

Practical Solutions to Set and Maintain Multifunction Workshop Labs

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ABSTRACT

Computer workshop lab setting and maintaining are very challenge and almost a must in any tertiary educational institution. In general, a combined environment of teaching classroom and hands-on exercise will achieve better results. But the administration and maintenance of the labs become more difficult. With the increasing demands from different courses and effective management of the lab resources, we cannot afford to add more labs to meet the needs. The labs need careful planning through both management and new technologies. This paper describes our practice in the past few years in managing the multifunction workshop labs. The problems that we met are discussed first. Then some practical solutions are given. These solutions show how to employ the current hardware and software technology to improve the workshop lab maintenance. The solutions answered questions: how to quickly prepare the whole lab's computers? How to avoid the courseware conflicts? How to use the multifunction lab efficiently? How to provide a more flexible lab for students? These solutions are proved to be good, feasible and effective in improving the lecturers' teaching and students' studying. Any institutes and universities can easily implement the suggested solutions here.

Keywords

Network, classroom lab, operating system, lab maintenance.

1. INTRODUCTION

Computer workshop lab setting and maintaining are very challenge and almost a must in any tertiary educational institution. Our school offers variety of computing and information technology programmes. Qualifications range from introductory courses for beginners to the Doctor of Computing for professionals. We provide industrial training programmes as well, such as MCSE and MCSA. The school has three workshop labs. They are isolated from campus network because nearly all courses in the workshop labs are related to network configuration and operating system installation and configuration. To ef-

fectively manage the workshop lab and meet all the requirements we have done a lot of test and got some experience. As discussed by Agarwal, Critcher, Foley, Sanati, and Sigle, John (2001), and Belles (2002), we have to make fully use of the lab resources and cut down the cost. This paper outlines our practice from 2001 to 2004.

2. THE EXISTING PROBLEMS

Before 2001, we carefully analysed the courses and divided the courses in groups based on the operating systems. Then we use disk partition utility to make multiple partitions on a big disk and install different operating systems on the hard disk. We can install multiple hard disks on one computer as well. In this way, one computer can be set to contain more than one course. So each lab can be scheduled for a special group of courses. To make sure a particular course start smoothly, students and lecturer should choose the correct operating system or change the CMOS settings to boot.

Generally this setting is good. But it is not perfect for a student environment. We met the following problems.

First of all, the students often make mistakes and crash the system when they do some exercises, especially for the first year students. This will affect not only themselves but also students in other courses because they share the same hard disk.

Secondly, to recover the crashed system, a technician usually takes long time and needs to choose the suitable time to do it. If there is class in that lab the technician cannot enter the classroom.



