Implementation of A Collaborative E-Learning Environment On A Linux Thin-Client System

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Abstract

The advances in electronic technology have created opportunities for new instructional designs to be developed. Since Knowledge is expanding at a tremendous rate, these designs make it easy to impact the necessary knowledge (both practical) on people to enable them survive in a competitive environment. The Collaborative E-Learning Environment as an important group learning mode sets a goal of convenience and an adaptation into our technologically advanced society. It emphasizes the communication and information sharing among group members. Implementing this collaborative e-learning environment on a Linux thin-client system makes it possible for this environment to be available in most schools and companies because the Linux thin-clients are less expensive than other conventional computing systems. Developing a Collaborative E-Learning Environment on a Linux Thin-Client System provides a means of delivering an improved quality of education in our society. This paper involves the setting-up of Linux Thin-Client system, installing the appropriate applications necessary for this environment, and developing the interactive portal that will enable registered users to have access to the appropriate collaborative tools.

1.0   Introduction

Students learn best when they are actively involved in the process. Researchers report that, regardless of the subject matter, students working in small groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats. Students who work in collaborative groups also appear more satisfied with their classes.
Learning is enhanced when it is more like a team effort than a solo race. Good learning, like good work, is collaborative and social, not competitive and isolated. Working with others often increases involvement in learning. Sharing one's ideas and responding to other peoples ides, improves thinking and deepen understanding [3].

The term collaborative learning has been used in two different senses. In one sense, some have treated collaborative learning as a distinctive form of socially based learning that is fundamentally different from prevailing psychological formulations. Another way to think about collaborative learning is not as a type of learning at all, but rather as a theory of instruction [4].

[2] defined collaborative learning as "a re-acculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to ".Collaborative E-Learning Environment" is a collaborative, convenient, adaptive, and productive learning environment which allows different participants to communicate and coordinate with each other in a productive manner. Productivity and efficiency is obtained through synchronized communication between the different coordinating partners [8]. Within this process of synchronized communication,

coordination can be accomplished by voice communication through video/voice conferencing, chat tools, share desktop and share applications [6]. Consequently, understanding the ideas and the techniques behind synchronized communication can be of great significance in the development of a Collaborative E-Learning Environment.

In this paper, a collaborative e-learning environment was developed on a Linux thin-client system, to allow communication between students and tutor(s). The operating system used is Fedora Core Linux. 2xThinClientServer software was installed on all the systems, and it was configured as a master server. A username and password was supplied to enable connection from the master server to MySQL database. After which the software that contains all the tools needed in the collaborative environment was installed. This software is the Global Communications Network (GCN) software.

The Mozilla Firefox web browser was set on the server to popup with the URL to the portal services. This was achieved by writing a bash shell script that ran at systems start-up. A user must log in to the portal before he/she can have access to the lectures going on, lecture notes, and interact with other students that are equally logged on to the collaborative e-learning environment.

2.0 Review Of Relevant Concept

The Linux thin-client technology is the system upon which collaborative e-learning environment is developed. Linux thin-clients have proven to be extremely reliable because tampering with settings are virtually non-existent, and in addition, an educational institution will also gain more control over how their students are using computing resources and access to data. Linux thin-client is distributed under the General Public License (GPL), meaning it is free.

A thin-client (sometimes also called a lean or slim client) is a client computer or client software in client-server architecture networks which depends primarily on the central server for processing activities, and mainly focuses on conveying input and output between the user and the remote server. Thin-client can also be said to be a generic name for client machines on networks that deliver applications and data via a centralised computing model with the majority of processing carried out by the server(s). This is also known as server-based computing [1]. Typically, the thin-client terminal sends key strokes and mouse clicks to the server and the server sends screen updates to the terminal device Because of its flexibility and cost effectiveness, thin client has been empowering schools, businesses, and organizations all over the world. Thin-client technology has high data security, low-maintenance, and terminals are less likely to be affected by virus because by default users are unable to tamper with settings [5]. Moreover, the entire system is simpler and easier to install and to operate.

Linux Terminal Server Project (LTSP) is a free and open source add-on package for Linux that allow many people to simultaneously use the same computer. Applications are run on the server with a terminal known as a thin-client (also known as an X terminal) handling input and output. Generally, they are low-powered, absence of a hard disk; produce less noise than standard PCs, less prone to problems because they have fewer moving parts and no installed applications, as such producing a pleasant learning environment.

Server-Based Computing (SBC) is a technology whereby applications are deployed, managed, supported and executed on the server and not on the client. Only the screen information is transmitted between the server and client. This architecture solves the many fundamental problems that occur when executing the applications on the client itself.

SBC environments hardware and software upgrades, application deployment, technical support, data storage and backup are simplified because only the servers need to be managed. Data and applications reside on a few servers rather than on hundreds or thousands of clients [7].

