APPLICATION OF SPATIAL METADATA STANDARDS FOR CATALOG WEB SERVICES IN KOREA

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ABSTRACT : Spatial information has recently been recognized as one of the major subjects of interest in information technology. With increasing variety and quantity of spatial data on the web, searching and maintaining these data are becoming a much focussed area of research. Interoperability is the key technology in solving the complexities of spatial data in web services. The problem of maintenance and searching of spatial data in an interoperable web service environment can be solved by establishing standardized metadata of spatial information. Then using the standardized metadata, catalog web services can be deployed for autonomous searching and binding of spatial data.

This study investigates the international standard for spatial data metadata(ISO/TC211 19115) and deployed catalog web service based on this metadata. Various heterogeneous spatial data of Seoul Metropolitan region were then used for experimental implementation of catalog web service.

KEY WORDS: Metadata Standard, Catalogue Web Service, Spatial Information

1. INTRODUCTION

The catalog web service is usually deployed to publish services on the internet and to make the published data easily accessible to other computer systems. But before the catalog functions of the web service can be applied, a set of standard metadata needs to be registered and validated.(Kim, 2004)

Before 1994 when researches into standards of metadata were initiated, sharing of information on the web was not an easy task. In 2003, ISO/TC211 19115 standard on Geographic Information-Metadata was published and many geospatial systems started adopting this standard for web services. (Telecommunications Technology Association, 2002)

In this study, a set of metadata following the ISO/TC211 standard was designed to describe various geospatial data. This metadata was then implemented and published to an open source catalog web system thereby publishing and making various types of geospatial data easily searched and available on the internet.

2. METADATA STANDARDIZATION ACTIVITIES IN KOREA

At present, the NGIS(National Geographic Information System) project is in its third phase in Korea which aims to create a nationwide geospatial database and use this as an infrastructure to produce various location based applications. Research efforts have been carried out within this project to set up a national standard for geospatial metadata. The proposed metadata standard was designed mainly for public office use and local government administrative purposes, but it lacked in many aspects as a comprehensive standard which would support industry wide geospatial applications. (National Computerization Agency, 2002)

There have also been other efforts independent to NGIS which aimed to publish application specific geospatial metadata. The Ministry of Maritime Affairs and Fisheries published a GIS metadata standard for the maintenance of its geospatial data. Also a Korean standard metadata for flood map was established by adding 8 customized categories to 7 categories of standards issued by FGDC (Federal Geographic Data Committee) of the United States of America(Yang, 2003).

3. IMPLEMENTATION OF GEOSPATIAL CATALOG WEB SERVICE

The catalog web service interacts with other web services based on requests of information on the metadata set and metadata elements. That is why metadata standard is a crucial aspect of catalog web service. Various components of the catalog web service is depicted in Figure 1. Various types of geospatial data stored at the backend tier of a user computer system can be in various formats such as shape format files, CAD files, DEM files or LiDAR mass point files. If the owner of these geospatial data files wants to make them available on the internet, he or she needs to make them visible to other potential users who would be searching for them on the internet. To do so, one needs to publish the descriptions of the data, i.e. metadata, to a catalog web server. It is just as if when you go to a library and want to search for a book, you would go to the catalog of books and search for a title, author or related fields and key words instead of actually wander about the library to find the book itself. The client then can connect to the catalog web server and search and preview various geospatial data that is available on the internet before actually downloading the data to one's own computer environment for further analysis. The previewing of the selected data set can be

serviced by another web map client such as OpenLayers[1], MapBender[2] or MapBuilder[3]. One has to bear in mind that to make all these possible: 1) the publishing of the geospatial data, 2) the description of the metadata, 3) the catalog web service, 4) the client web mapping service, and 5) the presentation of the actual geospatial data have to follow a well known and accepted standard.

