Hong Kong Certificate of Education Examination

Computer and Information Technology

Paper 3 : Coursework Report

Local Area Network System

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Date   :

Content :

I. Introduction

Though computers are capable of carrying out their intended function in a standalone mode, computers will be much stronger if they can exchange information with one another. In past, countless number of business companies had used computer in their daily run. For example, they used computer in accounting to record every transaction of the company made, in trading to record selling and buying information, in personnel management to record every employee's information and etc. However, nowadays the success of the Internet makes people to sense that network is a much more powerful tool for them to enhance their business and make their company running more efficient.

II. Objective

In this project, a LAN system will be designed for a medium-sized company. Through this networking system, the company can effectively reduce daily running cost, the company internal works can be more systematic and well organized, and the communication of the employees in the company can become more efficiently. The network can be used to share files, share company programme. Employees can communicate with one another through some network communication programme such as ICQ and MSN Messagers. Besides, some expensive hardware such as color printer can be shared by a lot of employees. Finally, employees can use the network to search information.

III. Problem Specification

The following is the assumptions for the medium-sized company:

- The company contains 80 employees;
- Each employee has been provided a computer;
- The company contains 4 departments : Accounting Department, Marketing Department, Personnel Department and Trading Department;
- All employees in the company are allowed go onto the Internet;
- All employees are able to access laser printer;
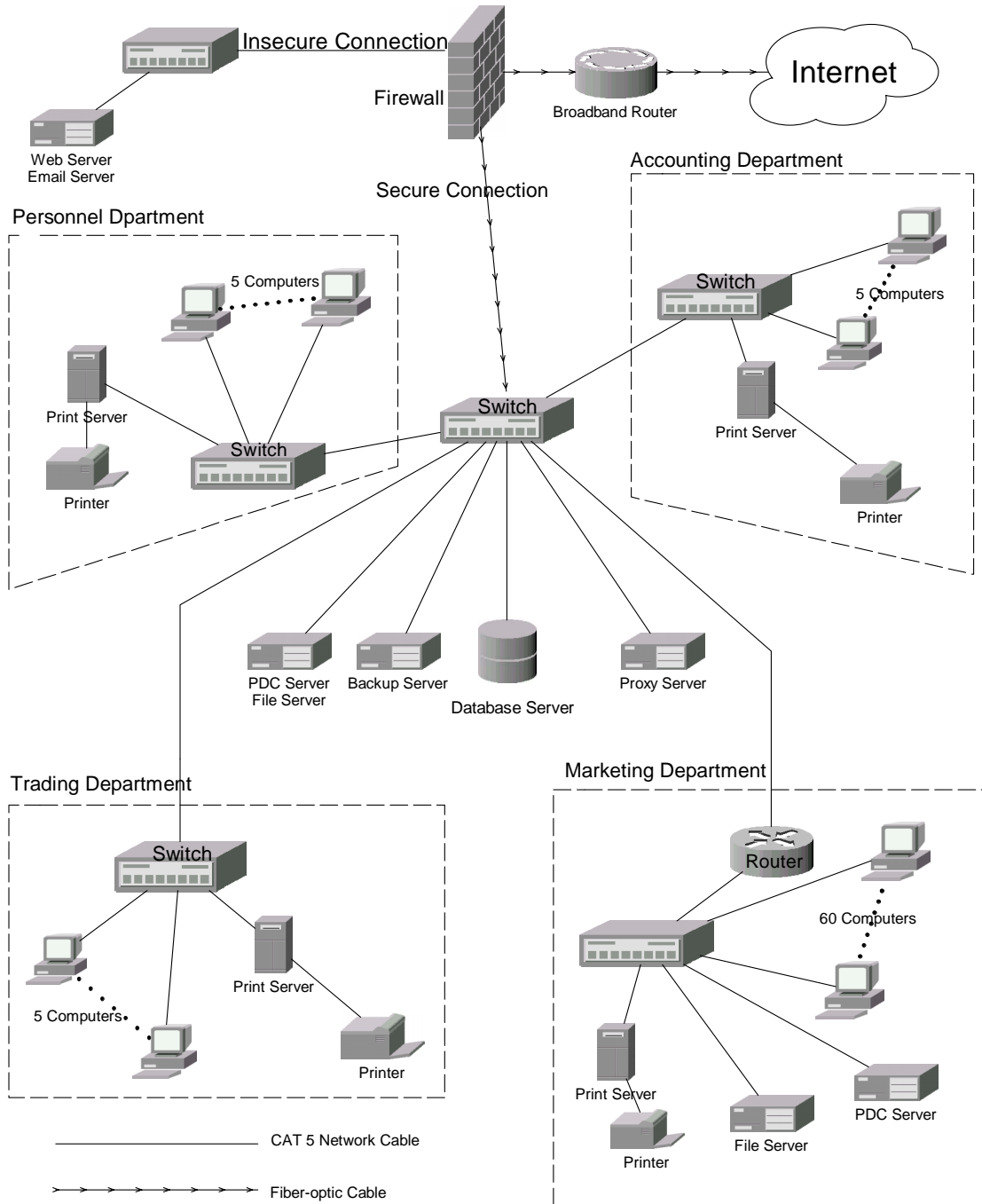- The budget of the whole computer networking project is $1,000,000 .

