

FULLY AUTOMATED DISKLESS DEPLOYMENT FOR UNIVERSITY'S LAB

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ABSTRACT

In universities, the computer machine and computer lab seem to be very necessary for learning and studying in terms of practical skills. It was found that 1) There are more and more students who are in need of such computers for their computer-related study. 2) More budgets are needed for hard disk drive maintenance caused by electricity problem and incorrect usage. 3) Incorrect way of data editing. 4) No virus-protection program is set up or no program updated. 5) Too complicated way of hard disk drive's management in computing center. 6) New developed software is not supported by old original operation system. 7) Too complicated way of software selection is the purpose of learning and study. So this research offers how to resolve problem by introducing the Diskless System for Computer Laboratory (DSCL) which is the new standard of storing the data which enable the computer and network center to save, retrieve and send-receive the data with high-speed network. The system will allow the transmission of the covered SCSI Command through TCP/IP package, which is the main protocol, used widely for the time being. The idea of DSCL is that each machine of Client has no hard disk but will boot up from Local Area Network (LAN) and retrieve the image file which contain the Operating Systems and other data from server and are used as hard disk (similar hard disk). The DSCL is enabled the system controller to manage more efficiently the laboratory in universities, easier and quicker. The computing center's staffs can use this developed DSCL to manage and operate the system maintenance for helping users efficiently.

KEYWORDS: Fully Automated, Diskless System.

1. Introduction

Nowadays, it is found that, from the management of computing center in universities, technology is one of the factors in studying and teaching. Thus the instructors required the computer operation room (laboratory) to help in teaching and training the skills of instructors, staff and students, also help the instructors prepare the laboratory (lab) so that the students can practice by themselves. However, there are also some limitations, each computer is of the old model / version of operating system which cannot support some new software, so the instructors cannot use the new version software for their teaching. Also the incorrect way of using from the students and instructors, they have some effects with other software and thus cannot use in some courses. In some cases it will destroy the hard disk which dues to the unstable of electricity and without UPS. Then, the staffs of computing center need to change or upload the programs, kill the virus, and delete the data which are not required [1]. So the researcher has created some solution to help the users for using the computer more effectively. The Diskless System for Computer Lab (DSCL) is then developed. The DSCL is new standard of data storing which help the computing center in saving, retrieving and sending-receiving the data with high-speed network. The system will allow sending the SCSI Command through TCP/IP package which is the main protocol of the network [2, 3]. The working system of the developed DSCL is that the client machine will have no hard disk but it can be booted from the LAN card in order to connect the server and retrieve the image file which creates the data of the operation system including image file of other data to use as a replacement of hard disk (similar hard disk). The DSCL divides into 4 working parts which is: Server, client computer, network system and Diskless managing program. The DSCL is enabled the system controller to manage more efficiently the laboratory in universities, [4] easier and quicker. So it means that, by uploading the software on server only once, we can retrieve the data very quickly and very cost-saving for the whole labs. The objective of this research is to develop DSCL for labs in university.

2. Literature Review

Diskless System is the iSCSI (Internet Small Computer Interface) system which is the standard of storing the data and is newly developed by IEFT (Internet Engineering Task Force) and Microsoft. The ISCI is the standard that assists the organization to save and

retrieve the data from remote distance no matter where it is. It is the send-receive of data through high-speed network. The ISCI will allow the transmission of the covered SCSI command through TCP/IP package, which is the main protocol, used widely for the time being. Hence, the way of SCSI's works is the connecting to Disk Storage which the interface of connection is IDE or SATA [5, 6] (see Figure 1).

