A STUDY OF SPATIAL DATA SHARING SYSTEM WITH WEB SERVICES

Fan Li [a, *], Xu Zhang [a], Xian Jiang [a], Yong Shan [b]

[a] Institute of Forest Resource Information Technique, CAF, Beijing, -（lifan,zhangxu,trista）@caf.ac.cn
[b] Daniel B. Warnell School of Forestry & Natural Resources, Georgia State University,Georgia-shanyongsy@hotmail.com

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ABSTRACT:

Web Services is service-oriented architecture advanced in recent years, with its definitive agreement and complete platform and language independence and a high degree of loosely coupled, gradually become an important direction of application integration. According to design ideas of spatial data sharing system, through exploring the Web Services technology, the design was proposed, based the Web Services technology node in the system. Based the description of the overall framework of the spatial data sharing system, the approach of the spatial data sharing service node was elaborated in detail.

1. INTRODUCTION

Recently, people have developed a lot management information systems for the demands of the forestry information building .The next building step is to share these data and information and accelerate the forestry information system more interconnected ,large-scale and integrated .At the same time, all the data are distributed in different department which form the information silos.We should integrate the data which scattered in various information systems and spatial data node ,by analyzing the integration of forestry to the needs of existing information systems, integrating the technology can be used to establish, supporting for heterogeneous databases and building operating system distributed spatial data sharing platform.

Spatial Data is the important basic data resources of multi-disciplinary innovation, eco-environmental monitoring and national sustainable development research. Multi-disciplinary innovation include Contemporary international earth science, environmental science, ecology, meteorology, oceanography, land science, natural resources, science, natural disasters, agriculture, forestry, grassland science and so on.

In order to extensively dispense Spatial data resource and satisfy the demands of science research , share spatial data is urgently. There's some problem:

1. Institute of Forest Resource Information Technique is receiving different kind data from 1990 which capacitance has increased to 30TB （TeraByte） , even now the capacitance is increased by more than 10GB per day.
2. The current spatial data even be processed and compressed which also size in few hundred MB . To obtain these data , network should as the transmit tool. And in the transmission process ,network should offer the the breakpoint Resume function while the network experiencing intermittent.
3. Our cooperant department Remote Sensing Ground Station of Chinese Academy of Sciences also has large amount data and developed spatial data share system,we should use the Web Services technology to integrate the different nodes spatial data and different platforms .Two units of spatial data sharing model of the design shown in Figure 1 Followed:

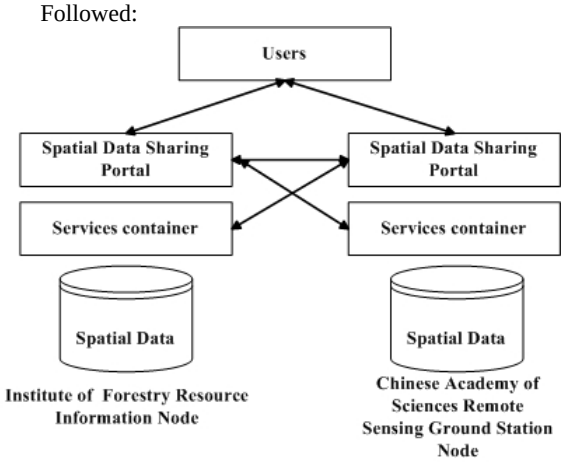

Figure 1 Spatial data sharing model

2. WEB SERVICES TECHNOLOGY

Web Services is a revolutionary distributed computing. It uses XML-based message processing as a basic data communication, to eliminate the use of different component models, operating systems and programming languages that exist between different systems, so that heterogeneous systems can be used as part of the computing network to run concurrently. Developers can use to create distributed applications

such as the use of components, by creating Web Services from a variety of sources, combined with the application. Because Web Services are built on the basis of some common protocols, such as HTTP (Hypertext Transfer Protocol), SOAP (Simple Object Access Protocol), XML, WSDL (Web Services Description Language), UDDI (Universal Description, Discovery, and Integration, etc..

