THE DEVELOPMENT AND THE USE OF CLEARING HOUSE SERVER INFRASTRUCTURE FOR GIS INTEROPERABILITY

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The Development and the Use of Clearing House Server Infrastructure for GIS Interoperability

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ABSTRACT

Rapid development of internet technology allows more spatial and tabular data available and accessible publicly. But those data can not be utilized directly due to the differences in data acquisition techniques, data definition and their semantic meaning. This situation reveals the need of interoperable GIS to support seamless information sharing. This is the future GIS architecture that may increase the reusability of available spatial datasets and reduce data acquisition cost.

Under the whole framework of the on going research has identified four components (modules) to support the application of GIS interoperability. This paper discusses the development and the use of clearinghouse component (module) to facilitate end users to search, locate and retrieve the required spatial information or meta data from different organization at different time and places. This allows making further enquire about particular spatial data-information. The detail discussions on GIS Interoperability model as well as the development of architecture of these clearinghouse servers are given. The development of clearing house server employs an open sources approach and open file format. In this regards, fully available source code allows modification and customization without licensing restrictions.

KEYWORDS:

(1) Geographical Information Systems; (2) Interoperability; (3) Information Sharing; (4) Clearing House; (5) Middleware

1. INTRODUCTION

This research has been conducted under the framework of GIS Interoperability Project financed by KUTKM's short grant research project. This project is intended to increase the usefulness of GIS in different possible GIS application domains.

Within last few decades, GIS has been approved as a powerful (research) tool for scientific investigations, resources management and development programme. In this regards, GIS shows its strong capability for assembling, storing, manipulating and displaying spatial relationship [7].

There are so many GIS users using different GIS platform with a very limited interoperability. In one hand, this situation does not allow spatial data and information sharing between two or more GIS platforms that are used by different GIS users. In addition to this situation, a rapid development of internet (information) technology support different data, information easily available and more accessible publicly [2]. However those data are not always useable for other users due to lack of interoperability and compatibility. Because of this situation, unnecessary redundant spatial data acquisition conducted by different GIS users becomes unavoidably occurred. Data acquisition is very costly and time consuming.

Several vendors have introduced export and import conversion machine. But it has been found the introduced conversion techniques may cause losing too much data and accuracy. Editing spatial data is also a problematic.

Brief explanation as above shows the need of GIS interoperability that can be considered to become the option of the future GIS architecture. The introduction of this promising technology will be economically beneficial to all GIS users those who have plan to utilize the existing data.

Many issues related to GIS interoperability. This paper discusses the development of one GIS interoperability infrastructure names as Clearing House Server that can facilitate end GIS user to search, locate and retrieve the required information.

2. GIS INTEROPERABILITY DEFINED

Million of users all over the world utilize the capabilities offered by Internet Provider with emerging of GIS to perform their business in numerous industries. But one of the difficulties for GIS is that the interoperability between two more different GIS platform. Most of translation algorithms developed up until now has been specifically designed to suit only for a particular GIS. Difference semantic definition of geographic information systems is known as an edge that cause GIS suffer from interoperability.

The concept of interoperability can be understood as integration of software components - interoperability refers to the capability of software systems to communicate with each other independent of vendors and platforms or the system architecture. Interoperability is a complex concept, which involved many technical and business ramifications. The goal of interoperating GIS(s) is to achieve an computerized process that will allow us to use data and software services at any time and any where across the boundaries that their user and designers predict.

Actually at the end of the all effort done to achieve interoperability is to assist people to locate, retrieve the required data .

Component of interoperable could consist of

- Models focusing on technical aspects of achieving interoperability such as protocol, file format and technical solution used.

- Content such as metadata format, vocabulary use, semantic dictionary.
- Models that address organizational and operational aspects of interoperability such as agreement of exchanging of data, rules for accessing data, and reuse of data.

