Processing and Visualizing of Geodata with

HotSpot - a web-based GeoCMS

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Abstract—Nowadays many software products simplify the connection of geodata via the internet. Using commercial software products; the establishment of web map services (WMS) and web feature services (WFS) and the visualization of geodata via the internet is only a question of the routine. Standards of the Open Geospatial Consortium (OGC) are implemented in many GIS software products. As well open source products are able to realize cascading linkages of geodata, measurement data and metadata to get spatial data infrastructures (SDI). It is not important which GIS software will be used to connect data in a standardized way (UMN Mapserver, Geoserver, degree, ArcIMS,…), the software is able to retrieve geodata out of the sources like databases and to provide them compliant to OGC standards [1]. In many fields of interest the services are in use e.g. city maps, tourism information systems, atlases of the environment and SDI projects of the german federal states and the state authorities e.g. http://geoportal.bkg.bund.de. These projects are a first step into the right direction but SDI's could also be very important while collecting and digitizing new geodata. In many scientific institutes and public authorities high amounts of geodata were generated and recorded in databases or folders after accomplishing projects. These geodata very often were stored without saving metadata for datasets and without publishing them via the internet or the intranet. Problems occure when there are new staff members or colleagues who have to get information about the accuracy and the contents before starting to work. Not only for the access also for the collection of data e.g. for the environmental monitoring there is a demand for modern techniques for a fast and fail-safe conflation of measurement data and metadata. Until now these tasks were fulfilled by using expensive software products or by implementing new software which only could be used for specific surveys.

Many institutes also have problems to provide data in a local network or via the internet because specialists who are able to implement the software for publishing geodata are not existent. On the other hand expensive licenses of commercial software products are not affordable for institutes. For example there are facilities at universities in threshold or developing countries which are not able to buy these licenses to collect and share data in a standardized way. Even for these countries open source products are a very good solution but there are several software products which have to be implemented on a server to achieve the objectives (e.g. Mapstorer for writing mapfiles, Geonetworks for describing metadata, Mapbender or OpenLayers for visualizing data, additional software to produce descriptive statistics and others).

Regarding fields like the environmental monitoring modern techniques basing on open source software are rarely in use e.g. the Moss Monitoring in Germany which was conducted by using the WebGIS MossMet. The system was developed by using applications like the UMN Mapserver, the Mapbender and the PostgreSQL database management system [2]. Another example is the GIS based field monitoring with the product eMapper which was implemented by using OpenLayers and Geoserver [3]. The eMapper software supports the collection of data of different species and allows users to digitize areas where species were found. Even though there are examples of implementations very often sheets of paper were used to record measurement data in the field. Afterwards the records were conveyed into access databases or EXCEL sheets to analyse them. With a workflow like this errors could occure like mistakes in writing or rounding errors with measured data and also wrong coordinates of observation sites could be detected. The next step between the survey and the analyses is a centralized conflation of data e.g. from the databases of the authorities of the federal states to get an overview of the condition of the environment of the whole state. This work sometimes requires days or weeks. Hence the European Union started to implement the SDI INSPIRE with the directive 2007/2/EC of the European Parliament [4]. With this instrument a conflation of data should be accomplished in a more homogeneous mode. But this directive only is a contribution for public authorities to share data and to meet the demands for reporting commitments. Additional the environmental law in Germany implies that public authorities have to provide environmental data by electronical methods. Scientific institutes for example still have the problem to share data from different environmental monitoring programmes and research projects. Even though scientists have a demand for measurement data and geodata they are not able to receive them because of missing permissions and reserved rights. These problems are samples for the variety of reasons which lead to a lack of access to data.

To oppose the problems in collecting, visualizing, analysing and publishing geodata via the internet the idea arised to implement a content management system (CMS) with additional tools for these responsibilities. It is related to the WebGIS "WaldIS" which also includes a CMS for publishing geodata [5] but it comes without a modular concept which allows specific options for new requirements. The new system should be platform independent and all parts of the software we are using should be taken out of the open source pool. The standards given by the OGC also should be implemented within the GIS based software products. The administrator of the application as well as the end-users should work with a browser (IE or Mozilla Firefox) without additional desktop software or java implementations. To achieve these objectives we started using the CMS "CMS made simple" because it is coded with Hypertext Preprocessor (PHP) which is easy to understand and allows people to add their own source code. The CMS is in use for thousands of websites and may be stored in a PostgreSQL database. The possibility to create new modules and to implement them into the CMS is very important. These modules may be used for the administration as well as for the end-user platform of the CMS. The main modules which will be implemented are tools for the:

- integration and management of geodata (databases and folders)
- establishment of individual web forms for collecting data via smartphones / creation of new geodatasets
- layout (SLD) and visualization of geodata via WMS and WFS (UMN Mapserver / Mapbender and OpenLayers)
- download of data and geodata

- web forms for integrating and querying metadata
- GIS functions for analyses (PostGIS) and the integration of the results into existing maps
- integration and use of web processing services (WPS)
- integration and queries of analysing methods
- functions and visualizing tools for descriptive statistics

In the broadest sense these modules implement forms which adopt information from a configuration file (e.g. access information for databases or adresses of the UMN Mapserver and the Mapbender software) and additional new information entered by the user. These forms send information to different functions or an application server which are processing the data. One example is the integration of a new geodataset which will be uploaded via an upload form and the PHP script integrates the dataset into the PostgreSQL/PostGIS database or into a folder on the server. Also we implemented a module with forms for writing mapfiles for the UMN Mapserver and for creating the layout via SLD-files which can be made manually or automatically. For the establishment of survey forms EXCEL-sheets with coordinates of observation sites can be uploaded and web forms may be created by a rsponsible user. A mapfile for the UMN Mapserver will be created directly after saving the web form. The visualization then can be realized by using OpenLayers or the Mapbender software. After creating a web form for a survey the administrator gets a hyperlink which has to be send to the field workers. In the field the measurement data can be entered into the web forms using a PDA or a smartphone via UMTS or GPRS. Important are functions to apply new users and passwords for the survey forms.

Other modules will be implemented for integrating information about geodata. A modul for integrating metadata following the standards ISO 19115/19119 and a module which allows users to enter information about analysing methods which were used for creating geodatasets and calculating additional data are to be integrated. These modules will allow queries for methods and should be an assistance for using the same e.g. in different countries or federal states in Germany. The module for integrating and initiating web processing services (WPS) is still under development.

These are some examples of modules which were partly implemented to develop a GeoCMS which makes it more comfortable to run a system without installing and setting up several open source software products to get one running system. Also it reduces the time used to publish geodata without licensed software and without knowledge of programming languages like PHP or JavaScript and for writing mapfiles and SLD-files for the UMN Mapserver. The conflation and the analyses of data could be managed more faster and the data could also be analyzed in a standardized way for example by using distributed WPS on different application servers (cf. [6]) directly after recording or by using the vector-based analysing methods which were implemented with the PostGIS library of the PostgreSQL database management system. Also the GeoCMS HotSpot can be upgraded with additional modules which might be developed by focusing on individual requirements of the users.

Index Terms—WebGIS, content management, analysing methods, survey management, open source, geodata, mapserver.

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