Development of Open Web-GIS Prototype for Regional Geographic Information Network Project in the Philippines Region II

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ABSTRACT

In Region II of the Philippines, RGIN (Regional Geographic Information Network) has officially been started to develop since in August, 2003 by RDC (Regional Development Council) II. The primary objective of the Network is to develop an organized sharing of information and data amongst the network partners, which are consists of provincial governments, government agencies, NGO, NPO, institutes and universities. Therefore, we developed Web-GIS applications using Free / Open Source Software. Recently, Web-GIS is being implemented in various purposes and used as one of the most common way to share and manage geo-spatial data. This situation is due to the efforts of international standards such as ISO and OGC. This research discusses the potential capabilities of open standards for GIS data sharing based on the experience in the Philippines.

1. INTRODUCTION

Recently, Web-GIS is being implemented in various purposes and used as one of the most common way to share and manage geo-spatial data. This situation is due to the efforts of international standards such as ISO and OGC (Open Geospatial Consortium). OGC provides OWS (OGC Web Service) specifications for standardizing GIS data communication. These open standards have helped in implementing interoperable communication between different systems and accelerate for sharing and accessing spatial information.

In Region II of the Philippines, RGIN (Regional Geographic Information Network) has officially been started to develop since in August, 2003 by RDC II (Regional

Development Council). The primary objective of the Network is to develop an organized sharing of information and data amongst the network partners, which are consists of provincial governments, government agencies, NGO, NPO, institutes and universities.

However, the Philippines is divided into 18 regions, which consists of several provinces. Each region has each local governments and different policies. In developing GIS data and system, each region has different standards. Therefore, for RGIN project, these OGC features will be very effective when other regions developed each GIS applications and data in the future.

During the initial period, the progress of the project was very slow. We have tried to develop the RGIN system using proprietary software. We have faced due to limitations in budget and knowledge on effective implementation of proprietary solutions. The development of the system has been suspended for several years. However, FOSS (Free/Open Source Software) accelerated the project progress. We have developed Web-GIS prototype for RGIN project using FOSS.

This paper describes how FOSS facilitated the project development and discusses the potential capabilities of open standards for GIS data sharing based on the experience in the Philippines.

2 RGIN Prototype System

2.1 System Components

The system has been developed using Linux, Apache, PHP and PostgreSQL which are generally called as LAPP environment and widely being used in many other projects. Web mapping function has been incorporated in the system using UMN MapServer and GeoServer as web mapping server and Appformap (see http://www.mapuse.net) as web mapping viewer. Tomcat JSP/Java Servlet application server is required to be installed in order to implement GeoServer. And Apache/Tomcat connector is also installed as to have good performance on web page processing (Figure 1.). The connector is a module of Apache in order to assign proper process such as java application sites to Tomcat and other sites to Apache.