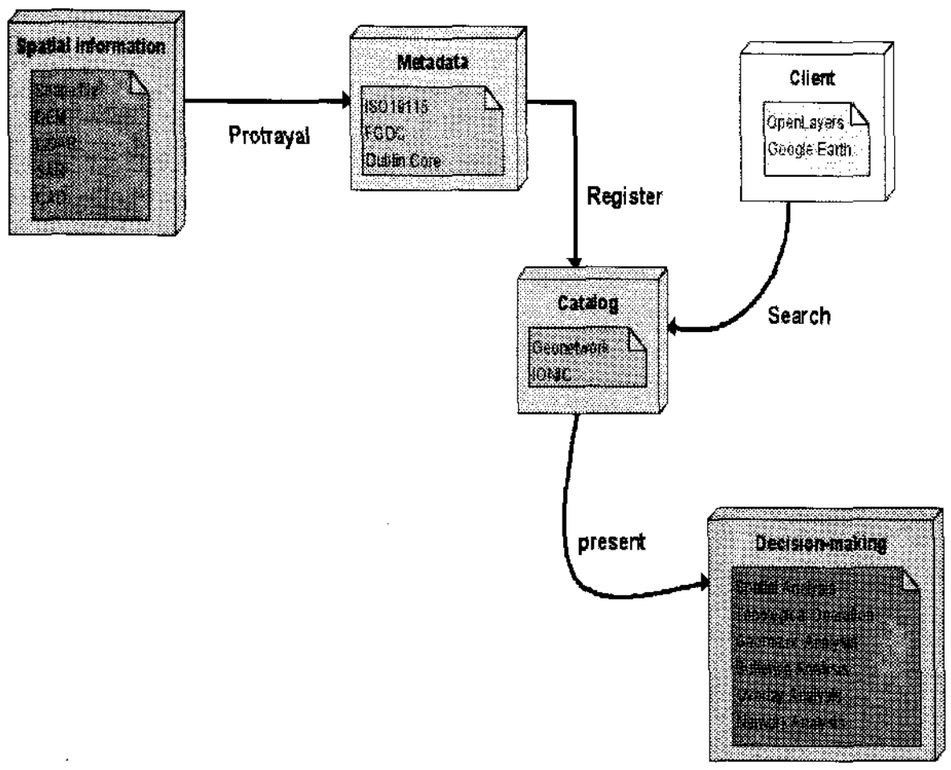


Figure 1. Components of Catalog Web Service

The implementation of Catalog Web Service begins with design and editing of metadata and then harvesting the metadata from various published sources. The Catalog Service should also link a web map viewer so that the user can have a preview of the geospatial data set.

In this study, as the role of data publisher, various types of geospatial data were stored in Oracle DBMS.

As catalog web server, metadata items are edited following the ISO/TC211 19115 standard. The metadata was implemented for catalog web service with the GeoNetwork Catalog Server[4]. After the establishment of catalog web service, client web mapping services were set up using OpenLayers and Google Earth. Some experimental searching and previewing through the catalog service were performed.

3.1 Extension of ISO Metadata standard

An extension to the ISO/TC211 19115 metadata standard is proposed here where different level of structuring is considered as another element of metadata. This is because in reality geospatial data goes through channels of processing where structure and information is merged into the data set. In many cases, the middle product is needed to accessed as well as the end product.

The geospatial data that are to be stored in spatial database is diverse in nature. Geospatial data is usually classified to vector and raster data where digital maps files and CAD files are vector data and scanned aerial imagery, satellite imagery and are raster data. Some data which are end products of the latest technology are better classified into new classes. Some of such data are 3 dimensional building data which includes vector data plus corresponding image patches for visualization, and surface data such as LiDAR data, which are further processed to produce DEM data. Other spatial data such special spatial sensors with unique physical characteristics which do not fit into the vector, raster, surface or 3D building category, can be extended as another row to the end of the table.