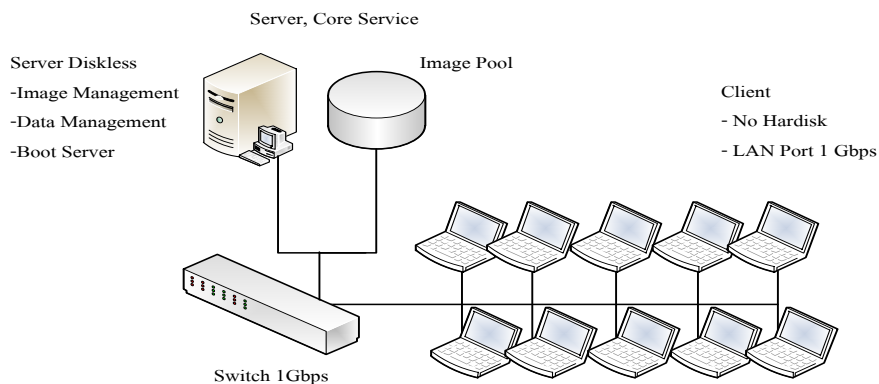


Figure 1 Diskless Network system Diagram

The basic duty of Diskless System is to simulate image file from server to become similar hard disk. When the client machine would like to write data, system will do it in temporary file. Normally, each client machine will have separate temporary file and system will clear or delete all new files every time when the client machine is booted. Diskless system function divides into two types: the first is Diskless (Network-Disk) or SAN Technology which makes use for the space of hard disk through network [7, 8], then the system can apply in computer center for university. The second is Diskless System (No Hard Disk) is the use of simulated hard disk through network, same as Network-Disk, but the operation happened through the server directly. Everything will be booted through Local Area Network (LAN). Steps of work start from ROM on LAN card, retrieve all files from server to boot to Windows [9].

3. Methodology

Following the waterfall model of the system development life cycle (SDLC), there are four steps in this research.

3.1 Requirement

1) The researcher has studied about how the diskless system works, also the architecture of the system, the design and the development of Diskless system. The findings of the adaptation of the use of Diskless system with Internet Café or on-line Games shop is that they went well with the design and development of DSCL.

2) It comes from the study of the open source software, the operation of Linux and the use of Python program in designing and the DSCL development.

3) Gathering of data, researching. Researcher has researched the requirements of users who are the system controller, instructors, and students.

3.2 System Analysis and Design

1) The researcher has analyzed and designs following DSCL system:

2) The design of the network construction of the DSCL system for university's laboratory (lab), showed as Figure 2 below.

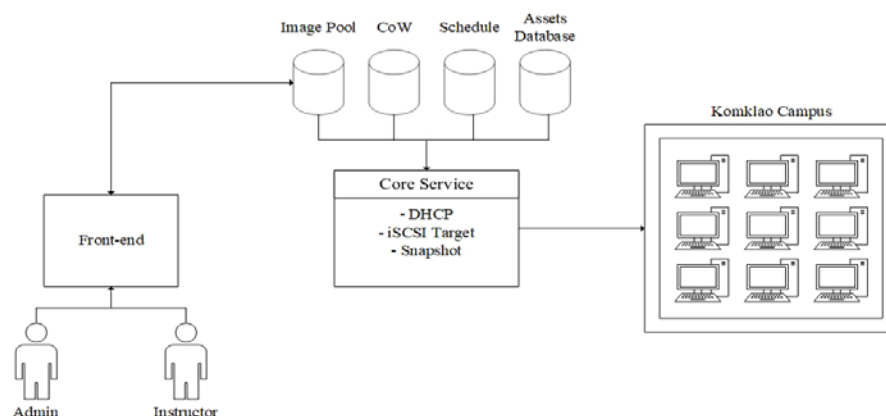


Figure 2 The network structure of the Diskless system

Figure 2 showed the network construction which simulates the computers in the lab at Kasem Bundit University. The network system will be in "TREE" by having fifty client machines and one server. Each client machine will be used by instructors and students, while server is used by the system controller.

3) Design of Use Case Diagram of DSCL system for university's lab, as shown in Figure 3.

