SASPARM 2.0

EUCENTRE European Centre for Training and Research in Earthquake Engineering

IUSS Scuola Universitaria Superiore Pavia

Support Action for Strengthening PAlestine capabilities for seismic Risk Mitigation SASPARM 2.0

Deliverable D.G.1 & D.G.2

Software Requirements and Architecture

ECHO/SUB/2014/694399 - SASPARM 2.0 Support Action for strengthening PAlestine capabilities for seismic Risk Mitigation
Project co-funded by ECHO - Humanitarian Aid and Civil Protection

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1 INTRODUCTION

The activity described in this deliverable regards specifications for the development of the website and WebGIS platform of the project SASPARM 2.0. After an initial assessment, it was decided to develop the project's website and to put in it a link for the WBP (Web Based Platform) in order to: (i) exploit the potential provided by the software for the creation of web pages and so get a website with a graphic effect in which it is possible to place contributions that are easily accessible and (ii) release from the site the platform for the development and for the use of geographic databases.
In this period the IT industry dedicated to the publication and the processing of geographic data (Geographic Information Systems, GIS) is in great expansion for what concerns both the production instruments and the publication of geographic information, especially via the Internet (WebGIS). All that is possible thanks to the dissemination of instruments that are able to provide maps in an easy and cheap way such as Google Earth.
For this reason, nowadays, the availability of tools and software solutions is particularly high, both on the side of traders and on the side of research institutions and open source development community. In spite of that, it is important to underline that not all available products are at the right level of the required technique and/or they can represent a suitable platform of development for the geographic services.
It has been necessary to carry out a study activity and a selection of the IT offer concerning the GIS systems by paying particular attention to the tools developed for the use of geographic information in the web and on their publishing. Specifically, the latter should be performed according to standards that are not tied to a particular software platform (Web Services) in order to ensure the widest availability and integration of geographic data.
In this report Chap. 2 information on the possible system architecture and on the selected one are given. In Chap. 3 the standards to be used to exchange data are given. In Chap. 4 the library used for the GUI are listed. In Chap. 5 the format to exchange geographical data are given. In Chap. 6 the software components are listed and, finally, guidelines on how to integrate the calculation routines can be found in Chap. 7.

2 RESEARCH ON GIS ARCHITECTURE

A study on the state of the art of GIS architecture has been carried out and an architectural model has been identified as a reference for the future development of the system.
The architectural adopted model is an evolution of WebGIS, known as "Spatial Data Infrastructure" (SDI), of which the system being developed by the partners of SASPARM 2.0 (i.e. the responsible for software development EUC and IUSS) will represent a node.
The main components that belong to this architecture have been identified and they are Geo database, Map Engine, Web Services Standards, Web Map Viewers, Map Desktop Clients. For what concerns the selection of the server, even if all servers can be considered usable for the project, the one that best meets the requirements sought for the project is UMN MapServer. The latter, in fact, is easy in the configuration, complete as product, widespread and characterized by the presence of updated and extensive documentation

The system architecture provides the virtualization of computing machines that make up the system (frontend server, database, map server, computing server).
The entire system will be provided by a VMWare virtual architecture that is set up to scale transparently, both horizontally (by adding more servers in the cluster of VMWare machines) and vertically (by increasing the endowment of the available physical machines).
In addition, the partitioning of the various tasks of the system among the different virtual machines allows to act precisely on each single component that could reveal itself as a bottleneck in terms of resource consumption or calculation times in the future production use.

3 IDENTIFICATION OF THE GEOGRAPHIC STANDARDS FOR DATA EXCHANGE

The geographic information contained in the various geographic databases will become GIS products.
It has been identified and adopted the standards proposed by the "Open Geospatial Consortium" (OGC): the latter deals with the development and dissemination of international standards for the publication of geographic information and geolocation services.
Table 3.1 shows the adopted standards:

Short cat	Name
WFS	Web Feature Service
WMS	Web Map Service
WCS	Web Coverage Service
GML	Geographic Markup Language
CSW-ebRIM	Catalogue Service
SF/SQL	Catalogue Service

Table 3.1: Adopted standards

4 STUDY OF LIBRARIES FOR GUI WEBGIS

An important aspect of the WebGIS architecture is represented by the user interface, which is built inside a web browser.
Such task has involved a study for the identification and evaluation of javascript libraries and of GIS framework, which are useful to build the dynamic HTML pages in order to be able to offer the ability to view, query and manipulate geographic data.
The usable libraries have been three: Open layers, MapFish and pMapper, whose characteristics are summarized in Table 4.1.

Library	Technical Characteristics	Notes
Openlayers	Libreria javascript opensource	It is widespread for the presentation of maps and geographic layers inside HTML pages while it is less suitable to build interfaces to manipulate.
GeoExt	Framework javascript open source based on Openlayers and ExtJS	It allows the creation of graphical interfaces that are very rich in GIS functionalities. However, this software is still very young.
pMapper	Framework opensource with both client and server components (PHP/Mapscript).	It is a complete software tool that allows the creation of very interactive GIS interfaces but on the other side it is strongly linked to the use of UMN MapServer.

Table 4.1: Adopted libraries

Each of these frameworks is used with a different purpose and, according to the needs of interaction with the geographic data, it will be selected the one which results the most appropriate or a combination of all in function of each type of use.

5 STUDY OF THE FORMAT FOR THE UPDATE OF GEOGRAPHIC DATA

It has been performed a research to identify the mechanisms and the formats usable to implement a feature that allows to notify changes or to update the geographic data.
Two formats of data exchange have been identified. They are widespread in the geographical context and they have a growing support from the different programming languages and popular WebGIS frameworks.
These two formats will be implemented in the SASPARM 2.0 geographical portal and they are listed in Table 5.1.

Format	Technical Characteristics	Notes
GeoRSS	XML specification that allows providing geographic data that are expressed in standard GML as RSS feeds.	It is a good way to notify geographic data through the architecture of RSS feeds and it is widespread and used by both browser and automated interfaces.
GeoJSON	Format to encode the different geographic entities through textual data structures.	It is a format that derives from JavaScript; for this reason it is easily integrated in graphical interfaces that use JavaScript (e.g. Openlayers).

Table 5.1: Adopted formats

6 SOFTWARE COMPONENTS

The software components of the platform are listed below:

- Web Server: Apache HTTPD
- Geographic Database: POSTGIS
- Engine maps: GEOSERVER
- Application Server: Apache Tomcat
- Development languages from the server side: Java, Visual Basic.NET that is used for some specific services of calculation
- Languages for the GUI side: Javascript, Openlayers, GeoEXT

7 INTEGRATION OF THE CALCULATION ROUTINE

The calculation routines available through the platform will be developed by programming codes, which are suitable to the engineering developments such as Fortran, C or Matlab.
The possibility of integrating some calculation routines written in Matlab involves the creation of a new virtual machine, which is dedicated to this purpose.
The machine must be configured with a Java Application server Tomcat, to which the server runtime component of Matlab "MATLAB Builder JA" has been added. The latter allows performing the routines which are developed in Matlab language within a Java Virtual Machine.
The calculation routines (written in Fortran, C, Matlab) has to be integrated within the code that exposes its functionality through HTTP calls, according to the paradigm of web services that are the ones based on the JSON-RPC.
These services will be linked to the features of the portal and they will be accessible from the WebGIS interface.