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Massive Open Online Content based e-Learning System using Peer to Peer Network Technology

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Abstract: In conventional educational methodology the speed in the transmission of knowledge has gone through a rapid transformation. An excellent example is web based learning which has broken through the restrictions of time, space and financial constrains. In recent years it has become one of the most popular teaching methods. SCORM (Sharable Course Object Reference Model) the most popular web based learning standard has been adapted from many differing web based learning platforms. Normally, courseware meeting SCORM standards is sharable with other web based learning platforms. Most web based learning platforms however are unable to share courseware directly on the Internet. With this in mind, we have employed one type of peer to peer computing technology in order to achieve this. This technology allows the integration of different SCORM platforms into a huge web based learning environment.

Keywords: *MOOC; Web Based Learning; e-Learning; Peer to Peer Computing; SCORM*

Introduction

Distance Education is a very effective method of learning. The advantage of Distance Education is that it can overcome the obstacle of geographical location; making students on remote sides feel that they are at the incidence like being in the environment of attending classes in a classroom. With the swift development in internet technology and infrastructure, real-time transmission of high-quality video and audio has become possible. Because of these significant transitions, conventional methods of school education have also followed this trend. A good example is in web based learning which has become one of the most admired teaching methods. An increasing number of educational institutions and organizations are setting up web based learning platforms for their students and employees. A web based learning platform requires a Learning Management System, to store and manage the teaching content [1]. The Learning Management System plays two important roles which are, to deliver the desired courseware when and as needed and also to track the reactions and responses of a learner. However, every Learning Management System platform runs its Own learning materials and cannot be exchanged with another Learning

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Management System. This makes web based learning resources unavailable for sharing which doesn't make it very resourceful.

In late 1997, the U.S. government launched an interactive technical standard; known as SCORM (Sharable Course Object Reference Model) [2] SCORM aims to establish a mechanism to make courseware reusable and acceptable in different Learning Management Systems. Courseware meeting SCORM standards is sharable with other Learning Management Systems. The problem that now arises is that almost every individual Learning Management System does not have the capability to share courseware directly with another Learning Management System. The main reason is due to the lack of a reliable and handy courseware sharing system. Sharing of web based learning platforms is also possible using access grid [3] and data grid technology but because of the high implementation cost of the grid technology, in this research, we have used peer to peer technology to set up a courseware-sharing platform, where courseware can be reused and shared successfully.

Background

A peer-to-peer (or P2P) computer network uses diverse connectivity between participants in a network and the cumulative bandwidth of network participants rather than conventional centralized resources where a relatively low number of servers provide the core value to a service or application. P2P networks are typically used for connecting nodes via largely ad hoc connections. Such networks are useful for many purposes. Sharing content files containing audio, video, data or anything in digital format is very common, and real time data, such as telephony traffic, is also passed using P2P technology.

A pure P2P network does not have the notion of clients or servers but only equal peer nodes that simultaneously function as both "clients" and "servers" to the other nodes on the network. This model of network arrangement differs from the client-server model where communication is usually to and from a central server. [4]

An important goal in P2P networks is that all clients provide resources, including bandwidth, storage space, and computing power. Thus, as nodes arrive and demand on the system increases, the total capacity of the system also increases. This is not true of client-server architecture with a fixed set of servers, in which adding more clients could mean slower data transfer for all users.

The distributed nature of P2P networks also increases robustness in case of failures by replicating data over multiple peers, and -- in pure P2P systems -- by enabling peers to find the data without

relying on a centralized index server. In the latter case, there is no single point of failure in the system. [4]

Peer to Peer Architecture

The peer-to-peer architecture is a way to structure a distributed application so that it consists of many identical software modules, each module running on a different computer. The different software modules communicate with each other to complete the processing required for the completion of the distributed application. One could view the peer-to-peer architecture as placing a server module as well as a client module on each computer. Thus each computer can access services from the software modules on another computer, as well as providing services to the other computer as shown in fig 1.

