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CONSTRUCTION OF GEOGRAPHICAL INFORMATION SHARING GRID ARCHITECTURE AND SECURING IT BY USING AUTHENTICATION ALGORITHM

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Abstract- In recent years, Computer Science and relative technology developed rapidly. Now days, the rate of data increase is high and difficult in transfer through network and process it. With the increasing application requirements of GIS, traditional GIS techniques unable to solve such application problems. Geo-Information science experts and computer experts have difficulty to develop internet technology to solve these problems. To solve these problems effectively, Grid computing is one of the best technology to solve current network resources imbalance problem. Mainly, Grid is used in the high performance computing area. The properties of geographic information system and its related computing properties determine that the grid technology has great potential in the construction of geographic information sharing system. This paper analyses the concepts of traditional GIS and it gives the method to solve these problems with traditional GIS by grid computing. It also focuses on security of Geographical Information sharing grid Architecture by using principle of Kerberos. Here, we put research emphasis on architecture of GIS Grid and security in order to provide technical foundation for succeeding. This paper is based on the analysis of the character of grid technology and geographic information system, the concept of the geographic information sharing grid architecture, grid geographic markup language (GridGML) and web services technique.
Keywords- Geographical Information System (GIS), Ticket Granting Server (TGS), Kerberos, GridGML.

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Introduction

Geographic information system (GIS) came into picture in the 1960 and developed rapidly. In recent years, with the progress of computer science and remote sensing and global position system, GIS has developed at very fast speed. From different sources GIS has discovered information and knowledge. It also finds knowledge integration method. Everything relative to geographic position is described by Digital Earth strategy in digital form. Digital Earth strategy store that data into computers and through data sharing it provide services for the users .

Open GIS and Geographical information Sharing are of increasing importance for GIS application fields. GIS avoids the waste of information and resources. GIS is helpful to find a good method to access and process these data and information. The architecture in the pilot platform consists of 3 tiers: application layer, service layer and resource layer. The major type of data that human beings have collected is Geospatial data. Information and Geospatial data are significantly different.

Grid technology is developed for sharing of computational resources. The fundamental application of Grid technology is spatial Information Grid in spatial information application service domain. From distributing parallel computing and network high-performance computing, Grid computing is derived. Both technologies are expensive to be used universally and both depend on specific computer hardware. Grid computing solves the question easily.

Computer network has come through web period and internet. For correspond among different computer hardware, internet dose it. For communicate information in different places, web dose it. Grid computing tries to make all the resources shared, such as computing resources, storage resources, communicating resources, software re-

sources, information resources, knowledge resources, etc.
The series of flexible and extensible information service system structure ensures the grid system running favorably. To construct GIS grid architecture, apply grid computing to GIS field. So it is very necessary to design and build grid GIS system based on grid computing environment.
The construction of GIS Grid architecture will support present GIS concepts and gives new direction for GIS development. For difficult tasks such as complex computing and tremendous data, it will give more easy way to complete task. This will also provide access to the required information for the analysis and interpretation of an initial dataset. From Security point of view, the access to spatial database in Geo-information sharing Grid Architecture based on Mobile Agent we use the principle of Kerberos. Kerberos mainly uses the working principle of implementing authentication by using validating Tickets.

