Campus Computer Network Construction Simulation and Cyber Security Technology

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Abstract. With the rapid development of the network age, the network has become an indispensable part of our daily life and work. Computer network is also an indispensable part in campus. How to build a suitable computer network according to the campus environment has become an important problem. Then, while improving the level of network security management, it helps the school carry out its work smoothly. Therefore, this paper expounds the construction scheme of campus computer network, so as to help the campus computer network more perfect.

Keywords: Network, campus, computer network.

1. Introduction
In today's information age, the network has been widely popularized on campus, and it has gradually become the basis of school running practice. Many management and teaching activities on campus are inseparable from the support of computer network. Convenient and fast network has become a necessity for every campus.

2. School Network Demand Analysis

2.1. School Network Demand
The main requirements of a learning network are as follows:
(1) The school has five departments (Machinery Department, Law and Politics Department, Foreign Language Department, Economics and Management Department and Computer Department), with 40 / 20 / 20 / 60 / 100 computers respectively.
(2) Departments A, B, C, D and E have their own file servers, which allow cross departmental access to the same building.
(3) Computers in the school can communicate with each other and use internal network applications (video on demand service).
(4) 100MB / s optical fiber access is used between the school internal network and the Internet.
(5) Each department of the school uses the DHCP server address to obtain the IP address.
2.2. Physical Structure of Each Department of the School
(1) The Department of machinery (floors 1-4 of the North Building), the Department of Law and Politics (floors 6-8 of the North Building) and the Department of Foreign Languages (floors 9-10 of the North Building) are in the North Building of the school, and the Department of Economics and Management (floors 1-4 of the South Building), the classroom (floors 5-7) and the Computer Department (floors 8-10 of the South Building) are in the South Building of the school. The distance between the North Building and the south building is 1000m. As show in Fig.1, their requirements for computers are show in table 1.

| Department Name                  | Number of Computers | Network Requirements                         |
|----------------------------------|---------------------|---------------------------------------------|
| Mechanical Department            | 15                  | Access to internal networks and the Internet |
| Department of Law and Politics   | 25                  | Access to internal networks and the Internet |
| Department of Foreign Languages  | 35                  | Access to internal networks and the Internet |
| Economy and Management Department| 45                  | Access to internal networks and the Internet |
| Computer Department              | 55                  | Access to internal networks and the Internet |
| Total                            | 175                 | -                                           |

Figure 1. Floor Distribution of Each Department.

3. Specific Scheme Design

3.1. Network Design
(1) The design adopts a three-tier network structure. Each college and department sets up an access layer switch on each floor, then converges the access layer switch on each floor to the convergence layer switch in each building, then connects the convergence layer switch in each building to the core switch, and finally connects to the router to access the Internet. A firewall is set behind the router, and the Internet adopts 100MB/s optical fiber.

(2) The North Building and the South Building gather for 1000m, and the middle is connected by optical fiber. Each department adopts super class 5 unshielded twisted pair. Class 6 unshielded twisted pair is used for connection between colleges and departments in the same building. Each floor is connected to the horizontal distribution room with PVC trunking. The vertical trunk is laid from the main distribution room along the communication shaft to the horizontal distribution room. Set the main distribution room on the top floor of each building, set the main distribution room in the foreign language department and computer department, and set the distribution line room in other departments. Each building forms a local area network.

(3) DHCP technology is enabled on the layer 3 switch so that computers in each VLAN can automatically obtain IP addresses. OSPF technology is enabled on the layer 3 switch level router so that the internal network can be connected.
3.2. Campus Intranet Design Principles

(1) Strong mobility. The attractive point of wireless campus network is mobility - users can move freely among classrooms, laboratories, offices and libraries, and maintain a continuous connection with the network. And the transmission range is greatly widened, and the maximum transmission range can reach 15km. The terminals in the wireless network communicate wirelessly, which can provide real-time information services anywhere, get rid of the constraints of cables and increase mobility. At the same time, the infinite LAN not only supports the communication between mobile terminals, but also allows wireless devices to access the limited network.

(2) Flexible and fast. WLAN can exist in the form of an independent and wired network. When needed, it can establish a temporary network at any time without relying on a limited backbone network. Wireless LAN networking is flexible and can meet the specific application and installation needs. The system structure can be used in the peer-to-peer network of a small number of users or the complete basic network of thousands of mobile users. It is quite easy to add or reduce mobile hosts in WLAN. Adding wireless access points can increase the number and coverage of users, and allow roaming in a large range.

(3) High transmission rate and strong code division multiple access capability. The wireless network can reach 10m, can support 200 user connections, and is easy to expand to meet the needs of a larger number of readers.