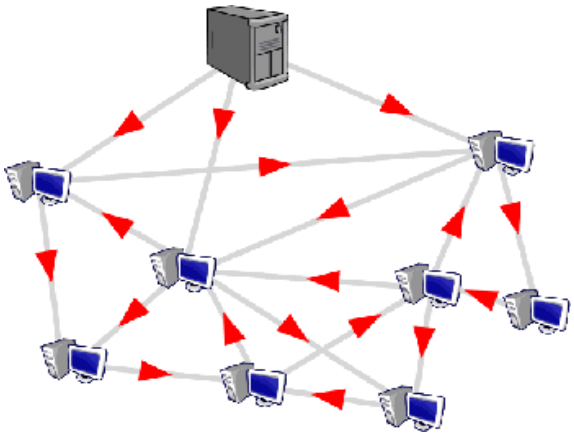


Fig 1: Peer to Peer Network

However, it also implies that the discovery process in the peer-to-peer architecture is much more complicated than that of the client-server architecture. Each computer would need to know the network addresses of the other computers running the distributed application, or at least of that subset of computers with which it may need to communicate. However, this problem can be solved by using both centralized and decentralized peer to peer networks, in which each peer is registered with the peer indexing server. The combined processing power of several large computers could easily surpass the processing power available from even the best single computer, and the peer-to-peer architecture could thus result in much more scalable applications.

SCORM standard and Web Based Learning

In conventional web based learning systems, each of the learning platforms and the courseware had a different method of communication as they had different programs and API functions. To overcome this problem SCORM standard is used.

In SCORM two main frameworks are defined:

1. CAM (Content Aggregation Model),
2. RTE (Run-time Environment) [5].

CAM produced courseware is based on the principle of being sharable, reusable, and interoperable. This main framework comes with three major elements: content model, metadata and content packaging. In content model, the courseware is defined with content objects with the elements being properly arranged before becoming a course for reuse, also known as SCO (Sharable Content Object). The elements in SCO are known as assets (such as html files, graphic files or multimedia files.) Metadata files are used to describe information on the courseware through XML [6]. Through the description of courseware and the elements made by metadata, we can further manage the resources of the course. Content packaging uses the Manifest XML files to arrange and pack SCO as the framework of the course.

In SCORM, the RTE (Run-Time Environment) is built to overcome above communication problem. The RTE is a simple Client-Server relationship. Client end is the browser and the API Adapter is provided by LMS which plays a key role to successful communication between LMS and the courseware. At the same time, it is responsible for relay and reception of information between the Client and the Server.

System architecture

In Conventional Learning management system, as shown in fig 2:, where we will see that all courseware are in the courseware Repository. If the learner logs onto LMS for a lesson, all of the courseware available would be in the Local LMS. Although courseware meets SCORM standard and can be running in every LMS it is still inconvenient sharing courseware between multiple LMS because of the lack of a fast, safe and secure mechanism.

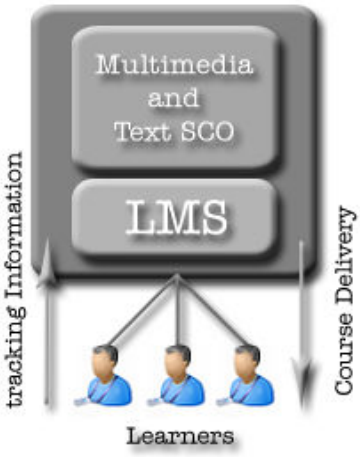


Fig 2: Conventional LMS

Our system which is based on peer to peer technology consists of a WBLS (Web based learning system) Main Server. The purpose of the WBLS Main servers is to register peers/learners and store standardized courseware. It also stores client application (customized web browser) and the LMS software. The WBLS Main Server comprised of a Web Portal, Courseware Catalogs, Peer Location Service and Courseware repository as shown in fig 3:

Web Portal: It is an interface for peers and learners to interact with the WBLS Main server.

Courseware Catalogs: Lists various courses offered by our web based peer to peer learning system.

Peer Location Service: Within our web based peer to peer learning system, the Peer Location Service plays a vital role by displaying a list of peers which is based on a comparison feature between peers hosting the same courseware based on peer traffic load.

Courseware Repository: It stores both text as well as multimedia courses.

Client Application: It is a customized web browser which interacts with the peer for lessons. The basic purpose of client application is to display the courses delivered by the peer. It also stores information about the peers.

LMS Software: It is learning management software installed at peer end. This software delivers courses to the learner and it also keep track of the progress of the learner.

