Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia - Social and Behavioral Sciences 56 (2012) 774 – 782

Procedia Social and Behavioral Sciences

International Conference on Teaching and Learning in Higher Education (ICTLHE 2012) in conjunction with RCEE & RHED 2012

A Distributed Learning and Teaching Environment across Institutions Based on Advanced Grid Portal Technology

Dayang Hajah Tiawa Awang Hj. Hamid[a,*], Md. Rajibul Islam[b], Norma Alias[c]

[a]*Department of Multimedia Education, Faculty of Education, Universiti Teknologi Malaysia, UTM Skudai, 81310, Johor, Malaysia*
[b]*Faculty of Information Science and Technology, Multimedia University, Malaysia*
[c]*Ibnu Sina Institute, Universiti Teknologi Malaysia, UTM Skudai, 81310, Johor, Malaysia*

Abstract

This study presents web-based networked information and collaborative authoring architecture as Information and Knowledge Grids. This architecture is made possible by advanced open source grid portal software in combination with distributed parallel computing system. The distributed learning and teaching grid environment are use for improving the quality of higher education as an initial stage. This Grid architecture provides reasonable and effective online assisted learning environment at the institution for any courses. The paper describes in some detail the architecture of an advanced grid portal based on parallel computing system, learning and teaching interactions and the processes of courses management over it.

Keywords: grid portal; collaborative authoring; parallel computing system; web-based learning

1. Introduction

The conventional Web Based Education (WBE) based on one server which is as a result, very slow for the operation of searching, uploading, visualizing output and numerical computational. Grid portal technology with parallel computing platform in supporting WBE is very high speed up in terms of searching, editing and sharing, supporting the huge memory, high quality of visualization and increasing the computational performance.

* Corresponding author. Tel.: + 607-5534559.
E-mail address: drdayang@utm.my

1877-0428 © 2012 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of Centre of Engineering Education, Universiti Teknologi Malaysia
doi:10.1016/j.sbspro.2012.09.715

Several kinds of approaches [8] [9] [10] have been proposed by various researchers for authoring activities environments. Among them Begona et al. [1] have described KADDET which is a cognitive diagnostic environment designed to assess the conceptual and procedural learning activities of students.

To fulfill graduation requirements, it is common practice in the Malaysian universities that students majoring in Mathematics are required to work on a two semesters' project during their final year. By involving in the research projects, the students are trained on how to learn about a new math topic or to study more in-depth a topic that they are already familiar with. Web based Education through grid portal technology is becoming a major recent trend [7]. The computational platform is supported by a low cost shared and distributed memory in solving the grand challenge applications. Individual work is essential in any learning course but, student should learn the collaborative behavior as well. Student contributions are important in group efforts. Group work on designing and authoring a courseware is not a simple task. One of the major problems in work group is unequal distribution of task (among student in a group) and compensation (performance evaluation in the form of grades). The WBE in parallel computing are designed to provide students an efficient authoring environment to overcome the unequal distribution of tasks and performance evaluations in group efforts. That means they will have the opportunity to searching, uploading, visualizing output and file saving by the help of online collaborative efforts through grid portal technology.

In the paper a sample module of graphics, animation, audio and video technology courses have been presented in this section. In Section 2, we illustrate the development and the implementation of Grid portal and web service technology for students. In Section 3, web service paradigm as well as the data and analysis methods, findings as well as qualitative observations in Section 4 followed by discussion in Section 5. Section 6 will conclude the paper.

1.1. Graphics, animation, audio and video technology course

This course provides exposure to the theory and basic concept audio, video, graphics and animation digital to student. Students shall be exposed with key concepts each stated element and how to use properly in the development of an application of multimedia and website. Students will be led to use variety of techniques procedure, element and the quality of multimedia by using software audio, video, graphics and animation. Emphasis would be also given to the aspects intermingle among element in multimedia produce education and learning material effective and having quality.

LEARNING OUTCOME: At the end of the course, students will be able to:

- state basic concept relating with key elements multimedia.
- use effectively multimedia technology relating with education and learning.

Digital multimedia technology is used to increase the quality of professional jobs especially in education sector. For a 14 week/semester, the subject covered on the topics stated in Table 1.

