The Integration of Different-Structure and Distributed Education Resources Based on Grid Environment

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Abstract—This paper analyzes the actuality and requirements of the integration of different-structure and distributed education resources. At present, the service mode of the education resource library system based on the network is changing from Client/Server mode to Browser/Server mode which generally uses ordinary WEB Browser as the user interface. However, from the use effect of recent years, the quality and the utilization rate of resource library are still not high. The lack of a uniform standard for the resource library construction and the behindhand design scheme impede the resource share, which is often considered as the main reason for the information deserted island. A new scheme of the education resource library integration in the grid environment is proposed in the paper based on the comparison of traditional resource integration scheme.

Index Terms—different-structure and distributed education resources, integration, grid, grid service

I. INTRODUCTION

With the development of computer, particularly the development of network and multimedia, the education resource construction is becoming more and more important. A definition of education technology was given by the United States Association for Education Communications and Technology (AECT) in 1994, which is: "Education technology is theory and practice of learning resources of design, development, utilization, management and evaluation." It is obvious that learning resources development is an important content of education technology. The Ministry of Education established "For the twenty-first century, the Action Plan for Invigorating Education" on Dec. 24, 1998, where definitely illuminated for building a national education resource library. At the beginning, most contents of the resource library are the multimedia courseware of single machine version. Years of development have made it transmit to an education resource library based on the network. At present, the service mode of the education resource library system based on the network is changing from Client/Server mode to Browser/Server mode which generally uses ordinary WEB Browser as the user interface. However, from the use effect of recent years, the quality and the utilization rate of resource library are still not high. The lack of a uniform standard for the resource library construction and the behindhand design scheme impede the resource share, which is often considered as the main reason for the information deserted island.

At present, the domestic research of the distributed resource library is becoming a hotspot. The content of the research is divided into two parts. One is the theoretic discussion of the basic characteristics and functions of distributed resource library according to the research fruits of modern education theory, which prepares for the development of related system. The other is the implementation of the heterogeneous distributed resource library at the level of technology, particularly the computer technology, which uses the technology of Grid computing, describes and organizes resources in a uniform form by the XML language and achieves the binding, storage and query of the resource metadata. At the same time, the distributed resource share can be implemented with the technology of SOAP, WSDL/GWSDL, UDDI, WS Inspection, etc.

II. THE INTEGRATION REQUIREMENTS OF HETEROGENEOUS DISTRIBUTED EDUCATION RESOURCES

A. Enterprise/Industry Development of the New Information Technology

Internet is changing every aspect of our lives. We are facing an information explosion era. The methods for producing information, accessing information and using information are varied. While information systems based on computer technology is mainly to solve the problems encountered in the production, acquisition and use of information. From 1980’s, with the development of the computer technology, the structure, construction technology and usage characteristics of information systems developed quickly, which has changed from a platform for a few experts to the platform for the daily life of the general public. A lot of investigation and use showed the life cycle of the current information system is very short and use efficiency is very low. The reason for...
Education Resources classification is not Tight coupling mechanism of system integration: 
Version, interface update problem: If each of the ration between the two sides change its e object
Resource discovery problem: the premise that Repeat resource deployment: For each application, provider and service
he systems is difficult to adapt to such changes, changes in business often leads to the need of develop new systems. Coupled with the management system and planning and other reasons can not be met, leading to there are multiple information systems in a large number of enterprise / industry at the same time, not a substitute for each other, but also can not be a seamless information-sharing, there is a wealth of information silos.

Therefore, information integration and sharing is a fundamental contradiction. How to do? The methods are varied. Many enterprises are re-planning and design all of the previous n-integrated platform for systems integration when demand has accumulated to a certain extent, as time goes by, needs continue to change, it may also lead to m - systems co-exist, and further integration, they need a new integration process of the information, this way is the most common case, which cause the system to changes fast, high cost and short life cycle, and we even do not dare to do information technology.

B. NEW Challenge for Education Resource

It is the same for education resource. The current education resource library is also low quality, low usage phenomenon. The reasons for these phenomena are due to the following aspects:

1）Education Resources classification is not standardized, randomness strong, this is not conducive to resource sharing and interoperability.

2）Education Resource Library Construction is lack of unified standards, to form relatively closed island phenomenon.