Geographical Information System
GIS is defined as computer assisted systems for the capture, storage, retrieval, analysis and display of spatial data. There are four main components of a GIS system:
[1] Data input system: This component collects spatial data from existing sources, such as maps, remote sensing data, images, etc. It can also process the same. Data can be collected through scanning and digitizing.
[2] Data storage and retrieval: Data storage organizes spatial data and allows for quick retrieval and updates.
[3] Data analysis and manipulation: Data analysis and manipulation allows for changing form of data. It also allows for simulation modeling and spatial-temporal comparison.
[4] Output: Output displays spatial database and analysis in graphic or in tabular form.
There are two basic types of data normally entered into a GIS. The first type of data is real world phenomena and features. These types of data have some kind of spatial dimension. These data elements are depicted mathematically in the GIS as points, lines, or polygons. This type of data is entered into the GIS by number of devices like scanners, GPS, digitizers, and air photos. The second type of data is referred to as an attribute. Attributes are nothing but pieces of data. That are connected or related to the points, lines, or polygons mapped in the GIS system. The attribute data can be analyzed to determine patterns of importance. Attribute data is directly entered into a database. The user can enter, analyze, and manipulate data that is associated with some spatial element within the GIS database. Modern GIS technologies use digital information, various digitized data creation methods are used for this. Digitization is the most common method of data creation.
The distributed Objects/Component technology can extend by Web Services. Web Services accomplish the accesses to objects in the loose coupling circumstances. Web components can implement and publish in any computer which provides corresponding services and functions. So, Web Services adapts to share the Geographical information of heterogeneous GIS.
The Architecture of Web Service includes three roles : Service Provider, Service Registry and Service Requester.

Service Provider
The provider of the web service is Service Provider. The Service Provider implements the service and makes it available on the Internet.

Service Requester
The Service Requester is utilizer of the web service. The requestor consumes an existing web service by opening a network connection and sending an XML request..

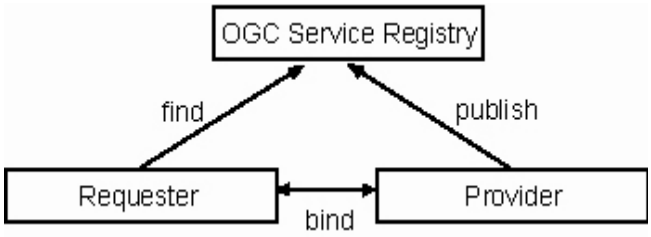

Fig. 1- Roles in Web services

Service Registry
Logically, Service Registry is a centralized directory of services. The registry provides a central place where developers can find existing ones and publish new services.
These three roles communicate with each other through three behaviors: Publish, Find, and Bind. The Provider descripts a service with WDSL and then register the service in Registration Center. The Request entity may find out the description of a service in Registration Center and then bind with the Provider that publishes the service. Request and Provider may communicate with each other and may invoke the service.

Grid computing
Grid computing was firstly put forward by Ian Foster in the 1990, aims to share all the resources on the internet to form a big, high-performance computing network. User may connect the grid computing system through internet is main characteristic of grid computing environment, and provide all kinds of services for the user. Ian Foster suggests that there are three characteristics of grid computing:

- It should coordinate users and computing resources that exist within a variety of control domains, which differs from a local-area network.
- It must coordinate resources with open, standard, general-purpose protocols and interfaces.
- Nontrivial qualities of service must be delivered by Grid computing.

Spatial information grid (SIG) is the useful tool to construct the Geographical information sharing. SIG is an intelligent information platform. SIG is built based on the current spatial information infrastructure and spatial information network protocol specification, from which the user can easily obtain the common spatial information services. In this platform, the procession of the spatial information is intelligent and distributing. By using common protocol the user can visit all spatial information and need not to know the information from million website.
GIS Grid Architecture is the application of grid computing. The concept this technology can be clear by following points:

- The aim of grid computing is work every node together, which fulfill the requirements of GIS projects. Sharing resources and data is characteristic of grid. According to these characteristics it ensures that all resources in the grid system work well together.
- Grid computing is technology that must have many techniques to ensure resources sharing and cooperation with each other. There must be different rules to ensure the communication and security of

each and every part of the system. Grid GIS needs such techniques to share all kinds of resources efficiently.

- Grid system is made up of all kinds of computers, equipments, data, and services. The development of grid should provide excellent services for the users. It should integrate many resources on the internet and Users can use grid resources from internet when grid environment is established.