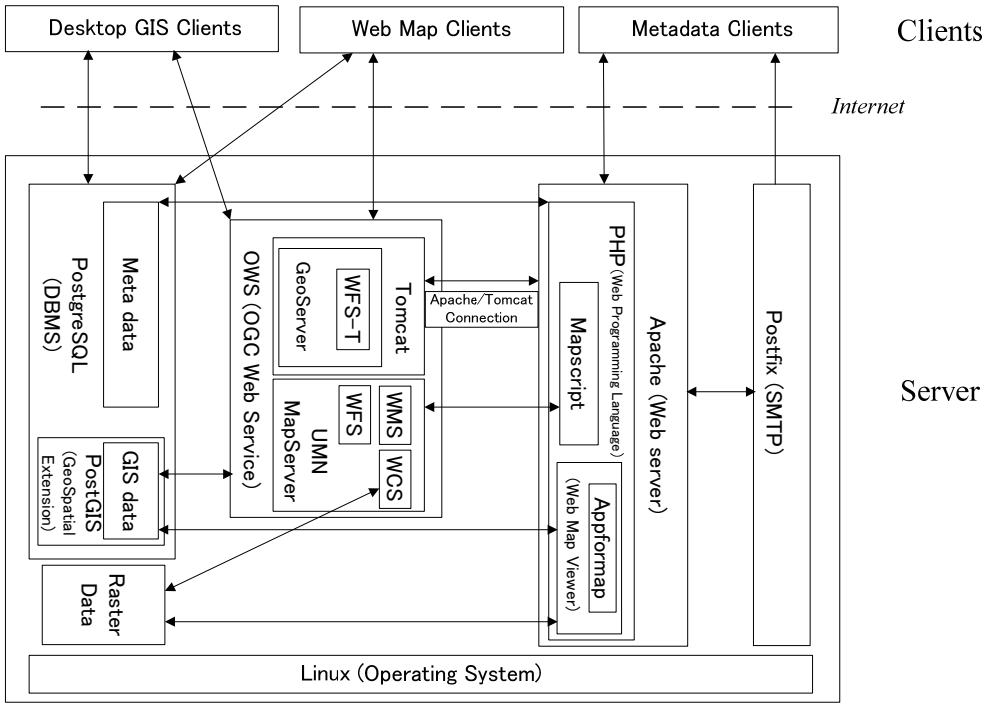

Figure 1. System Components and Data Flows

Yoshida and others (2002) experimented and used GRASSLinks for web-mapping systems. GRASSLinks can be used to develop applications with data processing and analytical capabilities. However, the implementation task is cumbersome and the system does not comply with existing standards. On the other hand, UMN MapServer and GeoServer have commonly being used in many practical applications. It is easy to be implemented and applied to cater many of the user's demands.

PostGIS has been implemented as geospatial data extension for PostgreSQL in the system. PostGIS fully follows OGC Simple Feature Access for SQL/ ISO19125 and very powerful and offers many advantages. GIS data can be stored and managed in RDBMS together with other DB data due to the extension. Therefore, the system can offer advanced map query using the geo-spatial and attribute data. Also the GIS applications enable to share a DBMS server through the OGC/ISO standard. Further, the users can easily access, operate and even edit the maps (Add new data, modify, delete, etc) in the remote servers through desktop GIS clients or web map clients.

All of the software used to develop the system are available and freely usable under OSI compliant licenses (http://www.opensource.org/licenses/)

2.2 System Functions

Access to GIS database is restricted only for the project partners. Therefore, the system requires user authentication by user name and password before entering the system. This system is designed as to allow the user to search, view and manage the regional GIS data through the Internet. the basic functions are shown as below,

- Data Management

This function allows the data administrator to manage the data such like data insert, update and delete over the Internet.

- Metadata Search

The metadata for each map has been developed. The user can retrieve the data by keywords through this function (Figure 2). Also the searched result page is links to the map display, attribute table display and map request page (Figure 3).

