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The Development of Location Based Services in Malaysia

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ABSTRACT
This paper discusses on the development of a Location Based Services (LBS) in Malaysia. As first of its kind, it plans to take full advantage of the data provided in our National Spatial Database Infrastructure (NSDI). The system cooperates with Open Location Service (OpenLS), which is based on web service platform as it provides suitable method to gather requested information. By using an open LBS platform, different kinds of data can be obtained from different kinds of sources. The case study involves areas in Kuala Lumpur as there are needs of implementing LBS on that area. First of all, the paper will provide a brief introduction about OpenLS and why it should be implemented. Basic architecture and core components will be discussed. With this, the role of web service can be fully understood especially when transporting XML-based data. Overview of NSDI implementation in Malaysia will also be given, in terms of standard usage and current architecture.The paper will also highlight the use of Rapid Application Design (RAD) in system design and development process. Finally, the possibilities of obtaining and handling data sharing with NSDI architecture will be a concern, in order to provide efficient data management.

INTRODUCTION
Location Based Services (LBS) are one of the new technologies derived from the capability of Geographical Information System (GIS) technology. An LBS is capable to provide real time data through different kinds of positioning methods. Such technology can be crucial to the public especially in developing countries because an LBS will not just enhances personal decision making, but also helps business functionality depending on its implementation strategy. By embedding this technology to mobile phone users, this kind of information can be retrieved anywhere, and more people will notice and gain benefit of this new wave technology [1]. LBS can be considered as a new platform of providing current information to the user. By capturing current location of a user, LBS has the ability to tell the user their exact location, and also provide information regarding their surroundings. Thus, it is important to maximize the capability of mobile network technology to a level where it can be reached by most people in the country. The focus of this research is to use the standard specification in providing an LBS service. The core standard is OpenLS, which specifies several guidelines that makes a system an LBS. Other

standards included were Web Map Service (WMS) and other standards from Open GIS Consortium (OGC). These standards also will help to leverage the presentation of the system, which can be easily accessed on any platform. By following the specification recommended by OGC, it is also possible to overcome the problem of different data types through different Computer Aided Design (CAD) software used by providers, thus enhancing data sharing. This study may in long run help to boost user awareness on the capability and importance of such system, in providing location based information. The system would provide similar information provided by a kiosk machine in a shopping complex, but with an enhanced capability of data analysis and manipulation. It would provide a detailed presentation of the data and simplify most of the maintenance process involved.

1 PROBLEM DOMAIN

The implementation of LBS is still at its infancy stage, and many may still be wondering what LBS is all about. Up until now, information such as current traffic status and weather reports are mainly available for the public use via media such as radio and television. These media would not provide users with current information, because of the data collection and summarization were done before the user requested for the information. City Hall of Kuala Lumpur (CHKL) has taken some alternatives by providing real time traffic data through its Integrated Transportation Information System (ITIS). However, still lack of information, with its only focus is for the traffic condition. Imagine how convenient it would be if users can gain access to a system that is integrated from different data sources at a single time through their mobile phones. Before this, It is tedious to get data on traffic report and landmarks that are compiled into a system if the source is not the same. Now, there exists an advanced web technology that can provide a total solution for it. Data from different systems can be integrated by using web services over the web. Web services, which uses XML as its basic foundations, makes data transformation and manipulation easier so it can be shared among different systems. The syntax of a web service can be exposed through Web Services Definition Language (WSDL), whish allows provider to publish information related to service location and its access mode. The information exchange is performed through the Simple Object Access Protocol (SOAP), which sends and received information coded in XML through the internet. GIS has been around in the industry for quite some time in Malaysia with only a few which are open for public access, such as PLUS GIS that provides user with information about highway routes and others. Malaysian Geospatial Data Infrastructure (MyGDI), has played a major role in spatial data distribution and sharing in Malaysia for years, but are currently not ready for public accessed and custumization outside the MyGDI platform.