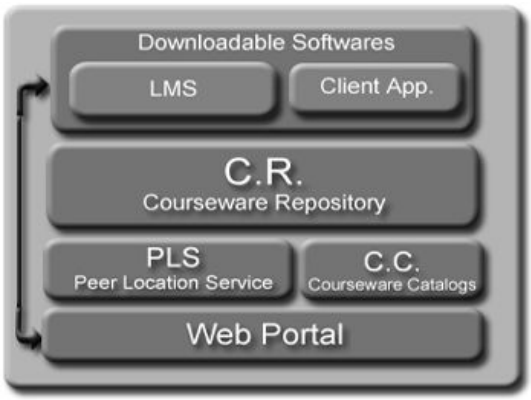
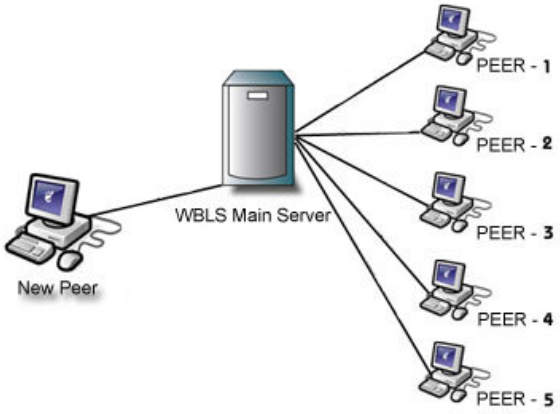


Fig 3: Structure of WBLS Main Server

Peer Registration and Downloading Courseware:

Our web based peer to peer learning system requires every peer to register with the system. After registration the peer has to download LMS software and the desired courseware as shown in fig 4.



The peer is provided with the list of the courseware that it can host on its own machine. After selecting the courseware the WBLS Main Server provides the downloadable links of the courseware. The peer can download courseware either from a peer hosting the desired courseware or from the WBLS Main Server (if no peer is found).

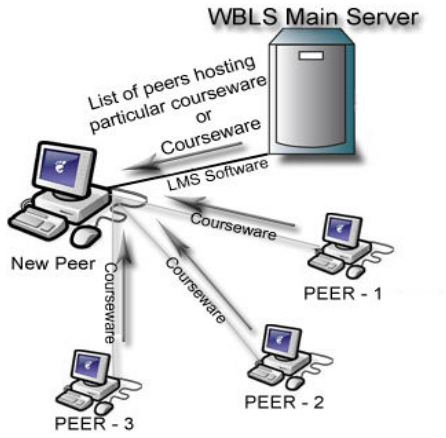


Fig 4: New Peer Downloading Courseware

Learner Registration

Our web based peer to peer learning system requires every learner to register with the system. After registration the learner has to download client application (customized web browser) which interacts with the peers, hosting the LMS software and courseware, for classes as shown in fig 5:

Fig 5: Downloading Client Application

Learning Process

To start the learning process the learner has to login into the WBLS Main server using the username/password. After successful login the learner can select the desired course from the courseware catalog. After selecting the course the Peer Location Service (PLS) will display the online peers currently hosting that courseware. If more than one peer hosting the same courseware exists, the Peer Location Service will display the sorted list based on peer traffic load (peer with less traffic will be at top of the list).

After selecting the peer from the search result the learner can establish a connection with the desired peer. The LMS software downloads the learner's progress from the WBLS Main server and delivers the courseware at the client-end accordingly; the client application will then display the courseware. The LMS software keep track of the progress of the learner and it also uploads the learner's progress to the WBLS Main Server.

Special Case: If the WBLS Main Server is down then the learner, using client application, can establish connection with the previous peer, as the peer information is maintained at the client end, and continue the learning process. Next time when WBLS Main Server is online the previous learner progress is updated at the Main Server.

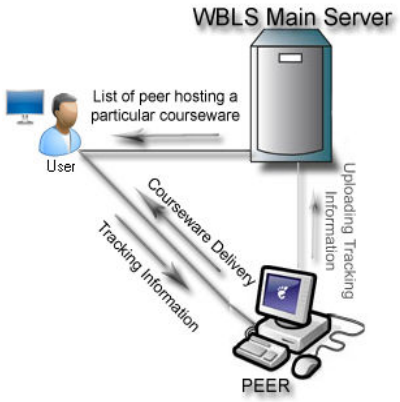


Fig 6: Learning Process

Conclusion

This research aims to merge the technology of Peer to Peer with that of SCORM using centralized peer index server (WBLS Main Server). As long as each and every peer has the LMS duly installed and tested and the courseware meets the SCORM standard, an environment in peer to peer architecture for sharing of courseware would be available. Learners can learn more courses without having to be affiliated with other LMS. A huge amount of software & hardware equipment purchasing expenditure can be saved. It basically acts as a communication facilitator. So, you can use it for academics also.

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