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Designing and Implementing the Intranet for ZhuHai State-Kai Polymer and New Materials Co.,Ltd

Min Jiang, Si Chen

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ABSTRACT

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This Thesis was commissioned by Zhuhai State-Kai Polymer and New Materials company, which is a chemical and pharmacy SME in China. The Thesis aimed to design and implement the Intranet with the characteristics of the case company on the basis of the identified requirements. The designed Intranet innovates in a computerized system to replace the current manual system used in its business life.

The questionnaire approach was used to gather the information and requirements both from the view of the IT manager and the whole staff in the case company. In addition, in order to improve the reliability of the thesis, the constructive research and case study methods were used in this thesis.

The designed Intranet was documented with available functions and services provided by the Intranet based on the identified requirements from the case company. The pilot implementation was performed by using the VMware software to construct the virtual Intranet. The result indicated that the virtual Intranet fulfilled the functions and services of the designed Intranet. The implication of the Intranet can be recommended to solve the problems about the information technology deficiencies existing in the case company.

Keywords: the Intranet, identified requirements, pilot implementation, functions and services, innovative computerized system

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1 INTRODUCTION

1.1 Motivation

This research aimed to design a tailored Intranet for the case company, which was motivated by the needs both from the case company and researchers. The preliminary demand of the case company was providing a solution to its current problems. The problems include accessing information in short and poorly managing its daily business affair by an outdated man-made way. While, the advent of the Intranet used in business provides a new business model to facilitate labour efficiency and a strategic management vision to improve centralized management (Desborough 1996). Therefore, the Intranet development in the case company provides a solution to the problems it has faced. Furthermore, the evolution of Intranet can enhance the competitive advantage for enterprises with the aid of utilizing information technology to meet the information age (Dodd 1997).

Moreover, the researchers aimed to practice their information technology, especially the project engineering skills and networking technologies. This research to develop the Intranet not merely met the expectation of the BIT (Business Information Technology) department in Kemi-Tornio university of applied sciences, which is applying information technology into the business field, but also fulfilled the researchers' self-actualization as project engineers to deal with the Intranet development. Thus, in order to examine the theoretic knowledge, the researchers utilized their abilities to design and implement the actual and available Intranet for the case company. Synchronously, the researchers can gain the precious experience and comprehensive insights into the Intranet technology. Additionally, if the authentication and availability of this research get the approval of the case company, this project work can be continued to realize the Intranet development.

In the view of the needs to motivate the research, the designed Intranet can ensure the timely, reliable and secure data transport. Using Microsoft Visio as the designed tool, the topology of Intranet infrastructure can be illustrated by diagrams and models. By demonstrating the innovative computerized system to deal with the business process among the Intranet, the benefits of the Intranet implementation are clearly to solve the IT problems in the case company. If the case company decides to select the designed Intranet as the appropriate solution to its IT problems, this thesis will be a valuable blueprint to guide the processes of the Intranet implementation in the realization.

1.2 Background

(Liu 2010) introduces that the case company- Zhuhai State-Kai Polymer and New Materials Co., Ltd. (henceforth Zhuhai Polymer) is a typical SME which owns about 200 employees. The case company operates in the chemical and medical industry and spreads both in Zhuhai city and Wuhan metropolis, one of which is in the Guangdong province and the other is in the Hubei province in China. Therefore, cross-cities business operation has been contributing to the complex distribution and communication of the information resources. (Liu 2010.)

The poor IT application problem existing in the case company spreads on four departments comprised of the production and research (R&D) department, sales department, human resource (HR) department and financial department. In order to solve this problem, the top-level manager of the case company planned to utilize the modern information technology as the solution to the problem. Simultaneously, the researchers found a significant application of the Intranet to the case company can provide a solution to improve the IT application. After the researchers talked about their interest to design the case company's Intranet, the case company attached

importance to their suggestion and authorized the researchers to design and implement its own Intranet.

With the objectives of developed Intranet for the case company, a variety of specialty software applications can be installed and utilized by each department to enhance the competitive advantages in the technique field. In addition, the staff can access the latest information and master the most up-to-date technology contributed to development of products and services. More, the great expenditure spending on the daily operation can be decreased. The developed Intranet can reduce the expenditure via fulfilling the office automation (OA) and the computerized system (O' Donnell & Gilmore & Cummins & Carson 2003). Consequently, the staff can access and share the information resources in a convenient way to improve the operational efficiency with lower costs.

1.3 Research topic and questions

This research topic combines the requirement engineering knowledge and networking technology into a practical Intranet development for the case company. The aim is to design a tailored Intranet to meet the needs of its business development based on the identified requirements. The processes of the research consist of requirement specification, the architectural design, and the IT staff management. The result of the research plays a role as a high-level overview for the case company to realize its Intranet development in the future. Additionally, this research provides an alternative choice for the case company to compare the outsourcing products. By implementing the research, the researchers explored three following questions to map the processes of the research.

1 What are the case company's requirements for the Intranet development?

The objective of this research question is to identify the Intranet requirements from the demands of user and system. The analysis of the requirements supports investigating both the services and constraint within the Intranet. Also, the most important phase is to organize the different requirements into the requirements documents can be used in the Intranet design.

On the one hand, user requirements collected are described by interviewing the representatives, separately standing the point of the end-users and the point of the IT manager. The user requirements show the expectation of what the functions the Intranet can provide and to what extent it is unable to operate. The functional requirements indicate information transfer and spread, application installation, and centralized management. On the other hand, system requirements are collected and analyzed to describe the functional and non-functional requirements of the Intranet in more details. The non-functional requirements include devices, servers, operating system and security requirements. The description of this detailed specification involves the interactions with all the Intranet stakeholders including the end-users, business managers and networking developers and maintainers. This specification is illustrated by using diagrams.

The investigation of the case company's requirements facilitates the further design phase of the Intranet in the research. This requirement research aims to define a simple and clear requirement specification in a natural language to facilitate the client's understanding.

2 How can design and implement the Intranet for the case company based on the identified requirements?

In answering this question, the researchers use a document report to design the Intranet architecture with the help of models and diagrams. This Intranet architecture gives an outline as a blueprint for configuring the Intranet's hardware platform based on the

identified requirements.

The architectural design process is concerned with establishing a basic structural framework for the Intranet, which consisted of infrastructure topology, devices connection, server's configuration and security configuration. This research uses several case studies which about the Intranet design used by other organizations. In Addition, alternative choices of the outsourcing products are suggested in this research.

This research focuses on establishing the Intranet hardware platform in the technical aspect. However, in terms of the software platform, such as various applications which contribute to the case company's business development among the Intranet are not considered.

The output of the architectural design is an architectural design document. This document consists of a number of graphical notations and representations of the Intranet models along with associated descriptive text by using Microsoft Visio. According to the Intranet architecture, the designed document demonstrates the performance, robustness, distribution and maintainability of the network. Besides, it is an overview of the Intranet development for the further implementation phase.

The implementation process executes the pilot establishment to install virtual network by using VMware software. According to the designed Intranet, the pilot implementation involves the server installation and security configuration. Moreover, the pilot Intranet performs the functions expected both by the users and managers to meet the initially identified requirements.

The result of the implementation provides one testing report and one video demonstration for supporting the evaluation and assessment by the case company. The virtual implementation of the Intranet enhances the reliability to realize the Intranet infrastructure among the case company.

3 What kind of IT team or support does the case company need to administer the Intranet?

This research question identifies the important issue involved in selecting and training staff in the Intranet development organization. The staff represents intellectual capital to ensure that the case company can get the best possible return on investment (ROI) in the Intranet development.

Firstly, this research solves this question by describing the current skills of the IT staff including the networking administrator and the security group. Secondly, the researchers study the needs of IT staff in developing and maintaining the Intranet. Thirdly, the basic capability of use required from the staff is introduced for the case company. Lastly, this research considers the training procedures such as showing users how to use printer, distribute information, and log into the Intranet.

This solution makes the Intranet more manageable and secure when the IT staff participated in the operation and maintenance among the Intranet. Indeed, IT support represents a supportive assessment for the case company to adopt the Intranet designed.

1.4 Research methodology

1.4.1 Constructive research method

Keeping in mind the essential demand of the research, which focuses on the practical design and implementation of the enterprise Intranet, the researchers used the constructive research approach as main research method. Constructive research method

is building an artifact to solve a practical problem in order to know how the problem can be solved. The artifact can be a software development method, a programming language or a business model. (Ryabov 2010.) The initial purpose of our research was to explore a solution to the problem faced to the case company. Therefore, the constructive method was applied to create a solution idea with a heuristic process of the Intranet design and implementation for Zhuhai Polymer.

According to the constructive research approach study, this research performed seven crucial tasks. The detailed tasks were explained on below:

1. Found out the practically IT relevant problem existed in the case company, which also has research potential to improve its IT competitive. Based on the case company's needs to provide information and technical resources to employees, one solution to develop its own Intranet was proposed to the case company as the research topic.
2. Identified the scope of the theoretical knowledge about the Intranet used by the case company in current situation.
3. Selected cases execution to study for reference.
4. Interviewed the representatives in the case company to analyse the user requirements.
5. Designed models of the Intranet based on the requirements and the current company's resources.
6. Implemented the pilot connection of the devices using WMware software to set up the local area network.
7. Recorded the results and gave the feedback.