Web Services as a new method for the function and application integration technology, solve the original integration of technology in the Internet telecommunications issues. Web Services based on XML service description documents, service requests and feedback the results on the Internet can be passed through the HTTP protocol, it is easy to be accessed and return results. Web Services is a dynamic integration program, all services can be dynamically through UDDI standard was found，bound and use, easy to adapt to changes in the system, improve system flexibility and scalability. The basic model of compositive system using Web services is followed.

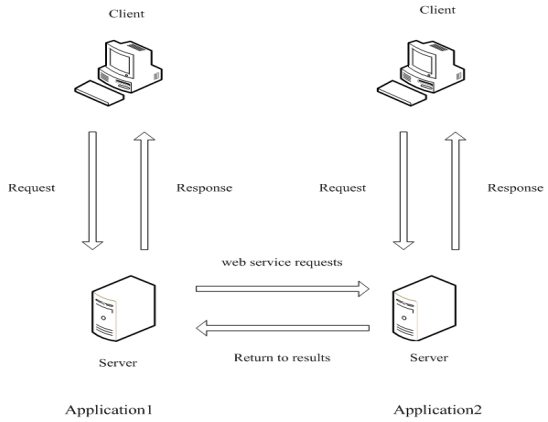

Figure 2 The basic model of compositive system using Web service

3. DATA SHARING PROGRAM

Data sharing management is the general name for establishing, clarrifying, controling, accessing and maintaining of metadata sets. A metadata database is combined by various single metadate sets. The metadata management system is used to manage and control the metadata databse by a centralized or distributed way. Users are allowed to share the metadate. This system can provide demanding metadate for data administrators, database administrators, system analysts, programmers and ultimate users. The database interoperating technology is adopted by this system, the metadate could be extracted from the database at anytime.

This system supports diversification of database, differentiation of operation platform, non-unity of data type and storage methods. The main problems that should be resolved is that: isomerism elemination, standards based, diffuse coupling and data security. And Web Services based data sharing is the best way to resolve those problems.

4. DESIGN OF DISTRIBUTED SPATIAL DATA SHARING PLATFORM

4.1 Functional Design of Distributed Spatial Data Sharing Platform

Distributed spatial data sharing platform is not only the important part of data sharing research and construction, but also the main interface through which to provide convenient and high-efficient services to end users. Considering spatial data's properties in terms of multiple sources as well as ensuring that this service sharing platform can become a main platform providing authoritative, consistent, fleet services, it is necessary to conduct a great deal of research and technology improvement in the fields of meta-data, data management model, users management strategy and data index, and to buildup a uniform platform that can provide data transition service and distributed information from spatial 's portals to all departments, parties and the public. Meanwhile, it is also necessary to leverage data portal technology to setup uniform data accessing interfaces so that to create uniform interfaces to all types of data for purpose of user management, authentication, and security control intensively. Currently the spatial data sharing platform consists of several levels, such as portal level, service sharing level, core service level, resource management level and network platform level, and functions such as meta-data management, data publishing, search and exploring, data download and user management, etc. The multi-node spatial data portal's functions are displayed as below.

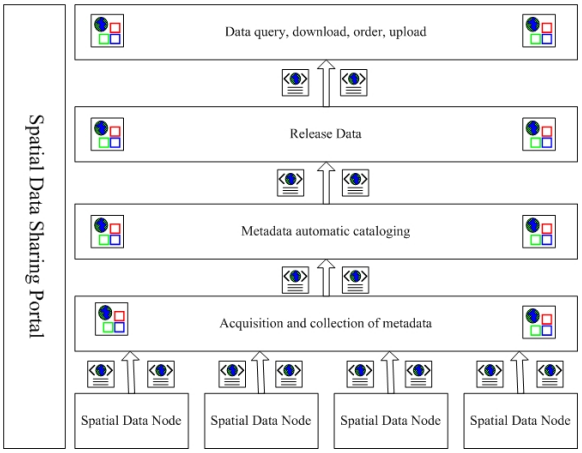

Figure 3 Multi-node spatial data portal function

1. Data searching/exploring and booking system: Be able to provide service abilities such as sharing spatial data set, searching/exploring and booking download text data set, searching/exploring of spatial data based on several methods.

