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A DESIGN OF GRID BASED RELIABLE MODEL FOR MODERN E-EDUCATION

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ABSTRACT

The number of educational resources in universities has been growing explosively during the past decades; some learners couldn't access the educational resources conveniently although e-learning system could provide learning service access for learners. Also, the current Grid system couldn't solve the problem of interoperability resource sharing and can't provide reliability of service for learners. This has brought about the need to develop ways to effectively share and manage the resources available in the Grid system.

In this paper we propose a Grid-based model for modern e-education system. The grid-based e-learning model presented in this paper possesses the features that will facilitate efficient use of available resources leading to improvement of the overall quality of the operations of e-education.

The necessary of the study on the higher e-education based on grid is demonstrated. Then the infrastructure scheme is presented for reliability and efficiency to set up grid on e-education. It is described from the system constitutes, access model, service database management and resources library design for higher special education grid.

Keywords: Grid Computing, Grid-Based Model, E-Education, E-Learning, Access Grid, Data Grid

1 INTRODUCTION

The incredible enhancement in the internet technologies during the last couple of decades has changed the way students thinking, learning and working style. It can conserve money, time and energy consumed in commuting between classes, improved flexibility to study in any convenient location, Just-in-time learning; more opportunities to study the most current material available. E-education based on Grid provides the worthy content and knowledge as that of traditional learning environment provide. Many universities or institutions in the world are adopting e-learning as their principal teaching method. Due to increase a number of users, services, educational contents and resources, and hence some educational institution have needs to reduce the development, operating and maintenance costs [1] [2].

The modern knowledge society requires changes in educational processes, forms training and skills. Grid services improve the management efficiency of educational resources in universities or institutions; also provide efficient teaching and learning service. The number of educational resources in universities has been growing massively during the last decades, and the efficiency of educational resource management is very low, at the same time there is a growing interest for users to get those resources which could raise the utilization rate. This time it is big question how to improve the performance of resource management and the quality of education. And how to design network architecture for campus which could helps to provide high-quality services. Grid which could improve the efficiency is one of the models of network which integrates high performance computer, large-scale database, and remote facility in the different locations to huge supercomputer [3].

An increasing number of universities and institutions set up e-Learning platforms to follow the trend. E-Learning has increased lately as a result of the development of learning tools and techniques, which make the modeling of the teaching learning process more flexible to students and professions [4]. An E-Learning Platform requires a Learning Management System (LMS) to save and manage the teaching content [5]. However, every LMS platform runs its own learning material and cannot be exchanged with another LMS.

To overcome this problem, an interactive technical standard, known as SCORM (Sharable Course Object Reference Model), was launched [6][7]. SCORM objectives to establish a mechanism for repeated use and sharing of courseware which help to reduce time and cost in developing courseware and make courseware be reusable and acceptable in different LMS. Next the problem that arises is that almost every individual LMS does not have the capability to share courseware directly with another LMS due to the lack of a reliable and handy courseware sharing system. Then Grid Computing and Data Grid technology to set up many courseware sharing platforms for the reusing and sharing courseware.

This paper presented a system truss of e-learning grid for higher special education which services to the disabilities combined with the grid technology.

2 GRID COMPUTING IN E-EDUCATION

Grid technology significantly proved in the field such as genetics, electrical and cryptologists. Also it plays a good role in educational field [8]. But still there is big scope for enhance Grid computing to compete the cloud computing. One of the important areas for the technology is animation. By providing resources to students, the present structures of e-education drastically change. Grid computing is a method of distributed computing which includes software, hardware, location and organization to provide a lot of control and authority. Anyone in the grid can cooperate and access each other's information. Grid computing needs software that can split a program in a number of pieces. Further completing the each process it merges into a single large one. There is one concern about grid is that if one piece of the software on a node fails; other pieces of the software on other nodes may fail [9].

One of the kinds Access Grid enables users to process interactions through audio and video. At present, it has been used in many sites that need video such as teaching, training, seminar and conference, etc. The application software of Access Grid is known as Access Grid Toolkit.

Grid is only a kind of video conference system. Access Grid has already tightly combined with Grid so that all the functions of Grid technology such as resource allocation, authentication, remote data access and fault detection are the standard function of Access Grid.

Virtual location based on Grid technology is a place where users collaborate so that we can set up one Data Grid Node in one Virtual location as the place for storing teaching resources. For the students who could not participate in the real-time, they can also watch them after the classes. We would have needs the files that record the video or audio of the deliver lecture are usually so massive that they require high capacity of storage device such as Disk Array, NAS etc. Therefore, we can use another kind of Grid technology called Data Grid to substitute the above storage devices [10]. Data Grid only uses the internal idle training or administration computer resources within the institutions. In this method, it is possible that the storage space obtained will not be less than that of expensive storage devices.