2 LITERATURE REVIEW

2.1 Introduction to OpenLS

The main objective of OpenLS is to define access to the core services and Abstract data Type (ADT) that comprises its main technology called geoserver. It enables communication of location, routes, types of service and others, with diversity on technology platforms, application domains, classes of products, carrier networks and national regions. The core services provided by a OpenLS are [3] :-

i. Proximity Search using POI database.
ii. Location Determination to fetch user location using Open Mobile Alliance (OMA) Mobile Location Protocol (MLP).
iii. Routing Services for travel routes and navigation.
iv. Map Rendering to produce maps with a set of Abstract Data Type (ADT) as overlay
v. Geocoding and Reverse Geocoding to manipulate address into latitude and longitude or the other way.

The ADT provided by OpenLS is the basic information constructed used by geoserver and associated core services. It consists of well known data type and structure for location information. ADT are defined as application schemas that are encoded in XML for Location Service (XLS). They are designed in a compact form to avoid complexity and are totally extensible. Major benefits of obtaining OpenLS for LBS are:-

- To fulfill most of users expectations such as cross cell phone roaming boundaries, where operators may share positioning technology as a support from their own, as well as integrated billing just like the provided by other services.
- Carriers or operators may look forward into an integrated system, and easy migration product

which is much more cheaper.

The ease of data management provided through OpenLS. Obtaining data from different sources, without having to worry about duplication. This approach is can be realized through web services platforms and XML based protocols.

2.2 MyGDI as the Main Source for Geospatial Data

Currently, the implementation of MyGDI through out the world focuses on data collection and updates. Data were gathered by land surveyors and processed according to the standards provided by the government. A set of definitions were use in order to group geographical layers and its tabular data inside the database. So far, an MyGDI plays an effective role of promoting land information sharing. It obviously can avoid wastage of duplicate efforts on data collection and maintenance. MyGDI has emerged as an important bridge among data providers and users to enable data sharing and exchange using the latest online information technology. A concept, which is called data custodianship, which determines that the data custodian holds the responsibility of fulfilling the required standard in ensuring the integrity of their data by taking all necessary measures and plan to manage their data to meet the requirement [11]. Data custodian are mostly government agencies, such as municipal, City halls and others. Data custodians must be responsible for the matters of data collection and maintenance to avoid any duplication. They must ascertain that their data is always available and ready to be accessed. At the same time, they must systematically provide metadata and ensure the format of the metadata complying with the guidelines of provided by the government. Once distributed, GIS users can collect and integrate them in their own GIS applications. Such data sets would provide GIS users with the most up-to-date and highest quality data sets publicly available. Hence the users have to spend only a minimum amount of cost for the core data in their GIS applications.