Grid Middleware

Middleware is a sort of service program or system software. It runs on client computer or server computer and can serve many roles, such as spatial information and resources sharing, process management, information storage and access, services monitor, system security login and authorization etc. Middleware serves as the connection of every part of the application as well as implementation of complicated operations in grid computing. Location of Middleware is always between the application layer and the basic layer. Middleware always makes the application software independent of computer hardware and operation system. Middleware increases modularity and haleness system. It is widely used in many huge enterprises' standard platform. GIS grid architecture system is designed and implemented with basis of characteristics provided by middleware.

In grid computing system, Grid middleware is a sort of middleware. Grid middleware possesses some extra characteristics in GIS grid architecture system. As per functions of middleware in the system, it can divide into: message middleware, object middleware, security middleware, registry middleware, resource management middleware, duplication middleware, task management middleware and error management middleware.

The function of grid middleware in GIS Grid architecture is as follows

- The principle of software modularization: Using middleware, in GIS project, help us to lighten our 'software's weight', that work with the principle of component software. But grid middleware helps our system to develop toward software modularization. Due to such technology we can easily advance the service quality and efficiency of our software by improving some grid middleware.
- The principle of reuse of software: The development of GIS software, many software become complicated due to the increase of their function. Based on different middleware if we change their architecture and reconstruct their architecture and every middleware is an essential part of the software system and every part has its specific function, finally we will get benefit from it. The programmers will complete their work very easily as every middleware become light.
- The different middleware has different mode or architecture and independent of system platforms. So, due to this characteristic, it is to communicate between different platforms.
- The principle of software system: in the client-middleware-server architecture, allocate different grid middleware to complete different work and finally assemble them to form a whole system. Due that the weight of client and server become light. The traditional client/server architecture worked well in designing different GIS software system and it provides the system many flexible characteristic but it leads to some bed phenomena.

XML and GML

Extensible markup language (XML) is a sort of internet description language for communication; it has become a necessary means of communication across internet. Since XML can be extended easily and, very easy to master. The use XML in our system is as follows:

It is used as an internet description language

For communication, XML defines many standards. In our system, it serves as task description language and resources description language.

It is used as a main standard exchange language

XML has ability to provide number of mechanisms for the security and integrity of data exchange. XML is convenient to publish, find and bind services. It is a good language for internet communication.

Geography markup language (GML) was launched for geographic information communication on the internet, and it is the extension of XML. GML is the encoding for the storage and transport of geographic information and data. It may include spatial and non-spatial properties of geographic features. GML provides users methods to store and transmit all kinds of property information and geometry information, by defining the XML Schema syntax, mechanisms, and conventions. GML is also extensible as XML.

In our system, GridGML is an information description language based on GML, its main functions are task description, resources description and internet communication and serves as a main communication language among different middleware. GridGML has the characteristic of both GML and grid computing.

Geographical Information Sharing Grid Architecture

Between grid nodes, grid computing defines many protocols and APIs to ensure all kinds of operations and applications of grid system running successfully.

Fig. 2 Displays the Architecture of grid GIS system. GIS grid architecture is made up of five layers, from top to bottom application layer, implementation layer, control layer, resource layer and basement layer. Each layer has its specific functions. To ensure the information communication between grid middleware and the grid system, the basement layer includes basic structures and protocols of network. The resource layer has number of resources consisting of local resources and remote resources which are registered to resource registry center for sharing. The control layer, being the core of the whole system, ensures the whole system to run correctly. The implementation layer connects with the system by some specific interfaces. The application layer is the applications of users based on GridGML.

Table 1- Comparison between Grid base GIS and Web base GIS

Sr.No.	Methods	Present GIS	New GIS
1	Software Structure	Based on present Internet	Based on Grid Computing
2	Functionality	Data sharing	Resource sharing
3	Implementation	Simple	Complicated
4	Service	User must buy whole software even if they wants a part of software	User can select the services that they need and build their software.