In the Scientific research such as computational genomics require access to large amounts of data for the file management, distributed data, access management etc. The data grid integrates the data storage devices and data management service into the grid environment. Data Grid consists of distributed computing and storage resources, which, though located in different location, easily accessible to users.

The Grid-based E-Learning Model Architecture for open Universities being proposed in this paper emulates the grid-cluster model that was implemented in. With implementation for the front end that consist of the Grid Portal and the back end to contain the Data Grid contents. Here we introduced the Access Grid layer as shown in **Figure 1.**

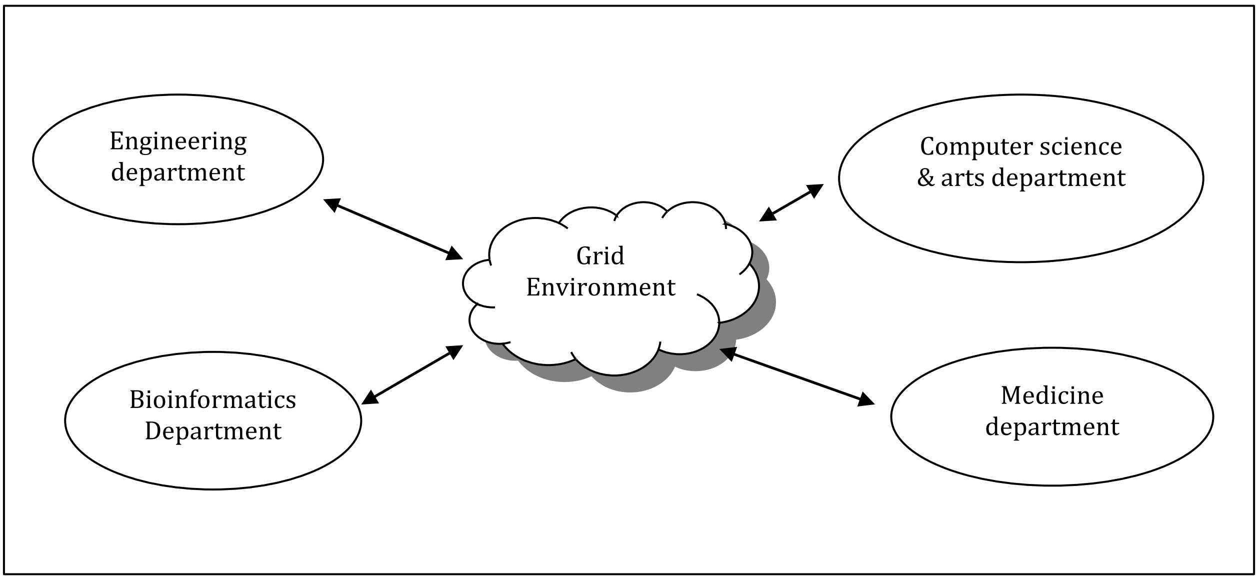

Figure 1: Access content through Grid Environment

3 CHARACTERISTICS OF GRID COMPUTING

This section describes the resource management found in Grids and Clouds, covering topics such as the data model, data locality, compute model, programming model, virtualization, monitoring, and provenance. These topics are extremely important to understand the main challenges that both Grids and Clouds face today, and will have to overcome in the future.

3.1 Data Model

To tackle data rigorous applications, Data Grids have been specifically designed with the concept of virtual data playing a vital role. Virtual data captures the relationship among the data, programs and computations. It prescribes various abstractions such as location transparency where data can be requested without regard to data location, materialization transparency means data can be either recomputed on the transferred upon request, depending on the availability of the data and the cost to re-compute, representation transparency where data can be consumed and produced no matter what their actual physical formats and storage are exits [11] [12].

3.2 Data Locality

As data sets double in size every year and CPU cycles become cheaper and cheaper, the main challenge for efficient scaling of applications is the location of the data relative to the available computational resources. To achieve good scalability at Internet scales for Grids, and their applications, data must be distributed over many computers, and also computations must be operated towards the best place to execute in order to minimize the communication costs [13]. Google's map reduces system runs on top of the goggle file system, loaded data is partitioned into chunks and each chunk replicated. In Grids, data storage usually relies on shared file systems such as NFS, PVFS, GPFS and Luster where data locality cannot be easily applied [14].