As seen in Figure 1, the interoperability takes place at different levels of interoperability as follows:

1. Application
2. GIS
3. Database system (search and access)
4. Remote procedure call
5. File operating system
6. Network protocol

nteroperability means sharing of information, this include network of computer software, hardware, spatial data, rocedures, application, and personnel. The network of GIS components provides a framework in which users an access, utilize, and share spatial information via the Internet or an intranet. The GIS components themselves re used for collecting, manipulating, analyzing, and presenting information that is tied to a location on the arth's surface. Procedures such as methods, flowcharts, scripts, and data models can also be incorporated into he network when data analysis becomes complex or tedious.

o achieve interoperability, a system should understand the semantic of the user's query and use the available esources as well as it can provide meaningful answer [4].

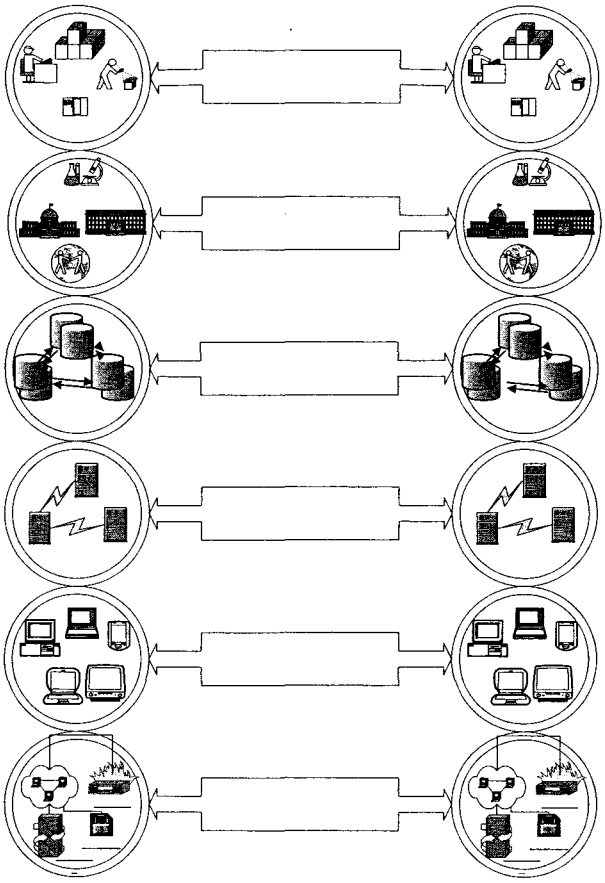

Figure: 1 Level of Interoperability

This paper is focused on the interoperability at application levels.

Taken as whole, sophisticated geo-spatial data processing has been pushing [5] the computing power and storage capabilities of the GIS clearing house server (CHS) in order to increase the efficiency of information sharing such as memory, security issues, computing processing, communication, power ability, bandwidth and mobility capability. However, most of the GIS do not permissible direct translation and utilization [6] because it involves working in heterogeneous systems.

Part of the system development for GIS implementation now involves establishing crossing point with other systems. If it involves just a few systems, custom one to one interface development satisfies these particular needs. In case involving many different systems this approach becomes unsustainable. Since each application must be altered with every change made to overall workflow or business structure. Thus middleware has regularly been choosing as preferred method as an integration tool for adding functionality to legacy systems.

The need to setting up data infrastructure is to make the use of geo-data more efficient. In this paper the importance of GIS interoperability infrastructure is highlighted to achieve the following objectives:

- Simplicity – user no need to understand what is deal with the system in order to retrieve or import the data that they need.
- Transparent – complexities related with data transfer should be hidden from user aspect.
- Open--interoperability in term of exchanging data should be independent of the technology used.
- Secure and Effective – data transfer should be reliable, and the resultant data should be useful for the intended purposes.
- Universal – all geospatial databases should be accessible.
- Data management – the data integrity of common dataset shareable by user.

To develop CHS infrastructure to facilitate GIS users to access, share and disseminate information at any time, any places no matter how the CHS will be accessed but in no doubt with the company of highly interoperable in system, data, semantic and information integration issues.

The genuine goal of this work is in establishing CHS component in order to be able to function as a clearing house to provide metadata of a particular request of end user.

