Linbing MA, Jianya GONG & ChunSen ZHANG

RESEARCH ON AN APPLICATION SOLUTION AND KEY TECHNOLOGY OF MOBILE GIS

Linbing MA, Jianya GONG , ChunSen ZHANG

National Laboratory for Information Engineering Surveying, Mapping and Remote Sensing of Wuhan University
mlb1999@yeah.net, cszhang@263.net

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ABSTRACT:

The paper presents an application mode and key technology of Mobile GIS. The application solution integrates several wireless application technologies such as WAP, SMS, STK and Location Service to provide mobile geographic information service in urban GIS. The solution put forward a general, economical and oriented-user approach to fulfil the most application requirement for example, urgent location providing, location navigating, querying ambient, looking for buddy, personal security service and so on. And the same time, the paper also involves a key technology to solve the problem on how to integrated distributed GIS data. The paper considers that the Web Service is a rather effective method to update and integrate GIS data, especially property data at real time. Web Service is developing rapidly in recent year. It will become a main method of integrating distributed data source by way of various services in Internet, which are provided by irrelevant enterprise in the scope of all worlds.

1. INTRODUCTION

Since 1990's, Internet and Mobile Communication Technology have been applied widely, which has affected the life style of all world greatly. But the promotion of mobile data business is not enough. So it has been noticed by many people that how to expand the mobile value-added service.

Geographic Information System is the most active technology in Geographic Science and Earth Science. With the development if software and hardware, especially Internet, GIS has got a lot of new feature to fit for the Web application. GIS technology integrates common database operations such as query and statistical analysis with unique visualization and geographic analysis benefits offered by maps. GIS usually provides a number of tools for people to get various geographic information. So is GIS not only served as a spatial data management system but also acted as important role in many geigeo-based application fields.

Basing GSM (Now GPRS and CDMA have been launched into service), WAP (Wireless Application Protocol)m SMS (Short Message Service), STK (SIM Toolkit) have expanded the application scope of Mobile Communication Technology besides the general calling service. In addition, many kinds of mobile terminal devices (mobile hand phone, personal digit assistant) have possessed some new features and functions, such as Internet surfing, WAP connecting, Java supporting, high performance CPU, big capability RAM and so on. Even then, the promotion of mobile data business is not enough. The combination GIS with Internet and Mobile Communication Technology provides a convenient and economical approach for people to break the limit of time and space and utilize the geographic information flexibly. As a new program, Mobile GIS involves a lot of special fields. At present, it is a lack to make an extensive discussion on it. The paper focuses on presenting a feasible application solution of mobile GIS and giving some approaches and key technologies of implementing

ot integrating them. The paper is organized as follow. Section 2 brefly presents several relevant technologies for implementing Mobile GIS. In section 3, an integrated system of WAP-based Mobile GIS system is described. Section 4 discusses how to integrated distributed GIS data by Web Service. Finally, conclusion is given.

2. SEVERAL RELEVANT TECHNOLOGIES FOR IMPLEMENTING MOBILE GIS

WAP
Wireless Application Protocol. WAP provides a set of open and uniform technology platform, it make it easier that the user's mobile device access and get the various information service of Internet and Intranet, which are presented by the uniform content format.

SMS
Short Message Service. It is the most family service in mobile communication service. Basing it, quite a few mobile value-aded are carried through.

LCS
Location Service. Usually there are two schema to provide LCS. One is to embed GPS module in mobile device(phone, PDA), another one is to make use of cell base station network getting location of a mobile device in GSM/GPRS. The paper mainly discusses the former.