IV.   <u>Working Schedule</u>

Date	Time Used	Related Work	Remark
14/12/02	2 hours	Question analysis and requirement setting	The size of the company. The need of the company.
17/12/02	3 hours	Search related information from world wide web and library	Find and study the concept of computer networking
18/12/02	2 hours	Design the network	Use the software "Paraben LAN Charter" to draw the network diagram
19/12/02	2 hours	Refine the network design	
28/12/02	2 hours	Start to write the interim report	Write "Introduction" part and "Objective" part
29/12/02	5 hours	Continue to write the interim report	Write "Design Specifications" part "Discussion", "Conclusion" part and "Working Schedule"
03/01/03	1 hour	Finish the interim	Write the "Reference" Grammar checking
04/01/03	45 mins	Discuss the report with teacher	Find the weakness of the report
05/01/03	3 hours	Final Report Writing	Refine the interim report

V. <u>Network Design</u>

Network Design

Insecure Connection

Firewall

Broadband Router

Internet

Web Server
Email Server

Secure Connection

Accounting Department

Personnel Dpartment

5 Computers

Switch

5 Computers

Print Server

Switch

Print Server

Printer

Switch

Printer

PDC Server
File Server   Backup Server   Proxy Server

Database Server

Trading Department

Marketing Department

Switch

Router

60 Computers

Print Server

5 Computers

Print Server

Printer

PDC Server

CAT 5 Network Cable

File Server

Fiber-optic Cable

Printer

VI.   <u>Design Specifications</u>

There are two approaches to build this network – Mainframe/terminal and server/client.   In my design, server/client approach will be used.   Although the price of a terminal computer is lower than client computer, the price of a mainframe computer is very high and cannot be afforded by a medium-sized computer. Also, the function of a client computer is better than that of the terminal.   If the network is down, client computer can still work alone, but terminal will not work anymore.   The cost of a terminal computer is not much higher than a client computer.   Hence, I have chosen server/client network.

CAT5 UTP cables are used because the cost of UTP cable is very low and can be easily installed.   Also, CAT5 UTP cable can support high bandwidth and up to 100Mbit per second.

There are alternative choices of cabling such as coaxial cable, fiber-optic and wireless connection.

Coaxial cable is also very cheap and easy to install.   However, network connected by coaxial cable cannot support a lot of computers.   Wireless connection is another good choice since it does not need to deploy a cabling system which makes installation very easy.   With wireless connection, you do not need to make any cable trays.   You can also move computers around the company and do not need to concern any cable issues.   However, the cost of wireless LAN is much expensive.   Wireless LAN requires a lot of wireless hubs and transmitters which are quite expensive.   Besides, the transmission speed of wireless LAN is much slower than that of cable-based LAN.   Hence, in my network design, wireless connection will not be used.

Another alternative choice for cabling is fiber-optics.   It can support very high bandwidth, but the cost of it is very high and the installation is very difficult. In company's daily operation, such high bandwidth (2Gbit per second) is much more than enough.   Hence fiber-optic cable is only used at the network backbone that interconnects each of the individual LANs scattered throughout the trading company.   This also allows the company network to expand in future.