Table 1: Subjects of a semester of 14 weeks for Graduate Students

Week	Learning Activities	Remark
1	Introduction To Course, Assignment And Students Responsibility Introduction to Multimedia • Key Elements Multimedia • Technological Development Multimedia • Development Factors Multimedia	Information about method course management, presence policy and each student responsibility.
	Introduction To Graphics Technology • Graphics Interest In Education • Role of Graphics Digital In The Application Multimedia Or Web Development Technology Digital Graphics: Technical Aspect Category Digital Graphic: Bitmap And Vector	Student must form project team for graphics assignment and animation (not exceeding 3 people for one group) Demonstration and practical training in the laboratory graphics software use (Adobe Photoshop) – Activity 1 (Photoshop)
2	Digital Graphics Technology: Technical Aspect • Digital Graphic File Format • Digital Graphics Quality: Resolution and Colour Depth • Image Size And File Size	Cooperative learning activity and PBL: Digital Graphics Quality
	Introduction To Animation Technology • Brief Animation Technology • Multifaceted Animation Use Life • Animation Interest In Education	
	Animation Technology Digital: Technical Aspect • Traditional vs Digital animation • Animation Production Basis Techniques	
3	Animation Technology Digital: Technical Aspect (cont.) • Basic concepts Digital Animation • Techniques Digital Animation • Categories Digital Animation • File Format Digital Animation	Cooperative learning and PBL activities: Basic concepts Digital Animation Test: Covers Graphics topic only (15 marks)
	Animation Software and Tools • Animation software: 2D, 3D and Special effects • Tools: Digitise Tablet, 3D Scanner etc..	Guide to produce several main types of animation such as motion tweening, shape tweening, frame by frame etc.
Meetings	Learning Activities	Notes
5	Animation Technology Digital: 3D animation and Special Effects • Introduction 3D Animation • Process to create 3D Animation • Special Effects: Morphing, Warping, Virtual Reality	Dateline to submit assignment 1a (5 marks)
	Practical at Graphics Software and Animation Lab (Adobe Phostoshop dan Macromedia Flash)	
6	Introduction to Audio • Basic Concepts Audio • Audio in Multimedia Application Education • Introduction to Audio Analogue and Digital Audio	
	Basic Principles Digital Audio • Sampling Process: Audio Analogue to Digital • Factors Affecting Digital Audio Quality • File Size: Digital Audio	
	Further Digital Audio • Various Audio Compression Techniques • Types and Format Digital Audio File • Digital Audio Software and Applications	Demonstration several digital audio softwares applications

7	Introduction to Video • Video in Multimedia Application Education • Basic Principles Video • Introduction to Video Analogue • File Format and Standard Video Analogue Introduction to Digital Video • Digitizing Video Process • Tools for Digitizing Video Process • Advantages and limitations of Digital Video	Quiz : Covers Audio topic only (5 marks)
	Editing Digital Video • Techniques editing Digital Video • Softwares editing Digital Video	Demonstration using editing Digital Video softwares
	Determine File Size and Digital Video Quality • Determining Factor Digital Video Quality • Determining Factor Digital Video File Size	Dateline to submit all assignments
	Digital Video Compression • Principles Video Compression • Types and Standard Video • Limitations Video Compression • File Format Digital Video	

The weekly hands-on laboratory exercises provide practice on graphics, animation, audio and video technology skills and authoring, sharing and communication activities. The laboratory exercises may support the student research projects outside of class.

2. Grid Portal Technology

The proposed Grid portal is an efficient web server as well as gateway by which users may access web services, manage data and compose workflows [14]. The portal is used by the administrator to construct the service for others to use and by the users who wish to act together with the service by its automatically generated web interface. Our Grid portal technology offers a framework for supplying single-point access to Grid services, similarly a Web portal such as Yahoo or MSN comprehensive site information, indexes and web pages [5][6]. A Grid service that is accessible within the portal. A distinctive feature of our grid portal is, a user navigates to the portal page, and afterward, the portal presents the appropriate applications that the user may interact with, derived from their identity and the authorization policies [12]. Like this, a virtual organization may be formed. The Grid is a mixture of network infrastructure and software framework distributing computing services based on distributed hardware and software resources [15].