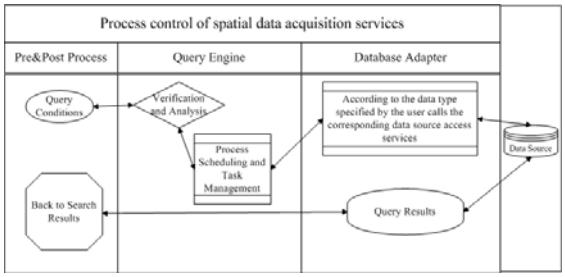

Fig 4 The services process for obtain data

(1) Metadata-based data set query: Provide metadata query service to sharing spatial data set, display to users by means of fast-graphic, fast-graphic-description, etc, and provide multi-query ways based on time, satellite type, latitude and longitude coordinate.
(2) Data set download: Provide booking function to sharing spatial data set. Be able to provide download service via FTP of HTTP according to a user's own requirement.

2. Data publishing sub-system: Can manage and publish information of data sharing websites, including homepage customization, publishing content management, news information, latest updated information and images.

3. User management sub-system: Support functions like multi-type user ID authentication, authentication management, log tracking, etc. First, to manage administrator, data exchanging people and normal users by means of certification, password; Second, to grant different access to users according to different user type; Third, access information can be statistically collected and inquired online no matter to administrator, data exchanging people or normal users.

4. Metadata catalog service sub-system: Provide metadata catalog services to implement metadata's collection, database creation, setup/upload/maintain catalogs. Coordinate current metadata for spatial data set, add related data service, download information, delete expired data, etc, provide spatial data set's catalog services.

5. Administration functions implemented for the platform:

(1) Save metadata into database: The program can analyze metadata's file name that to be uploaded automatically, and then judge whether the going-to-upload data exists already or not. If the data doesn't exist, it will be written into the database's specific field. Otherwise, wrong operation information will be shown to administrator and requires the administrator to re-input again. The administrator input all the contents to fields manually, and the program will check with the record exists or not. If the record doesn't exist, it will be written into database. Otherwise, administration domain error will be displayed, re-input will be required.
(2) Upload fast-view: The selected fast-view will be upload to dedicated position on server, and related information will be written into specific field in database according to the file name parsing result.
(3) Data export: Data can be exported to Excel sheet according to input data period.
(4) Data import: A given Excel sheet can be parsed according to specific fields, and such data can be written into database accordingly.
(5) Files in server can be written into database automatically: By scanning a dedicated catalog's file storage structure, data can be written into related tables in database.
(6) Check booking information: After log in, the administrator can check all users' booking information.

The distributed spatial data spatial 's well running not only increases the sharing services' efficiency and affinity, but also provides strong technical support to future construction of information sharing platform and data integration and sharing in a standardization way.

4.2 Composition of Spatial Data Sharing Services

Currently the spatial data sharing services constructed include data service (data processing, data mining, data provision), statistics analysis service (statistical sheets, graphic analysis processing), spatial analysis calculation service (buffer, graphics overlying, key factor's filter, topology analysis, etc), spatial information publishing service (supporting roaming, zoom out, zoom in, selection, etc), interface processing service (support text, statistical graphic, table, video, vector graphic presentation, etc), project data interface service (implement Returning farmland to forest business data extraction, conversion, and loading). These web services can be distributed among different servers.

4.3 Register Spatial Data Sharing Services

The register process management of spatial data sharing service includes register information syntax checking, web service ID creation, web service register. Detail web service information consists of two XML documents, which are detail document of web service and interface document (WSDL document). The register information required during registering process include service name, selection of service catalog, saving path of the service, service description. The system records a registered user according to his login information automatically. Web service process is depicts as below in Figure 5.