The LOS (level of structure) of geospatial data can be based on the amount of inherent structural information which would reflect its maturity to be used for spatial analysis and applications. The concept is as illustrated in Table 1. LOS0 would be non georeferenced raw files out of the sensor. LOS1 would be where features are georeferenced and would be distinguishable with Unique Feature Identifier and have a one-to-one correspondence with actual objects in the real world. Some data might exist in the gray area of between levels. For example digital map produced freshly out of photogrammetric stereoplotter or hand digitizing would be between LOS0 and LOS1 because although most of such data would be georeferenced they would still need further cleaning an removing of errors such as overshoots and undershoots and other digitizing errors as well as not having an unique identifier for each feature. LOS2 would be at the top level where objects are linked with attributes ready for use for a selected application.

Table 1. Level of Structure of Geospatial Data

	LOS0	LOS1	LOS2
Vector	Points, lines, polygons (non georeferenced vector files)	One-to-one correspondence with features on map with objects in real world	Application specific attributes linked to objects
Raster	Non-georeferenced image map	Georeferenced and mosaicked orthoimages	Application specific classified raster imagery
Surface Data	Irregular point clouds	Filtered point clouds separated and linked to features	TIN or DEM
3D Building	Non georeferenced wireframe model	Georeferenced and rendered building surfaces	Application specific building internal model

3.2 Implementation of Catalog Web Service

Figure 2 illustrates the implementation of catalog web service in the study. Four separate computers were used

[1] http://www.openlayers.org
[2] http://www.mapbender.org
[3] http://www.mapbuilder.net
[4] http://geonetwork-opensource.org

to test the service. Geospatial data were stored in Computer A where Oracle Spatial[5] was installed. There can be hundreds of other distributed "computer A's" which can publish their geospatial data to the Catalog Server. In Computer B, the GeoNetwork Catalog Web Server was installed together with Tomcat Web Server[6] which is used to deploy the catalog service. In Computer C, another open source software called Geoserver[7] was installed for OGC compliant web services of geospatial data. Computer D is the end user computer with just an internet browser such as the Internet Explorer or Modzilla Firefox. OpenLayers or other web mapping clients can be linked with computer B which will enable previewing of data set referenced by the metadata in the catalog web server. Computer D can also be a desktop GIS client if spatial analysis is required with the data accessed through the catalog web server.

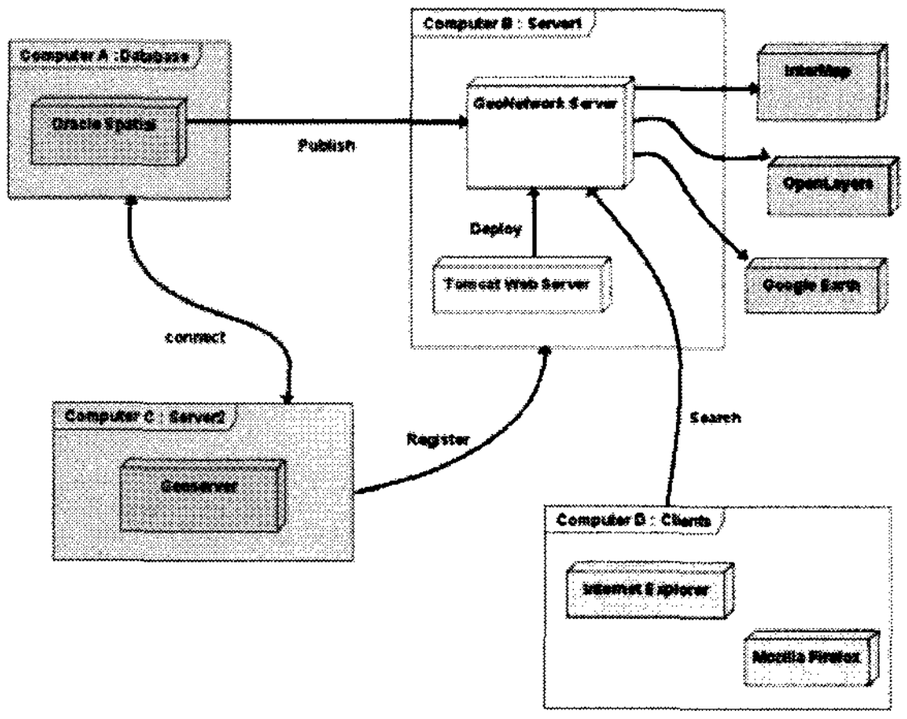


Figure 2. A Configuration of a Distributed Geospatial Data Service Using the Catalog Web Service

As an end user using an internet browser one would get an initial catalog of available geospatial as shown in Figure 3.