3）Education Resources thinking of building is not open, lack of distributed storage and unified management concept.

To solve these problems, we put forward a new idea of resource construction -- grid from aspects of the concept technology. The so-called grid is built on top of a group of Internet emerging technologies, it can use a reasonable allocation of geographic distribution, heterogeneous network resources (computers, clusters, computer pools, instruments, equipment, sensors, storage devices, data, software, etc.), in non-centralized control environment which provide seamless, high-quality service for scientific and technical personnel, and ordinary people . The use of grid nodes can be distributed education resources in an effective way to organize the sharing of resources, as well as to provide users with better performance and higher quality data processing services and enhance the utilization of education resources.

In the Internet era, enterprise / industry must keep the flexibility to adapt to continuous change. How to use new technology to the enterprise profits? Enterprise / industry, information architecture hardware and software solutions for how to achieve internal and external customers and their integration, while freely respond to unpredictable changes? Therefore, the integration of resources for education research is to study how to use grid technology to establish a distributed, shared, resources can be dynamically expanded space management model, realize the education resources management in grid environment is registered, release, orientation, say, access mechanism, the dynamic extension education resources to solve, single system, control and resources images of integration and sharing of core issues, improve the efficiency of using existing resources.

III. SOLUTION SCHEME FOR THE DIFFERENT-STRUCTURE AND DISTRIBUTED EDUCATION RESOURCE LIBRARY

A. The Traditional Solution Scheme

At present, the traditional business / industry use COM / DCOM, CORBA, RMI and other technologies as inter-system integration program. However, because of the limitation of these methods, it leads to serious resource waste, such as:

• Repeat resource deployment: For each application, the programmer must write connection code for each requiring business / industry resources or external resources to allow applications to run. The integration between enterprises is even more need to deploy a unified interface at both ends.

• Tight coupling mechanism of system integration: The systems developed based on COM / DCOM, CORBA, RMI techniques and methods are all a kind of tight coupling mechanism, requires a system consistent with the underlying structure. For example, COM / DCOM are widely used in Windows platform, but for non-Windows platform, they are beyond the reach of; and CORBA, while providing cross-language, cross-platform interoperability features, the application integration need both sides must support compatible with the object request broker (Object Request Broker, ORB). Since we can not guarantee that the service provider and service requestor are using the same operating system, programming language or object model, so that, now the possibility of integration between the systems is difficult to achieve.

• Version, interface update problem: If each of the system integration between the two sides change its implementation mechanism, then the other companies have to make corresponding changes, otherwise the coupling between the two will fail. Commercial entities in transactions with partners, we must be able to handle communications failures or other problems, in the tight coupling mechanism, this error detection, recovery and adaptive function are difficult to achieve.

• Resource discovery problem: the premise that arbitrary application and application of the integration between applications are basis on the services provided by the other party. As for the other alienation between the two service providers, can not be found by the service requestor unless the integration of new business. This has prevented the widespread re-use of resources which are a direct result of a waste of resources.
B. Grid-Based Integration Pattern of Education Resources

In the past few years, based on Open Grid Services Architecture (Open Grid Services Architecture, called OGSA), grid technology has become apparent mature and standardized. OGSA combines computing grid with Web services (Web Services), extends the application of grid computing to a wider range of commercial applications to distributed system services integration as the main features, establishing the basic concepts of grid services. OGSA is an architecture based on service-oriented to serve as the center, abstracts everything for the service. Service can provide customers some ability through the exchange of information which can be defined as the specific sequence of information exchange leading services to perform certain operations. Here the concept of service with the general and application of the wide range of services, including management of resources from low-level functions (such as storage services) to the advanced system monitoring functions (such as fault handling services). All abstracted that services, are beneficial to manage and share grid resources for different functions with a unified standard interface.

