

Development of a Coastal SDI using GeoFOSS

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1. INTRODUCTION

At the Foundation for Research and Technology (FORTH) we are currently running a project towards the development of a spatial data infrastructure (SDI) for the coastal zone of Heraklion prefecture. The SDI hosts the geographic content collected for the coastal zone, accompanied with rich metadata. Additionally, effective methods to discover and visualize this content and sophisticated software and tools to support application domains related to coastal management have been implemented.

Provided the contemporary trend towards the adoption of free and open source software (OSGeo), we decided to generate, under this project, two parallel SDIs for the coastal zone at Heraklion: (a) one SDI using commercial software systems, and (b) an alternative SDI using merely Geographic Free and Open Source Software (GeoFOSS). The scope of this paper is to present in brief the architecture, the development phases and the servers of the latter SDI, i.e., the coastal SDI based on GeoFOSS.

2. ARCHITECTURE AND SYSTEMS

The SDI of the coastal zone at Heraklion accommodates a series of geospatial data layers (Shapefiles and GeoTiff images) collected based on the user and application needs as regards to the coastal management. The SDI also introduces geospatial mashups provided by other servers on the web (e.g., Google Maps, NASA JPL Portal Nasa's WMS, Integrated CEOS European Data Server).

The architecture, the software systems and the specifications adopted are shown in Figure 1. The architecture is compatible with the proposal for GeoFOSS SDI (Ticheler 2007, OSGeo) and follows the conceptual three-tier architecture for SDI's (Evans 2003). At the bottom layer, reside the SDI databases and database management systems. The geospatial layers are inserted into Postgresql/PostGIS in order to achieve a more efficient data management. In the middle layer (middleware) reside all the services that assist the accessibility to the data repositories. This SDI has two main servers, i.e., the Map Server and the Catalog Server. These two servers will serve the geospatial content on the web based on standard interfaces (e.g., WMS, WFS, WCS, ISO 19115/139) to facilitate the worldwide access to and the use of online geospatial data. At the top layer (the client) reside the users and applications. The access to the SDI geospatial content is possible through either a desktop or a web client.

3. PHASES OF DEVELOPMENT

The development of the coastal SDI using GeoFOSS comprises of four main phases:

Phase 1: Preparation of the geospatial layers. This Phase is focused on the preparation of the geospatial layers collected for the coastal zone of Heraklion. Specifically, appropriate transformations are carried out in order to insert the geospatial layers at the bottom layer of the coastal SDI.

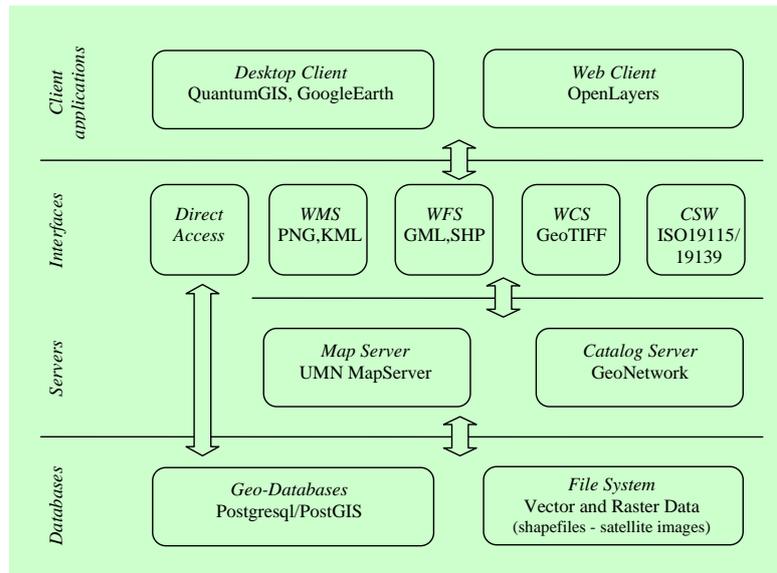


Figure 1: The architecture of the SDI using GeoFOSS.

Phase 2: Development of the WMS, WFS and WCS Servers. In this Phase the Map Server has been set up. The mapfiles have been edited and appropriate parameters have been inserted in order to serve geospatial data residing at the bottom SDI layer into the application layer using OGC specifications, i.e., WMS, WFS, and WCS. Geospatial data can then be retrieved and visualized by end users in various formats (e.g., PGN, JPG and GML).

Phase 3: Development of the Web Client Applications. This Phase is focused on the generation of user friendly interfaces to the SDI geospatial content through the web. The web client applications are connected with the geospatial layers provided by other servers (e.g., Google Maps, NASA JPL Portal Nasa's WMS, Integrated CEOS European Data Server – Mashups). Their functionality include the browsing/ visualization of the SDI geospatial layers and the retrieval/ discovery of information based on relatively simple geospatial analysis operations.

Phase 4: Development of the Catalog Server. In this Phase, the catalog server for the geospatial layers accommodated in the coastal SDI has been set up. Appropriate metadata items have been generated and coded based on internationally accepted specifications (ISO 19115/139).

