The Design and Implementation of Grid Information Service System Based on Service - Oriented Architecture

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***Abstract*-Grid computing shares the distributed computing resources and unites the virtual organization spread in the different geographic situations to deal with large scale and data intensive computation together. In order to make grid application program use the variety of resources effectively and conveniently some reasonable mechanisms must be adopted to monitor and discover these resources to provide stable, reliable and high-efficiency application environment. This paper main to explore the problem of how to solve the information service application in grid computing environment, construct simulation platform and simulate information service implement procedure by adopting the service-oriented architecture.**

Key words- grid computing; service oriented architecture; grid information service

I. Introduction

Grid concept and technology were initially introduced by Foster and Kesselman in 1998(Ian Foster, Carl Kesselman, 1998). And in 2001, Foster, Kesselman, and Tuecke defined grid as "Coordinated Resource Sharing" that resolves issues in dynamic and multi-organizational virtual structures (Foster, Kesselman, Tuecke, 2001). From then on people conduct comprehensive theoretical research and specific practice on grid computing, drawing high attention from research institutions in plenty of countries and becoming a hot research subject in IT sector.Grid computing introduces coordinated and seamless resource sharing and computing issue. Through grids, grid computing integrates geographically scattered and systematically heterogeneous resources into a virtual "Supercomputer" (Foster, Kesselman. 2004) for largely scaled distributed and high-performance computing. Grid computing offers users huge computing capability by resource sharing and virtualization. It is right its tremendous application potential that IT makes enterprise associations hold greater expectation on grid computing as well.Grid environment is a complex and wide-area distributed system. In grid environment, the computing resources which are in great quantity, heterogeneous and dynamic belong to virtual organizations of different geographic situations. These shared resources and large numbers of users probably result in a series of problems such as the failure of hardware and software, unbalanced load and etc.In order to make the grid users to have access to the variety of resources .effectively and conveniently, many mechanisms must be adopted to monitor and discover the resources to provide the excellent application environment.In the wide-area heterogeneous environment, the resources operating includes the resource organization, discovery, access, location, scheduling, allocation and acknowledgment .The resources in grid include processor, storage resource, directory, network resource, distributed file system, and distributed computing pool and computer cluster. Information service system plays an important role in discovering and monitoring the many resources in different virtual organizations.In grid computing environment, the functions of the information services include the following.To have access to the various static and dynamic information of service system components.To configure and adopt the information services aid to heterogeneous and dynamic environment.With a unified and efficient access information implement interface.Scalability of the access to dynamic information data.To have access to the kind of information resources and distributed-based management.

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II. Service-oriented architecture

1) Overview

SOA is an ideal project to deal with the grid computing environment with application distribution and platform heterogeneity. SOA is a component model which links the application program service by the service definition interfaces. When designed, these interfaces should follow the principle of independence which is independent of service implementation hardware platforms, operating systems and programming languages to construct system services by unified general approach. In SOA, the service which is packed in the business flow is the application program function of the reusable components, which makes the information or business data change from an effective and consistent state to another one. The flow which implements the particular service is not very important. It is enough for the flow to respond the users' command and provide high-quality service for the users' request.By definite communication protocol, mutual manipulation and transparency of the positions can be emphasized through call service. A service appears to be a software component. A service is just like a self-contained function from the point of service requester. Actually, implementation services probably involve many steps carried out by the different computers within the companies or the computers owned by

manybusiness cooperators. As far as software package is concerned, service may be a component or may not be a component. Like class objects, requester application can regard the service as a whole unit. SOA uses service-oriented software packaging technology to provide services by service interfaces and service implementation.SOA includes service description, service discovery and service invocation. Service provider first gives the WSDL description about the service specific implementation and the definite service interfaces, and registers it to the service registry. The service requestor sends out find request, receives the service description from service registry and binds to the service provider by using the service information of the service description to invocate the corresponding service. SOA is a very important model to implement grid information services which can decrease the development difficulty and is convenient to system integration.

2) Web Service

Web service refers to the interfaces which describe some operations (the operations can be accessed by standard XML message transmission mechanism).Web service is described by standard XML concept called the service description of web service. This description includes all the details needed by the service interaction, which are message formats, transport protocols and location. The interface hides the implementation details of the service, allows the programming language used by the writing service of the hardware or software platform which is independent of implementation service and supports the application based on web service to be loosely coupled, component-oriented and cross-technology. Web service fulfills a particular task or a component task, which carries out complex aggregation or commercial transactions independently or together with other web services.Web service belongs to a service based on XML and HTTPS, and it is a new platform for distributed applications which can set up interoperability. The new platform is considered as a set of standards which describe how the application programs implement interoperability on the web. Web service can be written in any language or on any platform, as long as query and access to the service can be implemented by web service standard.The communication protocol is mainly based on SOAP, the service is described by WSDL and metadata car be found and accessed by UDDI.The XML standard used by web service includes the following three parts:SOAP (Simple Object Access Protocol), based on XML,is a kind of message communication protocol within web service application. SOAP defines a XML document format, which describes the method of how to call a remote code.WSDL (Web Service Description Language) is based on XML language, and it is used to describe the web service interfaces.UDDI (Universal Description, Discovery, and Integration) is a industrial standard of service register and discovers on the web service. It defines the SOAP interface to web service registry.

