

DEVELOPING AN OPEN ROMANIAN GEOPORTAL USING FREE AND OPEN SOURCE SOFTWARE

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ABSTRACT

The article explore the world of free and open source geospatial (FOSSG.I.S) software with the aim of proving that is possible to design and deploy web based Enterprise Geographic Information Systems only with FOSSG.I.S programs.

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1. THE OPEN SOURCE CONCEPT

The idea of free/libre open source software is not something new, it has been around for almost as long as software has been developed. In 1983, Richard Stallman defined the concept of Free Software in form of four freedoms:

0. freedom: The freedom to run the program, for any purpose.
1. freedom: The freedom to study how the program works, and adapt it to your needs.
2. freedom: The freedom to redistribute copies.
3. freedom: The freedom to improve the program, and release your improvements to the public, so that the whole community benefits.

In the same year Stallman started the GNU-Project, followed shortly (1985) by the “Free Software Foundation”, a legal established body to support the Free Software concept. The GNU General Public License (GPL), developed within the GNU Project, not only grants the four freedoms described above, but it also protects them. Today a myriad of different open source software licenses were derived from GPL and the “Open Source Initiative” (<http://www.opensource.org/>) has the role of general arbiter of license correctness.

2. OPEN SOURCE G.I.S

The Open Source G.I.S space includes products to fill every level of the OpenG.I.S spatial data infrastructure stack (Ramsey, 2007, Zavante et. colab., 2006, Crăciunescu V., 2007). A great advantage brought by geospatial FOSS (free and open source software) applications, beside the classical open source advantages presented above, is the compliance with existing ISO/OGC standards. At this moment, the majority of the open source G.I.S applications are designed in respect for these standards. This is possible due to the high rate of code reuse. Basically there are some strong core libraries (e. g. GDAL,

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OGR, PROJ), already standard compliant, that are further use by the majority of software applications.

An important moment in FOSSG.I.S history was represented by the birth, in 2006, of the Open Source Geospatial Foundation (OSGeo), a not-for-profit organization whose mission is to support and promote the collaborative development of open geospatial technologies and data. The foundation provides financial, organizational and legal support to the broader open source geospatial community. It also serves as an independent legal entity to which community members can contribute code, funding and other resources, secure in the knowledge that their contributions will be maintained for public benefit. OSGeo organize an annual OSGeo Conference, called FOSS4G, which gather together the people who create, use, and support open spatial software.

3. DEVELOPING AN OPEN ROMANIAN GEOSPATIAL PORTAL

A geospatial portal is a human interface to a collection of online geospatial information resources, including data sets and services (OGC, 2004). Geo-spatial.org is a collaborative effort by and for the Romanian community to facilitate the sharing of geospatial knowledge and the discovery and publishing of free geographic datasets and maps. It was created by a small team of young scientists as an attempt to overcome the Romanian specific geospatial dysfunctions.

Anyone can make a contribution by submitting articles or datasets for publication, adding comments to the existing articles, join the discussion on the mailing list or users forum.

Portal structure

geo-spatial.org was developed following a distributed architecture (Fig. 1). The content is managed by Textpattern, a powerful and flexible, open source content management (CMS) application. For supplementary, specific functionality, custom modules were built. Other free applications are providing server-side functionality: MySQL (relational database management system), PHP, Python, Java (server-side scripting languages), Apache (webserver), Tomcat (servlet container), phpMyAdmin, phpPgAdmin (web clients for database management).

For geospatial data management, top open source applications were also integrated in the website.

UMN Mapserver is a internet map server, a server-side piece of software which renders G.I.S data sources into cartographic map products. Mapserver is one of the most successful open source G.I.S project to date.

PostG.I.S is an extension for the PostgreSQL enterprise relational database. PostG.I.S is certified as "Simple Features for SQL" compliant by the Open Geospatial Consortium. First released in 2001, PostG.I.S is now used around the world as a high-performance server for spatial objects. The spatially-enabled query planner, highly concurrent R-Tree spatial index, and hundreds of spatial analysis and processing functions allow for G.I.S-style data analysis right inside the database.

Mapbender is a software and portal site for geodata management of OGC OWS architectures. The software provides web technology for managing spatial data services implemented in PHP, JavaScript and XML. It provides a data model and interfaces for displaying, navigating and querying OGC compliant map services. The Mapbender framework furthermore provides authentication and authorization services, OWS proxy

functionality, management interfaces for user, group and service administration in geoportals projects.