As it was mentioned before, the case study method contributed to the Intranet design, whereas, the Intranet implementation was performed as a prototype based on the pilot construction in the laboratory. The result of using constructive research created the Intranet prototype for the evaluation of the research. (Ryabov 2010.)

1.4.2 Case study method

Regarding the existed variety of resources and examples about the Intranet used by SMEs, this research used multiple case studies to obtain the current technical resources and refer to the former experience. A case study usually means a single unit of analysis, which is an in-depth investigation aiming at an overall description of the research object (Soy 1997). This might be a company, an organization and a school, but it could also be multiple cases (Ryabov 2010).

This research planned to select three case studies include two SMEs and one school, all of which have developed their Intranet already. In fact, this research just finished two case studies about two SMEs, while the school case had to be abandoned because the security restrictions of the school resources.

For the two SMEs case studies, they were literature studies for understanding how to develop the Intranet for SMEs with sufficient pictures, models and instructions. This research learned the details about the basic needs of developing the SMEs' Intranet, the structures of the network, and the configurations of the DHCP server, WINS server, Email server, FTP server and Printer server (Xu & Lin & Lin 2008). These two SMEs had the similar locations to Zhuhai Polymer, their offices are in different areas. In terms of the location factor and the number of staff, the solutions to their problems provided by the Intranet development also might be adapted to Zhuhai Polymer. Therefore, this research chose these two SMEs as case studies to aggregate their settings of Intranet into the case company's features.

The results of multiple case studies not only provided a well-integrated form to the case company, but along with explored the particular design based on the case company's status and features. Applying case studies method was important to refer and compare the Intranet used by other organizations to provide a general technical architecture that supported the design and implementation of the Intranet in this

research.

1.4.3 Data collection and analyses

To find out the case company's requirements, this research performed data collection and analysis by using interview and questionnaire techniques. The research is a qualitative study with the aid of literature review and analysis of document techniques. According to the lectures addressed by Ryabov (2010), these two techniques are used to help researchers to read, understand, and estimate valuable information of others. Using others' valuable information can avoid redundant labour work on the approval of the prior outcome. In this research, the reliable information resources were accessed from books, magazines, annual reports, periodicals and theses, both in the library and on the Internet.

The questionnaires were designed to examine what functions expected by users among the Intranet. The answers of the questionnaires were a distant collection by sending email on June 2010. These questionnaires covered three parts referring the basic information and resources, the current application of the Internet and the expected Intranet applications. In addition, structured questions were used including closed questions and open ended questions seen in Appendices 1- 3.

Furthermore, this research interviewed the representatives of Zhuhai Polymer according to the arranged date and time. All the results of data collection by interviewing were recorded and documented contributing to the background information and requirements of the case company. The findings of the data-analysis were documented as a requirement specification to be used in the design process.

2 REQUIREMENT COLLECTION AND DATA ANALYSES

Dodd (1997) suggests the intranet plays an important role for SMEs in the modern and competitive age. The Intranet is the infrastructure for SMEs' informationization and also a way to improve the competitive force. In order to design the Intranet for the case company, the first step in this research was to acquire the user requirement. Some specified users were investigated in the form of a questionnaire sent to them via conventional mails. These investigations by questionnaires were done in order to find out answers to questions posed in section 1.2 about the user requirements and the system requirements for clarifying the main purposes and the needs of the Intranet. The results of requirements investigation further support the point of design section.

2.1 User requirement collection and analysis

This research designed three questionnaires (see Appendices 1-3) including the basic status of the case company, the current application and the future needs of the Intranet, and the cost and effectiveness plan of the Intranet construction. The first and the third questionnaires were replied by the IT manager in the case company and the second one was answered by five managers in different departments in the company.

2.1.1 The basic status of ICT uses

The questionnaire 1 was planned to acquire the answers to analyse the current resources existing in the case company to support the further design. The questions in the questionnaire 1 dealt with three items on the below:

a) The status of the computers and applications uses.

b) The status of the informationization uses.

c) The status of IT staff.

See appendix 1 for the questionnaire 1 form.

The subject in the study was the specified IT manager in the case company. He is in charge of the whole IT execution and development for the case company, as a sole employee at the IT department. The purpose of this questionnaire was to realize the current status of the resources available and technologies applied.

Overall results on the data collected by replied questionnaire are displaying below:

1) The count of the computers: 46 (46 PC machines, no server and workstation)

2) The type of link to the Internet: ADSL

3) Main users: Financial officers, Human Resources officers, top-level managers in each department and IT staff.

The current resources about the IT devices and staff and are 46 end computers and only 1 professional IT person dealt with daily computers issues and charged the IT outsourcing and IT department establishment. Meanwhile, the case company outsourced the web site for e-commerce.

The current IT resources such as devices and staff are limited to be used to construct the Intranet in the case company. Not only having the need to purchase the quantity of the devices such as computers, cables, hubs, switchers, routers and printers, but also having the need to employee or train more IT professional staff to develop and maintain its IT resources.

The results of the study implied that the current IT resources are considerably limited and the applications of the IT are under-utilized. The case company still stays in a man-made office system with lower effectiveness on business performed by the delay of information sharing and obstacle of communication. Further, the professional IT staff are scarce and the IT knowledge and application mastered by the whole staff need to have IT training.

2.1.2 The needs of the Intranet

The questionnaire 2 was sent to the whole staff in order to find out and analyse the objectives of users and system. This was sent and collected respectively to the managers in administrative division and four main departments covering the R&D department, Sales department, HR department and Financial department. The results of the questionnaire 2 emphasizes the uses of the current IT resources and the needs for the further uses within the Intranet.

Table 1 shows the answers of the subjects to the questionnaire 2 about their uses and needs for the computer and network. These data were provided by the main managers in different departments. The results help to design the scale and services of the Intranet to satisfy user requirements.

Table 1 The result table of the questionnaire 2

Subjects	The count of employees	The count of computers existed	Needs	Requirements
Administrative department	16	12	the Internet, email，Distributing files and data	Security, Stability
R&D department	120	16	OA, the Internet, email，Sharing files and data, Sharing the printers, other professional software's application	Speed, Stability
Sales department	80	12	OA, the Internet, email，Sharing files and data, Sharing the printers, ERP application	Speed，Security，Stability
HR department	8	2	OA, the Internet, email，Sharing files and data, Sharing the printers, MIS application	Speed，Security，Stability
Financial department	11	4	OA, the Internet, email，Sharing files and data, Sharing the printers, financial software application	Speed，Security，Stability

The current applications of the IT are basic and limited software used by the financial and other officers. Even the case company owns the web site outsourced, the internal informationization is deficiency and the internal communications are obstacle.

Considering from expandability of the Intranet, all the staff would be the end users, thus, the quantity of terminals should be counted according to the staff number. The services provided by the computers are basic official software applications and the Internet use with the requirements of speed, stability and security. Thus, the designed Intranet refers above requirements as the designed principles.

2.1.3 The investment budget

According to the answers from the questionnaire 3 (see Appendix 3) charged by the IT manager in the case company, the questionnaire 3 investigaes the scale of the Intranet construction and the investment plan. This questionnaire collects the building structure in order to design the topology of the Intranet within the expandability. Furthermore, it also reveals the budget from three components: devices, IT group support and the operating expenses.

The building structure are drawing on the following based on the description by the IT manager in the case company. Below are the status of each building are showed in tables and the frame structures of each building are drawn in appendix 4.

Table 2 The status of building 1

Building 1	Department	Floors	Remarks
Headquarters building	Info center	1	3 rooms and 1 hall
	Sales offices	2	14 rooms
	Financial & human resource offices	3	11 rooms and 1 coffee room
	Managers & Meeting room	4	11 rooms
	rooftop	5	

Table 2 is the description of the current official status in building 1, which facilitates to design the topology of the Intranet in building 1. This research planned to design two sockets for each room to connect the end devices into the Intranet.

Table 3 The status of building 2

Building 2	Department	Floors	Remarks
Manufacture building	Manufacture hall	1	9 rooms
Research department	Research laboratory	2	14 rooms

Table 3 shows there are two floors in building 2 with 23 rooms in a total number. Building 2 is the main building for R&D department, and this department requires the Intranet with the speed and security features.

Table 4 The status of building 3

Building 3	Floors	Remarks
Dormitory building	1	48 rooms
Dormitory building	2	48rooms

Table 4 shows the status of building 3 with two floors and 96 rooms. Building 3 is the dormitory building with a great quantity of end users using the Internet and the Intranet together. Thus, the point to be considered is the speed of the Intranet providing to the users.

Table 5 The status of building 4

Building 4	Floors	Remarks
Logistic building	1	4 rooms
Sales department	2	8 rooms

Table 5 shows the structure of the building 4 in Wuhan city. This building is the sub-company of the case company with the main businesses on sales and logistic. The total rooms of the building 4 are 12 rooms in two floors.

The current capital of IT devices are considerably weak based on the investigation about the current status of the case company, whereas, fortunately, the case company values to build and invest the IT application as one of developing strategies to enhance the competitiveness. The investment budget about the Intranet construction is flexible according to the whole project scale and the purchase of the terminal IT devices. The case company planned to invest 2% capital of the infrastructure construction around 1,000,000 (RMB) as the first phase construction of the project.