3.0   Problem Definition

It is important to note that the economic survival and development of a nation

depends on the productive capacity of the citizens, which depends on the kind of training and education the individuals receive from the educational sector in a nation. The problem of poverty has been used in most societies as an excuse and a reason why quality training and education is not given to students in most schools and organizations. This paper provides a way of providing information, bridge communication gap between people, and also training at a cheaper and less expensive rate.

4.0 Design For The Collaborative E- Learning Environment
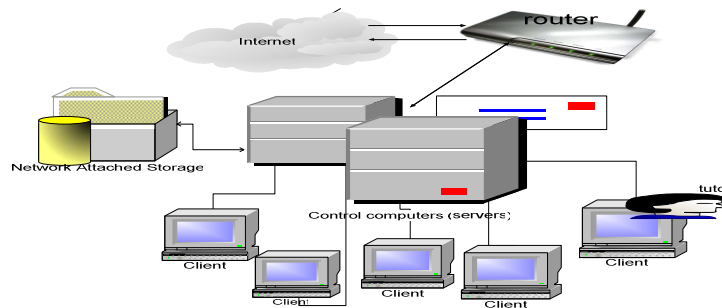

Figure 1: Design for Collaborative E-Learning Environment

Figure 1 illustrates a design for this Collaborative E-Learning Environment.

The control computers (servers) consist of the following: mail server, print server, Domain Name System (DNS) server, Dynamic Host Configuration Protocol (DHCP), Network-Attached Storage (NAS), and the server that serves the thin-clients with the user applications.

Client: These are the students, administrative staffs, and academic staffs. Also the tutor can be an e-tutor.

DHCP Sever: This is the Dynamic Host Configuration Protocol sever. It is used basically to dynamically allocate IP addresses to systems whose IP addresses are not statically configured. It is used mainly for fat clients that will be attached to the network, that is, in cases where some students or staff come with a laptop.

DNS Sever: The Domain Name Service/System (DNS) sever is used to translate domain names into IP addresses.

Print Server: This server manages the shared printers.

Network Attached Storage (NAS): This is the file server, and it is dedicated to file storage. This is mainly where the electronic books and research materials will be stored.

Domain and Cooperate Mail Server: This server manages the domain and cooperate mail of staffs.

Firewall and Router: This server is the gateway which controls asses to and from the network.

5.0 Developing The Collaborative E-Learning Environment

After choosing the server hardware (the control computer), the Fedora Core Linux OS distribution was installed. After which the 2x ThinClientServer software was installed.

The 2X ThinCientServer is configured before starting up its services. This is done by opening the terminal as root (super user) and running the following commands:

2Xthinclientserver_conf.sh

In the first part, the configuration script detects whether all necessary tools are present on the system. Then it 'backs up' the current configuration files for safe keeping. The license agreement is then reviewed and accepted to continue.

Next, the network and security setup is probed. The total number of network interfaces installed on the machine is shown.

```
Please choose from the following menu entries:
*************************************************

1) Configure as a master server.
2) Join server as a slave in a farm.


Please enter a number []: 1

Building network configuration per service ...

The following credentials shall be used to secure the local MySQL database ...
Please enter a user name []: admin
Please enter a password:
Please confirm the password:

Please enter the master host name/IP [geoffrey]:
Please enter the master internal IP, as seen by the thin clients [172.19.0.40]:
```

Figure 2: Master or Slave Menu

Since our server was configured as a master server, there was a prompt for a username and password to connect to the local MySQL database. The following information was also asked for:

Master server host name or IP: This is used by the slave servers, to communicate with the master server. Please note that hostnames are resolvable by all slaves. Internal IP address, as seen by the thin clients: This IP is used by the thin clients to communicate with the server.

After entering all the information, the details were reviewed before proceeding with the configuration. After this phase, individual services were configured. The Apache and MySQL services, including all other services are started and the script exits. These lead to the configuration of the consoles and settings for direct connection to the terminal server. Settings were applied to individual thin client, by username, by group (effectively capturing all the members of the group).

The next step was installing the software that was used in the collaborative environment. This software is the Global Communications Network (GCN) software. It contained all the tools that were needed in the environment. These tools consist of: E-mail, Chat Rooms, Private Messages, Games, a Web Browser, Popup-blocker, Profiles, Message Boards, Desktop Sharing, MSN, Yahoo, Voice Chat Rooms, Video Conferencing, Language Translation, File Transferring, Whiteboards and a Media Player.

The interactive portal was created using the Hyper Text Markup Language (HTML). This portal enabled the users of the collaborative e-learning environment to have access to the needed tools.

1   6.0   Implementation, Methodology and Updates

After 2X ThinClientOS has booted from the client's hard disk, it obtains the IP address of 2X ThinClientServer from the network settings returned by the 2X DHCP Helper Service.

Figure 3: 2X ThinClientOS booting up

It now prompts for the username and password.

Figure 4:Log on screen

Acknowledgement

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