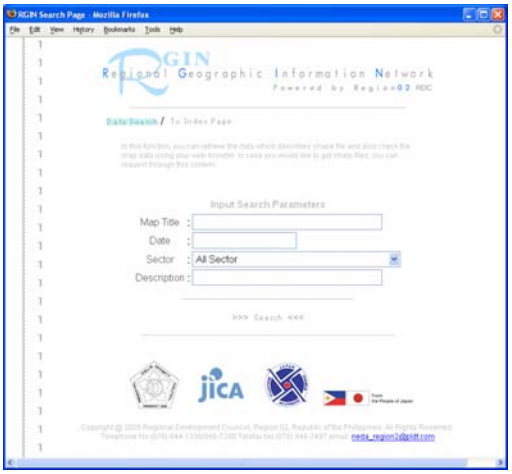

Figure 2. Keyword Search

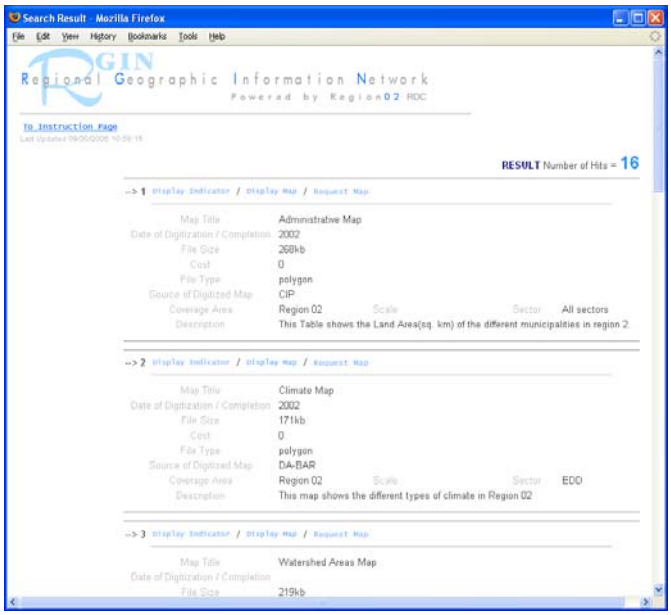

Figure 3. Result Page

- Attribute Table Display

Attribute tables for each map can be displayed through the result page in metadata search. The system retrieves the attribute data from PostGIS/ PostgreSQL when it is requested.

- Data Request Transaction

When the user would like to obtain map data, he/she can apply the form through this page. After the registration, automatically the application form as e-mail will be sent to the data administrator and the user through Postfix SMTP.

- Map Display using Appformap web map client

Powerful and multi-functional web-map client application, Appformap has been integrated into the system as the map viewer (Figure 4. & 5.). We have implemented some web map clients and examined the functions. Appformap has been chosen due to the qualified the requirements in the project. Appformap is AJAX (Asynchronous JavaScript + XML) enabled and WMS/ WFS compliant client. Appformap offers basic manipulations; map selection, zoom in/out, pan which already implemented in previous viewer using Gmap client and necessary manipulations; distance measuring, PDF publisher, rendering WMS maps from registered WMS servers in Appformap (Figure 6. & 7.).