Fig. 3 displays the running frame of the grid GIS system. After login, a user can apply for resources from system and submit the task by GridGML description language. After receiving the task offered by user, system searches for usable resources that are registered to resource

registry center and parses the user's requirement. Task management middleware then hands out and distributes the task to grid nodes. Grid nodes do their jobs given by task management middleware and return the results to task management middleware. It also sends reports (including task source, start time and end time, error info, etc.) to task management middleware.

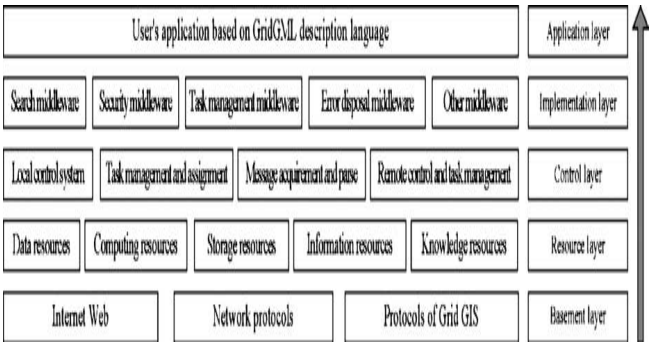

Fig.2- Architecture of grid GIS system.

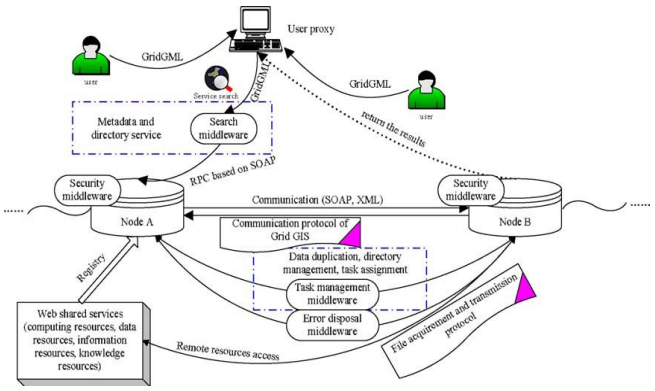

Fig.3- Running-frame of GIS-Grid Architecture.

Application Of Geographical Information Sharing Grid Architecture based on Mobile Agent

Mobile agent is considered as an enabling technology for flexible, automated and customized service provision in a highly distributed way as network nodes become active. Also, take part in the computation of applications and provision of customized services. Mobile Agent can offer potential technical advantages besides the clear separation among the key functionality and the aspects of deployment on the functional side, such as reduction in communication cost, bandwidth usage. Mobile agents enable temporal and spatial distribution of the service logic, that makes another technical advantage, such as scalability and bottlenecks of centralized approaches. Mobile agents can provide a suitable framework for spatial data resource and service discovery in grid platforms. Also Mobile Agent can support optimal access and interaction through heterogeneous terminals.

In Mobile Agent and Spatial Data Grid construction, the middleware layer allows users to access distributed resources in a transparent, secure and effective way. The Grid middleware is integrated with functions to make data mining and transferring easier. And the mobile agent that manages the user and the issues related with the heterogeneity of the devices is applied. The system provides two types of Agents: user agent and information agent. User Agent carries users' requests for spatial data. Information Agent represents information of distributed spatial data resources and services for other agents. Otherwise, Agency Agent is proposed to settle distributed transparency of system. Agents could communicate with other Agents through Agency Agent and get other agents' information (i.e: attribute, location, and resources, etc), and then move to the resource node located and complete corresponding work. The Mobile Agent system consists of a set of agent subsystems and the agency agent system which manages the information of all agent subsystems. The agent subsystem which includes User Agent, Native Query Agent and Collaboration Query Agent. The system architecture is shown in Fig.4.

