Distributed GIS framework design based on XML and Web Service

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Abstract. Network WebGIS geographic information system is a solution which is more open and conform to the trend of distributed GIS application , the paper discusses the technology and face WebGIS, elaborated the XML Web Service this new dynamic distributed computing model of technology. It put forward to Supermap IS the.net provides Service type GIS platform, based on XML Web Service system design of open mode WebGIS, and how the system plan of superiority and feasibility.

1 Introduction

With the rapid development of internet technology, traditional GIS enter a new ear. Based on modern web technology，we can publish the GIS information to any one any where through the world wide web, the GIS data presentation method has become the main stream in the past few year。Compared to traditional GIS，Web GIS gains many advantages, such as platform independent, low development cost, friendly usability, easily system update and load balance. In short, WebGIS technology is the integration of component technology, interoperability technology 、distribute computing technology。And GIS based on XML Web Service push the modern WebGIS technology one step further，it can do real-time multidimensional analysis and make prediction on all kind of data come from any organization.

2 Web GIS

2.1   Web Geographic Information System

Web Geographic Information System take advantage of both traditional GIS technology and internet，the functionality of GIS can be extend to a new level on top of the internet, and concerning the software architecture，WebGIS is the combination of client side technology and server side technology. Server technology include CGI、ASP/ASP.NET、JSP and Serve-let，meanwhile client side technology include Java Applet、AJAX and so on。Both the client side technology and server side technology form a perfect service pipeline.

But because of some characteristics of the various restrictions of the web and GIS itself, the WebGIS technology gain some flaw inborn such as being unable to implement heterogeneous spatial data interoperability and a cross-platform development process, difficulty in debugging and maintenance etc.

2.2   The characteristics of web geographic information system

In the development process of GIS, it has experienced the concentrated mode to the distribution mode on local area network (LAN), from simply client/server pattern to multi-tier client/server pattern. From a single PC system to the LAN based system, and now it move a step further to WebGIS and Internet hypermedia network service. Three kind of organizational pattern of WebGIs is mainly used nowadays:

(1) server based WebGIS：in this working model, client post the request to the server, the web server receives the request and redirect them to GIS server for spatial data process, when the GIS server finish the process and return the result, the web server deliver the result back to the client，this is what we call rich server architecture.

(2) Client based WebGIS：in this working model, there are usually a suit of both server-side and client-side software, The client side download the geospatial data needed from the server side, and the processing of data is handled by the client software. This working model has enhanced client-side processing capabilities, through the use of Java applets, GIS analysis and cartography you can add web browser functionality, and reduce the amount of data transmission through the network and alleviate the server side processing overload. Its disadvantage is that the processing capacity of the geo-spatial data is limited by client machine, in to an extreme case, the process would be slow.

(3) Mixed of client and server GIS: the hybrid computing model can make great load balance of both client and server, reduce network traffic, and properly distribute GIS tasks, fully utilize the client and server computing power, improve interoperability and whole system performance.

2.3   Drawback of WebGIS

As the types of information on the Web is growing. Traditional Web language HTML is not conducive to the presentation of geo-spatial data, development of WebGIS facing some technical difficulties:

(1) Geo-spatial data of digital Earth will be maintained by thousands of different organizations,To convert large amounts of geographic information data in the GIS database to accommodate Web expression of high efficiency and low cost, WebGIS need resources and information sharing, and really accomplish GIS data is physically dispersed and the logic centralization.

(2) Although GIS can handle a huge amount of data, fast response delivery mechanism and highly user interaction must be established in the limitations network bandwidth for provides fast geographic information services.

(3) HTML page is suit to data presentation, but lack of mechanism for describing the internal structure and associated of the data, therefore it is not conducive to complex queries and integration of geospatial data;

An distributed geographic information service under the network environment utilize the XML Web Service technologies can effectively address these problems.

3 XML Web Service

3.1 XML

XML (Extensible Markup Language - extended Markup Language) is an extensible mark Language, Internet coalition (W3C) creates a set of specification, so that software developers and content creators can efficiently organizing information in web pages, its purpose is to satisfy the growing demand of web application, at the same time also keep good reliability and operability when interact.

3.2 Web Service

Web Service, also known as the XML Web Service, is a web based distributed communication technology, it performs a specific task, adhere to the specific technical specifications. It can use the standard Internet protocols, like HTTP and XML hypertext transfer protocol expose the function in the Internet and Intranet.

Web Service is based on XML and SOAP (simple object access protocol). In the processing of Web Service, the client requests and the server respond data is encode with soap described with XML, and finally transmit HTTP. Web service is described used WSDL, and through the UDDI

(universal Description, Discovery and Integration) for registration and Discovery.