Due to the investment plan is flexible based on the devices configuration and the scale of the Intranet, in this research, it paid more attention to study components of the cost.

Gartner (1987) develops one way to measure the return on investment of network construction called the network TCO (Total Cost of Ownership) which is the sum of cost of the physical infrastructure to build the network. It includes devices investment, IT supporting group and network operating expense. The details of the network TCO is explained on the following.

(a) Devices Investment includes Hub, Router, Switchboard, etc., which are the core infrastructures of the network

(b) IT Supporting Group charges the tasks to maintain the operation of the network devices and system and to provide the IT support

(c) Network Operating Expense is one kind of expenditure to keep the daily services provided by the network efficaciously. It consists of communication optical cable fee, the Internet discharge cost, systematic maintenance expense, electric expense and machine room charge. (Gartner 1987.)

Referring to the Intranet design of Xuri Corporation (BaiDuWenKu, 2010), these three items are the components of the whole network TCO, whereas they own the different percentages to be considered as the following. (Nicholas, 2007.)

(a) Devices Investment: 48%

(b) IT Supporting Group: 36%

(c) Network Operating Expense: 16%

The main factors to influence the investment of the Intranet construction are alterable according to the devices purchase and IT group recruit and training. The first phase of investment to construct the Intranet utilized the existing terminal computers to avoid the mass capital uses during the same period, whereas the topology of the Intranet construction should be considered from the whole scale of the employees as the potential end users. (Hyötyläinen 2000.)

2.1.4 Summary

From the point of the end users in the case company, the requirements about the uses of the Intranet and IT are on the following.

1) Establishing technological department in the headquarter building on the fifth floor

2) Establishing the enterprise post office for sharing and distributing information among the employees

3) Implementing OA system, management system, training system and service system

2.2 System requirements

Based on the analysis of the current resources and the needs of the case company, the system requirements consider the quality, speed, stability, security, investment and simplicity of installation and maintenance. The choice of the devices including server, cable, switchboard, computers and printers need to own the high quality to satisfy the daily applications under the Intranet and the Internet. Meanwhile, applications and services provided by the Intranet linked to the Internet require high-speed, security and stability. (MacGregor 2004.) To summarize the needs of the systems, the Intranet should own the following characteristics.

1) System expandability (allows increasing users)

2) System availability (7*24h)

3) High speed to connect to the Internet and no limit in local area network

4) Security ability to avoid external intruder

5) Simplicity of installation and maintenance

The system expandability means that the Intranet has the ability to add the end users

when the scale of the case company increased. Thus, the designed Intranet should consider the whole number of staff as the end users around 200 terminals. Furthermore, in order to ensure the system could provide the services in 7*24 hours, the designed Intranet should configure one more switchboard as backup choice. It is critical consideration for the backup strategy for the power which is the core factor for the servers and network equipments. Accordingly, the UPS (Uninterruptible Power Supply) can offer the solution to ensure the power supply. UPS provides the emergency power by one or more batteries and associated electronic apparatus. It can protect the computers, devices and servers continuously work if the power was interrupted. (Wiki 2010.) In addition, the speed of the Intranet is depending on the choice of the Internet service supplier and the physical medium to transfer the signals. For instance, the optic fiber and he twisted-pair copper wire can provide the high speed. Moreover, the security among the Intranet need to formulate a series security strategies both considered from the user security and the system security. The user security should be paid the attention on the password configuration, user's right, log-in tracking and etc.. The system security should consider the data encapsulation, firewall setting, backup and anti-virus software application. Lastly, the whole system of the Intranet should be designed in a simple way to be understood and managed by the staff with the IT training courses.

2.3 Summary on the requirements

The purpose of the Intranet construction was to satisfy the user's needs within corresponding services and functions. In this research, it studied the user's requirements and system requirements from the perspective of the case company's needs and of the current environment. The functions of the Intranet are summarized on the following:

● Sharing printers

● Using Email (internal and external)

● Sharing database

3 CREATING A DESIGN OF THE INTRANET

3.1 The structure of wiring system

In chapter 2, the building structure charts show there exists four buildings including headquarters building, manufacture & research building, dormitory building and sale sub-company building. The first three buildings are in the same industrial area in Zhuhai city, and the last building is in Wuhan city. The headquarters building has five floors consisted of the info centre which has 3 rooms and 1 hall, the sales department which has 14 rooms, the HR and financial department which have 11 rooms and 1 coffee room, the administrative group which has 11 room and the rooftop for IT machine room. The last three buildings all have 2 floors but have different rooms. There has 50 meters from the building 1 to building 2 and 1 kilometer from building 1 to building 3. For the sake of establishing IT machine room in the building 1, hence, it seems to be the centre of a circle to wire the Intranet system.

Each department owns its rooms and terminal devices such as computers, printers, servers, etc. The detailed count can be referred in chapter 2 (table 2). The purpose of configuring individual server for each department was simplifying the management and reducing the interference. Besides, not only counting the existing desk computers as the end users to design the project, but also counting the whole staff as the potential end users in order to ensure the system with expandability.
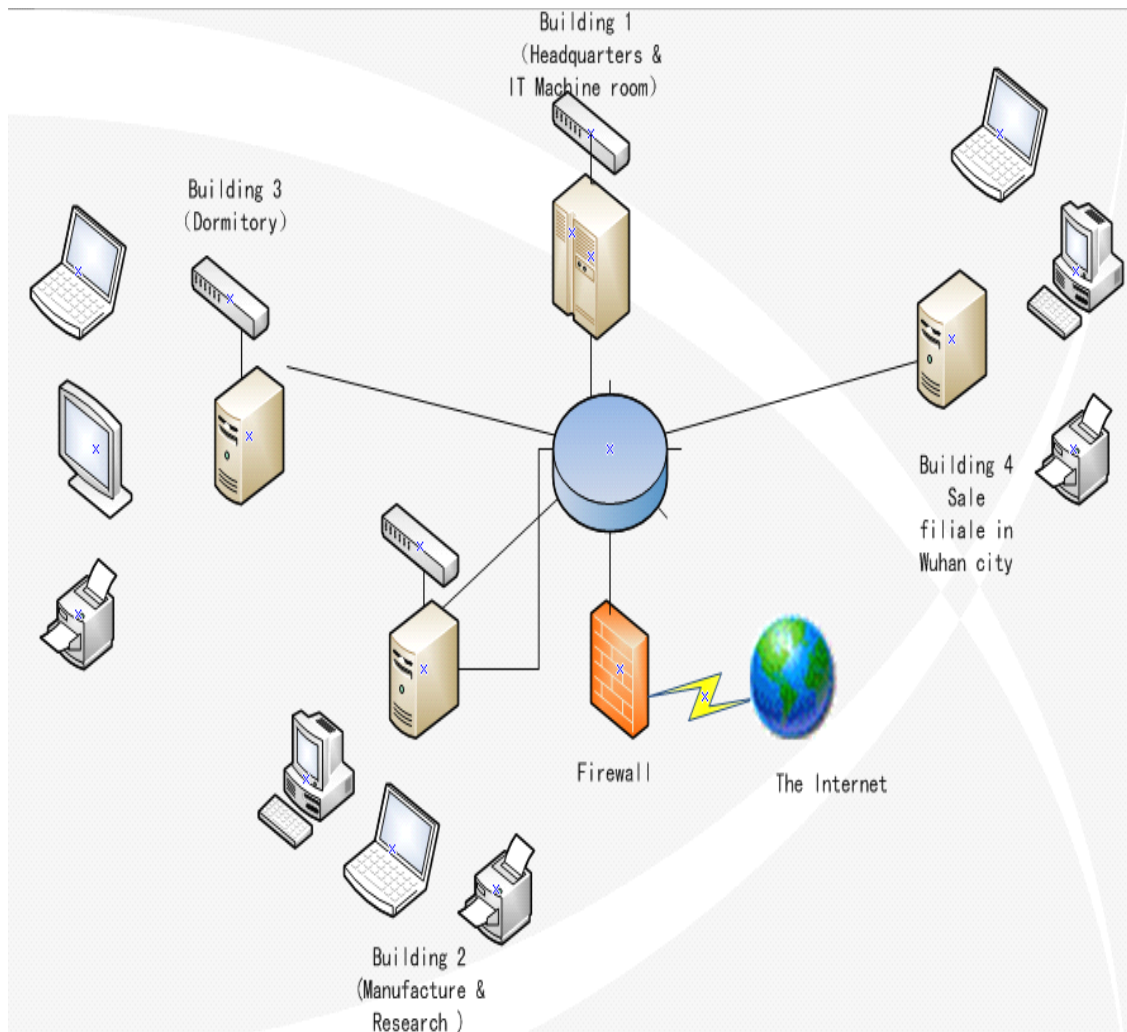
Figure 1 The structure diagram of wiring system

Figure 1 illustrates there is the Intranet linked the four buildings, and the building 1 is the centre of IT machine room. All the buildings have their own hubs to connect the end users existing in their buildings. Through the firewall to protect the Intranet to connect to the Internet. The end devices for instance desktop computers, printers and laptops are connected together within the Intranet.