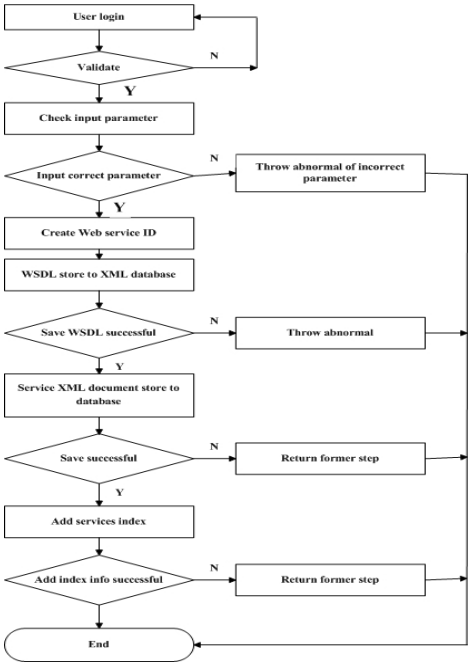

Figure.5 The flow of the web services registering

4.4 Invoke Mechanism of Spatial Data Sharing Services

During an invoke process of sharing services, spatial data management platform will invoke web services access interface (service container's client interface) first, then communicate from service container's client to service container's publishing interface via related protocol, the service contain plays a role of invoking services. The invoke process is virtualized to invoke services directly by a series of protocols, and a series of details during the process are hidden. There are many services registered in spatial data management platform, so the services can be looked up according to service name, service catalog, and finally check the details.

4.5 Spatial Data Sharing Services' Combination Model

SDS, the spatial data sharing services combination model, is a three-mode group (D, S, R, X), as

1. D = (d1 , d2 , , dn) is the set of spatial metadata;
2. S = (s1 , s2 , , sm) is the set of data services;
3. R: the set of services' logical relationship, $\sum_{1}^{n} s_i \bigcup \sum_{1}^{m} s_j \bigcup \cdots\cdots \bigcup \sum_{1}^{t} s_k$, where I, j, k are arbitrary elements belong to service set.
4. X=(x1 , x2 , , xt) is the set for use of transferring XML messages;

Combination relationship is constructed by the procedure from service query to data achievement.
X（Query message）——>SRS（service conformation）——>X（transfer message）——>D（invoke data）——>X（transfer message）——>S（return to data service）——>X（return to message）

4.6 Construction of Spatial Data Sharing Services Nodes

It is required that all types of data service integrate to work coordinately and combine as thick-size format. Meanwhile, the automation of spatial data service is required to describe the integration and coordination of services, as well as to implement the internal process for spatial data processing nodes.

The spatial data service nodes publish and register the services to dedicated service resource management center, and update the services periodically. After receiving users' invoke queries, the spatial data service nodes achieve data from remote data server or local ones according to users' requirements, and trigger services to monitor the running status. The spatial data services nodes divide tasks from up level into sub-tasks, and distribute such sub-tasks to PCs (or high-capacity computers) in data pool, execute, callback, and integrate the execution results, finally, the spatial data service nodes return the results to up level. As a separate node, the data service node will provide a simple interface to outside, and the user can access this node via IE explore.

5. CONCLUSION AND FUTURE PROSPECT

Web Services technology brings new solution for spatial geography information sharing, inter-operation and integration. Future spatial information sharing will be presented as service format, including spatial data query service, spatial data processing service, etc, and all these services can be integrated into a dedicated a new service to present.
Web Services technology constructs a distributed sharing system model for spatial data in the scope of Internet, it helps to increase the scalability and inter-operation abilities and implements a multiple levels system structure. Meanwhile, it leverages group environment to process TB level spatial data, supports spatial data distribution calculation, spatial information distribution sharing in the network environment.

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