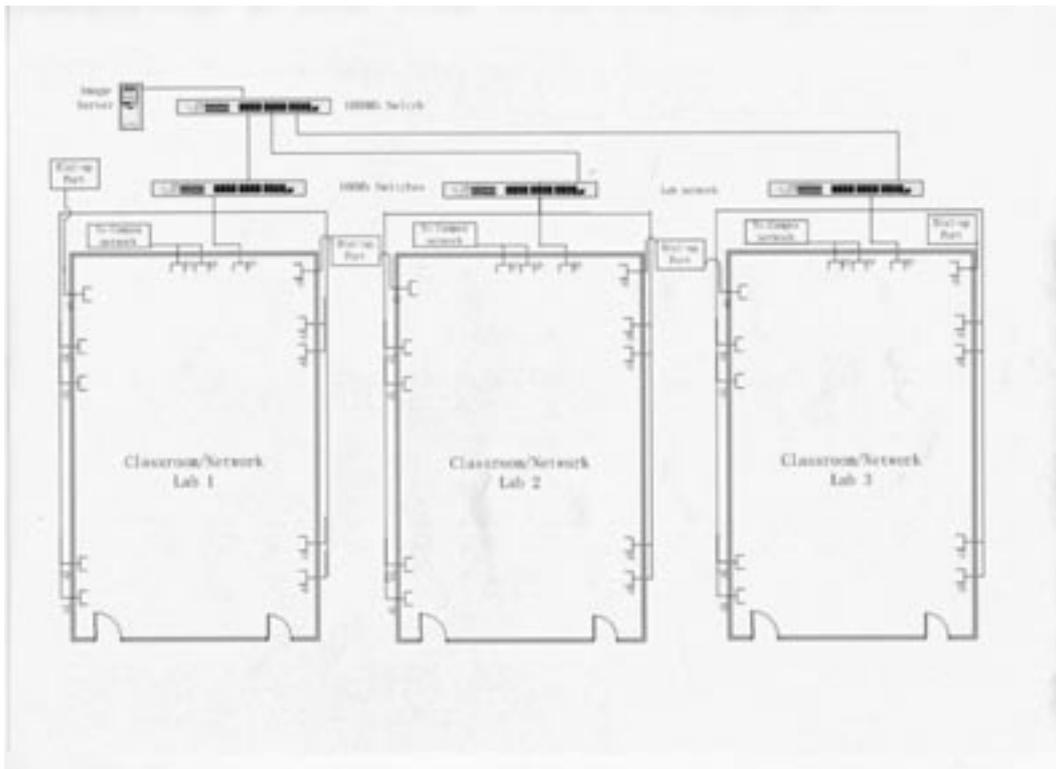


Figure 1: Workshop lab network structure

Thirdly, to install and test the courseware are very difficult and time consuming because one hard disk is usually used by more than one course. Generally we need lecturers working together to solve the conflicts. We even did not have enough disk space to hold all the necessary course materials.

Finally, the three labs are open labs. But students can not freely use the lab to do their exercises and assignments in the three labs because students install and configure their own system for a course on a particular computer. It seems that the students are fixed on those computers.

The goal for us is to combine hardware and software technology to solve all these problems with minimum cost.

3. POSSIBLE SOLUTIONS

Because several courses are scheduled in the same lab, the students often change the topology of network. As mentioned by Hill, Carver Jr., Humphries, and Pooch (2001), and Belles, Gorka and Miller (2002), we need to provide some easy way for students to change their networks. We approach the issues in three areas: modifying the network structure, adopting removable hard disk and choosing suitable software.

3.1 Workshop Lab Configuration

Figure 1 demonstrates the physical structure of the three workshop labs. Each lab has twenty four student computers and one lecturer computer. All lab computers can be linked to its own 100Mb switch through the wall sockets. The switches are up-linked to the top 1000Mb switch. An image server is linked to the top switch. Using this topology we can easily separate each lab from the other labs or link them together. Any of the computers in the labs can be connected to the image server to download necessary files.

Two wall sockets are provided to connect to campus network in each lab. Lecturers and students can use the sockets to connect to campus network to retrieve course materials and to emulate to connect to an ISP. Two dial-up telephone sockets are provided as well to use dial-up network to connect to Internet.

A Windows 2000 server is installed as a course image server. Some of the necessary services should be installed, for example DHCP server. It holds all the disk images and necessary software for different courses. The technician uses any computers in the three labs to duplicate a hard disk for any courses. Students download necessary programs from the server in the three labs. This will greatly increase the work efficiency and reduce the response time when students crash the

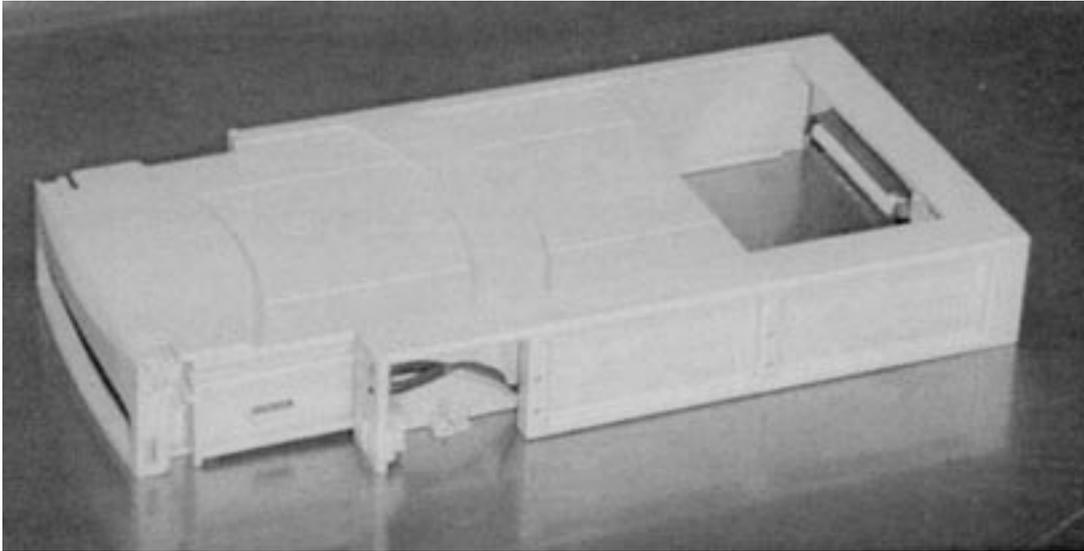


Figure 2: The docking bay and removable disk tray

system and need another working disk.