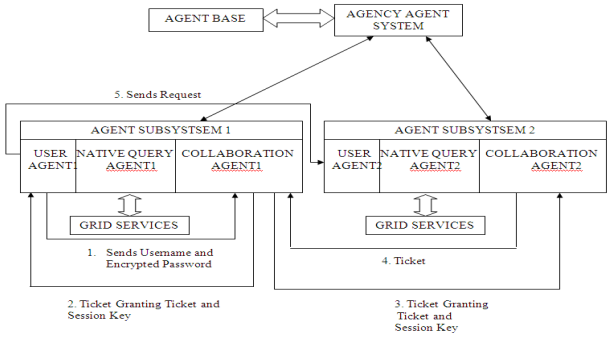

Fig.4- Geographical information sharing Grid architecture based on Mobile Agent

To solve the requirement of distributed transparency Agency Agent plays the important role in whole system. The Agency Agent is responsible to collect, manage, query all agents information. It also acts as a dependable secure authentication center to ensure communication among different agent subsystems. The information base of agents provides information needed by the Agency Agent.

User Agent (UA) provides the user with the required services. User Agent has friendly user interface with the help of which it accepts spatial data requests from users and give back the results. User Agent transforms users requests into commands which could be identified by other agents, and search correlative information agent automatically.

Native Query Agent (NQA) accepts request coming from User Agent It then communicates with native spatial data services which are built up in the grid environment to obtain information needed. Native Query Agent, which runs in background, is founded by User Agent. It is also transparent for users.

Collaboration Query Agent is a mobile agent. It accepts collaboration information query requests from User Agent, gets the address of target agent subsystem from Agency Agent and moves to target host computer, completing the information query task.

The process for information query is described as follows:

- By using a Web Browser, a request for spatial data is sent to User Agent.
- User Agent sends a request for native information query to Native Query Agent.
- As soon as the native information query is accomplished, the collaboration information query is provided. Other agent subsystems' profile information is taken from Agency Agent by Collaboration Query Agent.
- After Collaboration Query Agent gets other agent subsystems' context information, it dispatches a mobile agent which carries

corresponding request to the spatial information node located. Mobile agent then asks for native information query in the target agent subsystem's context and returns the result.

From Security point of view, the access to spatial database in Geo-information sharing Grid Architecture based on Mobile Agent we use the principle of Kerberos. Kerberos mainly uses the working principle of implementing authentication by using validating Tickets. These tickets are provided by the Ticket Granting Server (TGS). In our model, the TGS is our Collaboration Agent of another Grid. The working is as explained below

- The User Agent1 (UA1) of Grid1 wants to communicate with the User Agent2 (UA2) of Grid2. UA1 send its username and password to the Collaboration agent of Grid1 (CA1).
- On receiving the username and password from UA1, the CA1 sends the Ticket Granting Ticket (TGT) along with the session key to UA1. The format of the TGT is: TGT : [client, address, validity, Key(client)]Key(TGS) [Key(client,TGS)] Key(client). Here CA1 acts as the Authentication Server (AS). It also sends the TGT and session key to the Collaboration Agent of Grid2 (CA2). Here CA2 acts as the TGS.
- After receiving the TGT and session key from CA1, CA2 sends the validating Ticket to the UA1. The format of the Ticket is : Ticket(client,service):service,[client,clientaddress,validity,Key (client,service)]Key(service)[Key(client,services)] Key(client,TGS).
- On receiving the Ticket from CA2, UA1 is authenticated to communicate with UA2. Hence, now UA1 sends it request to UA2.

Conclusions

Grid based GIS is a new issue that faces many researchers in computer and GIS fields. Geographical information sharing Grid Architecture provides integrated spatial information and applications for users. In this system the best suitable methods for spatial data sharing and interoperability in Grid Environment is provided. While it provides us a good foreground of application in GIS field, it also provides us many challenges. Grid GIS is a sort of project that involves in different regions, platforms, subjects and fields researchers. Users can access spatial data resource through the uniform interface. By using the principle of Kerberos, we have implemented authentication security. There is to a great extent future work to be done in this area. However there is a problem of the management of geographical information service life cycle. Our related research is on its way.

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