3. CLEARING HOUSE SERVER ARCHITECTURE

Clearing House Server (CHS) acts as a catalogue that providing metadata on GIS data and services thus as a middleware that generally provide adaptability, flexibility, reduce development effort, shrink integration effort, and boost return of investment [8] to the users of heterogeneous GIS system.

As depicted in Figure 2, three important elements in the proposed system architecture have been identified namely CHS with catalogue pull consisting of global metadata, GIS service or product provider, and GIS user modules.

Clearing House Server (CHS) is identical to resources discovery server and is considered as a database engine (see again Figure 2). It is intended to simplify the process of connecting application or modules as to whether distributed and or running on heterogeneous platform or otherwise. This architecture will concern on data access among different geographic information system. The CHS employs client to DBMS server architecture [8] to facilitate cross platform communication to the server from client side driver.

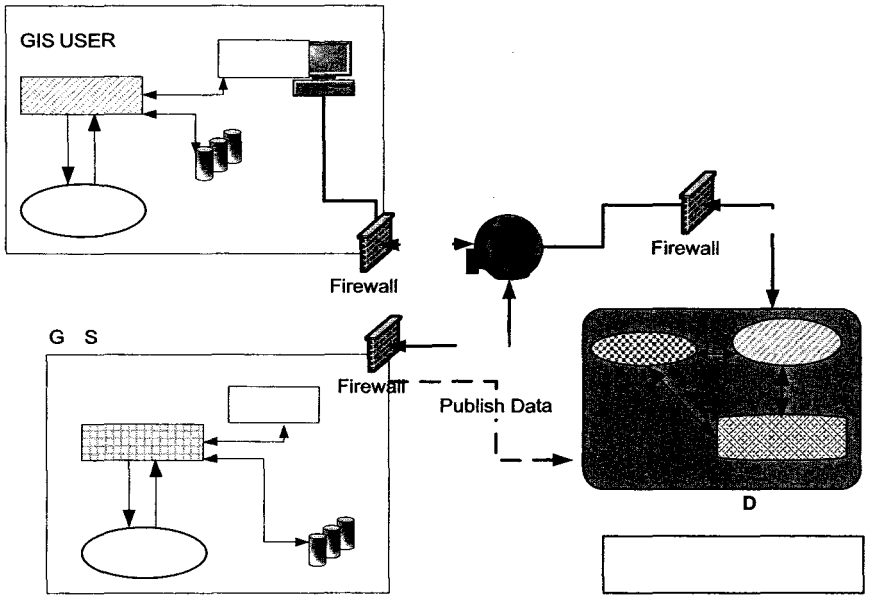

Figure 2: Architecture of Clearing House Server and
other GIS Interoperability Modules

Catalogue pull in CHS consists of the metadata – data about data [7] and operations working on these metadata [8]. In general each service providers or data owner such as government, commercial entities, non government organization, educational institution, news organization and general public has to register (publish) its offering by means of metadata to a catalogue to permit accessibility. This CHS with its catalogue will carry out responsibility to search data across different sources that may be scattered geographically.

3. CONCLUDING REMARKS

In today's business and industries scenario, sharing of information could increase return of investment on business infrastructure, thousand to million of GIS user all around the world depend largely on other party provided information to support own business. As yet, interoperability within the organization has meant exchanging data between systems based on a smallest amount common denominator file format. This costs time and money, degrades data precision, introduces data loss and quality issues as the data is translated and copied numerous times within the organization.

Sharing of information suppose should be 'easy' tasks even both party are separate by physical aspect. One such GIS system should be capable to enables end-user accessing geographic information that would be working with a state-of-the-art GIS package with all data that is interested in on our own computer. Interoperability should be containing several factors to make it effective and efficient since we know the key investment for organizations that deal with geospatial information is in the data itself. In order to make interoperability of GIS become a reality, organizations and data provider must willing to make the data shareable by the user, in other words they must create effective frameworks for data exchange among geographic information communities [10].

Through the review of the paper we can see an interoperability of GIS that capable share geospatial information is increasingly importance. In this paper we presented architecture of Clearing House Server (CHS) to achieve interoperability. Yet still a variety of issues remain to be resolved in future study such as security, network architecture, agreement, policies and metadata standard.

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