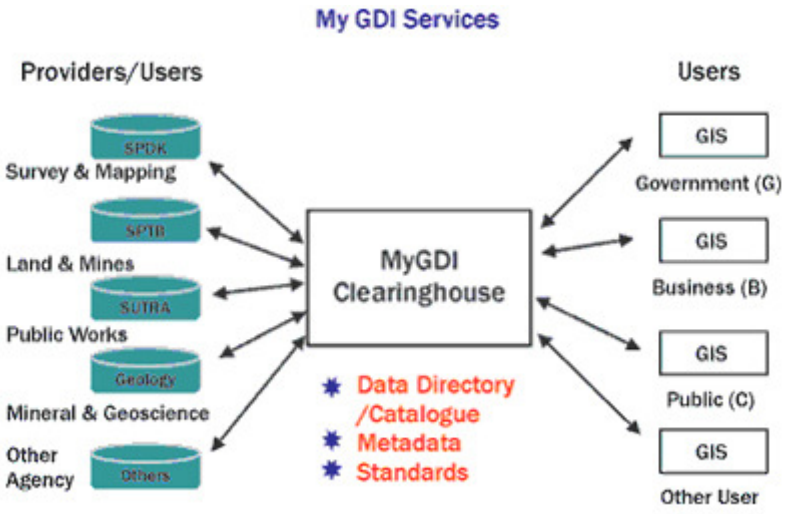

FIGURE 1 EXAMPLE OF SDI, MyGDI

2.3 The Importance of Standardization

Standards are key building blocks that will determine the success of an MyGDI. It emerges as the prime mover to allow data sharing and further integration, and promote economic management of resources by federal, state and local authorities. The goal of standardization in the field of GIS is to develop a set of standard that will support the understanding and usage of geographic information. Standards such as features attribute codes were used in order to provide multi-disciplinary GIS data sets that can be understood throughout all government agencies. Standards were normally divided into categories, such as Aeronautical, Built Environment, Demarcation, Geology, Hydrography. Then, this categories will be divided into more detailed sub-categories. Standardization also aims to provide the availability, access, integration and sharing of geographic information, thus enabling interoperability of geospatially enabled computer systems. For geospatial discovery, MyGDI adhere the concept of Clearinghouse which will be discuss later in this paper, to provide catalogue service that is normally use in a library information system. Further integration of this service with web mapping, live access to spatial data, and additional services can lead to an exciting user environments in which data can be discovered, evaluated, fused,

and used in problem-solving. To achieve this, there is a real need to document the data infrastructure properly. A standard metadata that describes the content, quality, condition, and other characteristics of data was be used as a basis for data structures in MyGDI. A proper monitoring mechanism of the published metadata used in MyGDI to make sure that the metadata status is good in terms of completeness and the state of compliance to the metadata standards for business usage. Taking spatial data as an asset, the use of metadata can provide the following benefit [12]:-

- Metadata helps organise and maintain an organisation's investment in data and provides information about an organisation's data holdings in catalogue form
- Coordinated metadata development avoids duplication of effort by ensuring the organisation is aware of the existence of data sets
- Users can locate all available geospatial and associated data relevant to an area of interest
- Collection of metadata builds upon and enhances the data management procedures of the geospatial community
- Reporting of descriptive metadata promotes the availability of geospatial data beyond the traditional geospatial community
- Data providers are able to advertise and promote the availability of their data and potentially link to on line services (e.g. text reports, images, web mapping and e-commerce) that relate to their specific data sets

2.4 The Clearinghouse Concept

Clearinghouse is a system of institution comprises of distributed network between the producers, managers and users of land information connected electronically, utilizing sophisticated software to facilitate the discovery of geospatial data, evaluation and on-line access. It is the backbone of NSDI for the management and production of spatial data in the electronic media. Clearinghouse serves the purpose of providing facility to all related agencies to standardize the production of spatial data which can be accessed online through Internet. Here might be a lot of different terms depending on the implementation of SDI, such as "Catalogue Services" (OpenGIS Consortium), "Spatial Data Directory" (Australian Spatial data Infrastructure) and the “Geospatial One-Stop Portal” (U.S. FGDC) but it all serves the same functionality [12]. As it is distributed, the Catalogue Gateway and its user interface allows a user to query distributed collections of geospatial information through their metadata descriptions. This geospatial information may take the form of data or of services available to interact with geospatial data, described with complementary forms of metadata. Figure 3 shows the basic interactions of various individuals or organizations involved in the advertising and discovery of spatial data. A user interested in locating geospatial information uses a search user interface, fills out a search form, specifying queries for data with certain properties. The search request is passed to the Catalogue Gateway and poses the query of one or more registered catalogue servers. Each catalogue server manages a collection of metadata entries. Within the metadata entries there are instructions on how to access the spatial data being described.