3.2 Lab Computer Configuration

To meet the maximum requirements of the courses and increase the productivity, we install removable disk docking bays on all lab computers and disk in removable disk tray. They are showed in Figure 2, Rick (2004).

We prepared a hard disk for every student in each course. Lecturers and students can easily swap the disks for different courses without open the PC case and change CMOS settings.

Two network interface cards are installed on all lab computers because several courses need two network interface cards to do network exercise, such as configuring router, proxy server and etc. So students can do any exercises on any of the labs.

3.3 Software Tools

It is not easy to deploy the different operating systems on many computers for many courses. We need some powerful tools to help us to implement this. There are many such products on the market. We compared two products: Symantic's Ghost, Ghost (2004) and Rembo Technology's Rembo Auto-Deployment (RAD). Ghost Corporate Edition has many powerful features. It provides a comprehensive solution for PC management and software deployment. The most important features for the multifunction network lab setting are:

- Operating System deployment
- Multicast File Transfer

- Create and restore disk or partition image

There are much more functions in the latest version of Ghost. We will not discuss here.

RAD assembles target computers from various building blocks. The basic block is the operating system image. Other applications can be created as block saved in database. All complicated disk images can be built by the base image and gradually add the necessary blocks upon the base image. So it is very flexible and suitable for deploy lab computers with many different applications. Because most of the workshop labs courses are basically operating systems, but not many applications, we finally decided to use ghost to do disk images.

3.3.1 Operating System Deployment

Some of the courses require that the operating system be installed and customized for the courses so that students need not to install operating system. We can use Ghost to deploy different kind operating systems, such as MS DOS, Windows 2000/XP Professional, Windows 2000/2003 server.

3.3.2 Multicast File Transfer

With multicast file transfer function, technician can duplicate many removable disks at the same time. The maximum number of connection depends upon the license. We use 25-license version. So we can ghost 25 PCs simultaneously. It is very fast and efficient.

3.3.3 Create and Restore disk or Partition image

The lab technician installs the sample system according to the course requirement. Then lecturers will test and confirm the system. Finally the technician use Ghost program to create an image file and save it on the image server. According to the number of registered students of the semester, the technician can quickly Ghost the required removable hard disk for the course.

Nowadays disk capacity gets bigger and bigger. The capacity of hard disk is normally more than 20 GB. So we make a disk partition and reserve it for students to backup their system. Because many exercises require students to constantly change the system settings, these are more likely to crash the system. To avoid reinstalling the operating system and re-doing all the work that have been done; students can use Ghost to create an image of the working disk partition and save it on the reserved partition. This image is like a milestone that records the important steps to the end of the course. If the system crashes, students can boot from floppy disk or from the network. Then use the Ghost program to restore the working disk partition from the image file on reserved partition of their local disk in a few minutes. This gives students great help.

3.4 Lab Management

With the above network lab setting, the lab management is much easier. At the beginning of a semester, when students take removable hard disks, they will fill the borrowing forms. They are responsible to the disk for the whole semester. At the end of the semester, they have to return the disks and get the forms back.

The lab technician will focus on the maintenance of the image server, network devices and connection maintenance. Pilot testing for new devices and course material is the main work for lab technician.

4. CONCLUSION

To efficiently setting and maintaining the workshop lab, we must investigate of the demands of all the courses in the workshop lab. Then we have to investigate and choose the latest hardware and software technology that meet the

needs. The hardware includes 100Mb network devices, different connection to internal and external networks, identical workstations. The software includes deploy tools, such as Ghost enterprise, and image server operating system. Careful planning and testing are important. All the disk images should be tested and confirmed by lecturers. Finally we set up some formal management rules, for example disk borrowing form.

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