We are using Netbeans IDE platform to create web service because it provides an integrated Development Environment for Java (Desktop and Enterprise) and Service Oriented Architectures. SOA concept can build upon and evolving from older concepts of distributed computing [13] and modular programming.

For the authoring environment, we have built a web services (Fig. 2 represents the diagram) for creating, editing and sharing knowledge as called as web services portal using java native. In grid portal service, we create schema Web Service Definition Language (WSDL) using tools such as Neatbean IDE, GlassFish as web engine, C compiler and Parallel Virtual Machine (PVM). After finish, students can access web service portal from a server as called as distributed or grid Computing.

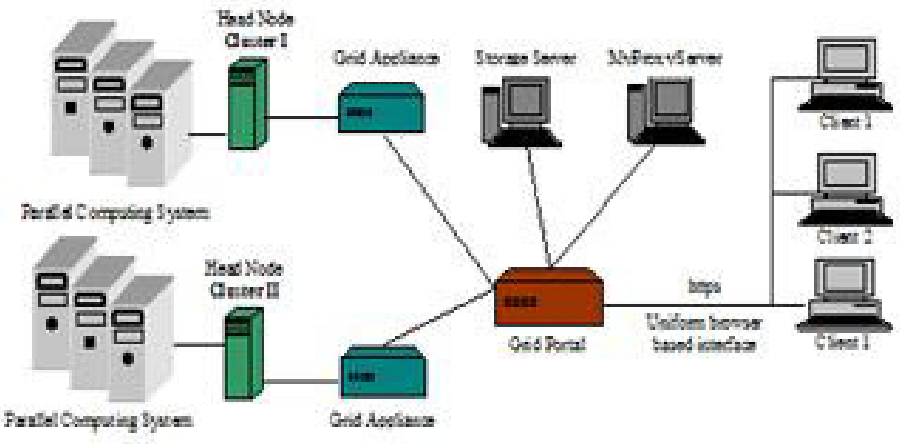

Fig. 1: Grid portal technology with parallel computing system

Grid portal supports a framework to provide a web service interface to the existing applications without having to write extra code or modify the existing web services.

2.1 Web Services Technology

Web programming is the design and construction of a program, example an “applet”, to perform a task on a web page. In the web services development, some concept on GUIs, concurrency; event handling; graphics; network communication; and software engineering techniques and tools are exploited.

For this kind of relationship, we choose service-oriented architecture (SOA) style. Each web services are easily maintainable since there is loose coupling between interacting nodes. The development of this architecture is based on several programming language as it involves algorithm implementation on C, parallelization using Parallel Virtual Machine (PVM) and Java for web services development. The grid computing platform is an open source-based and will be develop under Linux environment. The platform development will increase the acceleration and scaled-out across a virtualized grid. The clusters of processors involved in this platform are developed on increasingly larger computational hardware with inexpensive architecture [16].

Web authoring environment Design: This document will discuss the web interface architecture and its process flow diagram. Web Architecture of Web authoring environment is shown in Fig. 2. The above figure (see Fig. 1) is the general web architecture for enabling efficient grid portal authoring environment for Internet as well as Intranet. Norma server cluster consists on n-number of servers connecting together with a central hub. One of the servers will be the master server as well as the Web server. Once the web server is running, depending on network setup, all users such as government departments, home offices and universities can access authoring web portal service [11].

The following is the list of item involved:

- A web browser
- Infrastructure Component (LAMP - Linux Apache MySQL PHP)
- PHP scripting.
- An Apache web server (free on LINUX machine)

- PERL-CGI (A PERL script running in Apache CGI-BIN directory)
- HTML pages (One plain HTML page – input.htm, One embedded HTML page in PERL-CGI script)
- PVM, MPI, C programs (Sequential and Parallel architecture)
- An open source grid portal software.