Web services provide a good prospect for distributed software system interoperable, at the same time leading to novel approach for implementing WebGIS.

4 WebGIS system architecture

WebGlS system based on Web services need to provide interaction interfaces to the user, including application interface, data interface, function interface. Among them, the user interface means a Web application, data interface is providing the user metadata updating service, and functional interface is remote function call.

The architecture of the system includes three layers:

Presentation layer: include a Web browser and desktop application. Web browser requests the system through the HTML application interface, desktop application invoked system service directly via SOAP/XML data interfaces and functions.

Application layer: the responsibility is to assist the Web browser and desktop application providing geographic information service. Geographic information service including spatial data services, space, function and spatial metadata services, geographic information service interfaces include spatial data service interface, space service interfaces and metadata service interface.

Data layer: the layer is composed of 2 individual components, the existing relational database and newly added XML/GML based database, relational database can be transformed to XML/GML based data using GML/XML transformation services, any new function will directly based XML/GML database.
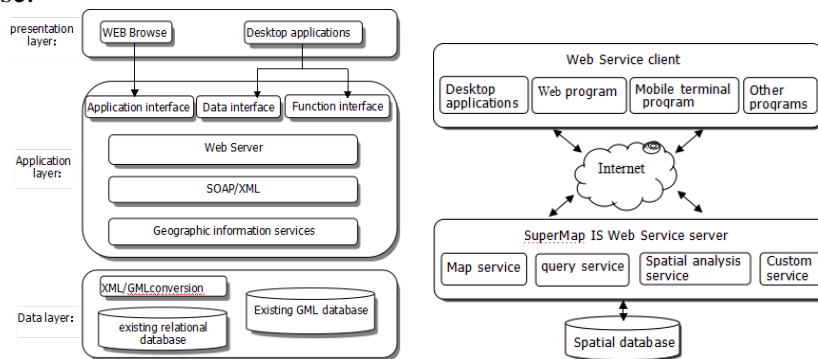

Fig. 1 the WebGIS system based on Web Service architecture **Fig. 2** SuperMap IS Web services framework

5 Construction of geographic information system based on XML Web Service

WebGIS system based on XML Web Service is an integrated, distributed, multi-source heterogeneous spatial data interoperability system, the multi-source heterogeneous data integration and sharing is implemented by publishing a Web Service interface for public accessing, any clients can access the interface through remote function call.

Based on the hyper-graph company Supermap IS the.net services provided by the GIS platform, as building network geographic information system based on XML Web service solution. SuperMap IS the.net follows OGC standards, provide SuperMap based on Web Service technology to build web services, service for the WebGIS system interoperability and data sharing Service platform.

The proposal system in is built upon Supermap IS.NET GIS platform, and it can be used as a technical solution for building XML based Web GIS service.

SuperMap IS.NET follow the OGC standards，SuperMap is based on Web Service technology specification to build Web services, delivery a platform for building interoperability and data share WebGIS service. SuperMap IS web services is platform-independent and based on .NET technologies stack and SOAP protocol, allowing heterogeneous systems to interoperate in the same manner. Different systems do not require a unified platform support, different development languages (C++,Java,C#) and development tools can be used to interoperate with SuperMap IS Web services functionality. The client system and the host system is loosely coupled, system upgrade and

migration is independent, in this point of view, the system is superior to some other distributed computing technologies such as DCOM, CORBA for a good loose coupling architecture and low maintenance cost.

SuperMap IS web services include some useful functions such as special geographic processing and analytic，all the functions is described with WSDL protocol，exposed uniform interfaces for service accessing，the clients have no idea about how the service is processing and what technology is used by the server。

Based on SuperMap IS web services, we can provide some special Services based on of GIS, such as: location query service, by entering a place name, the system can provides a list of fuzzy match querying spatial information result; Traffic guide service, determine the best path and the driving message according to the multiple vehicle routing key-points;

Statistical information service, this kind of service is based on the input region name, generated population map or economic indicators and reports, and provide high resolution satellite image data services.

WebGIS system based on Web Service has gains the following advantages: (1) it is a highly rueful. (2) Flexible. (3) low maintenance cost. In addition, costs of service consumers are also greatly reduced.

6 Summary

The emergence of the Web Service brought a new dawn for the development of WebGIS, it can solve the issues exist in most of the current WebGIS, such as cross-platform, interoperability, and other. The using of XML technology can standardizing geographic data description, resolve challenge of interoperability between different WebGIS with different inner data representation, so to say the main communication is based on SOAP and a uniform XML representation of geographic data. WebGIS based on XML Web Service implements the distributed multi-source heterogeneous data integration and sharing, it introduced a new way of implementing distributed geographic information service. In practice, a Uniform resource distribution center offer security management for the urban data will play an important role.

Acknowledgement

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