3.2 The topology of the Intranet

3.2.1 Topology introduction

Topology structure describes the logic placement of the network for linking each unit. To be specified, it draws the connection way for every nodes in the network standing for physical structure, especially for the placement of end computers and cables. There are three popular topology structures covering bus topology, star topology and ring topology. Based on these three topology structures, they also can be used to form tree topology, star-ring topology and fully connected topology. (Kurose & Ross 2001)

The choice of the topology should be considered network throughput, reaction time of network, reliability of network, complicacy of NI (Network Interface), and software applications. Furthermore, it also influenced the cost and complexity of cable installation, the expandability of the system, isolating ability of mistake happenings, etc.. Therefore, it is significance of network establishment referring to the choice of IT, protocol of communication and network performance.

3.2.2 The choice of topology

In order to make a choice for the research with sufficient comparison, this research summarized the benefits and suitable status among these different topology structures listing on the table 6.

Table 6 Different types of topology

Topology type	Benefits and suitable status
Bus topology	1) Small scale of network 2) Low cost 3) Slow increase on network scale
Star topology	1) Easy to add and delete end users 2) Easy to diagnose mistakes 3) Medium scale of network
Ring topology	1) Reliable to perform in heavy load 2) High-speed network 3) Frequent re-configuration
Star-line topology	1) Low cost 2) Available to re-configuration 3) Large increase in network scale
Star-ring topology	1) Large scale of network 2) High-speed performance 3) Large increase in network scale 4) Reliable to perform in heavy load

In conclusion, the star-line topology is the most suitable choice after consulting these different topology structures. The first reason is low cost of investment during the preliminary phase of Intranet establishment. Moreover, the star-line topology allows large expandability of network scale in further under the availability to re-configuration.
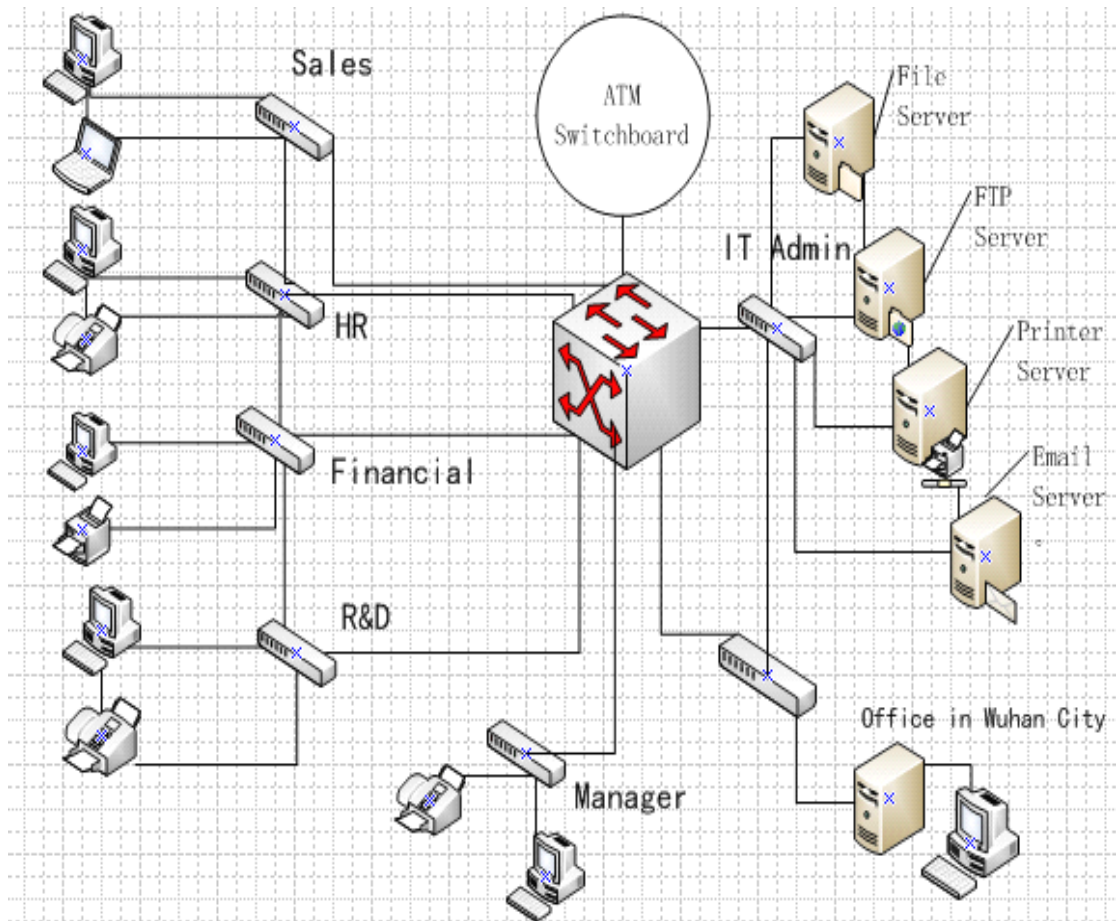
Figure 2 Star-line topology of the case company's Intranet

Figure 2 describes the star-line topology of the Intranet in the case company. The centre point is the switchboard as the core to send the information. Then, each department as an individual receiver with its own hub to connect its end users. Moreover, the IT machine room configures the different servers such as file server, FTP server, printer server and email server which are used by other end users among the Intranet.

3.3 The choice of network hardware devices

3.3.1 The principle of the choice

When the researchers designed the Intranet, referring to the user requirements (see Chapter 2), the preliminary needs of the Intranet are stability and reliability. Hence, the choice of the products and the corporative network operator determines the performance quality of the system. Moreover, the security and upgradability of the devices contribute to a valuable Intranet to ensure its development and expandability in future. Besides, tracked after-sales services provide by the devices supplier also need to be considered to maintain and manage the system. (Lei 2007.)

3.3.2 The choices of the devices

1) Cable

To access the Intranet in the company, physical medium is used to connect the devices to transfer signals. It directly influence the speed and capacity of the network with the measurement by transmitting bits. In current, there are three kinds of physical media used by the network called twisted-pair copper wire, coaxial cable and fiber optics. (Jaakohuhta 2003.) Below is the comparing table to summarize and analyse the characteristics within these different physical media.

Table 7 The characteristics of different physical media

Cable Type	Twisted-Pair Copper	Coaxial Cables	Fiber Optics
Charact ers	1) It consists of two insulated copper wires to reduce the electrical interference 2) It commonly used for residential users to access the Internet 3) It has mature technology with 100 years used by telephone 4) It clarifies UTP (Unshielded Twisted Pair) And STP (Shielded Twisted)	1) It consists of two copper conductors with a special insulation and shielding 2) It comes in two varieties: baseband coaxial cable and broadband coaxial cable 3) It is about a centimetre thick, lightweight, and easy to bend 4) It is commonly used in LANs	1) It consists of GOF (glass optical fiber), cladding GOF and plastic sheet 2) It is a thin, flexible medium that conducts pulses of light, with each pulse representing a bit 3) A single optical fiber can support tremendous bit rates which are immune to electromagnetic interference 4) It is popular technology used in the backbone of the Internet
Rate	10Mbps - 100Mbps	10Mbps	Hundreds of Mbps
Cost	Least-expensive transmission medium	A little more Expensive than twisted-pair copper wire	High cost of optical devices such as transmitters, receivers and switches
Model	1UTP- 5UTP	RG-8, RG-11, RG-58	OPGW, SMF

After taking an overview of these types of physical media, the twisted-pair copper wire is suitable cable to be used to the Intranet for the case company. The first reason is

based on the speed and stability principles, UTP owns higher rate than coaxial cable and it also transfers the signals in a stable and reliable path. Then, though the fiber optic provides the fast rate and capacity of transmission, the high expenditure of the devices is the weakness to compare with the twisted-pair copper wire. In conclusion, in this research, choosing 5-UTP as the cable is the most preferential prices with the highest value of performance.

2) Hub

When connecting two or more computers, the hub is necessity to build the network. It connects several computer to form a LAN (local area network), and then connecting to another hub or bandwidth to achieve sharing the Internet.

From the size of hub, there are two types distinguished by ports and size, one is normal hub with 8 ports, and the other one is rack mount hub with 19 inches. Meanwhile, the scale of the Intranet determines the choice of the hub. If built a small network for instance home or small office, the hub with 8 ports is the best choice enough for connecting limited end users and devices. While, for the case company, as one SME with around 200 potential end users, rack mount hub has more capacity and ability to handle the large network.

3) Switchboard

In the modern network, the use of Ethernet switch enhances the performance of the whole network. The switch machine not only improves the rate, but also provides more services to sharing the devices.

According to the most common classification, the switch used in LAN includes desktop switch, workgroup switch and campus switch. This research adored joint mode of campus switch as backbone switch and workgroup switch assigned to each department. The campus switch owns the enough capacity to support large scale

network and keep the speed and stability. In addition, the benefit of using workgroup switch to separate each department is that individual data, files, email, and news can be shared and encapsulated independently. This research took care from the security and stability of the Intranet for the users in different departments in the case company.

