Impact of Grid Computing in E-Learning

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Abstract

Education started off as traditional teaching where students and teachers are present and interact at a place in a particular span of time. Today, the idea of E-Learning or electronic learning has become very popular. It is the collection of teaching- and information packages – in further education which will be available at any time and any place and are delivered to learners electronically. Gradually, E-Learning is becoming Mobile Learning with the implementation of ICT (Information Communication Technology), wireless and mobility technology. Recently, the IT developers are approaching the concept of Grid Computing (GC) where increase in computational power leads to fast and efficient retrieval of information using large networked internet system. This technology will enable universities and research institutions to share their supercomputers, servers and storage capacity, allowing them to perform massive calculations quickly and relatively cheaply. This main aim of this paper is to discuss the impact of Grid Computing on E-Learning focusing on Multimedia Education field.

Keywords: E-Learning; M-Learning; Grid Computing; Multimedia Engineering

1. Introduction

E-Learning gave the opportunity of combining modern information and communication technology into the Education world. This increases the availability and efficiency of education among the young generation. Now the implementation of Wireless technology introduces mobile Learning. Mobile learning is a type of applications/services that generally presumes to use mobile internet technology for learning purposes. Thus, learning is more adaptable and flexible because of the availability to obtain information is wide. A new emerging concept, *Grid Computing* facilitates the implementation of the Mobile Learning concept even further, particularly in the Multimedia Education field.

Today research in E-learning mostly focuses into the success factors in implementing E-learning. Work in [1] introduces and discusses the Organisational Critical Success Factors (CSFs) for managing the implementation of E-learning in Higher Education (HE). It introduces the terms "information society" and "knowledge society" showing how these terms lead to rapid technological changes, and accordingly, radical change in the training pattern in education. While work in [2] focuses into the scope of current E-learning environment and the technological factors. Research in Grid is still on-going, even though Grid concept is emerging since 1997. Its concept and architecture are discussed in [3]. Work in [4] focuses in designing Grid Services for efficient Multimedia Streaming. However, no attention was given to Grid implementation in Mobile Learning. The main aim of this paper is to discuss the impact of Grid computing on E-Learning focusing on multimedia education field, and at the same time supports mobile learners.

This paper is organized as follows; section two presents E-Learning and M-Learning concepts and components. Section three presents and discusses the proposed Grid architecture for efficient E-Learning in a mobile environment. The last section concludes the paper.

2. E-Learning and M-Learning

E-Learning consists of important tools such as text chat, Email, Audio/Video Conferencing, Discussion Groups, shared whiteboard and shared applications. In E-

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Learning, time and place are no longer restrictions as the learning experience can be tapped anywhere one has computer and access to the Internet. The E-Learning environment requires computer network infrastructure for transmission and distribution of educational content as shown in Figure 1. It allows students to communicate with their teachers or peers through Internet. The advancement in multimedia, for instance, requires large amount storage, processing power and software to actually accomplish the desired task.

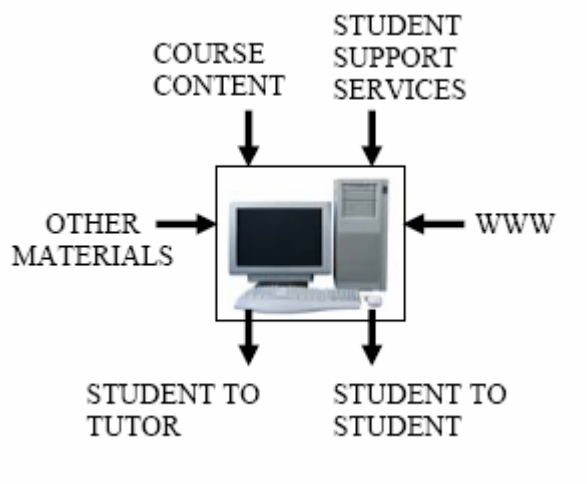

Figure 1. Virtual Learning Environment

The concept of M-Learning is slowly beginning to take shape. M-Learning is learning that can take place anytime, anywhere with the help of mobile devices. These devices must be capable of presenting learning contents and providing wireless two-way communication between teacher(s) and student(s). Typically, an educational organization administrates both the course content and the communication services [6]. M-Learning encourages both independent and collaborative learning experiences helping learners to improve their literacy and innumeracy skills and to recognize their existing abilities. This is due to the M-Learning method which is personalized, giving more space and time for learners to explore and acquire knowledge based on their own abilities. It also raises the self-esteem and confidence of the learners in using the ICT tools.

3. Multimedia with grid computing power

E-learning creates virtual classrooms by interconnecting lecturers to geographically scattered students. The availability of information at anytime and anywhere becomes more efficient with the current M-Learning concept. Multimedia education with mobile learning requires more processing power, storage and faster retrieval. Grid computing is an emerging infrastructure that provides seamless access to computing power and data storage capacity distributed over the globe. It focuses on resource sharing and coordinated problem solving in dynamic, multi-institutional virtual organizations [7]. The implementation of multimedia learning in Grid environment would benefit the learners as well as the lecturers and academicians. There are four main requirements to be taken into account in the proposal for the need of efficient Multimedia content distribution using Grid computing environment; these are content description, delivery, heterogeneous services integration and Quality of Service (QoS) [4].