3.3 Compute Model

A batch-scheduled compute model is used by many Grids, in which a local resource manager such as Condor, PBS, SGE manages the compute resources for a Grid site. Many Grids have policies in place that enforce these batch jobs to identify the user and credentials under which the job will run for the security purposes.

Many Grids don't natively support interactive applications because of expensive scheduling decisions, data staging in and out, and potentially long queue times. But in the Grid environment there are efforts to enable lower latencies to resources via multi-level scheduling to allow applications with many short-running tasks to execute efficiently on Grids [15].

3.4 Programming Model

Grids mainly target large-scale scientific computations, so it must scale to leverage large number of resources, and we want to make programs run fast and efficient in Grid environments, and also reliability and fault tolerance must be considered in the programs.

Message Passing Interface(MPI) is the most commonly used programming model in parallel computing, in which a set of tasks use their own local memory during computation and communicate by sending and receiving messages[16]. "loosely coupled" computations can involve large amounts of computation and communication, the concerns of the programmer tend to be different from those in traditional high performance computing, being focused on management issues relating to the large numbers of datasets and tasks rather than the optimization of inter processor communication. In Grids, many applications are loosely coupled in that the output of one may be passed as input to one or more others [17]. It is a parallel programming tool for rapid and reliable specification, execution, and management of large-scale science and engineering workflows.

3.5 Virtualization

Virtualization is not a significant characteristic of the Grids. However, there are efforts in Grids to use virtualization as well like Nimbus [18] which provide the same abstraction and dynamic deployment capabilities. A virtual workspace is an execution environment that can be deployed dynamically and securely in the Grid. Nimbus provides two levels of services; firstly quality of life where users get exactly the environment they need and secondly quality of service where is the guarantee all the resources the workspace needs to function correctly such as memory, CPU, disk etc [19] [20].

3.6 Provenance

The derivation history of a data product, data sources, intermediate data products, and the procedures is known as Provenance. Provenance information is essential in discovering, understanding, validating, and sharing a certain data product and the applications. It is also very important in some disciplines such as finance, medicine, and for audition purpose. By using provenance information, scientists can debug workflow execution, validate or invalidate scientific results, and guide future workflow design and data exploration. Chimera [21], Swift [22] and VIEW [23] Grid based system used provenance management to support the discovery and reproducibility of scientific results.

4 CHALLENGES IN GRID COMPUTING

The research challenges faced in grids include:

- Dynamicity: Resources in grid are owned and managed by more than one organization which may enter and leave the grid at any time causing massive load on the grid.
- Administration: To create a unified resource pool, a massive system administration load is raised along with other maintenance work to coordinate local administration policies with global ones.
- Development: Problems are concerned with ways of writing software to run on grid-computing platforms, which includes decomposing and distributing to processing elements, and then assembling solutions.
- Accounting: developing the methods to support different accounting infrastructure, economic model and application models that can face with the tasks that communicate frequently and are interdependent.
- Programming: The low-coupling between nodes and the distributed nature of processing make the programming of applications over grids more complex.

5 A PROPOSED FRAMEWORK OF GRID COMPUTING FOR E-EDUCATION

The aim of the proposed an educational grid system is to establish a secured, computationally fast, distributed and massive education resource management system by which users can conveniently access anything, anytime and anywhere. The proposed system is shown in fig. 1. Education resource servers distributed in different regions and then user can easily access all kinds of information services such as video on demand (VOD), network courseware, resources sharing, assistant study information and assistant supports by distance logging.

The architecture has been divided into three layers; Grid infrastructure layer, service layer and E-Learning application layer. We present a brief functional description of each of these layers.