4. THE WMS, WFS, WCS AND KML SERVERS

The WMS, WFS, WCS and KML constitute very powerful tools in contemporary web mapping and web GIS technology, provided that the SDI geospatial layers may be viewed or shared on the web using widely adopted standards and specifications. On the other hand, it is widely accepted that the use and exploitation of the content provided in similar servers is cumbersome, especially for non experienced users (Mitchell 2005).

In order to assist the end users and applications in retrieving and visualizing the SDI geospatial content through the servers above, a detailed web page has been generated (Figure 2). Through this page, the user is capable to browse the SDI content and easily access and exploit it by using an open source WMS/WFS Viewer (e.g., QGIS WMS/WFS Plugins, Integraph OGC WMS Viewer, etc.).

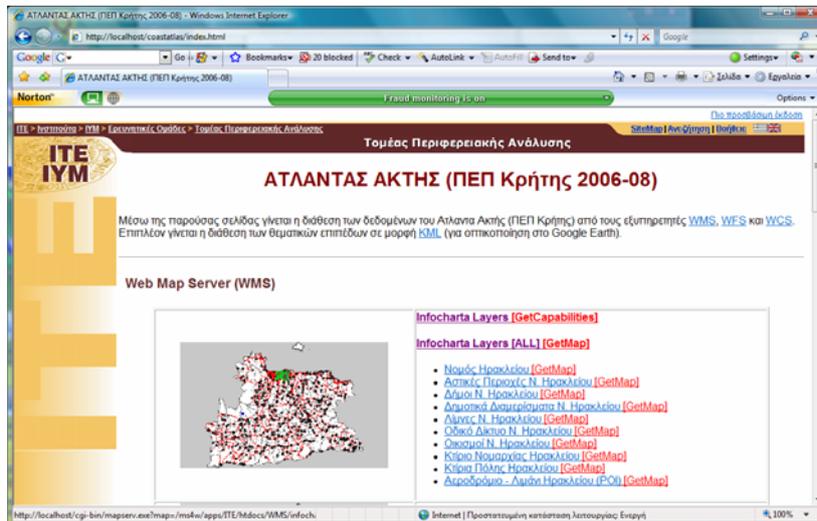


Figure 2: The introductory web page for the WMS, WFS, WCS and KML servers (part of).

The web page consists of four main sections. Each section is devoted to one server:

1. The *Web Map Server* (WMS) section serves all vector layers (Shapefiles) of the SDI. The web page provides a link to the capabilities document (GetCapabilities) and a set of links to the actual maps (as images) as served by the WMS (GetMap).
2. The *Web Feature Service* (WFS) section provides the same SDI layers as in WMS section. The web page provides a link to the WFS capabilities document (GetCapabilities) and a set of links to the actual layers (as features in GML) of the WFS (GetFeature - GML).
3. The *Web Coverage Server* (WCS) section provides the raster (GeoTiff) layers of the SDI. Similarly to the WMS and WFS sections the end user is provided a link (URL request) to the WCS capabilities document (GetCapabilities) and a set of links to the actual images of the WCS (GetMap).
4. The *Keyhole Markup Language* (KML) section provides the KML (or KMZ, i.e., zipped KML) files of the SDI geospatial layers. These layers are generated using the ogr2ogr utility provided in GDAL/OGR Geospatial Library (OSGeo). The end user may download these layers and visualize them either in Google Earth (Figure 3) or on top of Google Maps using Google Maps API.

5. CONCLUSION

At the Foundation for Research and Technology (FORTH), we are developing a Spatial Data Infrastructure (SDI) for the coastal zone of Heraklion prefecture, using Geographic Free and Open Source Software (GeoFOSS). In this paper, we provide an overview of the project and present the WMS, WFS, WCS and KML servers.

The access to these servers is assisted through the links of a web page, which has been implemented to offer the URL requests to the end users. This is a method that may help in overcoming the deficiencies in retrieving and using geospatial data and layers available in web mapping services.

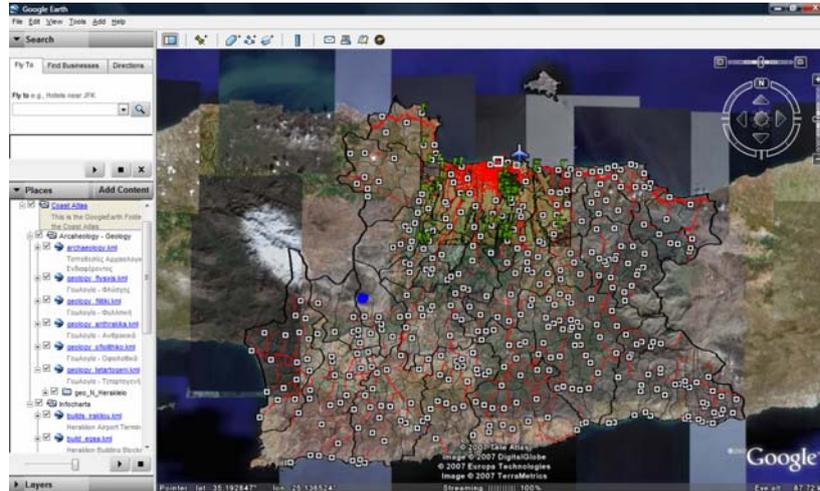


Figure 3: Visualizing the coastal SDI geospatial layers in Google Earth.

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