Presently, multimedia needs more storage and processing power to use in graphics, visualization and streaming media. Grid exploits underutilized resources that allow computing process to be faster and efficient. Besides utilizing processing resources, the large amount of unused disk drive space capacity increases the availability and scalability of data processing, retrieval and usage. For an example, a Multimedia application with unexpected peaks of activity will demand for more resources such as CPU and storage. Here Grid computing or ‘data grid’ allows the migration of partially completed jobs to other resources including the usage of processing power. This supports video editing, and animation in the Multimedia field. On the other hand, M-Learning needs efficient and reliable network infrastructure and high computational power. Grids makes it easier to provide such requirements, since it allows administrator to utilize far more of the resources in the data center, making the resources accessible to more than a single application sitting on a single physical server. Furthermore, grid components integrate tightly without creating rigidity and brittleness in the system enabling components to quickly react to change, and adapt failures without compromising performance and reliability. This makes M-Learning as a continual process.

Today, the process of multimedia learning involves different software and technologies. Grid has the advantage of consolidation where it minimizes the infrastructure necessary to meet learning material demands and also reduces costs by migrating from ownership or single-use systems to multiple applications. For an instance, animation work may need software that is very expensive. In this case Grid allows for software sharing within this big network. Using a grid, the jobs requiring this software are sent to the particular machines on which this software happens to be installed. In this case, not only students have the opportunity to save cost but their learning experience goes on continuously. Figure 2 shows the proposed M-Learning Grid Architecture.

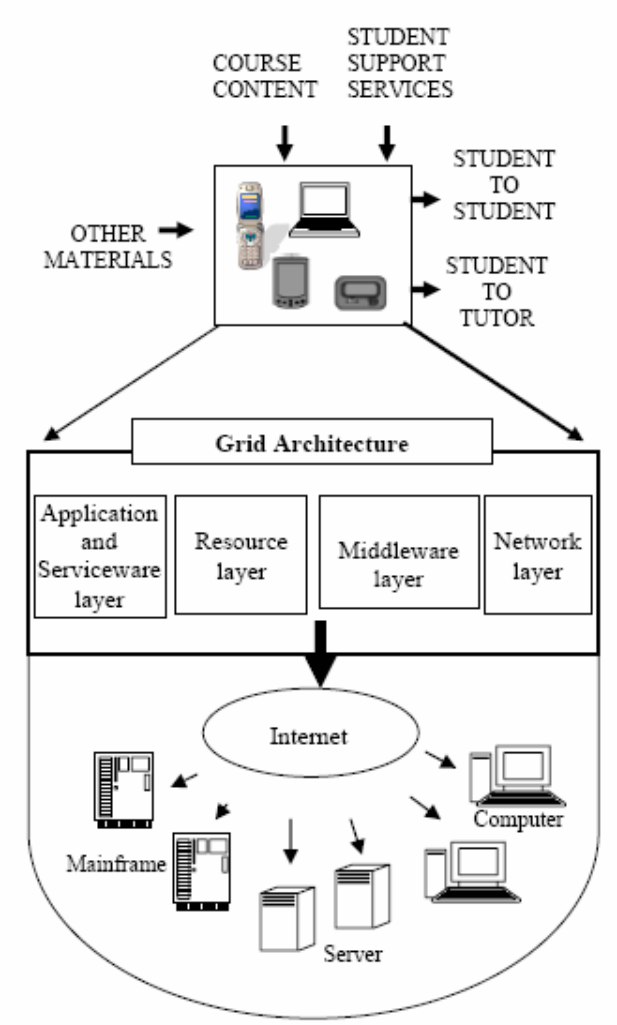

Figure 2. The Proposed M-Learning Grid Architecture

Multimedia learning materials need more storage and processing power. The animation or graphical material is sent through the Grid architecture that consists of five layers that have specific task. The higher layers are defined by application and serviceware software, whereas the lower layers are more hardware centric consisting of computers and networks. The highest layer is called application layer where it includes portals and development toolkits supporting different types of field such as science, engineering, business amongst others. Serviceware provides many management –level functions including billing, measuring the amount a particular user employs the Grid, and generally keeping accounts of who is providing resources and who is using them – an important activity when sharing the resources of a variety of institutions amongst large numbers of different users. The support of Grid layers and the Internet connection enables efficient data transfer. The network consisting millions of computers, servers and mainframe provides extra storage and more processing power.

4. Conclusion

E-Learning with advancement in Mobile technology allows the learners to access their classes anywhere and at any time. Complex applications, which are computationally intensive and handle large data sets have been avoided in E-Learning environment. This because of the high computational power needed to run such applications. This paper shows that the combination of E-Learning with Grid computing creates an affirm structure for efficient and faster retrieval of information, which gives better support to enable the integration of multimedia and M-Learning in an E-Learning environment.

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