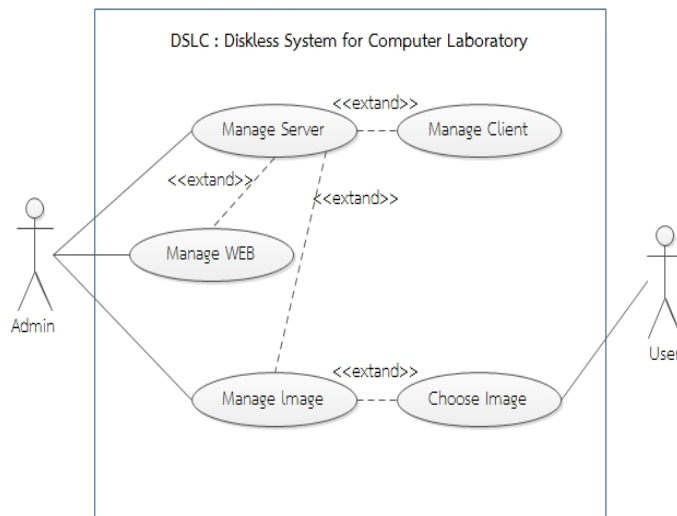


Figure 3 Use Case Diagram Diskless system

From Figure 3, the use case diagram of DSCL which consists of system controller (Admin) with following duties: Prepare Image Pool by storing the image of each course. When the client machine is opened, the server will distribute IP by using Protocol system, Dynamic Host Configuration Protocol (DHCP). The client machine will be loaded the image file (Snapshot) from Core Services which is inside the Image Pool by referring from MAC Address of the machine. System will check MAC Address that is connected at that time, and then checked that if any course is on duty (referring to course schedule) and system will distribute Image File to client machine. The instructor can adjust or modify the Image File through Front-end (Website) system.

3.3 Implementation

This step is to take the specific data of DSCL and to write a program according to the design set up. Then, it will test the program to check, if there is any error, and finally it will set up the system by setting the program, setting the tooling and preparing the manual and training course for related users, as shown in Figure 4 - 7.

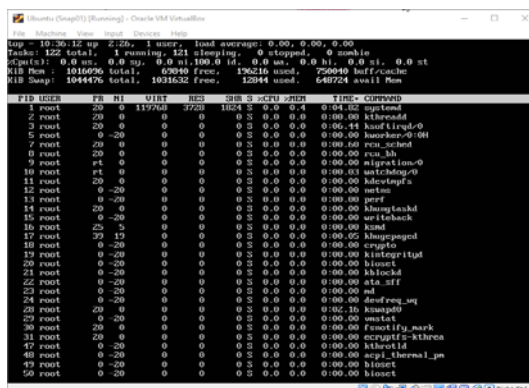


Figure 4 Install the Ubuntu system as a server

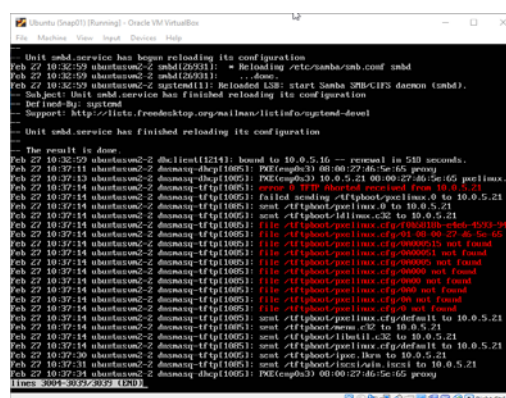


Figure 5 setups for using in Boot and Deploy Image files

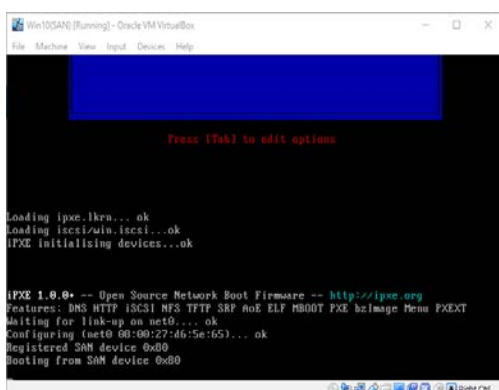


Figure 6 Boot Process from the SAN-based the MAC address



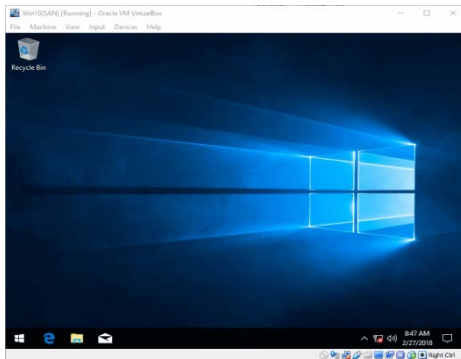


Figure 7 Boot Windows through SAN

3.4 System Validation and Maintenance

This step is to test the efficiency of DSCL. The researcher does the testing respectively by system engineering and tester team by dividing the test into 2 steps which are unit testing and integration testing.