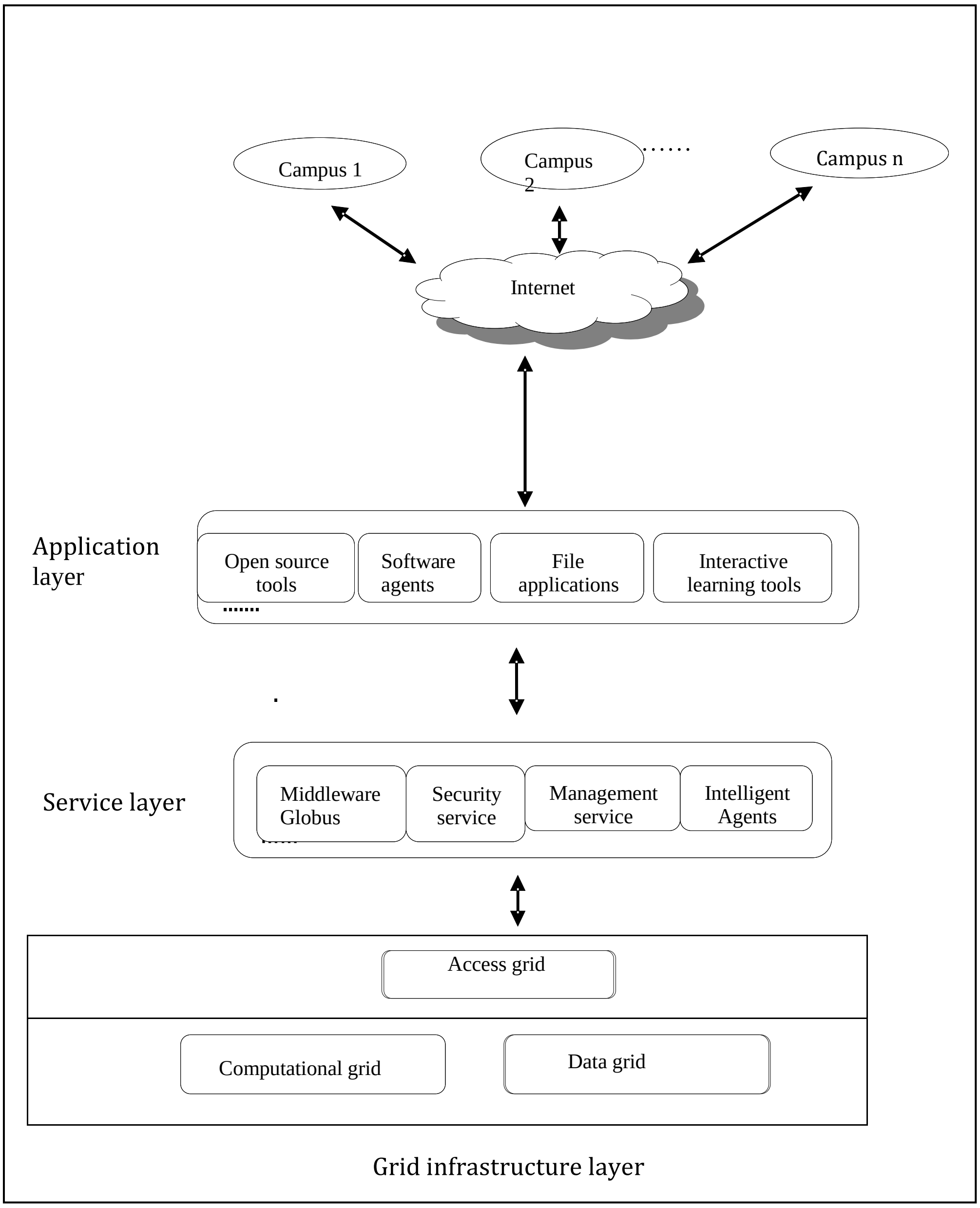

Figure 2: Framework shows Grids functioning with different layers

The grid computing paradigm essentially aggregates the view on existing software and hardware resources. In other words, "Grid Computing" can be considered as a virtual super computer [24]. In Figure 2, Grid infrastructure layer combined Data grid, Computational grid and Access Grid. Access Grid enables many people to process interactions and views exchanges through text, audio and video. It has been used in many institutions that need text, audio and video such as teaching, conference and training etc. The functions such as resource allocation, authentication, fault detection and remote data access are the standard function of Access Grid. The Access grid enables virtual collaboration between lecturers, students, researchers, etc to process interactions and opinion exchanges through video and audio. It also enables the campuses integrate teaching courses and materials within the grid for enhanced teaching flexibility. With the help of Computational Grid, institutions can optimize computing and data resources, pool them for large-capacity workloads, share them across networks, and enable collaboration [25] [26]. The data grid integrates the data storage devices and data management services into the grid environment. It consists of storage resources and scattered computing, which located in different locations across the world, remain accessible to users. Data Grid helps scientific studies such as high energy physics and computational genomics to access large amounts of data that will require management services such as data file management, replication files management, and distributed data access management. The Data grid technology will comprise of idle teaching or administrative storage computer resources within the campus. This will be used as a substitute for the demand of a large storage server knowing that as the size of teaching material(multimedia, text etc) and the number of students who use this e-learning platform (for real time courses or watch if absent) increase, there will also be a need for a high level storage server. With the Data grid, it is possible that the storage space obtained will not be less than that of an expensive storage device, such as a Disk Array or NAS, in serving as an e-learning platform storage device. The Computational grid will comprise of resources that will improve the processing capability of users on the Grid.

