Research on Innovative Reform Method of LAN construction and maintenance Curriculum Teaching Mode Based on ENSP Virtual Simulation

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Abstract: With the rapid development of information technology, LAN construction and maintenance has become one of the core courses of computer application major. The traditional teaching mode can no longer meet the needs of current education. Therefore, this study proposed an experimental scheme of LAN construction and maintenance curriculum reform based on Huawei's eNSP virtual simulation platform. The program aims to improve students' practical operation ability, enhance learning interest and reduce experiment cost through the teaching method of combining virtual and real.

***Keywords*:** LAN; Curriculum reform; eNSP

1. Introduction

The course of LAN construction and maintenance is an important course for computer application majors, which requires students not only to master the necessary network theory knowledge, but also to have practical skills. The traditional teaching mode often focuses on theory teaching and neglects the cultivation of students' practical operation ability[1]. In order to solve this problem, this study proposed a teaching reform scheme based on eNSP virtual simulation platform, which aims to improve the teaching quality by simulating the real network environment and allowing students to practice in the virtual environment.

2. Problems in teaching of LAN Construction Technology

As the core course of computer major, LAN construction technology plays an important role in cultivating students' practical ability and theoretical knowledge. However, there are some problems in the teaching of this course. The course content focuses on theory, lack of practical support and coupled with insufficient experimental equipment[2]. It is difficult for students to apply knowledge to practical operation, resulting in a decline in learning interest and a decrease in classroom efficiency. The description of practice content is not specific enough, and the lack of auxiliary materials such as images and videos affects students' understanding. Influenced by traditional teaching, many schools still treat this course as purely theoretical teaching, which makes it difficult for students to understand the practical application of knowledge and lack of learning motivation. These problems hinder students' in-depth understanding of network equipment and affect the teaching quality and learning effect.Therefore, it is urgent to reform the teaching of LAN Construction Technology, strengthen practical operation, promote the combination of theory and practice, and improve the teaching quality.

3. Teaching reform of LAN Construction Technology based on ENSP virtual simulation platform

3.1 Introduction to eNSP Virtual Simulation Platform

The Computer Communication Networks course poses a challenge for students due to its abstract content and complex protocols, making it difficult to understand and apply to practical network engineering problems. Huawei's eNSP simulator, as an enterprise-class network simulation platform, simulates Huawei's network equipment environment, supports protocol configuration and testing, and has become the preferred tool for network teaching and experimentation[3]. This project integrates eNSP into the computer communication network curriculum to deepen students' understanding of network protocols, improve their ability to analyze and solve complex network problems, and overcome key challenges in learning.

3.2 Teaching reform plan

3.2.1 Curriculum content reform

In order to meet the needs of modern education and improve the teaching quality of LAN Construction and Maintenance, this course has carried out content reform, combining traditional theory teaching with eNSP virtual simulation experiment, so that students can understand theoretical knowledge and deepen their understanding of knowledge through virtual simulation experiment[4]. This teaching mode can not only improve students' learning interest, but also help students better combine theory with practice and improve their practical operation ability.

The curriculum content reform is divided into the following parts:

(1) Basic knowledge of LAN: This part covers the basic knowledge, working principle and core technology of LAN. The course begins with an introduction to the history of communications, network infrastructure, and the two network layering models OSI and TCP/IP. Then, explain ARP, TCP, UDP encapsulation flow, data processing and forwarding mechanism. In the aspect of IP network construction, IPv4, the fundamentals of IP routing and the principle of OSPF protocol are first introduced. In the construction of Ethernet switching network, the Ethernet encapsulation format, the method of data frame processing in switch, and the basic knowledge of STP and VLAN are emphasized. The basic and access part of network security focuses on the realization of network security function and address translation through eNSP, including ACL configuration, AAA principle and the basic of network address translation. Finally, WLAN environment construction principle, protocol and equipment foundation are discussed, including AP, AC function, Fat-AP and Fit-AP network construction architecture. These contents provide a theoretical basis for understanding and building LAN.

Through theoretical teaching, students can master the basic knowledge of LAN and lay a solid theoretical foundation for the subsequent practical operation. At the same time, through eNSP virtual simulation experiment, students can intuitively observe the construction process of LAN and deepen their understanding of theoretical knowledge.

(2) Case teaching method introduces the understanding of network equipment and LAN construction and configuration: Case teaching method is an efficient teaching strategy in the course of LAN Construction and Maintenance[5]. It simulates a real working environment through the eNSP, enabling students to learn the identification, functional understanding, and configuration of network devices without the physical devices. In teaching, teachers will create a variety of case scenarios, such as small Internet companies, large manufacturing companies, university campus networks or park coverage networks. Students design network topology according to the scene and implement it on eNSP. Students learn to select and connect network devices, configure parameters to enable interconnectivity, consider using switches and routers to connect different departments and ensure network security and data transfer efficiency to enhancing interaction and practical skills. This approach enables students to apply theoretical knowledge to practice and build a solid foundation for their future careers.

(3) Network security and troubleshooting: Network security is an important part of LAN construction and maintenance. Students will learn how to identify and defend against cyber threats, as well as how to diagnose and resolve network failures. The eNSP platform provides simulation scenarios of cyber attacks and failures, enabling students to practice in a safe environment and improve their ability to respond to cyber security issues.

Through this course reform, students can not only systematically learn the theoretical knowledge of LAN, but also carry out practical operation in the virtual simulation environment, comprehensively improve their practical skills and theoretical level and lay a solid foundation for their future career[6]. Figure 1 below shows the distribution of course content. The theoretical basis is the cornerstone of the entire LAN course, and the protocol configuration of each device becomes the pillar of the entire course. Finally, the network security protocol is configured and troubleshooting is carried out to build the overall framework of the whole course.