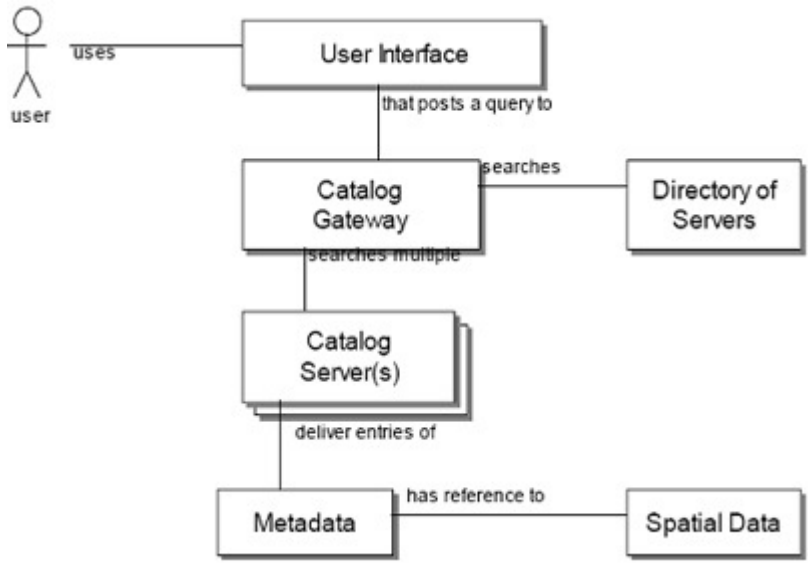

FIGURE 2 BASIC INTERACTIONS IN SDI

3 METHODOLOGY

Conventional software methodologies often fail to address the GIS-based application needs due to the complex and dynamic nature of the project. Software development is one of the most time consuming and expensive elements of implementing GIS. It also requires developer to integrate a lot of different technologies into one, high level user interactions with the system, multi step processing and analysis function. A highly Rapid Application Development methodology should be used in order to overcome this problem, as it allows high flexibility and continuous refinement and enhancement to the design during the software development process [7]. At a high level it is an application development technique that uses prototypes, iterative customisation, and Computer Aided Software Engineering (CASE) Tools. The core element of RAD can be described as the following [8]:-

i. **Prototyping:-** One of the key aspects of RAD. Provide a platform to jumpstart design and flushing out user requirements. The initial prototype serves as a proof of concept to the client, but more importantly serves as a talking point and tool for refining requirements. Requirements normally may change during system development and RAD provide a flexible approach to suite the new requirements with the existing prototype. CASE tools were used in capturing requirements, designing data models and database for the prototype.
ii. **Iterative Development:-**Increasingly creating functional version of a system in a short amount of time.The Joint Application Development (JAD) that consists of users and developers will work together to produce requirements that feed the next version. Each development cycle provides the user an opportunity to provide feedback, requirements and view progress.
iii. **Time Boxing:-** Time boxing is the process of putting off features to future application versions in order to complete the current version in as short amount of time as possible. Strict time boxing is an important aspect of RAD, because without it scope creep can threaten to lengthen development iterations, thus limiting client feedback, minimizing the benefits of iterative development, and potentially reverting the process back to a waterfall methodology approach.
iv. **Tools:-** RAD is designed to take full advantage of the latest technology available to speed development. There are a lot of RAD tools in the market that were designed to fit certain RAD process. CASE tools, which normally fits in RAD development can be grouped into several categories:-
    - Requirement gathering
    - Data modeling
    - Code Generation

    Benefit of RAD for this project can be seen as:-

    - Increasing speed of development, through different kinds of CASE tools implementation throughout the development process.
    - Increasing software quality as developers may focus on particular modules on the prototype until it is totally finalized. Integration between modules and subsystem can be done later when all modules function properly as the client requested.
    - Smooth system integration, while saving cost on testing with the use of Software Development Kit (SDK) and emulator programs.
    - Encourage developer to work in a small team and divisions

The RAD methodology used in this project can be broken down into four lifecycle processes, that is Requirements Planning, User Design, Construction and System Implementation. All these processes is repeated until all functionality is completed. This cycle really shows the importance of prototyping, as the development starts from the basic prototype until it can be considered as a final product. It also shows the need of user involvements, throughout the phases of the methodology. The transformation from basic requirement into a detail specification can be seen, as user tends to see their needs in detail description. After looking at the prototype. Here are some activities done during the RAD processes.