3.4 The choice of server's operating system

In the previous subsection, it gives an overview from the hardware aspects of planning and construction. As previous sections describe these choices for the structure of the Intranet, this research also indicates the software used to install and configure the Intranet. At the moment, the popular operating systems for network include Netware, Windows 2000 server, Windows 2003 server, Unix, Linux and Windows 2008 server. Well, Windows 2003 server is paid much attention to be operated in this research. Windows 2003 is a new generation OS with strong functions, in particular for the network, published by Microsoft in 2003. Comparing to Windows 2000, it totally inherits Windows 2000's functions with strong stability, classical user interface, simply operation, advanced technology and easily management. While, specially, Windows 2003 enhances the technology for NET, for instance it improves AD (Active Directory) and Group Policy. Thus, based on the benefits said above, Windows 2003 is chosen as the Intranet's OS.

There are four versions of Windows 2003, each targeted toward a particular size and type of business. It consists of standard edition, web edition, enterprise edition and database edition. In general, all these have the ability to share file and printer, act as an application server, and host message queues, provide email services, authenticate users, etc. Accordingly, the four versions of Windows 2003 are used for different types of business. The different versions own their own features described on the following table 8.

Table 8 Different types of the Windows Server 2003

	Standard Edition	Web Edition	Enterprise Edition	Database Edition
Number of Physical CPUs	4	2	8	32 / 64
RAM	256MB - 4GB	256MB- 2GB	256MB- 32GB	128MB- 512GB / 1GB- 512GB
Numbers of disk drives	4	2	Unlimited	Unlimited
Main application	SME, Centralized arrangement of applications	IIS 6.0 Web Server, XML Web Server	Cluster Server	Large enterprise or organization

According to the case company's resources and requirements, it prefers to apply standard edition as server OS. Thus standard edition of Windows 2003 was installed in experiment later in this research. The practically operation is showing on the next chapter.

3.5 Active Directory design

In order to centralized management among the Intranet, adoring domain name system, to be specified as AD installation to add, edit and delete end users to realize the central services. Creating AD (activity directory) allows administrators in the case company to assign policies deploy software and apply critical updates among the Intranet. AD provides simply management of user account, file resources, servers and applications.

The centralized management allows individual login, user authentication, and resources in divisional controller. (Kivikoski 2009.)

In this research, it designed the AD structure according to the resource' types and departmental titles to plan the OU (organizational unit) in AD topology. Figure 3 illustrates the OU of the Intranet below.
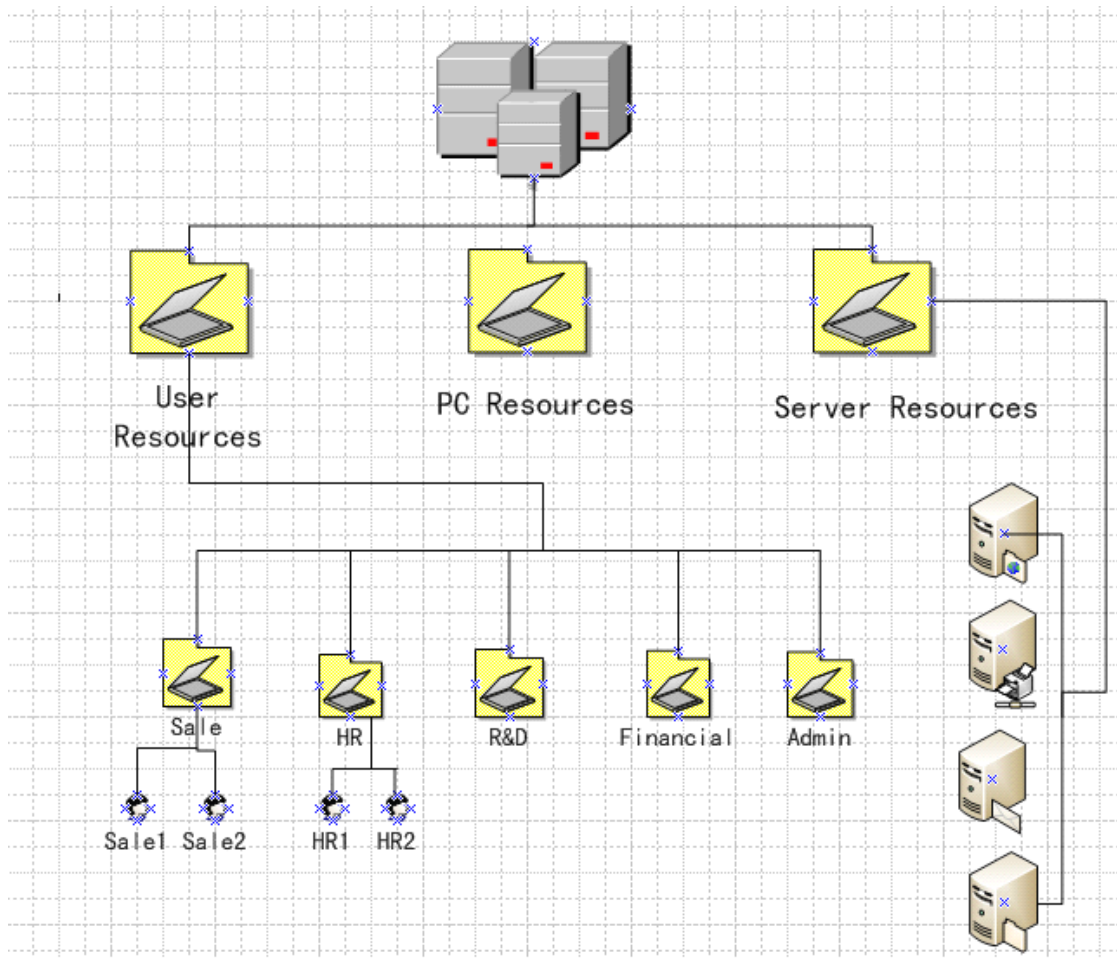

Figure 3 OU diagram in active directory

Figure 3 describes the divisions of AD creation according to the users resources, PC resources and servers resources. The user resources include four departments and administrative group to manage the end users. Further, the staff worked in different department as the end users can be centralized management for example add the end users, delete the end users in a regular control. In addition, the server resources consist of the printer server, email server, file server and DHCP server. The result of AD creation offers the IT staff to manage and control the end users in the Intranet with

automatic IP configuration.

3.6 The Intranet security strategy

On the one hand, security management in the Intranet provides ways for user license administration and violation monitoring. The tasks include monitoring and checking network and device accesses and access to resources stored on the Intranet servers in connection with administrator. (Häkansson & Gadde 2001.) In our security management as administrator to assign the login powers according to different registered group and to trace the information logged in collecting, saving and analyzing. It focused on who has access to what, and where access can be gained to network devices and services.(Niska 2010.)

On the other hand, during the designing the Intranet, this research considered the whole Intranet security with safety ability through configuring the firewall to link to the Internet. All the devices and wiring were designed to be connected internally and one centralized server through the firewall to link to the Internet and to link the others devices accessing the Internet through it.

3.7 The IT support group advice

The current human resources referred in IT field are comparatively deficient. Whereas, on the one side, maintain and manage the Intranet in properly, the case company has to recruit at least three persons to expand the IT department. The new recruited IT staff can charge the centralized management through the servers in machine room. On the other side, the specific training activities need to act among the normal staff to study and familiar the knowledge and operations of the Intranet.

3.8 The out-sourcing advice

According to the current status of the case company and the current products in the market, below is a list of hardware and software example products for choice. To speak of the following list is based on the products popularized and provided in China. This advice is convenient for the case company to purchase and compare the products.

Table 9 The list of physical devices and software

Items	Specification	Price (RMB)	Quantity
Server		25,000	1
Switchboard	BENQ- SS0224	2200	4
Network card	DCN- 550GT (Digital China)	690	1
Router	CISCO- 7513	11,800	1
Optical fiber	12 branches	37	300 meters
Twisted-pair	5-UTP	780	25 boxes
Server OS	Windows Server 2003	1957	1

The total cost of the devices and software is 99,447 RMB. The choices of these items were analyzed according to the status and resources in the case company. The quantity was evaluated by the scale of the Intranet with the consideration about the need in future. The price and specification were gained from the B2B electronic commercial web-site such as Alibaba commercial web. (www.alibaba.com)

4 IMPLEMENTATION

4.1 VMWARE introduction and application

VMware is one kind of software application providing a virtual platform like a physical hardware to guest the operating system. This software allows users to set up multiple virtual computers and to use one or more of these virtual machines simultaneously with the hosting operating system. Each virtual machine instance can execute its own guest operating system, such as Windows XP, Windows 2003 which were installed in our experimental Intranet construction. This reduces the complexity of building physical machine to implement the Intranet designed in our research. Through virtual construction of the Intranet, we can test our designed network and make a overview of the services and operation among the Intranet.