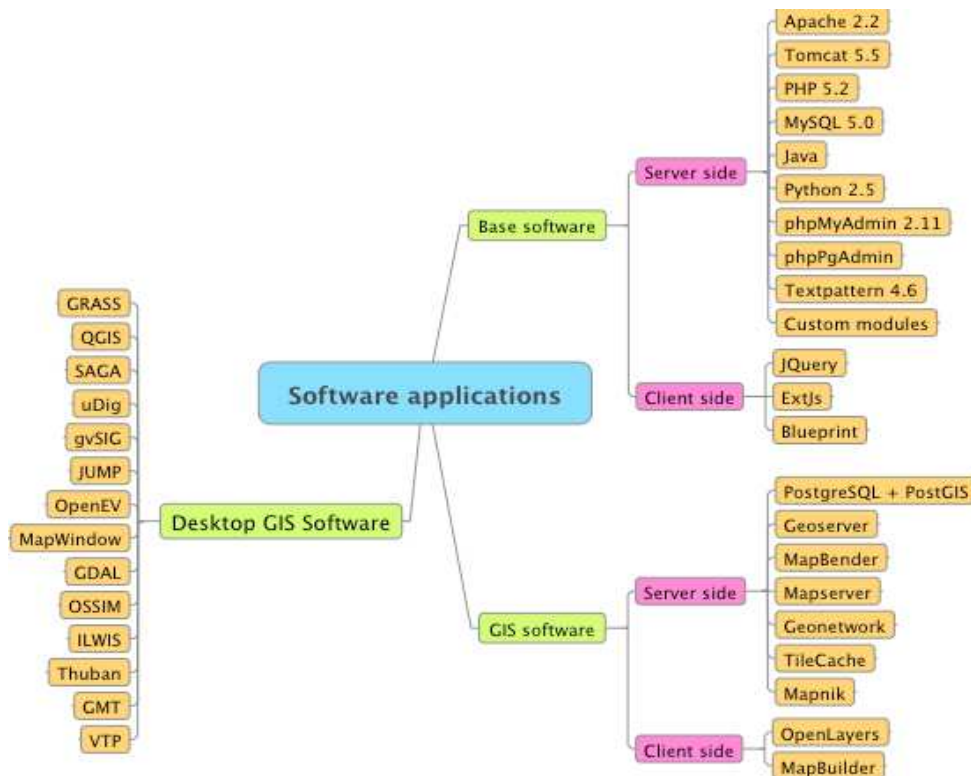


Fig.1 Portal software architecture.

GeoNetwork Opensource is a standards based, catalog application to manage spatially referenced resources through the web. It provides powerful metadata editing and search functions as well as an embedded interactive web map viewer.

Geoserver is a standard compliant geospatial server, allowing the users to publish and edit data. The information is made available in a large variety of formats as maps/images or actual geospatial data. GeoServer's transactional capabilities offer robust support for shared editing. GeoServer's focus is ease of use and support for standards, in order to serve as 'glue' for the geospatial web, connecting from legacy databases to many diverse clients.

OpenLayers is a pure JavaScript library for displaying map data in most modern web browsers, with no server-side dependencies. OpenLayers implements a JavaScript API for building rich web-based geographic applications, similar to the Google Maps and MSN Virtual Earth APIs.

TileCache provides a Python-based WMS/TMS server, with pluggable caching mechanisms and rendering backends. In the simplest use case, TileCache requires only write access to a disk, the ability to run Python CGI scripts, and a WMS you want to be cached. With these resources, a user can create local disk-based cache of any WMS server, and use the result in any WMS-C supporting client.

The information flow between the various server side application and the front end graphical interface is determined by the interaction with the portal users and their requests (Figure 2).

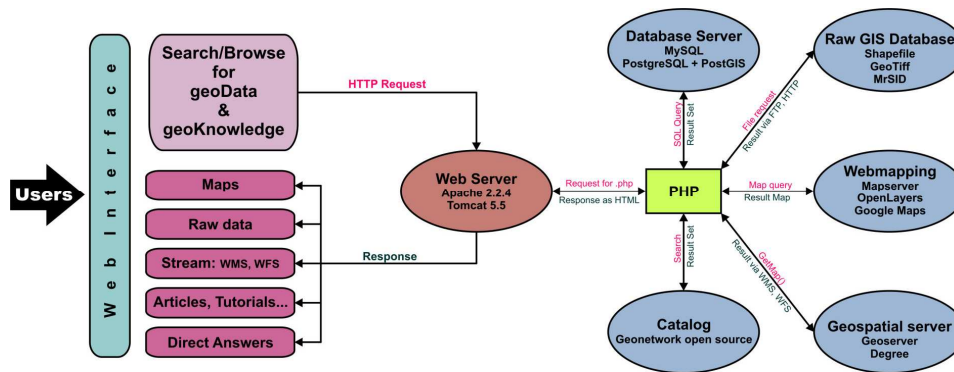


Fig.2 Portal information flow

An entire stack of desktop G.I.S open source tools were and will be further used to prepare the geospatial data published on geo-spatial.org and for technical demonstrations in tutorials. The most important roles were played by:

GRASS (Geographical Resources Analysis Support System). The oldest FOSSG.I.S application. GRASS is a raster/vector G.I.S combined with integrated image processing and data visualization subsystems. It includes more than 350 modules for management, processing, analysis and visualization of georeferenced data. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies.

QG.I.S (QuantumG.I.S) is a user friendly G.I.S applications that runs on Linux, Unix, Mac OSX, and Windows. QG.I.S supports vector, raster, and database formats. Comes with a plugin that provides access to GRASS from within QG.I.S. This includes the ability to view, edit, and create data, as well as perform analysis using the GRASS geoprocessing modules.