(4) Strong reliability. The wired network line is interrupted due to metal joint rust, water seepage, man-made accidental disconnection or poor network connection. The line failure may destroy the data exchange of the network. It often takes a long time to check the problems. Wireless networks do not have these problems. At the same time, infinite network is not easy to be affected by natural environment, terrain and disasters.

(5) Convenient for teaching. Campus wireless network can provide wireless Internet service for the whole campus network users. Through the wireless network, teachers and students can easily connect to the campus network anywhere on the campus for information query.

3.3. Campus Network Topology (as show in Fig.2)
3.4. Network Communication Networking Protocol
(1) TCP / IP: each network protocol has its own advantages, but only TCP / IP allows complete connection with the Internet and can realize information transmission between multiple different networks. TCP / IP protocol refers not only to TCP and IP protocols.

(2) Telnet: remote login access protocol enables other departments to remotely access the internal and external of the company. During remote access, corresponding ACL authentication and relative permission settings will be set.

(3) SNMP network management protocol: SNMP is a standard protocol used to manage network nodes (servers, workstations, routers, switches, hubs, etc.) in IP network. It is an application layer protocol. SNMP enables network administrators to manage network performance, discover and solve network problems, and plan network growth. Receive random messages (and event reports) through SNMP, and the network management system knows that there is a problem in the network.

(4) Routing protocols: Rip, IGRP, EIGRP, IS-IS and OSPF.

4. IP Assignment
4.1. IP Address Allocation Principle
The quality of IP address planning will not only affect the efficiency of network routing protocol algorithm, but also affect the performance and stability of the network, as well as the expansion and management of the network. It will also directly affect the development of relevant new services and the further sustainable development of network applications.

The address planning of network system is an important part of network design. According to the successful experience of existing project implementation, the planning of IP address should fully consider the needs of future development, and the principles of unified planning, long-term consideration and partition and block allocation. According to the scale of the internal network, the subnet, the clear division of each department and the trend of address expansion in the future, it is recommended that the private address 192.168.0.0 to 192.168.255.255 in the class C address reserved by the public network should be used as the IP address, and NAT address conversion should be used at the network outlet to realize interconnection with the legal address of the Internet, The corresponding legal address is used for the public network to access various authorized open information of the internal network. The division principle of network system IP address is as follows:

(1) Uniqueness: IP address is the identification of host and equipment in the network. Two hosts in an IP network cannot use the same IP address, otherwise they will not be addressable.

(2) Scalability: during IP address allocation, there must be a certain margin to meet the needs of network expansion.

(3) Continuity: the allocated continuous IP addresses shall be conducive to management and address summary. Continuous IP addresses are easy to summarize routes, reduce routing tables and improve routing efficiency.

(4) Materiality: when assigning IP addresses, try to make the assigned IP address have certain practical significance, so that people can know which department or region the IP address is assigned to as soon as they see the IP address.

4.2. IP Assignment
The IP address used by the school's internal network is the private address, the IP address used by the external network is the public address, and DNS is provided by the internal network server. According to the situation of the school, the IP address is allocated as follows:
Table 2. IP Assignment.

| Network Address Block | 220.78.168.0/24 |
|-----------------------|-----------------|
| Subnet Mask           | 255.255.255.0   |
| Host number / subnet  | 256             |
| Number of Subnets     | 2               |
| Host Address Range    | 220.78.168.1 - 220.78.168.126, 220.78.168.129-220.78.168.254 |
| Broadcast Address     | 220.78.168.127, 220.78.168.255 |
| Mask Wildcard         | 0.0.0.255       |
| CIDR Notation         | 220.78.168.0/24 |

| Subnet ID   | Subnet Address | Host Address range | Broadcast address |
|-------------|----------------|--------------------|-------------------|
| South Building | 220.78.168.0 | 220.78.168.1-220.78.168.126 | 220.78.168.127 |
| North Building | 220.78.168.128 | 220.78.168.129-220.78.168.254 | 220.78.168.255 |

5. Campus Network Application Deployment Scheme

5.1. Video on Demand Service

5.1.1. School Application Demand Analysis. With the continuous development of information teaching, excellent network teaching resource platform has gradually become an indispensable part of information campus. Audio and video materials are important carriers of school teaching, and their convenience is unmatched by other resources. By introducing learning resources into the school's internal network, students and teachers can access teaching resources anytime and anywhere, so as to realize students' free on-demand and autonomous learning of teaching resources.

5.1.2. Application Process (as show in Fig.3).

(1) Set up a web server to store user and video related information, and provide users with account login, video retrieval, log recording and information query services.

(2) The user logs in to the server using the client and provides the corresponding video list after the server completes the account identification. After selecting the corresponding video data, the user extracts the corresponding data stored in the hard disk through the video player.

