

# Utilizing the Virtualization Technology in Computer Operating System Teaching

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**Abstract**—As the course of computer operating system requires students to understand the interactions between computer systems, users and hardware platform, this paper concentrates on the problem of using the virtualization technology in computer operating system teaching. Particularly, virtualization technology is designed to simulate the real computer hardware environment, and then make the operating system run in a virtual computer environment. Because the virtual machine software can simulate real computer hardware equipment, several operating systems are supported, such as Microsoft Windows, Linux, and Unix etc. The main idea of this paper is to utilize the VMware software in operating system teaching. VMware provides a completely virtualized set of hardware for a specific operating system. Afterwards, we discuss how to design and implement an experimental platform with multiple operating systems based on VMware.

**Keywords**- Virtualization technology, VMware software, Operating system, VLAN, Port

## I. INTRODUCTION

Operating system is most core, the most basic software in the modern computer system. In the course system of computer Science, the operating system is a key course, which is a compulsory course for computer majors. Aims of computer operating system are to understand the interactions between computer systems, users and hardware platform[1]. Furthermore, the leading course of the operating system is the data structure and the computer system, and advanced language programming. The teaching objective of operating system is to let students master the basic concepts of the operating system, basic principles of operating system design, and then grasp the main operations of some famous operating systems, such as Dos, Windows and UNIX or Linux[2].

Operating system has a strong theoretical background and relative abstract contents. According to the characteristics of this curriculum, principles and concepts in this course should be explained by taking some common operating systems as examples, such as Windows, Dos and UNIX and Linux[3]. To enable students to master the overall characteristics of the operating system, the application of the principle and the algorithms in this course should be explained in detail. The structure of knowledge system in operating system course can be summarized as three aspects:

1) knowledge structure, 2) knowledge body and 3) knowledge point. In this course, knowledge structure is implemented by integrating computer technology and management technology together. The knowledge body is divided into two aspects: 1) operating system can provide a convenient way for users, and can effectively control computer software and 2) operating system has five major types and five functions[4].

With the rapid development of modern information technology, virtualization technology has been widely utilized in many fields. From view of the convenience of operation, system maintenance, system stability, system resource allocation and so on, virtualization technology significantly affects the traditional model of information technology[5].

To solve these challenges, virtualization technologies are introduced in different works. Using the virtualization technology, we are able to run various operating systems and applications on one computer[6]. Meanwhile, we should gain better host security, because the virtual machine based on a relatively isolated environment. Furthermore, virtualization technology holds several features, e.g. saving computer work status and easy managing hardware[7]. In the operating system teaching, exploiting virtualization technologies, students are able to configure lots of virtual machines to compose an isolated network infrastructure with one server[8]. Moreover, virtualization technology supports a student keeping the status of their work at any time. Furthermore, when learning the operating system course, students can easily control the virtual machine to complete the learning process.

Some related works are listed as follows. Kitazume et al. used Virtualization Technology to Support Cloud Services[9], Liu et al. applied Virtualization Technology to assess energy performance via Small Environmental Monitoring Sensors[10], Hsu et al. used Virtualization Technology to implement Services Composition[11], and Konno et al. applied Virtualization Technology to reduce Total Cost of Ownership[12].

## II. OVERVIEW OF THE VIRTUALIZATION TECHNOLOGY

Under normal circumstances, a computer can only run one operating system at one same time, and operating system use the device driver to control and manage the hardware of the computer. In general, computer hardware contains the mouse, keyboard, CPU, memory, disk controllers, disk drives, graphics cards, network cards and so on. Virtual machine software can be simulated on a computer to a number of PC, and each PC can run a separate operating

system and do not interfere with each other. That is to say that we can assess a computer to run several operating systems at the same time, where each operating system can run their own applications. In general, virtual computer technology is utilized to simulate the real computer hardware environment, and then let the operating system run in a virtual computer environment. As is shown in Fig.1, the architecture of virtual computer is illustrated, and virtual machines can also be called clients.