Below are the processes of the VMware installation and configuration. we had installed the Windows Server 2003 as our research server's OS used in the virtual platform within VMware. As well as we need to install two of Windows XP professional as end-user. Figure 4 presents platform of VMware which is a start to create virtual machine and create new team. During our pilot implementation we create a team which has one server and two end-users..
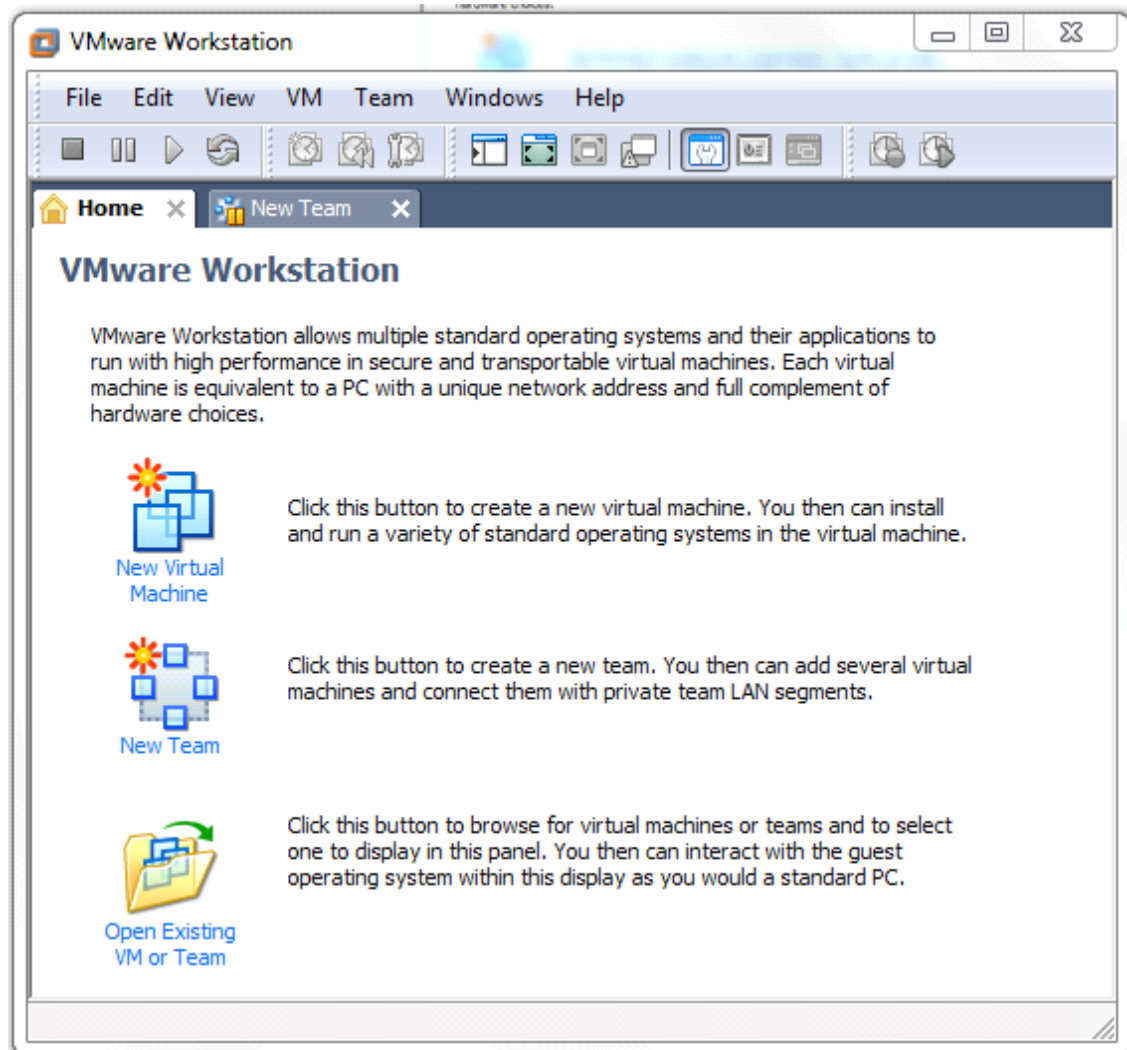
Figure 4 Interface of VMware software

4.2 Windows Server 2003 installation and configuration

As we had explained the choice of network OS with Windows Server 2003 in previous chapter, the practical processes and detailed configuration are presenting in our implementing phase by VMware. Figure 5 present Windows Server 2003 was installed and applied successfully in our virtual platform. In the virtual machine, the devices can have same configure like a host operating system. The devices include memory, hard disk, processors and so on. There have 4 different type of the windows server 2003 we have described it in chapter 3.4. So we choose to install windows server standard edition because it is more easy management and suitable for our case company.

Figure 5 Devices list of windows server 2003

Later, we clicked server management to control the server and execute more tasks.

Figure 6 shows the main page to configure the server under Windows Server 2003 operating system. All the server installation start from below page. Including Active Directory server construction, DNS server construction, DHCP server construction, FTP server construction, Email server construction, and printer server construction will be described in below chapter.
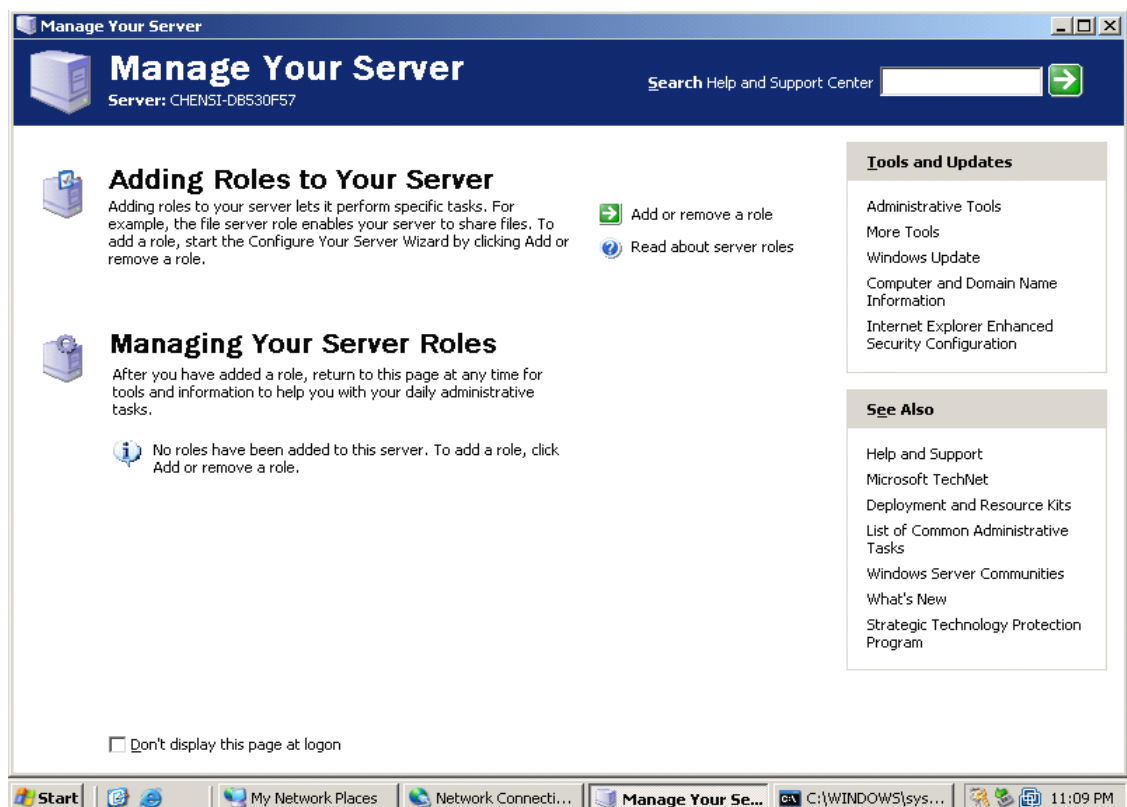

Figure 6 Management and configuration of the server

In order to construct a small local area network, we need to installation and configure the Intranet, We choose one Windows server 2003 and two Windows XP profession for the construct. Check the validity and available of the system and steps of configure are defined in below list.

Testing and configuring server 2003

1) Test for TCP/IP is execute the command "run-ipconfig" to check if the network protocol is working in properly.

2) Test for the network property by executing the command - "ping 127.0.0.1".

3) Configure IP address, Subnet Mask, and DNS address for network card

4) Computer name and workgroup as we defined "general-no-1", and "GENERAL"

5) Available Guest user

6) Configure high password configure by click account police and then password policy

7) Install network card and protocol IPX/SPX NetBIOS which used for connection computers

Here, we use windows XP professional as end-user for local area network costruct, and after initial configure server 2003 the initial configure of Windows XP are defined as follows list.

The processes of configuring Windows XP professional are displayed on below:

1) Install network card and protocol IPX/SPX NetBIOS which used for connection computers

2) Allow windows friendly log on

3) Allow other computers use my printer

4) Define IP address between "192.168.147.1" to "192.168.147.254" and same Subnet Mask "255.255.255.0" with server 2003.

5) We has installed two end-users and name of each respectively defined as

"general-financial1" and "general-sales1", same group name "general".

4.3 Active Directory installation and configuration

In the previous work, we had designed the AD (Active Directory) for the Intranet with the structural chart (see chapter 3.6). In addition, there are two basic conditions to install and configure the AD limited to the server machine. The first one is the server owns at least one NTFS disk, and the other one is the requirement about the hardware space with more than 1 GB. Converting the server's disk type by run the command - "convert /FS：NTFS".