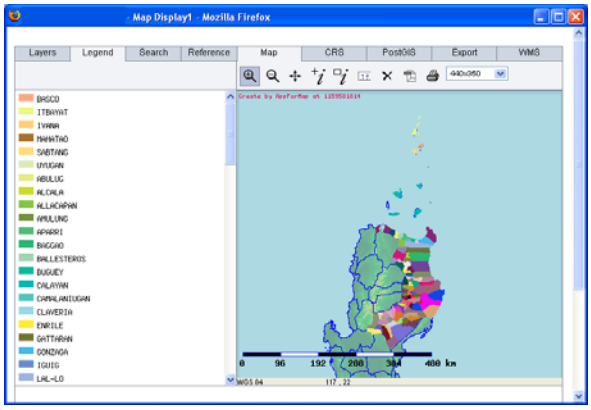

Figure 4. Appformap

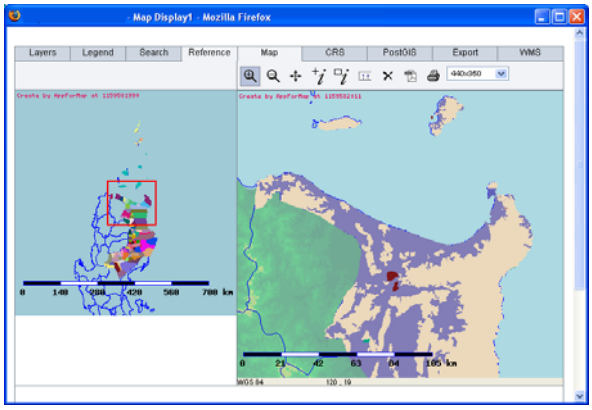

Figure 5. with Reference Map

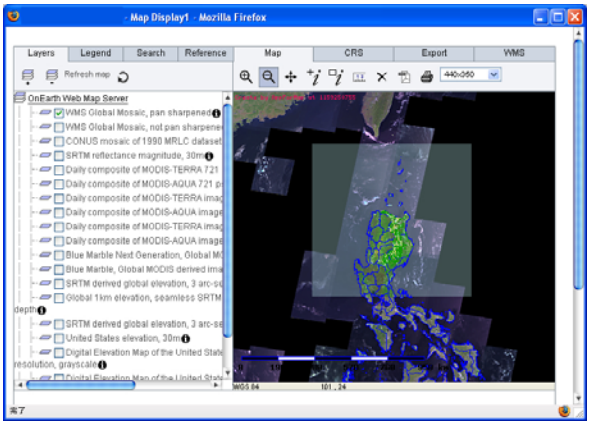

Figure 6. WMS Global Mosaic Layer

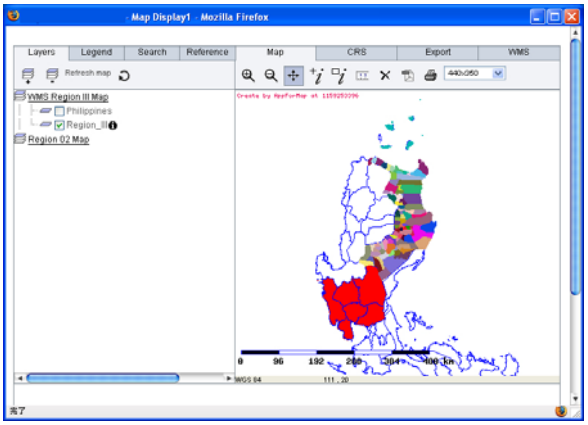

Figure 7. WMS Overlaid Map

This system has capability to be accessed to geospatial data from 3 different types of clients (Figure 1.). One is through Map display function using Appformap which we explained as above and others are described as below,

- Desktop GIS Client

Through desktop GIS clients such as QGIS, uDig, ArcGIS, OpenJUMP, gvSIG, etc. can directly access to PostGIS/ PostgreSQL DBMS and edit GIS data. This way is generally used for the data administrator in the system. IP restriction should be set up in PostgreSQL because of network security reason. Besides, these clients have function or extension for WMS, WFS, WFS-T (ArcGIS 9 and uDig only) and WCS (gvSIG only) connections.

- Web Map Client

We implemented some web map client applications. For instance, Appformap, Mapbuilder and msCross (see www.freegis.org), these clients are AJAX enabled and WMS compliant. The connections between these clients and OWS (WMS and WFS) in the system are examined. These applications have potential to be used in local distributed environment.