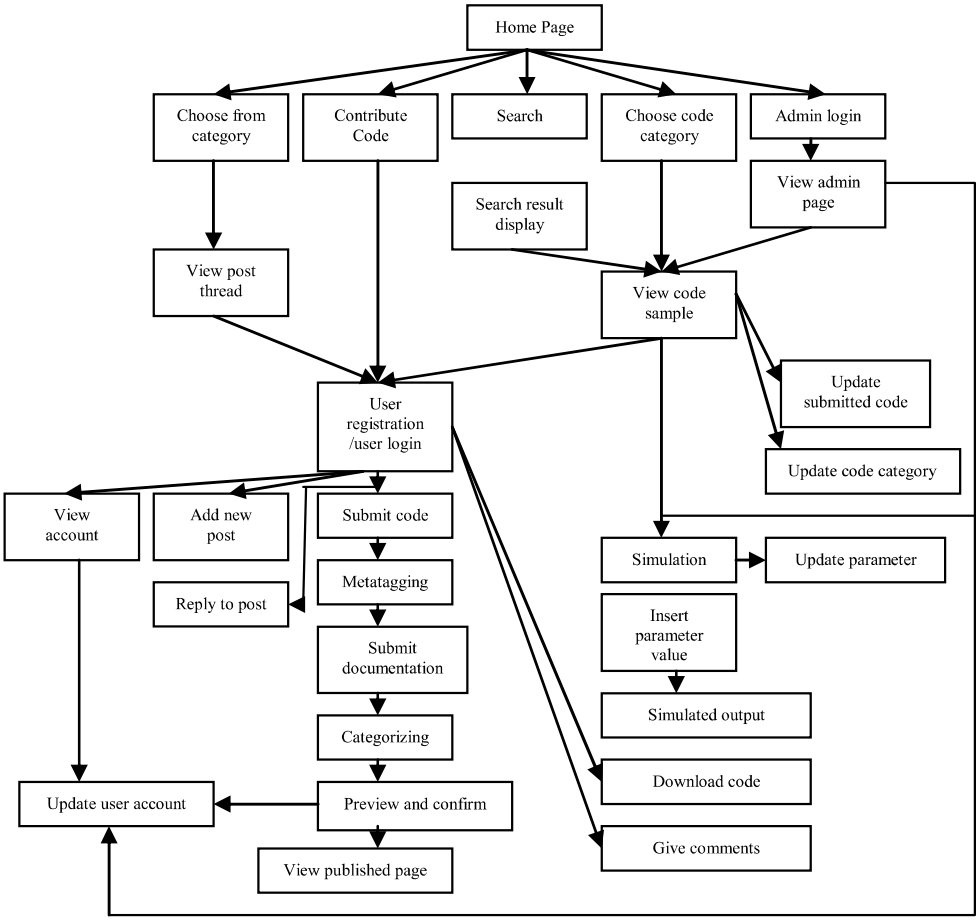

Fig. 2: Overall diagram of one web service of a grid based web portal

3. Web Service Paradigm

The web services provided the contents page which will present a synopsis of the selected subject. The user can then either follow a hypertext link to further comprehensive details. It'll provide a parallel programming exercise and the solution can be viewed after the user has completed the exercise. For the pioneer, user can retrieve a solution template. The web services covers most topics excluding domain decomposition technique, data parallelism, concurrency and domain and functional partitioning, message passing paradigm, performance measurements [4] and provide the some numerical libraries in exploiting parallelism for grand challenge applications for the authoring environment.

3.1. Authoring method

We are defining a complete set of generic authoring tasks at all three information layers (library, subject domain and course) that are supported correspondingly by the library engine, domain engine and course engine. There are number of composite actions such as delete all topics of a course, delete all concepts of a topic, delete all tasks of a topic, delete all concepts of a task or give value as to all the concept weights of a task, which can be implemented with a repetitive call to the atomic operation called delete topic and list all topics and the corresponding operations for task and concepts.