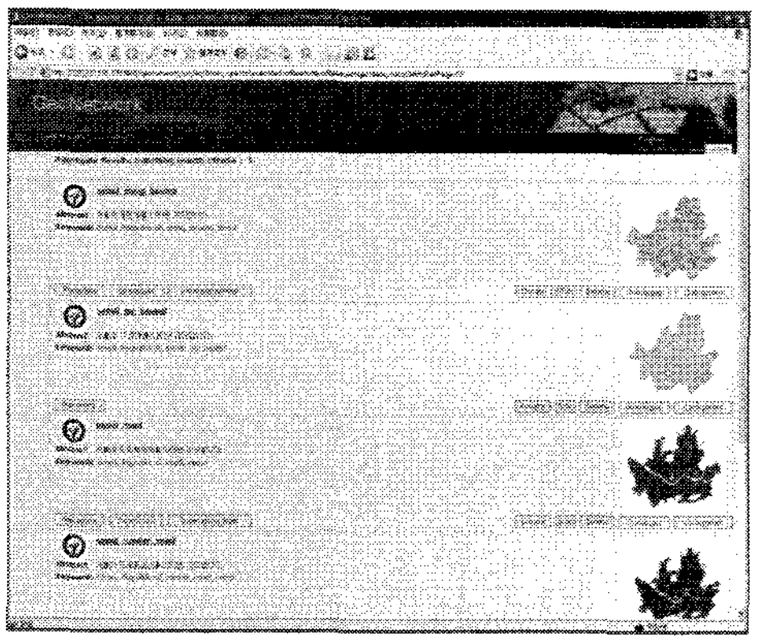
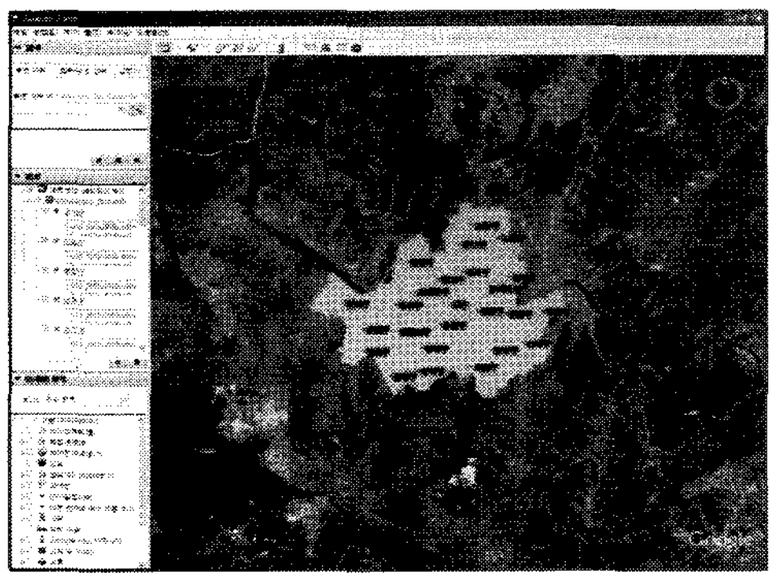
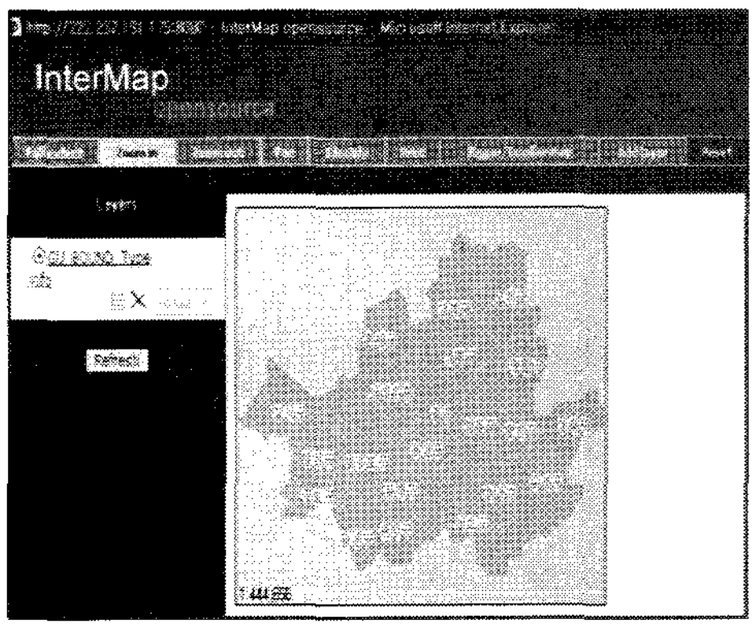