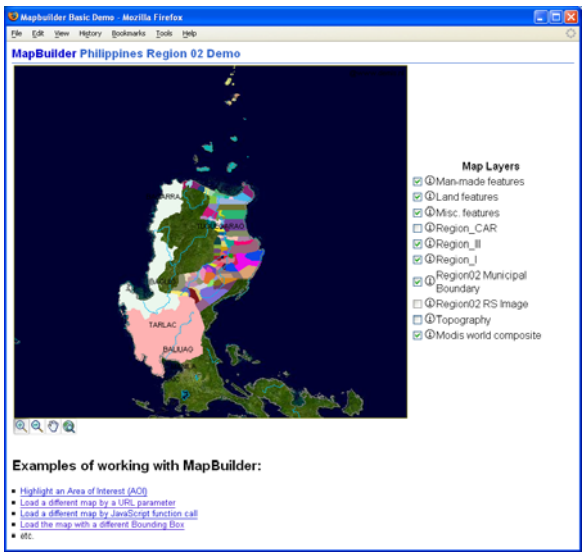

Figure 8. Mapbuilder

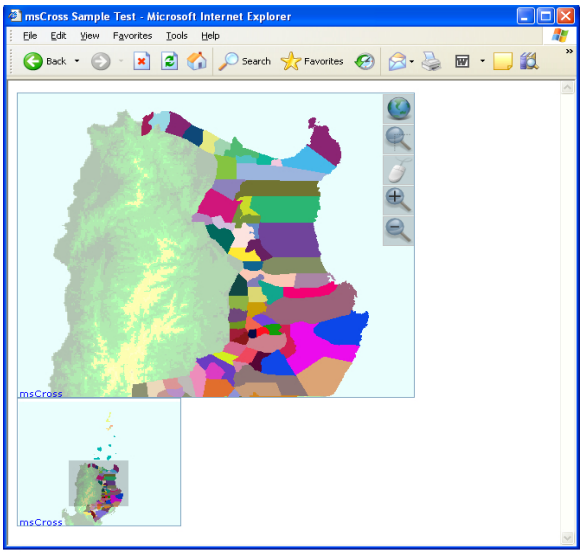

Figure 9. msCross

In addition, there are feedback page, access log page and the links to RGIN Operation Manual, System Manual and also URL pointing to related agencies. We developed this system as the project portal site for RGIN. As the one of the future improvement we plan to integrate with Portal and CMS (Content Management System) to enable interoperable GIS-aware community service (Raghavan and others, 2005). RGIN is collaborative project among Region II and the availability of integrated web-based system for data access and management will be great benefit to the region.

2.3 Implementing Interoperable and Scalable System

RGIN system supports most OWS (OGC Web Service) specifications which are WMS (Web Map Service), WFS (Web Feature Service), WFS-T (WFS-Transactional) and WCS (Web Coverage Service). These are now international standards (ISO/TC211) for Web-

mapping application. WMS (ISO19128) capability enables to render maps as image data accessing to several distributed servers. WFS (ISO19142 pending) provides a generic way to access raw feature data through GML (ISO19136 pending). On the other hand, WFS-T enables the user to have transactional manipulations (add, update and delete) of feature data through WFS-T compliant server and client. WCS is for a data sharing standard on Coverage data (raster data set) that represent values or properties of geographic locations such as satellite image, DEM (Digital Elevation Model), etc.

3 Conclusions

We successfully developed Web-GIS prototype making use of FOSS for RGIN project. The present system allows the user to easily search, view and request the GIS data through user-friendly interfaces. We also showed these implementations allow the user to have more informative result and easy interaction with the applications. Besides, OGC specifications were implemented into the system and examined the interoperability of OGC compliant system through experiments using different kinds of data type and GIS clients such as desktop GIS and web map clients. And the advantages and greater possibilities of open standards were shown.

As our future study, we will have to consider implementing OGC Catalog Services/ ISO23950 (Z39.50) for the metadata or attributes search of GIS data when it comes to search data across several distributed servers. Song and others (2003) successfully incorporated Z39.50 in their spatial enabled system. And Geographical Survey Institute of Japan provides Z39.50 web gateway service which includes more than 20 Z39.50 compliant servers. These systems allow the user to discover and share GIS data efficiently in distributed environments over the web. Clearinghouse software Isite will be integrated with metadata database.

Our system can be easily adapted to suite other applications and can be applied for other projects with similar requirements. Therefore, each region in the Philippines has standardized systems and data applying this study in the future, GIS related projects will be accelerated and more valuable.

4 Acknowledgement

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5 REFERENCES

Geographical Survey Institute of Japan. *Clearinghouse and Metadata*, URL: http://zgate.gsi.go.jp/.

Raghavan, V., Nguyen, B., Masumoto, S., Neteler, M. and Shibayama M., 2005. *Integration of GIS in Portal and Content Management Systems - A Framework for Participatory Spatial Data Infrastructure Development* -, Geoinformatics, Vol.16, No.2, pp.122-123.

Song, X., Kono, Y., Tanaka, K. and Shibayama, M., 2003. *Integration Geographic Collection Database Repositories with a Z39.50-Compliant Gateway*, Asian Journal of Geoinformatics, Vol.4, No.2, pp.31-36.

Yoshida, D., Masumoto, S., Raghavan, V., Nemoto, S. and Shibayama, M., 2002. *Development of On-Line Spatial Information System - OSAKALinks* -, Geoinformatics, Vol.13, No.2, pp.130-131.

Yoshida, D., Darauay, M., Rimando, M., Regional Development Council II and Raghavan V., 2006. *Development of Open Web-GIS Prototype for Regional Geographic Information Network Project in the Philippines Region II*, Geoinformatics, Vol.13, No.2, pp.130-131.