The interaction process between the course assistant and course engine is triggered by a set of common authoring tasks, such as create-new-course-structure, edit-existing- course-structure, delete-existing-course structure and copy-existing-course-structure. Each of them involve set of basic course-maintenance related tasks such as add/edit/delete topic, add/edit/delete task in a existing course structure, add/edit/delete concept in an existing topic or task, link/delete document to a topic or task. They, on the other hand, trigger a set of operations performed by the course engine over the existing course structures. The operations ensure data consistency by performing domain specific checks for conflicts. For instance, when the authoring task Add (To, CS) is performed by the author the course engine performs keyword search (both in the domain and in the course ontologies) on the entered topic expression. Then, the course assistant provides the option of manual editing options over those results. Next, the course assistant presents alternative views on the course engine results: (1) textual list of results with ranking according to their relevance to the search query, (2) graphical representation of the course trees with the matched concepts highlighted and (3) graphical representation of the domain ontology with the matched concepts (you are here indication). Within the same step the course engine also ensures the storage of the results for further reuse. Other possible course authoring tasks relate to document library and education metadata. They comprise: (a) Link a document to a topic, (b) Link a document to a task, (c) Delete a document from a task and (d) Delete a document from a topic.

4. Findings

The process of searching, saving, uploading, visualization has becomes extremely fast, reliable and precise with grid portal technology with parallel computing system. The parallel performance makes the product really attractive because of its high speed, efficient, effectiveness and high temporal performance algorithm [2] [3]. In terms of the performance of massive data execution, the result are also precise, highly convergence, stable and accurate to the exact solution.

4.1. Qualitative observations

The process of authoring of such concept based Web courseware for group works should include domain, course, and library authoring. By supporting the authoring activities further we aim at increasing the efficiency with respect to information reuse and collaboration between the course authors.

There are three main modules in AIMS authoring environment: Domain editor, Library editor, and Course editor [3].

The *Domain editor* allows the author to perform functions, such as add, delete and update domain terms and links between them, in order to construct a domain concept map structure. The editor facilitates the full description (name, definition and classification in the concept mapping hierarchy of terms) of domain terms and

the links between them. The editor also allows the author to create new types of links and to create links between a domain term and existing documents in the AIMS library.

The *Course editor* provides the author with a framework to define the structure of tasks and topics for a course. One course can consist of several topics and each topic can have several tasks. The author constructs this structure on the basis of domain terms and direct links from them to the library documents. This way s/he ensures a link between the course structure and the appropriate course material.

The *Library editor*, as most of the library systems, enables the maintenance of information collections. In this case the Library editor provides access to all the information and data related to different courses and domains. The novel feature here is the task- and use-oriented description of documents, by including instructional and presentation formats within the description of each document.

5. Discussion

In pure collaborative authoring, each author takes over an authoring sub-task(s). When each author accomplishes the sub-task(s), the group goal is reached and collaborative mutual interdependent authoring is achieved.

In the wider spread cooperative authoring, authors just reuse each other materials, style, learning goal settings, dictionaries, linking and sequencing, etc. The primitive interaction activities among participants during both cooperative and collaborative authoring, from a macro granulation perspective, are as follows (listed in their order of priorities):

1) Planning/Execution/Creation
2) Coordination/Control
3) Initiative/Supervision
4) Observation/Suggesting
5) Data/Idea sharing
6) Dialogue (with Interaction)

This research will provide the following benefits to students and participating universities:

- Facilitate and support work group students in their design and developing a courseware.
- The successful application of authoring activities environment through grid technology provides enhancements in work group performance, helps to lower cost, and encourages innovation.
- Learners and faculties can promote the exchange of ideas, information, knowledge, and joint research and development of Web-based teaching materials.
- Help member universities build a network of facilitators to support e-learners (forum with advanced Information and Communication Technology (ICT), i.e., with the use of massive parallel processors of globally distributed and yet interconnected mini-supercomputers through global neural computer network).
- Researchers can partner with colleagues in more advanced faculties, and perform joint collaborative research and development with the use of the emerging global GRID computer networking technology.

6. Conclusion

A convenient mode of obtaining most of the intrinsic worth of Web-supported or Online Supported teaching and learning for the huge quantity of institutions that does not necessitate extremely high investments concerning

the infrastructure of Internet is being applied as Grid Portal for education especially teaching and learning environment. The deployment of such a Grid portal environment is being on processed in the University Technology Malaysia. The grid portal technology with parallel computing system represents an effective upgraded approach to deploy C and JAVA programme code applications as Grid services. The more pervasive take-up of Grid technology requires high-level Grid application environments where users can easily create complex Grid workflows including different Grid enabled applications. The user only has to provide several mandatory parameters to an HTML pages in PERL-CGI Scripts based Code Interface Description File and PERL-CGI enables the code application to be run from a Grid service client. All these C and JAVA programme codes were executed from a single workflow and the execution output was visualized by the portal. We believe that, the accessibility of such a grid portal environment has the capacity in advancing the quality of teaching and learning significantly. Based on the strong foundations, hopefully the users are ready to apply their knowledge, creativity and leadership to fulfil the need of their future career development.