3.1 Requirements Planning

Location Based Services are subjected to a set of specific requirement. Although LBS requirements are bind together with other disciplines such as mobile commerce requirements, there are a few issues that need to be address to cover the basic LBS requirement needs. We focuses on gathering the functionality

and non-functionality requirements, until we then realize that there is no clear cut between this two categories. Some requirements tend to fit both categories, as requrement can be chained or made into more complex needs in the future. So , we chose to use a different category to categorize the LBS requirement. They are:-

i. **User Requirements :-** Where most of the functional requirement suits in. User requirements are formed on mobile user acceptance on LBS. A survey was conducted to analyze current user trends, needs and perception regarding LBS. Through this, some of the main requirements that were identified are:-
   - Map Browsing capabilities
   - Navigation guide for the users to let them acquire directions and guidance
   - Services must be accessed regarding user current location
   - Personalized access for the user so that they can customized their information need

ii. **Usability Requirements :-** Describe the requirement regarding mobile computing environment. Normally, issues involving bandwidth, computing power and memory size cannot be expected to be constant, as there are times where mobile network or terminal might be unstable. Some of the implied requirements are:-
   - Not very intensive use of mobile network and low data transmission
   - User interface should be user friendly and the amount of presented information content limited and well specified
   - Possibilities for offline access to the LBS

iii. **Reliability Requirements :-** Concerning on data reliability, software reliability to both servers and client side, appropriateness and precision of methods used to provide services.

iv. **Privacy Requirements:-** privacy handling consolidate issues like ownership of location information, use of location information, disclosure to service providers and others.

v. Location Infrastructure Requirements:- Deals with issues pertaining location positioning method. The method used in an LBS should :-
   - Provide good accuracy of current user location
   - Wide coverage of location determination signals
   - Method used should be fast
   - Interoperability between vendors
   - Ensuring customer privacy

vi. **Service Interoperability Requirements:-** Interoperability should be implemented at all levels, to make sure that an LBS can be fully utilized by the public users. LBS should be interoperable with different mobile terminals, servers, coordinate convensions, positioning technology and others.

3.2 User Design

The development of an LBS involves component based environment as the core technology relies on web services. A comprehensive and crucial modeling is the first crucial step towards building a successful application. To manage large application, model based design and development is paramount. Incorporating RAD with the industry standards modeling techniques and notations used in Unified Modeling Language (UML) delivers several advantages [8] :-

- Provides an overview of the application structure
- Facilitate the reuse of objects and rules
- Ensure consistency during development
- Functions independently of implementation, so when changes occur, the model remains valid

Use case Diagram serves to display the relationship between actors and the use cases in the system. Use case diagram are designed to give a rough, informal overview of the possible classes of users and the services and functionalities the system provides .It is the basic technique to elaborate all the requirements identified in the initial stage. UML also provides different diagram modeling approaches, such as Sequence Diagram, Collaboration Diagram, Statechart Diagram and more which will be used in more detailed and advance design.

4 DISCUSSION

The Web Service technique provides the interoperable capability of cross platform and cross language in distributed net environment. GIS services will be implemented more extensively by using web service

approach. NSDI lets users share data stores and applications in a distributed environment. The web services architecture establishes a standard interconnection rules between services and information clients that nicely support the dynamic integration of data, which is the key to creating a spatial data infrastructure [12]. On top of LBS is the presentation tier, which let users access the LBS through their mobile phones. LBS should provide multiple platform access such as WAP, SMS or J2ME software to reach as many users as it can. In a web service environment, the LBS will receives and sends response to the client in an XML formatted document through SOAP . The XML document will then be transformed into WMS or OpenLS presentation format, through Extensible Stylesheet Language Transformation (XSLT). On the LBS itself, OpenLS specifies five core services, as mention above. These services provide different functionality with the summarization done by the presentation to the client. The data from NSDI will be integrated with a loose web service component. The service called catalogue service will access all the data inside NSDI without having to modify or upgrade current NSDI implementation. Normally, Clearinghouse works with z39.50 protocol, a standard for Information Retrieval. With the advent of technology, binary data from z39.50 can be encoded into SOAP in a web service environment.