Next, the processes of AD installation were illustrated by Print Screen in virtual machine to implement the Intranet construction in our research. Mainly steps of Installation and configure Active Directory we defined in below list.

Main steps of Installation and configure Active Directory

1) launch the AD wizard by clicking item- "Domain Controller (Active Directory)"

2) Choosing one type of domain controller. Due to this is the first domain controller in our machine, we chose to create a new domain

3) Creating a forest or child domain. According to the current status of the network, we had to create a new forest from start

4) Type the full DNS name for the new domain, we give the DNS name with "general.com". In common, the enterprise need to apply the domain name from InterNIC, but if in local area network, it has no strict rule to define the domain name

5) Setting up the location to store SYSVOL folder. The SYSVOL must be to store in NTFS disk, it derived from the reason to set up disk type with NTFS format. It is used to maintain the consistency of the database's backup and copy. Therefore, all the data stored in SYSVOL folder will be copied to all the domain controller

6) Checks the correctness to the previous operations. The results data display all the executions were in validity, meanwhile, the AD installation and configuration were finished

7) Add users by clicking Users folder in AD- "new"-"user", and then create password

4.4 DNS server construction

In the whole network, every computer (whether server or desk computer) own its computer name. It is easy for accessing each other among the Intranet. While, the hardware of the computers only read the IP address with binary system, therefore, configuring the DNS (Domain name system) plays a significant role in the enterprise server.

Below are the configuration of DNS server were illustrated by print Screen in virtual machine to implement the Intranet construction in our research. Figure 7 presents launch the DNS wizard by clicking item- "DNS server".
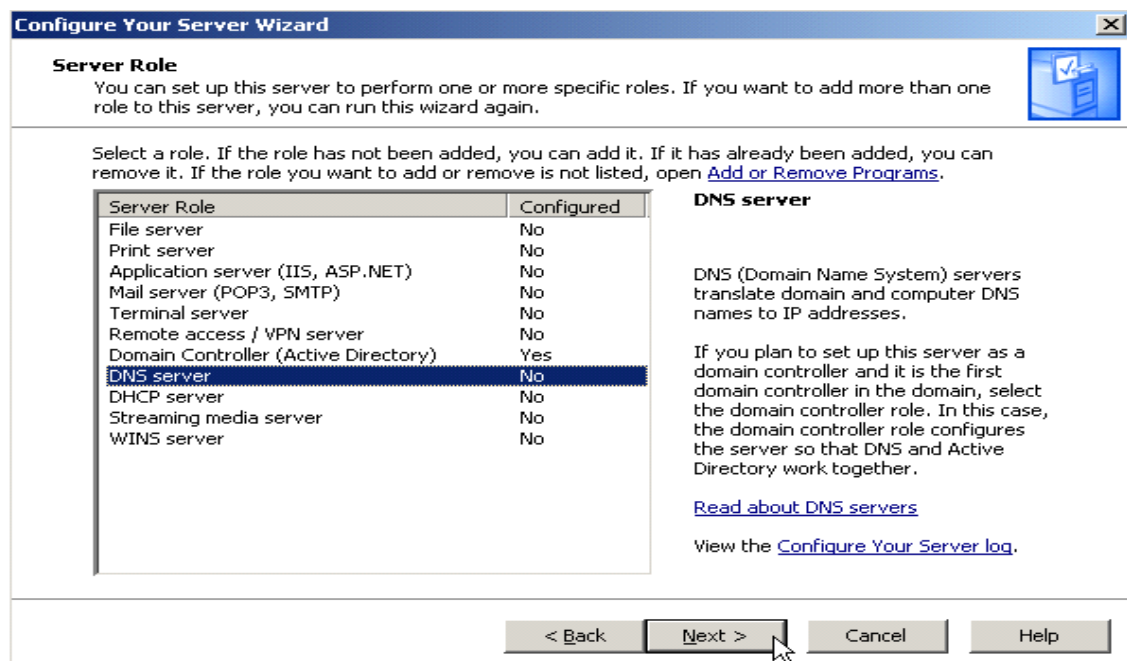

Figure 7 Entering into windows server to configure DNS server

Figure 8 shows the interface of DNS server we just configured, we can see from the below figure, we have create zone "com". Then we add new domain named "general" by clicking right side of "com". Construct the domain "general.com" used for defined a IP address for Web message and FTP server which will be present later.
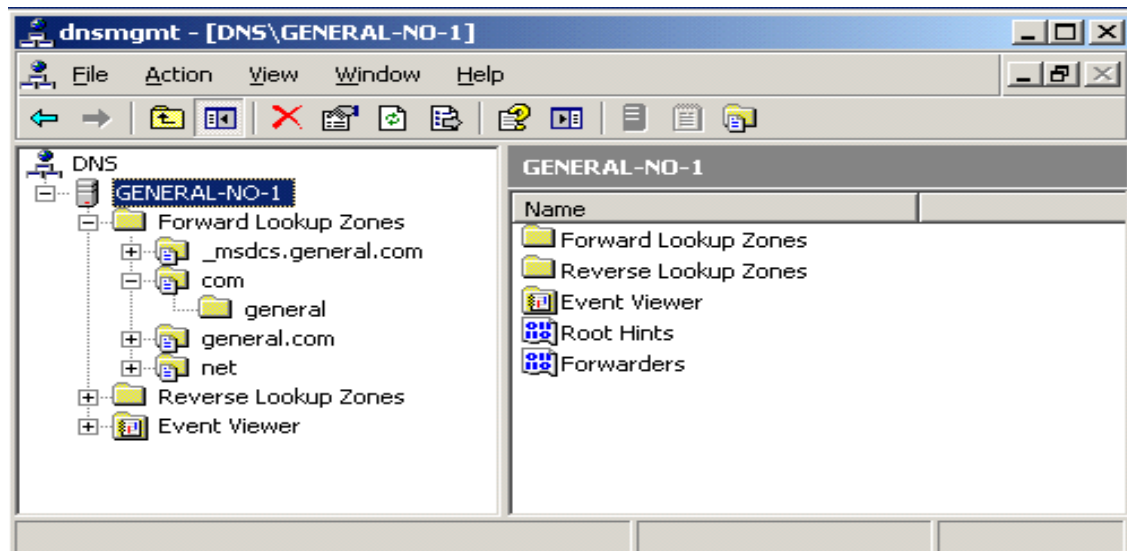

Figure 8 Interface of DNS server

The figure 9 shows add a host and configuration an IP address in domain name "general.com" which is used for web message deliver later. The IP we give "192.168.147.2" because it can be chosen from "192.168.147.1" to "192.168.147.254".
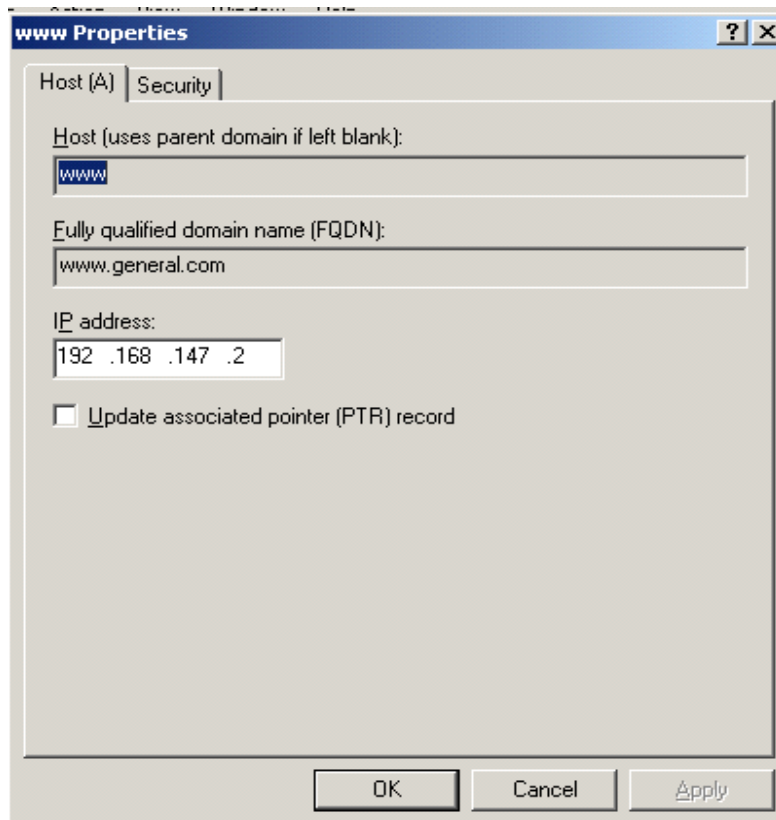
Figure 9 Add a Host "www"