Grid service layer is built upon infrastructure layer. It defined to realize the sharing, integration and interoperation of all the resources in infrastructure layer as well as access interfaces of resources and services are afforded to support the applications in application layer. Grid Management a service function is to processes requests for resources. It allocates the required resources for the processes or requests sent by the users. And then monitors and controls those processes or requests. It also generate the reports on the status of the e processes or requests during execution on the target resource. Broker service manages scheduling and allocating the Grid Learning. It is also responsible for a global state in the Grid

Interoperability can become a serious issue for cross-data center, cross-administration domain interactions, suppose your accounting service are running in Google infrastructure while other business operations on Amazon EC2. However Grids build on the assumption that resources are heterogeneous and dynamic and each Grid site may have its own administration domain and operation autonomy. The main issues are considered as single sign-on, so that users can log on only once and have access to multiple Grid sites, this will also facilitate accounting and auditing. Hence privacy, integrity and resources belonging to one user cannot be accessed by unauthorized users, and cannot be tampered during transfer; reservation, and sharing, taking into consideration of both global and local resource usage policies. The public-key based GSI (Grid Security Infrastructure) protocols are used for authentication, communication protection, and authorization. The Grid approach to security might be more time consuming, but in compare to another models it adds an extra level of security to help prevent unauthorized access. Grid resources are not highly virtualized as in Clouds for example the Ganglia distributed monitoring system can monitor a federation of clusters and Grids and has seen wide adoption in the Grid community. Virtualization brings to Clouds is the potential difficulty in fine-control over the monitoring of resources. Although many Grids such as Tera Grid also enforce restrictions on what kind of sensors or long-running services a user can launch. Grids in general have a different trust model in which users via their identity delegation can access and browse resources at different Grid sites with the help of intelligent agent. When making a computing task, such as which hosts are available, how much processing capability is left, what the available data is in the database, the middleware Globus [27] will check all the available resources in the Grid system. Then, the tasks required by the users will allocate its resources and control its action by the system. The middleware Globus includes software for security, information infrastructure, resource management, data management, communication, fault detection, and portability. The middleware Globus is responsible for checking systematically all the available resources in the Grid when making a computing task.

The top layer represents the applications layer. It implements various end-user applications: online group discussion, e-classroom, Quiz, assignment, test etc. The end user easily access educational matter with high efficiency and independence from managing the physical resources of the infrastructure. Through this layer, the learner deals with the system clearly with a high degree of search and flexibility through the learning material. Grids generally support many different kinds of applications, ranging from high performance computing (HPC) to high throughput computing (HTC). Related to HTC applications loosely coupled nature. Grids have seen great success in the execution of more loosely coupled applications that tend to be managed and executed through workflow systems or other sophisticated and complex applications. These loosely coupled applications can be composed of many that can be individually scheduled on many different computing resources. Tasks may be small or large, static or dynamic, uniprocessor or multiprocessor, homogeneous or heterogeneous, loosely or tightly coupled. A new teaching approach is presented for effective teaching through open source tools. These tools incorporate method to address the difficulties faced by students in learning different course. Use of Matlab ensures that students understand the underlying concepts, the animated videos helps in easy recalling and the questionnaire keeps learner attentive. Thus by improving efficiency of classroom teaching and offering a new method of teaching-learning for a mathematical subject like DSP, reduces the effects of diversity at curriculum level and improves individual's interest in the subject. Therefore ideal classroom experience should be amalgamated with E-learning so that everyone will be prepared for full participation and no one slows down the rest of the class. Further by integrating the course contents in open source tools, enables a teacher to assess and track each of the student's progress. This is simply not possible in a traditional classroom environment constrained by time and space. Some students are likely to be left behind. Today it is estimated that there are already more than 250 providers of commercial Learning Management Systems. In addition, there were recently identified more than 40 open source LMS offerings (some of the most well known are Moodle , OLAT, Desire2 Learn and SAKAI). For ensuring that users in the near future as well as the longer term have access to the best available applications, these Open Source software applications is been built on open standards[28].

6 CONCLUSION

In this paper we proposed Grid framework in which resources are virtualized into service pool, could achieve educational resource sharing for e-learning. The proposed framework can adapt to the distributed and dynamic grid environments, and has a better scalability. This research hopes to integrate those idle computer facilities in e-education by the techniques of Access Grid and Data Grid so as to make best use of resources. For those academies that have insufficient budges, they can then obtain better services and enormous teaching resources through the techniques of Access Grid. The implementation of the grid-based e-education model presented in this work will facilitate efficient use of available e- Learning resources and virtual collaboration between remotely located campuses. In this paper, we present a new E-Learning architecture. Efficiency is ensured using the Grid technology, which select the best available resources for the execution of data.

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