![Figure 1. The integration model of the different-structure and distributed education resource library based on grid](image)

In this mode, any service requestor side just to understand a universal grid service interface can directly invoke the service interface, it is not need to understand the service interface, the internal implementation mechanism, operating platform, development language and other details of the service interface. At the same time, the call of service will be achieved through SOAP messaging mechanisms to the remote call. Even in the future process of operation, when the grid service interface or feature change, service requestor side find such changes in a timely manner through a grid service description document, automatically update and adapt to such changes. The architecture of different-structure and distributed education resource based on grid gives a new resource integration solution whose advantages are in the following areas:

- Based on the current hardware and software: Grid-based architecture is not a completely new system. In-house solutions of the education resources management system can be fully maintaining the status, and can use different platforms, languages, and object model to achieve. Each resource pool in order to bring their services into the grid, just be packed simply on the basis of the original in accordance with standards so that it can provide service to the outside. Of course, such packages must be based on XML.
- Based on open platform: Grid is based on open standards, such as HTTP, XML, SOAP, WSDL / GWSDL, WS-Security and so on. Thus, many application of supporting these standard protocols (XML-based message format) also support the grid services.
- Black-box implementation: the same as the component, grid services are black-box operation, and can be reused when how grid services are circumstances is not know, because all the grid services are packed with a uniform standard interface, for the service requestor, what they see is a good package, grid service, regardless of what the service is used to achieve the object model.
- System Integration: Though the grid services, the applications can be easily interconnected, even through the Internet. Different clients can use the grid services. For example, the browser can also use the functions the grid provided; Grid service itself can communicate with each other or call methods other grid services provide. Many devices can also called grid services, a WAP devices such as mobile phones can also access grid services.
- The description, discovery and integration of resources: grid service providers register information on the description of Grid Services that they can provide through the Internet in the information service center. Service requestor can be carried out service discovery and service binding through the UDDI.

C. The Solution Scheme for the Different-Structure and Distributed Education Resource Library Based on Grid

With the development of informationization, the teaching platform construction has made a breakthrough in our country. However, as the teaching resource library at different times depending on the technical specifications, but to the various technical specifications and there are some differences, especially the metadata specification and technical specification of the contents of the first two were greater disparities. In addition, the
school's teaching resource base is often based on different operating systems, data platform, the encoding are not the same, so the achievement of the heterogeneous teaching resource library resource sharing more difficult. In addition, the original centralized management, centralized storage resources, organization and management model has been unable to meet network development, resources and application of a variety of practical needs, without alteration of the original resource base under the premise of the data structure to achieve cross-platform sharing of distributed heterogeneous database and interoperability issues become the research hotspot, despite a number of research results, but as a whole, does not have a unified and effective solution.

Therefore, how to integrate online teaching resources, to build a unified, open platform to achieve full integration and sharing of teaching resources, improve the network to become the key to the application level education. The emergence of grid technology, in order to resolve these issues provided the answer. The basic idea is that the grid integration in the information used open technology standards and virtualization technology. An open information system can solve the problem of dynamic expansion to meet future system expansion and seamless integration needs; virtualization technology can solve the universal model and the contradiction between private businesses to avoid case by case in the traditional way to address the problem of high costs.

The core issue in the integration of heterogeneous distributed education resources is the registration, location, denotation, management, storage and access mechanisms of information resources in the grid, solving the key problems such as the dynamic expansion of the system, a single system image, self-control and resource sharing, etc, and providing the basis guidance and practice methods for the information sharing construction of the heterogeneous distributed education resources in order to improve the utilization of existing education resources, avoid repeated construction and reduce the costs of system integration and development.

![Diagram](image)

Figure 2. The Architecture of the solution scheme for the integration of the different-structure and distributed education resources

Figure 2 shows the distribution of education resources heterogeneous system architecture for integrating the program. Grid-based solutions can be achieved in the Internet environment, heterogeneous distribution of education resources between the databases of their own style of minimal manual intervention in automated system integration, can be easily and quickly provided various services. This solution is the ability to achieve good integration of the aforementioned requirements and functional application requirements.

For the service provider, the needs to be done, including local resource management and virtualization, service release, the customer support.

For the service requestor (Service Requester) is concerned, you need to integrate all the services in the Internet, Grid Services of providers, while providing the interface for all user interface.

For UDDI, the main function is to complete the user registration, services, location, etc., and provide a single system image and transparent services for the service requestor.

IV. CONCLUSION

The Grid-based integration of heterogeneous distributed education resources is proposed to solve the critical issues such as the dynamic expansion of the system, a single system image, self-control and resource sharing, etc, provide the basis guidance and practice methods for the information sharing construction of the heterogeneous distributed education resources in order to improve the utilization of existing education resources, avoid repeated construction, reduce the costs of system integration and development and meet the needs of the development of education information.

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