Acknowledgements

The authors gratefully acknowledge the financial assistance from the Research Management Centre (RMC), UTM as well as Universiti Teknologi Malaysia in providing the facilities for the research.

References

1. Begoña Ferrero, Maite Martín, Ainhoa Alvarez, Maite Urretavizcaya and Isabel Fernández-Castro, Authoring and Diagnosis of Learning Activities with the KADDET Environment, Journal of Universal Computer Science. 11 (9) (2005) 1530-1542.
2. D. Dicheva, L. Aroyo, A. Cristea, Collaborative Courseware Authoring Support, CATE'02, ACTA Press, (2000) 52-57.
3. D. Garrison, W. Archer, A transactional perspective on teaching and learning: A framework for adult and higher education, ISBN-13: 978-0080437804, 1st edition, Elsevier Science, 2000.
4. K. Illeris, The three dimensions of learning, Roskilde University Press, Denmark, 2002.
5. G. Wells, Dialogic inquiry: Towards a sociocultural practice and theory of education, Cambridge University Press: US, 1999.
6. Fran Berman, Geoffrey Fox, Anthony J. G. Hey, Grid computing: making the global infrastructure a reality, John Wiley and Sons, ISBN: 9780470853191, 2003.
7. J. Tourino, MJ. Martin, l. Tarrio, M. Arenaz, A grid portal for an undergraduate parallel programming course, IEEE Transactions on Education, 48 (2005) 391-399.
8. Z.L. Ye, G.N. Qi, XJ. Gu, Z.G. Bao, Y.D. Qian, A cooperative process-management system based on the manufacturing grid, International Journal of Computer Integrated Manufacturing, 20 (2007) 244-253.
9. Ditu Soni, Jyotsna Sharma, Role of grid computing in Indian education, in Proc. of the 12th WSEAS International Conference on Applied Mathematics, Cairo, Egypt, 2007, pp. 417-423.
10. Chao-Tung Yang, Hsin-Chuan Ho, An e-Learning Platform Based on Grid Architecture, Journal of information science and engineering. 21 (2005) 911-928.
11. Mark Baker, Rajkumar Buyya, Domenico Laforenza, Grids and Grid technologies for wide-area distributed computing, *Softw. Pract. Exper.* 32 (2002) 1437–1466.
12. Kacsuk, P., Goyeneche, A., Delaitre, T., Kiss, T., Farkas Z., Boczko, T., High-Level Grid Application Environment to Use Legacy Codes as OGSA Grid Services, In Proc. of Fifth IEEE/ACM International Workshop on Grid Computing (GRID'04), 2004, pp. 428-435.
13. Jakob, the POVBench Parallel Processor Benchmark. Retrieved (March 3, 2004), from http://www.haveland.com/ index.htm?povbench/index.htm
14. Thomas, M.P., Burruss, J., Cinquini, L., Fox, G., Gannon, D., Gilbert, L., von Laszewski, G., Jackson, K., Middleton, D., Moore, R., Pierce, M., Plale, B., Rajasekar, A., Regno, R., Roberts, E., Schissel, D., Seth, A., Schroeder, W., Grid Portal Architectures for Scientific Applications. Journal of Physics: Conference Series 16, (2005), pp. 596–600.
15. Bing Wu, Matthew Dovey, Muan Hong Ng, Kaihsu Tai1, Stuart Murdock, Hans Fangohr, Steven Johnston, Paul Jeffreys, Simon Cox, Jonathan W. Essex and Mark S.P. Sansom, A Web / Grid Portal Implementation of BioSimGrid: A Biomolecular Simulation Database, Journal of Digital Information Management. 2 (2) (2004) 74-78.
16. Zamoya, A.Y., Parallel and Distribution Computing Handbook, McGraw Hill, 1996.