(3) Record the corresponding playback record in the background and the playback duration.
5.2. **Educational Administration Information Management System**

5.2.1. **School Demand Analysis.** In our daily study and life, we are faced with a lot of teaching information, such as selecting courses, querying teachers, querying grades and so on. For a large number of educational administration data, we can query and process educational administration information through such an information system, so as to improve the efficiency of our daily study and life, and make full use of the resources provided by the school.

5.2.2. **Application Implementation.** The management information system should include personnel management, student status management, logistics management and other aspects, and basically cover all our study and life. In order to realize the management information system between departments and teaching buildings, we can learn from the "Peking University Bluebird" system, mainly including the school educational administration information service system, instruments and equipment, laboratory management system, etc. Others, such as party affairs information and further education and employment information, can be redeveloped on this basis.

5.3. **Internal Data Management System**

Manage internal information based on Internet technology and various software, including document operation subsystem, document processing subsystem, office information transmission system, etc. Different subsystems are designed according to our actual needs. The first phase design should give priority to the design of document processing system.

5.3.1. **School Demand Analysis.** In daily teaching life, teachers often share information and send and receive homework, and administrative teachers usually face the forwarding and issuance of some notices. In this case, the internal data management system can be established through the internal network to realize the real-time transmission of data, which can improve the quality and efficiency of office teaching.

5.3.2. **Application Implementation.** Manage internal information based on Internet technology and various software, including document operation subsystem, document processing subsystem, office information transmission system, etc. Different subsystems are designed according to our actual needs. The first phase design should give priority to the design of document processing system.

6. **Hardware Selection**

6.1. **Router**

Huawei AR3260E-S Enterprise Integrated Router. As shown in Fig.4.

![Figure 4. Router.](image-url)

Reason for selection: since the router in the system is the general router and needs to cover two teaching buildings as a whole, the router needs a large coverage area. In addition, because it is a campus network system, it also needs to consider the access and use of some students other than teachers and cadres. Therefore, when the installed capacity is only more than 200, thousands of...
Enterprise level routers are selected. The router has a 10gbs firewall, which can effectively protect the network environment inside the campus and reduce the risk of information leakage.

6.2. Core Switch
Huawei S6720S-26Q-SI-24S-AC. As show in Fig.5.

![Core Switch](image)

Figure 5. Core Switch.

Reason for selection: as a key link in the series connection of Internet and internal network, the performance of core switch is particularly important. Switches placed in the core layer of the network backbone are called core switches. The network backbone is the core layer. The main purpose of the core layer is to provide an optimized and reliable backbone transmission structure through high-speed forwarding communication. Therefore, the core layer switch should have higher reliability, performance and throughput. In the current network system, the core switch connects the Internet with the South Building and the north building. In order to ensure the high-speed transmission of data, this core switch with 10 Gigabit network port is selected, which can play a good role in undertaking and ensure the efficiency and stability of the whole network system.

6.3. Convergence Layer Switch
Huawei S5720-32P-EI-AC. As show in Fig.6.

![Convergence Layer Switch](image)

Figure 6. Convergence Layer Switch.

Reason for selecting aggregation layer switch: aggregation layer switch bears the burden of gateway and three-layer routing and forwarding functions. In the network system, the convergence layer switch links the subnets in the north and south buildings, so it needs a large coverage area and fast performance. The selected switch has a 10 Gigabit optical port and a large coverage area, which can effectively converge the traffic in each network area and undertake the gateway function of terminal equipment.

6.4. Access Layer Switch
Hua San (H3C) S5024PV5-EI-PWR. As show in Fig.7.

![Access Layer Switch](image)

Figure 7. Access Layer Switch.

Reason for selection: the access switch connects the terminal equipment inside each department. Due to the large number and different number of terminal equipment equipped in each department, each department has at most 100 pcs and at least 20 PCs. In order to avoid the waste of network ports, this switch with 28 network ports is selected on the basis of meeting the performance standards. Because the convergence layer switch has excellent performance and sufficient network ports,
multiple access switches can be connected in the system with more PC terminals, so as to realize the establishment of LAN in the system. And because most of the same department are in the same office, the same floor, etc., it does not need too much coverage.

6.5. File Server

Tieweima F2-221 (Equipped with 8t Hard Disk). As show in Fig.8.

![File Server](image)

**Figure 8.** File Server.

Reason for selection: the file server needs to store all the data in a system and provide file management, transmission and acceptance. All the data in a system is very large, so the selected file server needs to have a large capacity. In addition, the memory also affects the processing speed of the server. Therefore, this server has moderate price and large hard disk capacity, High memory.

7. Conclusions

According to the above simulation, all aspects need to be considered in the construction of campus computer network. The combination and collocation of various machines and the reasonable allocation of network IP address need to be considered. I hope to build a more perfect campus computer network on this basis.

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