VTP (Virtual Terrain Project). Is a complex suite of applications that allow the users to create and real-time explore 3D environments. VTP offer support for realistic implementation of vegetation, sky, buildings, vehicles, roads and any other 3D object.

Portal interface

The website is divided in several functional sections (Figure 3). In each section, the information is placed in predefined categories and sub-categories. Most of the sections contains written materials:

- Articles - theoretical essays on geospatial topics;
- Tutorials - materials indented to teach the user, in a step by step manner, how to work with certain datasets, software, technique etc;
- Reviews - reviews for geospatial datasets, cartographic products, software, articles, books;

- Links - collections of references to other online resources;
 - Blog - a non conventional section for publishing thoughts, ideas, findings etc.
- The content of these sections can be accessed quickly via RSS and ATOM feeds.

The Download section contains categories for all kind of geospatial data (digital elevation models, processed satellite images, vector data: communication networks, localities, hydrographical networks, contour lines, points of interest etc.) at different scales and spatial extend. Other categories contain documents (PhD thesis, scanned books & articles), old maps, software.

The website interface was carefully designed, respecting the existing W3C (World Wide Web Consortium) standards and separating the structure from the presentation by using strict XHTML markup and CSS (Cascade Style Sheets). New web technologies, like AJAX (Asynchronous JavaScript and XML), were also used to increase the interactivity. The goal was to obtain a simple, friendly and accessible environment for geospatial data and knowledge publication.

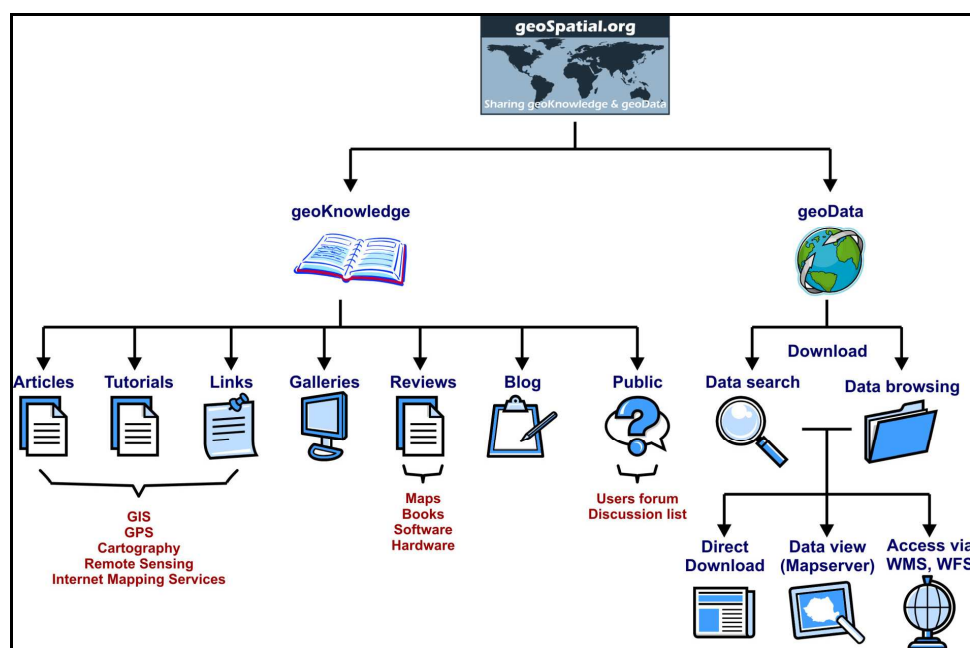


Fig.3 Portal interface

Portal services

Orientated to the users, they provide the single point access to the geospatial information on the portal. Are designed according with OGC (Open Geospatial Consortium) specifications. The user can access the services using a local client (thick client) like common G.I.S applications (E.g. JUMP, gvSIG, uDig) or via a web client (thin client) like webmapping applications (E.g. OpenLayers, Mapserver, MapBuilder).

- Catalog services: provide a mechanism to classify, reG.I.Ster, describe, search, maintain and access information about resources available on the portal. The Catalog functionality is supplied by Geonetwork open source.

- Portrayal services: provide specialized capabilities supporting visualization of geospatial information. The service integrates OGC WMS (Web Map Server Specification) protocol which allow the user to query the capabilities (getCapabilities) of the mapserver and retrieve maps rendered in a graphical file format (E.g. GIF, PNG, JPEG). The Portrayal functionality is supplied by Geoserver.

- Data services: provide access the geospatial database content. The service integrates OGC WFS (Web Feature Service Specification) protocol. WFS deliver, on demand, geospatial data in GML (Geography Markup Language) format. This service functionality was obtained also by using Geoserver.

4. CONCLUSIONS

The domain of free and open source geospatial applications is growing fast and provide reliable solutions for all the stages of geodata management. The FOSSG.I.S plays an important role in adaptation of G.I.S technology by stimulating new experimental approaches and by providing access to G.I.S for the users who cannot or do not want to use proprietary products.

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