Test case 1: the objective is to analyze the efficiency of hard disk in the system by using HD Tune Pro which is the program which works as Client-Server. The required client machine to test will Benchmark to see the efficiency of hard disk for read (Read) and Random Access [10]

The results was found that the efficiency of hard disk in system by the client machine that is required to test will benchmark to see the efficiency of hard disk for read. The results are shown in Figure 8. The test of Random access are shown in Figure 9.

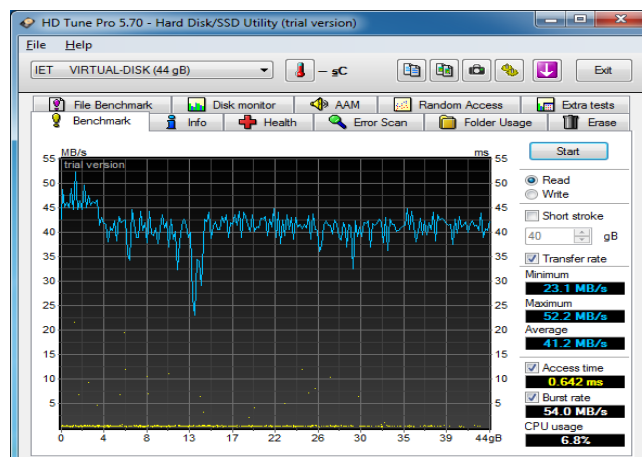


Figure 8 Performances Testing of Network Disk Readers

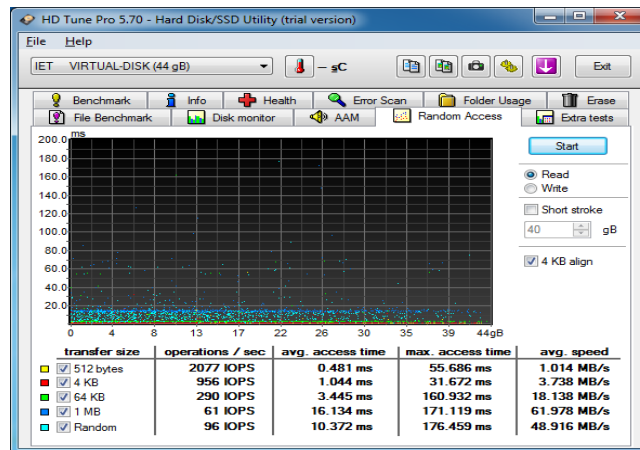


Figure 9 Random Accesses Testing of Disk

Test case 2: Objective is to analyze the efficiency of the system network. The test is to use 30 Client machines at the same time by creating batch file and keep it in startup of the client machines. After finish booting, Batch file will run and build up file with date and time indicated in Server. The result finds the efficiency of network in system after finished booting, referring from each client machine, which used the longest time, is shown in figure 10 and figure 11.

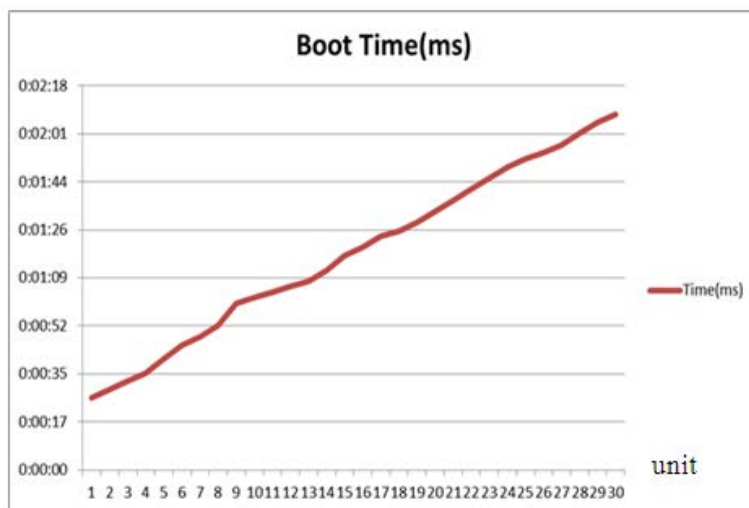


Figure 10 Graph with increasing rate due to the use of many client machines at the same time