Figure 3. Catalog Web Service View Showing Available Geospatial Data

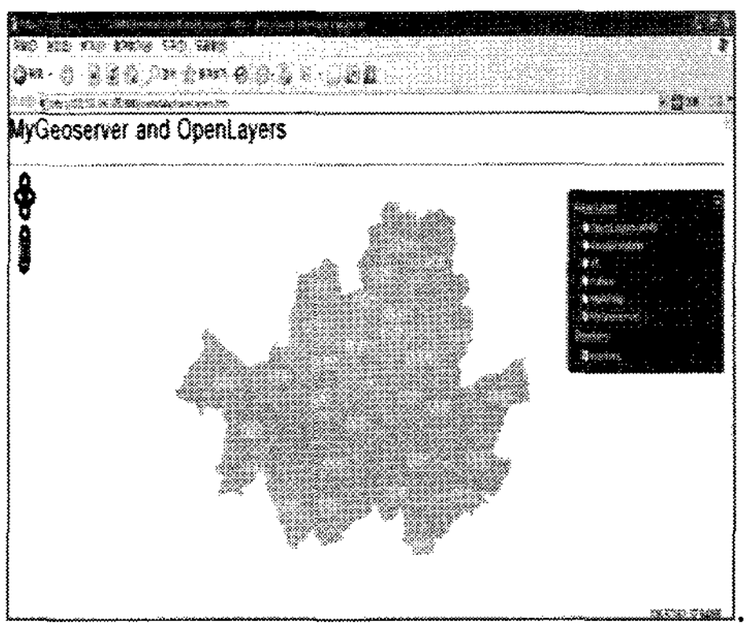
When one clicks on a geospatial data set, the web mapping viewer, such as OpenLayers or Google Earth is initiated to present a preview of the selected geospatial data set. Figure 4 (a), (b) and (c) shows various results shown by different viewers.



(a) Viewing with Google Earth



(b) Viewing with InterMap



(c) Viewing with OpenLayers

Figure 4. Viewing Geospatial Data Using Different Viewers from Catalog Web Server

4. DISCUSSIONS

It was shown in this paper that it is quite simple to publish geospatial data and also to set up catalog web service based on open standards. Some considerations

[5] http://otn.oracle.com
[6] http://apache.org
[7] http://www.geoserver.org

have to be given to the design of metadata standard of geospatial data. An extension to the ISO/TC211 19115 metadata standard was proposed where different levels of structure of the data set was included as an extension to the standard.

Although technology has proven itself to be feasible it still needs the acceptance of producers, processers and users of geospatial data to deliver its value. The geospatial community needs to embrace the open standards of geospatial web services and maximize the opportunities offered by free and open source geospatial programs.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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