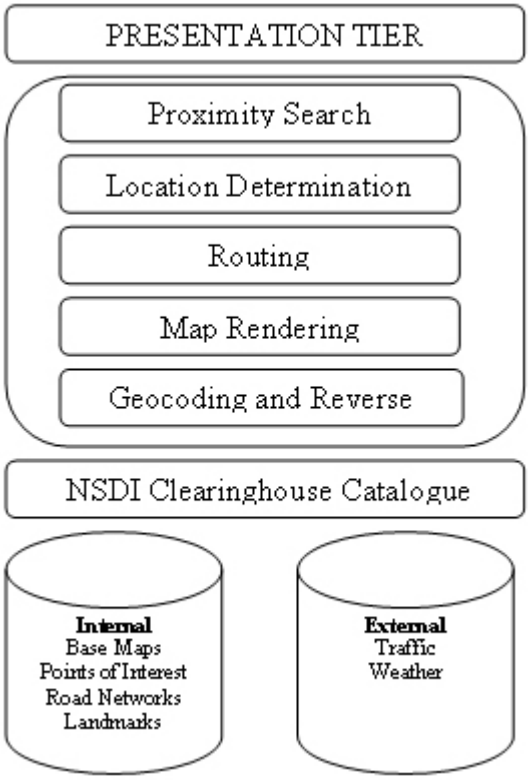

FIGURE 3 LBS WITH OLAP INTEGRATION

CONCLUSION

Implementing LBS platform may open a lot of opportunities and can be beneficial to the public. The openness of an LBS architecture through standard technologies have made it possible to provide user with a standard data under one system. Creating location awareness to the public may help them to increase their decision making capabilities, thus help them to face unexpected situations. By integrating LBS with NSDI, a lot of possible applications can be generated for the use of public and in the E-Government environment.

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REFERENCES

1. LBS The Ingredients and The Alternatives, Last Access Date 24th October 2005, at url: http://www.gisdevelopment.net/technology/lbs.
2. SAP and GIS Integration, Last Access Date 16th October 2005, at url: http://www.esri.com/library.
3. OpenGIS Location Services (OpenLS): Core Services [Part 1-5], Last Access Date 16th October 2005, at url: http://www.opengeospatial.org/specs.
4. Shashi Shekhar, Pusheng Zhang, Yan Huang, and Ranga Raju Vatsavai (2003), Trends in Spatial Data Mining. University of Minnestota.
5. J. Schiller (2004), Location-Based Services, San Francisco,CA. Morgan Kaufman Publishers, ch. 1, pp. 10-25.
6. ITIS.com.my, Last Access Date 20th November 2005, at url: http://www.itis.com.my
7. Andrew, H (2004).Highly Addaptive Rapid GIS Application Method. Proceedings of the ESRI User Conference.
8. Sommerville (2001), Software Engineering.Addison-Wesley, Lancaster. ch. 3, pp. 42-69.
9. GISMalaysia.com, Last Access Date 28th November 2005, at url: http://www.gismalaysia.com/showcase/svg
10. Autodesk Location logic Technical Specification, Last Access Date 20th November 2005, at url: http://locationservices.autodesk.com/about/literature.htm
11. MyGDi Application, Last Access Date 26th March 2006, at url: http://mygdi.macgdi.gov.my/nalis
12. Developing Spatial data Infrastructures: The SDI Cookbook, Last Access Date 28th March 2006, at url: http://www.gsdi.org/docs2004/Cookbook/cookbookV2.0.pdf