STK
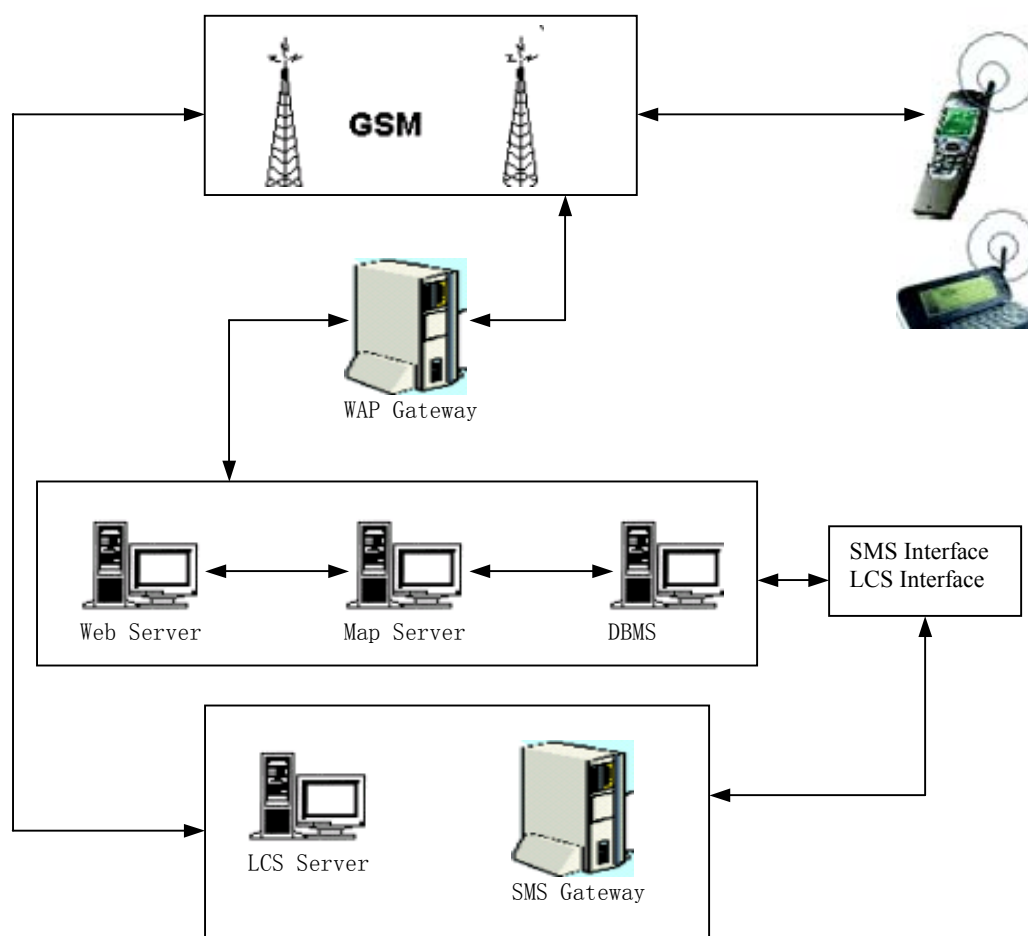SIM Tool Kit. It is called "User Identifying Application Developing Tool Kit".

Figure 1. A integrated system of WAP-based / SMS-based mobile GIS

3. A INTEGRATED SYSTEM OF WAP-BASED / SMS-BASED MOBILE GIS

At present, Mobile GIS is mainly applied in city apart from some special fields, it include the following application purpose:

Urgent location providing, such as fire fighting, first aid.
Location navigating.
Location tracking.
Query ambient.
Looking for buddy.
Personal security service.

Here, we present an Integrated System of WAP-based/SMS-based Mobile GIS. It can fulfil the above application requirement. See Figure 1.

The working flow of the integrated system is described below. There are two ways to send geographic information request from mobile devices. One is WAP request another one is SMS request. For WAP request, Users input a WAP URL from mobile device to connect the WAP connect server and then interact with it. But not all mobile devices posses WAP function module, so SMS request is another available and effective way.

Almost GSM terminals can send short message and receive response, but SMS is only consist of a string of text no more than 80 words and lack for interactive capability. So adoption of STK technology can solve the problem. STK card be written into a set of STK order and provide a friendly menu interface for users to interact with SMS gateway.

WAP request is translated into HTTP request by WAP gateway. So any general web server can handled the WAP request if it was configured correctly. So the WAP-based application can be tackled by the same mode as WEB-based application. After getting request, Web server peels off the inside geographic information request and delivers to Map Server. To SMS request, SMS interface get the SMS request from SMS gateway and parses the short message to extract out the geographic information request to Map Server.

Map Server usually consists of a GIS component module. As a core of Mobile GIS, it is responsible for processing geographic information request at real time and generating the relevant response. The response may be a string of text or a piece of image, which interpreter geographic information to mobile user. Web server functions as converting Map server's response into WML (WAP Markup Language) format and send it to WAP

gateway. WAP gateway is up to filter and compress the content from Web Server and to transfer the content to mobile device through wireless communication network. On the other hand, SMS response is send to SMS gateway by SMS interface and then to user.

LCS is a service provided by wireless communication service business usually, for example, China Mobile. It provides a way to get the location of certain mobile device. LCS expands the application scope and application mode of Mobile GIS greatly. LCS server has unique IP address. Any ICP (Internet content Provider) can access LCS server to develop the application project if he was authorized.

4. INTEGRATING DISTRIBUTED GIS DATA BY WEB SERVICE

4.1 What is Web Service

1. Web Service is reusable software module. It is a sublimation of object-oriented program design.

2. The software module of Web Service is looser coupling. The system of looser coupling structure need only simple harmonization and permit to be configure freely.

3. Web Service distinguishes with general Web site in essence. General Web site is only a Web application . Web service need not graphical user interface. Web service run on a level of code and called by other application.