To operate at 100Mbs speed, 100Base-T designed network cards and 100Base-T switched hubs are used.   In general, a switch interconnects

computers and passes data among them.   I use switch and do not use hubs because the performance of switch is better.   Hence, though switch is more expensive than hub, switch is selected for the network.

Since the marketing department is very large and has a lot of computers. Hence, marketing department is spilt to another domain and so the internal traffic of the marketing department will not use up the bandwidth of the whole network.   In this sub-network, a primary domain server is used to maintain a database of usernames and passwords.   A file server is used for storing and sharing files for all client computers.   It also enforces security on the network by ensuing that only individuals holding proper permissions can access the files.   In addition, a router is used to connect the marketing department's network to the main network.   This lets computers in the marketing department's network can still access the company's database server, proxy server and email server.

Each department can print a high-end laser printers shared by a number of computers than to purchase low-end printers for each individual computer.

An application-specific firewall is used to prevent hackers go into the company's network.   A firewall can reject untrusted packets from the Internet and protect computers in the intra-network.   Also, it can restrict the running of some high risk applications such as ftp and telnet.   A firewall can also restrict employees from going some

Given the trend towards web-based computing, a web server is put into the company's network.   Web-based systems provide efficient ways to share information, either within the company's private network or externally via the Internet.   As this is a trading company, the company can create and maintain a company web site in the web server.   Through this web site, the company can promote its product to customers.   In future, company can even extend the function of the web site, so that customer can buy products through the web site.

Database server supports the applications used in the company and it can store all daily company operation information such as employee's personal record, company financial information, company product information and etc. Many businesses have specialized applications that operate from network

servers.   These applications may operate in conjunction with the database systems.

In order to speed up the Internet connection, a proxy server is employed into the network.   Besides, proxy server can prevent employee's computer directly communicate with external computers.   This can further protect the network from attack.

Since some information stored in the file server and database server may be very important, so we should backup all this information constantly. Backup server should have a tape drive are added into the network.   We can schedule the computer to make a full backup every week and make an incremental backup everyday.

All client computers in the network will use MS Windows XP Professional Edition as the operating system since this is most common OS nowadays. PDC server uses MS Windows 2000 Server.   In order to reduce the cost, email server, proxy server and web server will use Linux as the OS.   MySQL is used as the database management system.   Also, hardware-based firewall and hardware-based print server will be used since the performance of hardware-based device is better and the configuration of them is much simpler.

VII.   Testing

- We should first use cable tester to test each CAT 5 cable and ensure that every cable is connectable and no broken inside.
- Check if the servers are working properly
- Check if each client can login the network
- Check if each client can connect to the servers and use the services provided by the server
- Check if the network speed is acceptable
- Check if the backup server can successfully backup the data and restore the data

After the above checking, we can let employees of that company to test the network.

VIII. Further Enhancement

In this network design, there are some feasibilities for further expansion of the network.   The backbone of the whole network can use fiber-optics which can support much more computers.

If the company extends its size and opens many branches in different countries, Virtual Private Network (VPN) server can be added into the network. Then company branches' network in different countries can be connected together.   In another point of view, individual employee may access company network at home through VPN connection.   This is a cheap way to enhance the network since we only need to spend about $30,000 to buy a VPN server.

To be more stable and secure, web and email server can be split into two servers, so that when one server is hacked or down, another server will not be affected.

There is a kind server called Backup Domain Controller Server (BDC) which can automatically replace the job of PDC server when PDC is down. That will make the network more trustable.

IX.   <u>Conclusion</u>

A medium-sized company network has been designed and every parts of the network have been carefully analyzed.   After creating this network, I am sure the run cost of the company can be reduced since the computer resources can be better used and managed.   Also, communication between employees can be more efficiently.

<u>References</u>

[1]   Eric Hall. Network Design Manual -- Internet Firewall Essentials. *The Business Tech. Network . http://www.networkcomputing.com/netdesign/wall1.html*

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[3]   Marshall Breeding. Network Design Manual -- Designing and Building the Best Small Office Network From the Ground Up. *The Business Tech. Network. http://www.networkcomputing.com/netdesign/ wall1.html*

[4]   Fred Halsall. Data Communications, Computer Networks and Open Systems Fourth Edition.   *Addison-Wesley Publishing Company.*