing and editing objects

The integration of a WFS-Transactional allows the grasping of geometries inside the FGIS Web client. For geometries it is possible to grasp additional attributes. Each attribute can be filled by using a predefined drop down list. Furthermore it is possible to configure attribute dependency, so that a value of an attribute restricts the value of other attributes to certain values.

After editing geometries the user can restrict access to them to certain roles and he can place text information via text boxes on the map

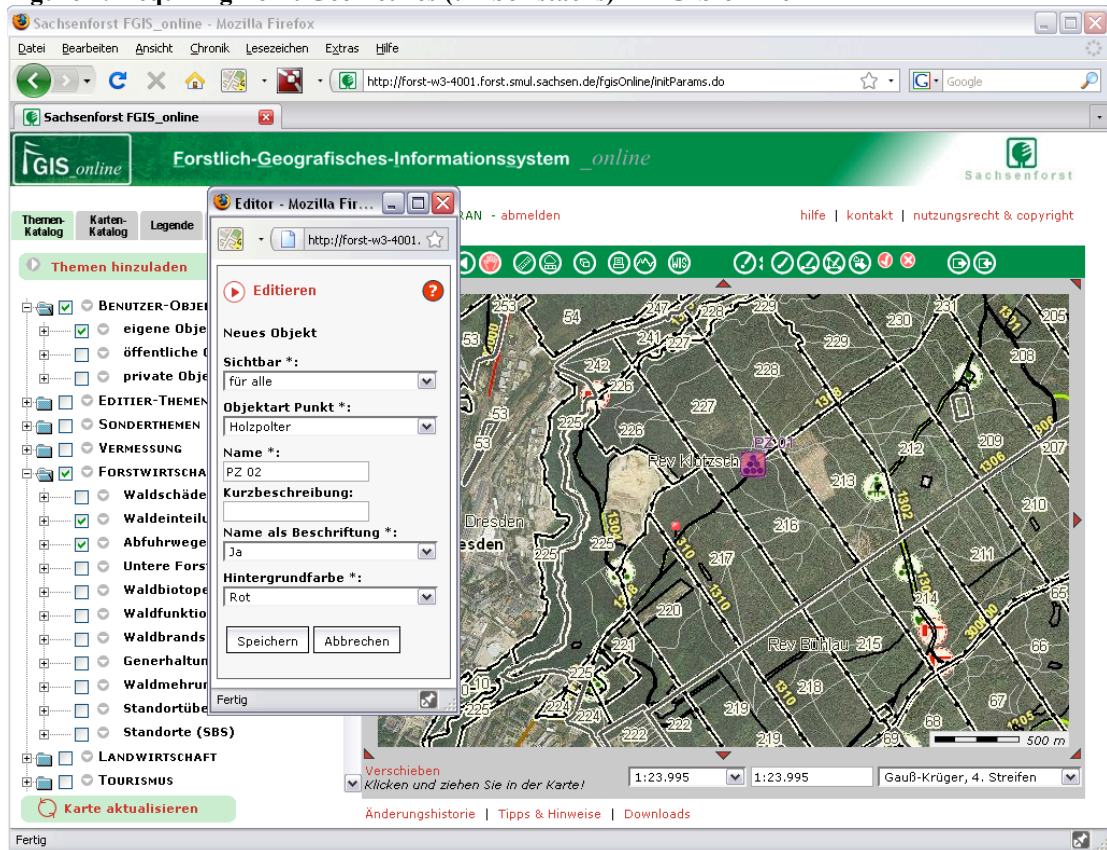
- central or local user based storing of map views

FGIS-online provides the possibility to store data views as OGC-conform Web Map context files (WMC) combined with the user name. The WMC files can be stored on a central server or on the local computer. By storing the WMC files on the central server, a user will have access to them as soon as he logs in to FGIS-online, irrespective from the computer he uses.

- Integration of the central business data warehouse
By selecting forest stands inside the map window of FGIS-online, the user can create detailed reports based on the data warehouse containing further information from the forest inventory like tree species or soil conditions.
- Creating simple maps based on the visualized Geo-Data
Users have the possibility to print maps with different sizes showing the actual Geo-Data of the map window. The maps can be printed as PDF files.

Figure 2 gives an impression of the FGIS-online web client.

Figure 2: Acquiring Point Geometries (timber stacks) in FGIS-online



4. Sachsenforst inside the SDI of Saxony

Sachsenforst as member of Saxony's SDI initiative acts inside the SDI not only as a service consumer, but also as a data provider. By providing numerous services, Sachsenforst supports Saxony's SDI with own content (Hergert, 2008).

Currently five map services from Sachsenforst (e.g. forest cover, forest functions, forest biotops) are available inside the SDI of Saxony. These services can be used by other state agencies and municipalities by integrating them into their GIS applications. Beside that Sachsenforst provides a CSW catalogue service based on the Meta-Information System (GeoMIS.Forst). The public Metadata Portal GeoMIS.Sachsen accesses this service via the CSW-Interface and harvests forest metadata, declared as public, making thus data available via the Meta-Information System of Saxony's SDI called Geo.MIS Sachsen.

GeoMIS.Sachsen provides metadata derived from Geo-Data of Saxony's SDI according to the ISO Standards 19119 and 19115.

A search inside GeoMIS.Sachsen using the keyword "forest" will deliver several results including Geo-Datasets, services and the FGIS-online application of Sachsenforst.

As a service consumer, Sachsenforst makes consequent and intensive use of the available map Services (WMS) of Saxony's SDI via FGIS-online. The available map services provide all necessary Geo-Basis data like topographic maps and aerial pictures. Furthermore the available metadata service from GeoMIS.Sachsen was embedded inside FGIS-online, providing the possibility to search and integrate further services and data.

5. Conclusions

The intensive use of available SDI services inside FGIS-online leads Sachsenforst to a more optimized Geo-Data handling inside their IT Infrastructure. Data handling and storing efforts could be reduced because most Geo-Basis data in Saxony are available via map services inside Saxony's SDI. Furthermore the possibility to make use of "distributed" Metadata searches inside the available Metadata Catalogues and the possibility to bind the found services inside FGIS-online gives the user previously not known independence and flexibility to support decision making based on different Geo-Information.

Focusing mainly on the visualization and combination of different map services, combined with a powerful data search and optimized edit functionality, further development cycles of FGIS-online will have the following main targets:

- Integration of OGC conform processing services (WPS)
- Development of a concept for a mobile solution, supporting synchronic and asynchronic data handling

The experiences of Sachsenforst with FGIS-online showed that the fear of bad performance caused by the intensive use of distributed services from different data sources is baseless. Of course such a solution will hardly reach the performance of an optimized closed web map solution with the whole data handling inside that solution, but users gain sufficient performance and much higher flexibility with respect to available Geo-Data and their actuality. If working in forest environments, users have to deal with complex ecosystems extending over large area. Decision-making in such an environment requires a lot of different, actual (geo)information. A solution like FGIS-online based on available SDI services shows under the given circumstances a high practicability and usability and makes data handling for Sachsenforst much more efficient.

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