4. Web Service is released and obtained in Internet.

4.2 Basic Structure of Web Service

Web Service Directory

Web Service Find

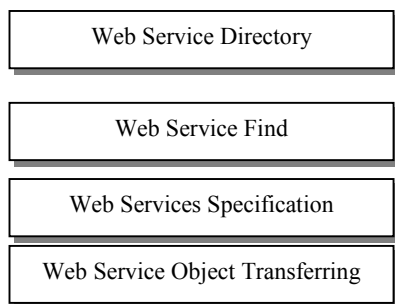Web Services Specification

Web Service Object Transferring

Figure 2. Basic structure of Web Service

1. Web Service Directory. It provides location of Web Service In Internet. UDDI(Universal Description and Integration) define a kind of normative method to release and find Web Service. Centre of UDDI Enterprise Registration is the core of UDDI schema. Using it, Enterprises can orientate dynamically the Web Service, Which was provided by other enterprise.

2. Web Service Find. It is a process of orientating one or more Web Service. These Documents are usually denoted by WSDL (Web Service Description Language). The clients of Web Service can find whether certain Web Service is exist and know how to catch the service.

3. Web Service Specification. The basic structure of Web Service is established on the basis of XML message

communication. These messages must follow the stipulation of Web Service Specification. Web Service Specification is a XML document denoted by WSDL, which defines the message format available to Web Service.

4. Web Service Object Transferring. Web Service can adopt several kinds of open protocol as its service object transferring protocol, for example, CORBA, DCOM. SOAP (Simple Object Access Protocol) is the most important object transferring protocol. SOAP is a simple protocol based on XML, which is born by HTTP and eliminates the distinction between different Network and Operating system. SOAP supplies a simple and light-weighted mechanism for exchanging structure information equally in a incompact and distributed environment by XML.

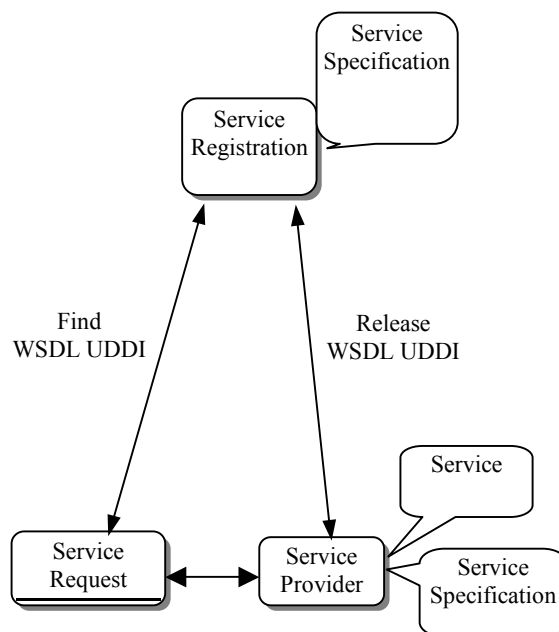The Figure 3 is an implementing mode of Web Service.

Figure 3. An implementing mode of Web Service

4.3 Integrating Distributed GIS Data

In urban GIS, Mobile GIS is the most promising application direction. But the data organization of GIS is very complicated, especially property data. In general, a Mobile GIS in city must involve various thematic information, such as Hotel, Shopping Centre, Government Office, School, Restaurant, Bus Stop, Phone Number, Traffic Information and so on. Traditionally, all data are readied by GIS provider, even if he can purchase some data. All data is managed by GIS provider, maybe the data is distributed in several server or Web site.

If certain data source have changed, It is rather difficult for GIS provider to update the relevant GIS data. For example, certain hostel 's phone number has replaced or a government office's address has changed.

It is possible to solve the problem with the presence of Web Service.

In the light of basic structure of Web Service, any enterprise can release a service in Internet to be accessed by others for fee or for free. So some thematic data used by GIS can be gained by way of Web Service. SO the task of maintenance of GIS data

can be divided from many enterprise. And the same time, Web Service also defines a set of normative standard to find and make use of these services.

The remarkable feature of Mobile GIS is convenience, betimes and nicety. It is intolerable for user to get a wrong address or phone number when he got there.

Of course, the development of Web Service is in a preliminary stage, there are several problems to be solved.

1. How to describe spatial information in WSDL effectively and normatively.
2. How to authorize the service to someone and how to charge.
3. When a Web application consist of several Web Service, how to debug and test application with a better method.
4. How to make sure the security of Web Service

5. CONCLUSION

The paper discusses the several key technologies for implementing Mobile GIS. In term of the feature of urban GIS, The paper present a integrated system of WAP-based / SMS-based mobile GIS as a general solution. On the other hand, the paper also discuss the problem how to integrate distributed GIS data and put forward making use of Web service to solve the problem.

We consider the Mobile GIS is connected with Mobile Communication Technology tightly and will become a main application in GIS field. Web Service will play an important role more and more in integrating distributed multi-sourced data. How to dig the potential of Mobile GIS and standardize the spatial information in Web Service is our future work.

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