III. MDS4 Information Service

1) The Characteristics of MDS4

MDS supports the construction of VO,which enables the users of VO capable of cooperating and sharing the resources. MDS provides the necessary tools to construct grid information infrastructure based on LDAP.MDS uses LDAP to construct a unified global resource information namespace. MDS adopts attribute-based query mechanism to implement the information query. It supports registry mechanism to renew state information. It also provides the secure access to information. It follows standard GSI andis compatible with the x.509 certificate. The system is extensible and etc.3.2 Architecture of MDS4 MDS4 is a distributed information system, composed of resource layer, aggregation layer and users.

1) Resource layer is made up of one or many service instances which produce service data. These monitoring resources will provide access to resources.
2) Clients, such as user applications, adopt subscription or query request to interact with index service.

2) Service Types of MDS4

MDS4 provides two high layer services, which are index service and trigger service.The index service collects the state information in grid information and publishes it as the resource properties.Trigger service also collects data from resources and meanwhile it monitors the collected data.

IV. Implementation of Grid Information Service

Take the talent exchange grid as an example.To find the real-time resources and services and support the dynamic management to the resources of the virtual organization is the reflection of information service.By adopting service-oriented architecture, it packs accessible grid entities into grid service by web service interfaces to carry out the unified management.

1) Develop Environment and Steps

a) Operation system: ubuntu10.04 windows XP Professional+SP2 in simple Chinese.
b) Toolkits: tomcat U5.0.24: sun java JDK V1.5

The steps are just like the following:

1) create eclipse project
2) add project file
3) Compile and deploy. That is to deploy the grid service to web service container.
4) Service testing and running

2) The Procedure of Implementation

A grid computing environment can be simulated by using six personal computers. The six computers are all installed with Intel Pentium 4. CPUis 2.40 GHZ. The memory is 256M and the hard disk is 320G.They is also installed with integrated sound card and NIC card on main board. Five personal computer (numbered A1, A2, A3, A4 and A5) are installed with ubuntu 10.04 and one (numbered A6) is

integrated sound card and NIC card on main board. Five personal computer (numbered A1, A2, A3, A4 and A5) are installed with ubuntu 10.04 and one (numbered A6) is installed with windows XP professional +SP2 in simple Chinese as a client computer. The network connection speed to your desktop is 100M and 7P-link switch is 100M. Globus toolkits4.2.1 is adopted as grid development platform A1 and A2 are used as resource severs, A3 is used as registry, A6 is used as a client computer and others are not used at present.Server A1 and A2 register separately to registry A3 and they publish to registry server in the form of resource properties. Client A6 enters the system by grid portal and finds the registered resource properties on registry A3 after submitting the task. If A6 finds the resource properties, it will get the access of service interface description service, bind it to the corresponding server and finally pass the result back to client A6 through grid portal.

In the grid computing system of the talent exchange, the" personnel application" is regarded as a grid service. The service provider registers by grid portal and submits resource properties to grid node and the service itself exists on the local server. After the user submits the service request, the system will try to find the service according to the service subscription and will enable the user to get the personnel application by binding the information. There is a rule that only after pre-job training costs are paid off, the user can have access to the service. The pre-job training costs are regarded as a grid service, job application service and pre-job training are assumed to be situated on service A1 and A2, and they are assumed to belong to different management domain. The job application service win have access to the pre-job training costs and subscribe the cost state change .Once users have paid for the training costs, which will cause the change of the cost state, the job-application service will get the notification to enable it to get the cost state. And this is called subscription or notification mechanism. By subscription or notification mechanism, when service state begins to change, the subscriber will be notified timely, and the subscriber will take the corresponding action according to the trigger event to make sure that the users will get job application service.

V. Conclusions

Service publishing, discovery and binding operation are carried out by adopting service-oriented architecture which is concerned on web service, composed of three basic elements of service description, service discovery and service invocation and plays the three roles as service providers, service consumers and service registry. Some main problems involved in some grid information services are solved by simulating a grid service implementation of information services which takes MDS4, the component of Globus toolkits 4.2.1, as information service tool. By the service interfaces of web service, grid entities are packed into grid service and the concrete realization of grid entities is shielded, which appears to be a unified interface to meetthe clients' concept of invocating the service on demand.This project is supported by National Natural Science Foundation of China (No. 60873235&60473099) and by Science-Technology Development Key Project of Jilin Province of China (No. 20080318) and by Program of New Century Excellent Talents in University of China (No. NCET-06-0300).

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