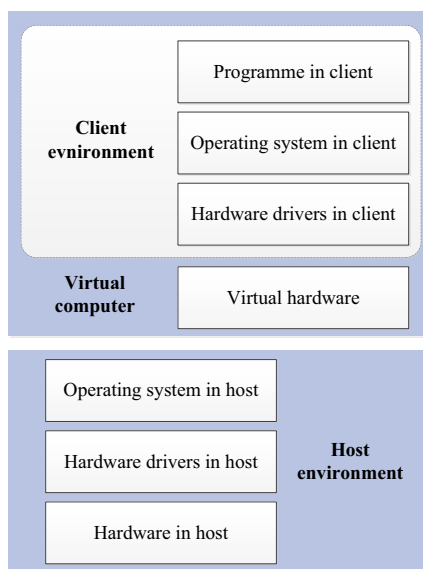


Figure 1. Architecture for the virtual computer

Virtual computer software can simulate all common hardware equipment, such as CPU, chipset, BIOS, interrupt controller, memory, graphics cards, IDE controller IDE hard

disk, CD-ROM, SCSI devices, SCSI hard disk, floppy disk, the computer clock, mouse, keyboard, sound card, serial, parallel, USB interface, network cards and so on. The client may directly interact and communicate with external environment using keyboard, mouse, serial, parallel, USB interface, a network card, CD-ROM, floppy drive of the host. As the virtual machine software can simulate real computer hardware equipment, a variety of operating systems can be executed on the virtual machine platform, such as the common Windows series, Linux, Unix and so on. Moreover, virtualization technology has also been widely used in the field of anti-virus. Particularly, in the anti-virus community, virtual computer is regarded as universal computer decryption device, and it has been an important part of the anti-virus software.

### III. SETTINGS OF THE VMWARE PLATFORM

VMware's desktop software supports lots of operating systems, such as Microsoft Windows, Linux, and Mac OS X etc. VMware software gives a completely virtualized set of hardware for a specific operating system. VMware platform is able to virtualize the hardware for a video adapter or a network adapter. Thus, VMware virtual machines are portable between various computers, the reasons lie in that each host is the same to guest. Actually, a system administrator is able to pause operations on a specific virtual machine guest. As is shown in Fig. 2, VMware is installed on a standard PC with host operating system, and four different types of virtual machines run on the VMware platform. Furthermore, Linux, Unix, Windows 7 and Windows 8 are installed.

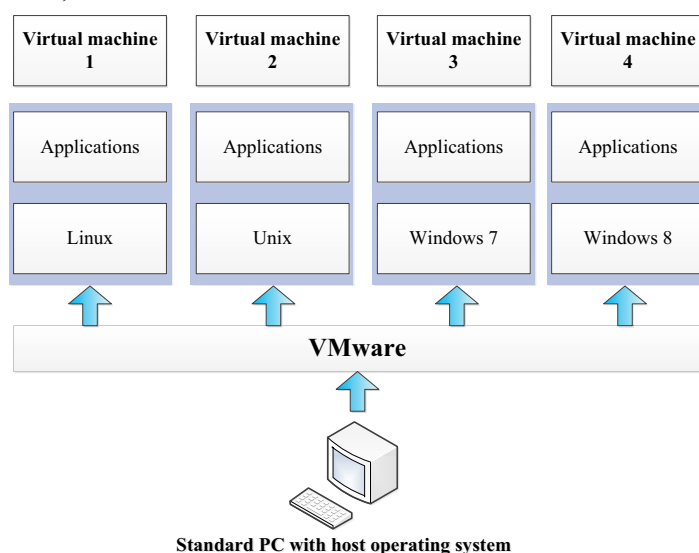


Figure 2. Working principle of the VMware platform.