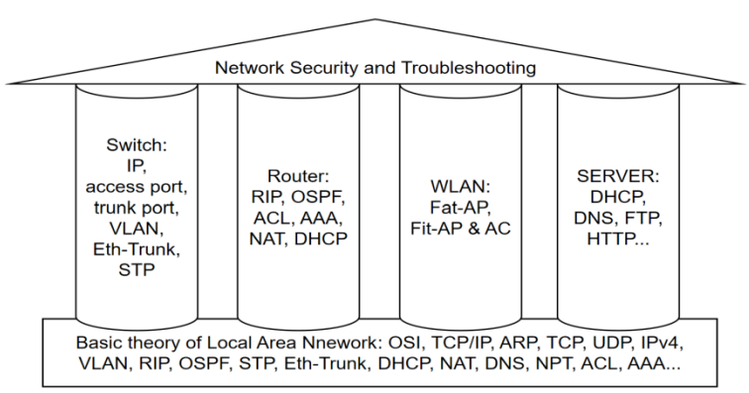

Figure 1. LAN construction and maintenance course content construction framework

3.2.2 Experimental environment construction and optimization design of practical training cases

Through the eNSP platform, students can simulate the configuration and network construction of routers, switches and other devices in a virtual environment. Task-driven approach and case analysis promote students' self-directed learning and improve their problem-solving ability. The group method enhances teamwork and communication skills.

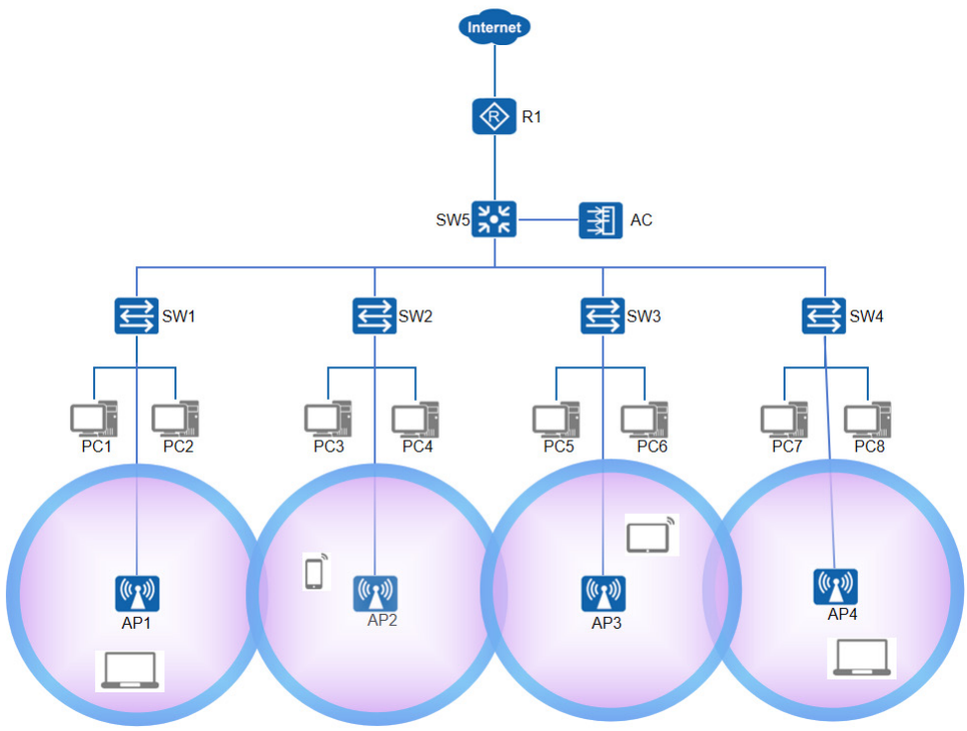

Figure 2. Network topology of a medium-sized manufacturing company

An example of a medium-sized manufacturing company shown in Figure 2. The company has four buildings representing the main office and three factories. The four buildings are connected to the Internet through switch SW5 and router R1, and each building is equipped with wireless network. According to the actual situation of the company, the practical training project was designed to build the local area network, Various knowledge points mentioned above were integrated and the practical training project title as shown in Table 1 was finally obtained.

Table 1. List of practical training projects

NO.	Practical Training Topic
1	IP Address and Subnet Division
2	VLAN Division and Inter-Switch Communication
3	OSPF Routing Configuration
4	DHCP Configuration
5	NAT, NPT and DNS Configuration
6	Eth-Trunk and STP Configuration
7	ACL, AAA, TELNET, FTP and PPPoE Configuration
8	WLAN Configuration

According to the above training exercises, after completing the network configuration on the eNSP, students will have a deeper understanding of the related technologies of LAN construction and maintenance. The students' experimental results were evaluated by means of experimental report, operation and results display. The evaluation includes theoretical knowledge, operational skills, innovation and teamwork.

4. Conclusion

This paper discusses the LAN curriculum reform based on Huawei eNSP platform, which aims to improve students'

practical skills and interest by combining theory and practice, while reducing costs. The reform program solves the problem that traditional curriculum is biased towards theory and lacks practice. Through the virtual experiment environment of eNSP platform, students' problem-solving ability is enhanced and teaching quality is improved. In the future, virtual simulation technology will be further integrated into teaching, promote the popularization of educational resources and the interaction of teaching modes, and provide students with a richer learning experience.

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