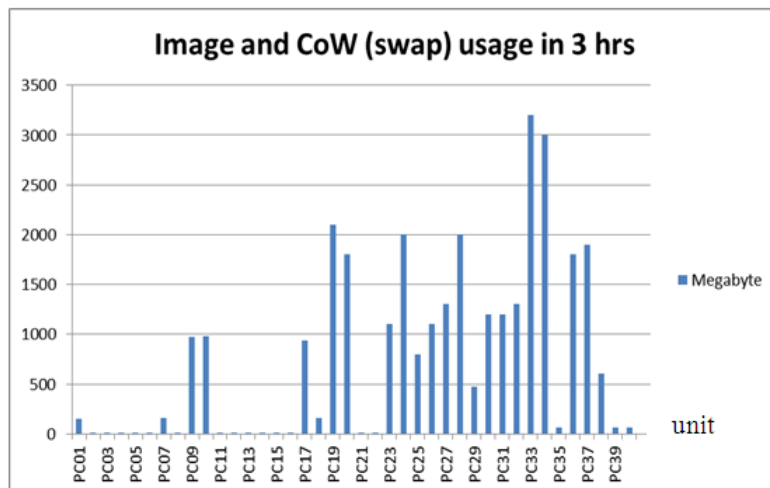


Figure 11 The traffic of each client machine

4. Results

The designed research and developed DSCL use in university's lab with following summary:

4.1 Conclusion of research

1) The developed system enables the instructors and students to use the lab which the system controller has prepared the data and software for each course, and this provides more convenience and reduces complication automatically.

2) The developed system enables the controller to manage the client machine easily and to reduce the problem of virus and duplication of work by 95%

3) The result of satisfactory survey is found that high rate of satisfaction. ($\bar{x}$ =4.03, S.D.=0.66)

4.2 Results clarification

The developed system enables instructors and students to use the lab which the system controller has prepared the data and software for each course and this increases more convenience and reduce complication in use. This research will be the future benefit for the management of the university, the management of computer & network center, to make decision for the adaptation of DSCL in lab. However, we should consider following factors:

1) Risk Reduction: Reduce the risk in storing the data and reduce the complication in use by switching to automatic system. 2) Cost Reduction: as much as 80%, thus reduce the expenses in buying the tooling for network 3) Performance: efficiency better than PC with faster booting speed and the use of any software. 4) Flexibility: flexible in working with other tools for data storing and other hardware servers.

4.3 Suggestions

1) The design and development of DSCL to use in university's lab in order to increase more efficiency to Diskless system, the user needs to set up the characteristics of the network tooling of the computer so that they have high efficiency. For example: server, client machine, network system, diskless program and operation system. If they choose Linux Operating System, it will have good points because it is the open source operation system but the weak point is that it does not support the billing program or any accounting program which normally works on Windows operation system. The solution of this problem may need to separate the machine from other server and uses as only the server on Diskless system. The good points on Windows operation system can be set up or used with other programs which need more help from server rather than just being a Diskless Server. For example: it can be both server which provides Diskless service and can be a billing machine or provide accounting system, but the weak point is that we have to pay for copyrights.

2) DSCL will depend all jobs on Server. So if anything happens to the server, all the client machines in system network will not be work immediately, so in order to play safe, we need to have another server or prepare any tooling for replacement for server in short time.

3) Although we do not need to buy hard disk for client machine, but we may have to spend more budget for server which will need high quality and more trustful hardware that can run the machine whole day and night.

5. Conclusions

The researchers design and develop the Diskless System for Computer Laboratory to use in university's computer operation center (LAB). The system can store, retrieve and send-receive data across the network in high-speed. The system will allow us to send the instruction which is covered, through package TCP/IP which is the main protocol of the

network system widely used nowadays. The developed system will enable students, instructors and system controller to manage the university's LAB efficiently. The university should consider following factors if they decide to use this system: 1) Safe purchasing budget. The diskless system does not need hard disk for client machine, so they can save a lot of budget to acquire hard disk. 2) Reduce the complication in managing the data, because the client machine will use the same data which is kept at server, so the data is the same. If we need to amend the data, just amend at the original file and it can be stored as back-up. 3) Reduce the expenses on maintenance. Normally computer will contain hard disk which may have some problems when used for some time. For example: problem of virus or defective on hard disk, thus have to set up operation system and programs which may take long time.

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