Table. 1 Settings of VLAN

VLAN ID	Port	Sub Network	Port Address	Subnet mask	Device
VLAN 1	Port 1	192.168.10.0	192.168.10.1	255.255.255.0	Server 1
VLAN 2	Port 2	192.168.20.0	192.168.20.1	255.255.255.0	Server 2
VLAN 3	Port 3	192.168.30.0	192.168.30.1	255.255.255.0	PC1
VLAN 4	Port 4	192.168.40.0	192.168.40.1	255.255.255.0	PC2
VLAN 24	Port 24	192.168.70.0	192.168.70.1	255.255.255.0	Router

VMware Workstation takes a more optimized path to executing a target operating systems on the host to simulate the function of each CPU instruction on the target machine. On the other hand, VMware software does not require emulate an instruction set for different hardware settings. VMware platform may effectively enhance system performance, however, it may generate problems while moving virtual machine guests between hardware hosts using various instruction sets.

#### IV. DESIGN OF THE EXPERIMENTAL PLATFORM WITH MULTIPLE OPERATING SYSTEMS USING VMWARE

In this section, we will discuss how to design and implement the experimental platform with multiple operating systems using VMware.

Apart from constructing basic network experimental platform, VMware can also build up complex network experimental platform, such as VLAN experiments across multiple sub-networks. Currently, the three layer switch is very common, and almost all small networks (that is, one hundred units within the computer network) may have a three layer switch structure. Particularly, the whole computer network is divided into a number of sub-networks. We divide the network environment into 5 VLAN (each port is connected to a different sub-network), the network address of this experiment is illustrated in Table. 1.

As is shown in Table.1, the Port 24 is connected to the router, and the other ends of the router are connected to the Internet. Moreover, other VLANs are connected to the Web through Port 24 by the router. All servers which are connected to Port 1 should run on the DHCP server. We should allocate TCP/IP addresses and parameters for The VLANs which contain Port 2, Port 3 and Port 4. Furthermore, Vmnet8 provides the Internet connection for the router. Structure of the proposed experimental platform is illustrated in Fig. 3

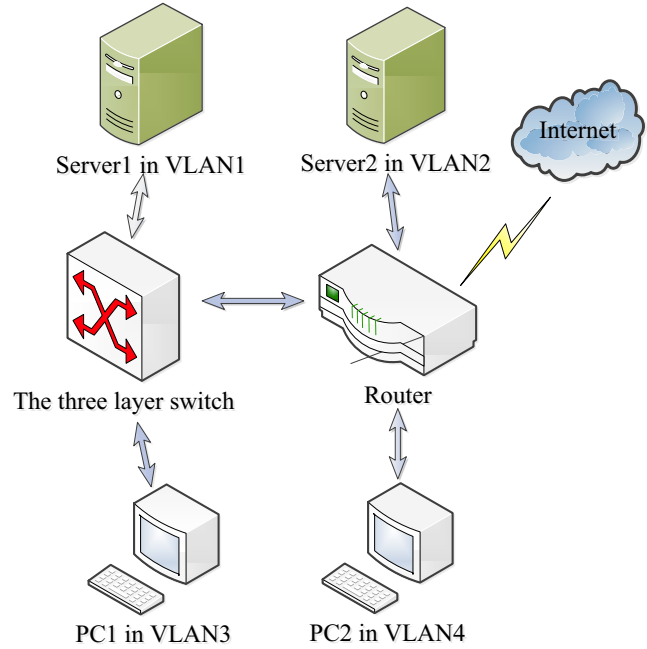


Figure 3. Structure of the experimental platform.

#### V. CONCLUSION

This paper focuses on the problem of using the virtualization technology in computer operating system teaching. As is well known that, virtualization technology is widely used to simulate the real computer hardware environment, and then make the operating system run in a virtual computer environment. Particularly, VMware software is used in operating system teaching, and an experimental platform with multiple operating systems based on VMware is constructed.

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