Figure 10 shows add a host named ftp, which is used for file exchange from one computer to another. The IP address we define "192.168.147.129".
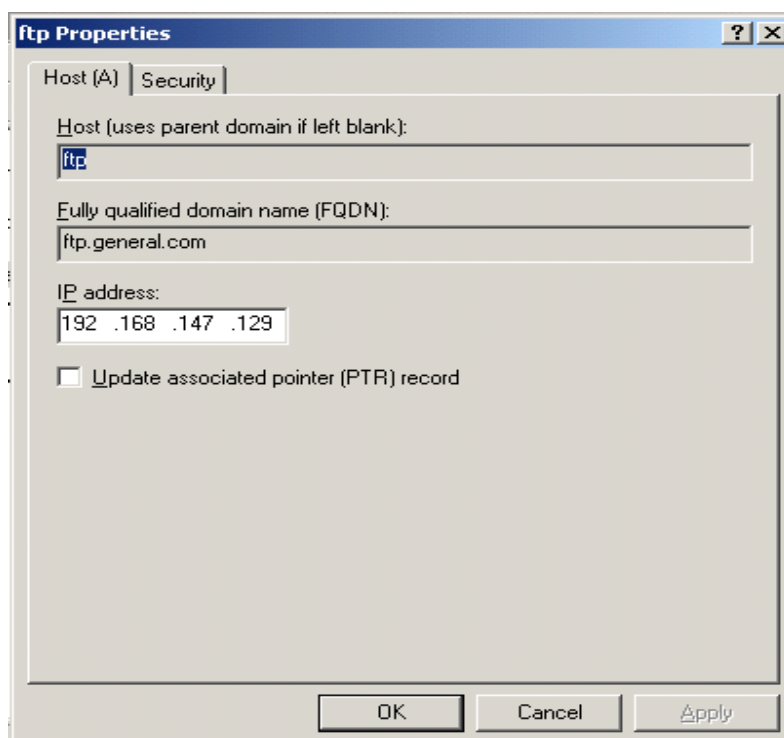

Figure 10 Add a Host "ftp"

4.5 DHCP server construction

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol for IP networks. When one computer ask for one IP address, then DHCP will auto check and give an unused IP to the computer. (Lei, 2007.) DHCP allows a computer to be configured automatically, and network administrators can easy management and keep track of computers. In our pilot implement, we have two end-users so DHCP will automatic give IP address to the end-users.

Next, the processes of DHCP server were illustrated by print screen in virtual machine to implement the Intranet construction in our research. Figure 11 presents launch DHCP wizard by clicking item "DHCP server".
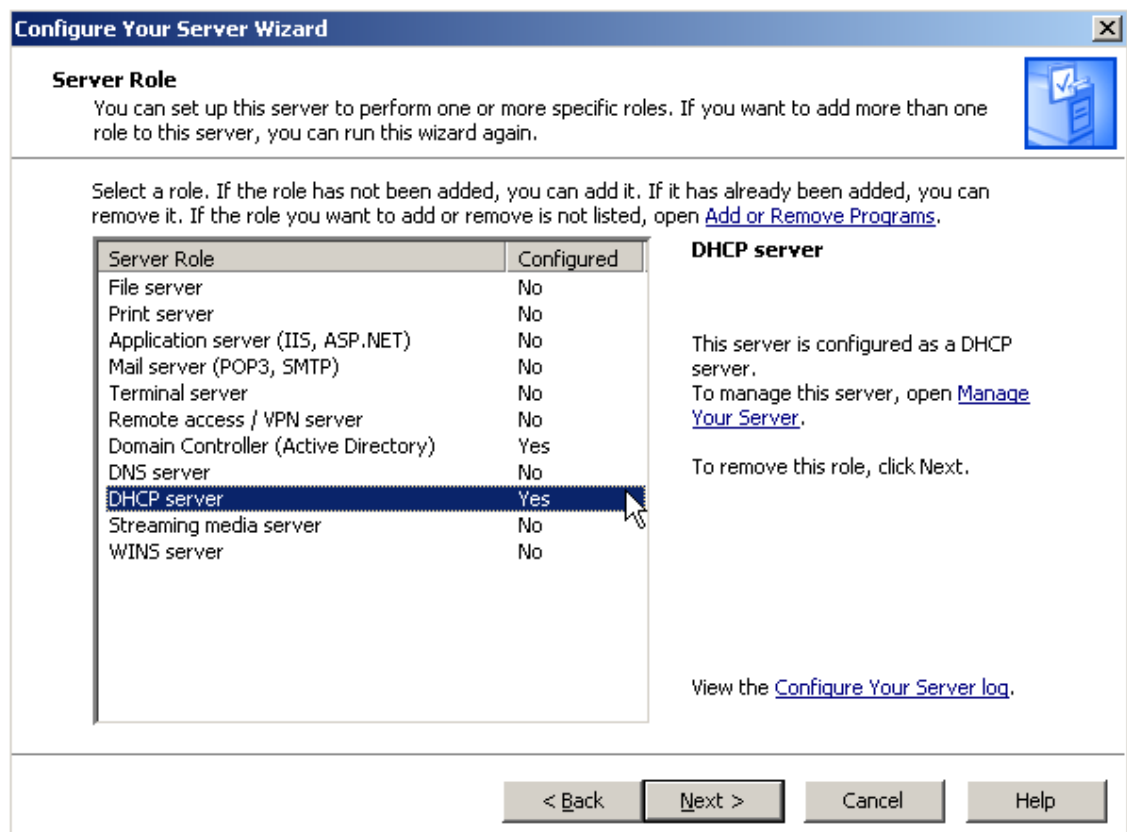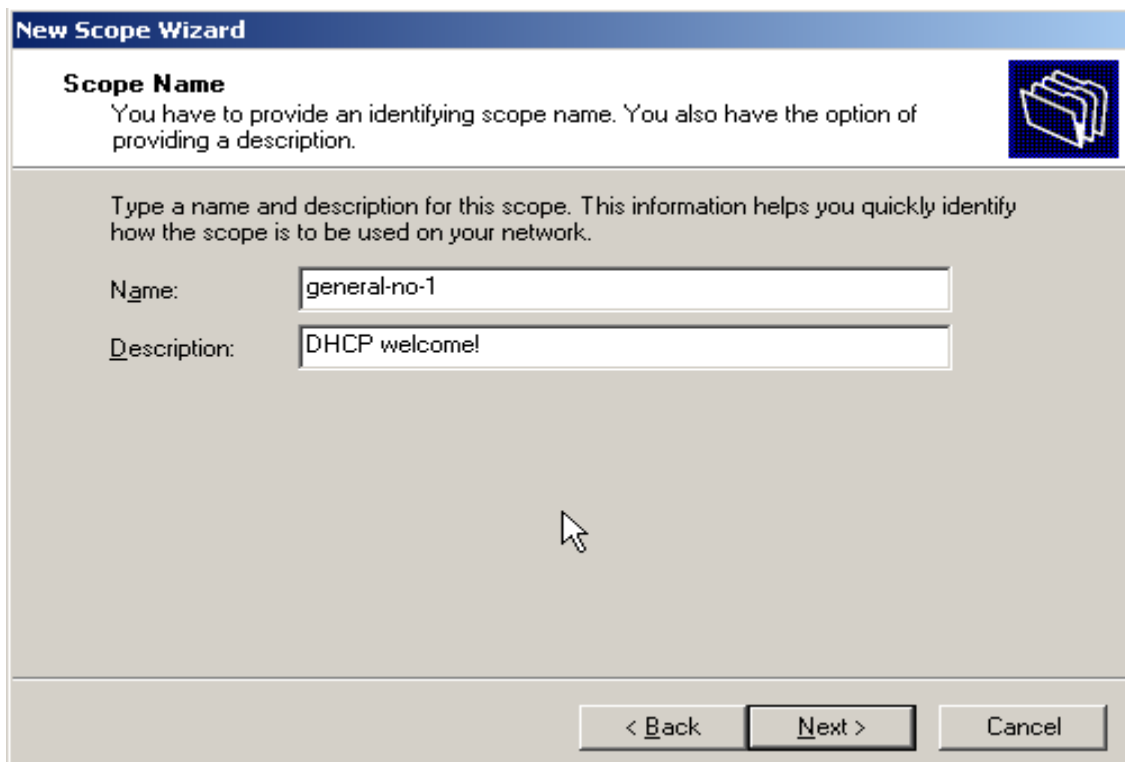

Figure 11 Configure DHCP server

Before install DNS server, we had install Windows server 2003 Service Pack. SP is a collection of updates, fixes and enhancements to a software in the form of an installable package.

Figure 12 shows a definition and description of the DHCP name. According to our server name, we give same name here for easy remember. And then we need to distribute scope of IP address for end-user. We define network IP address valid from "192.168.147.1" to "192.168.147.254". After define IP attribution, system will automatic configure subnet mask"255.255.255.0".

Figure 12 Configure DHCP server2

4.6   Email server construction

IMail server is an email server application that includes a lot of email protocol.   We can use ISS to configure email server, but we choose install IMail because it is very

suitable for SME as email server, It includes strong function and easy management than email server made by ISS configure. IMail also provide security, high-speed performance for email deliver. IMail is not only used as email server, it also can be used for calendar, enterprise workers can easy get day plan. The Figure 13 shows initial installations of IMail application. We downloaded the application from official website www.ipswitch.com

We give Host name for IMail same domain name "general.com". The Figure 14 shows some email protocol, just click the one you would like installation. Here we choose POP3 Service, SMTP service, Queue manager service. POP3 server means users can store email from server. SMTP is a useful and efficient email transfer protocol, mainly used in sent email between different systems. After configure the email server we can check if it is right configure from service.
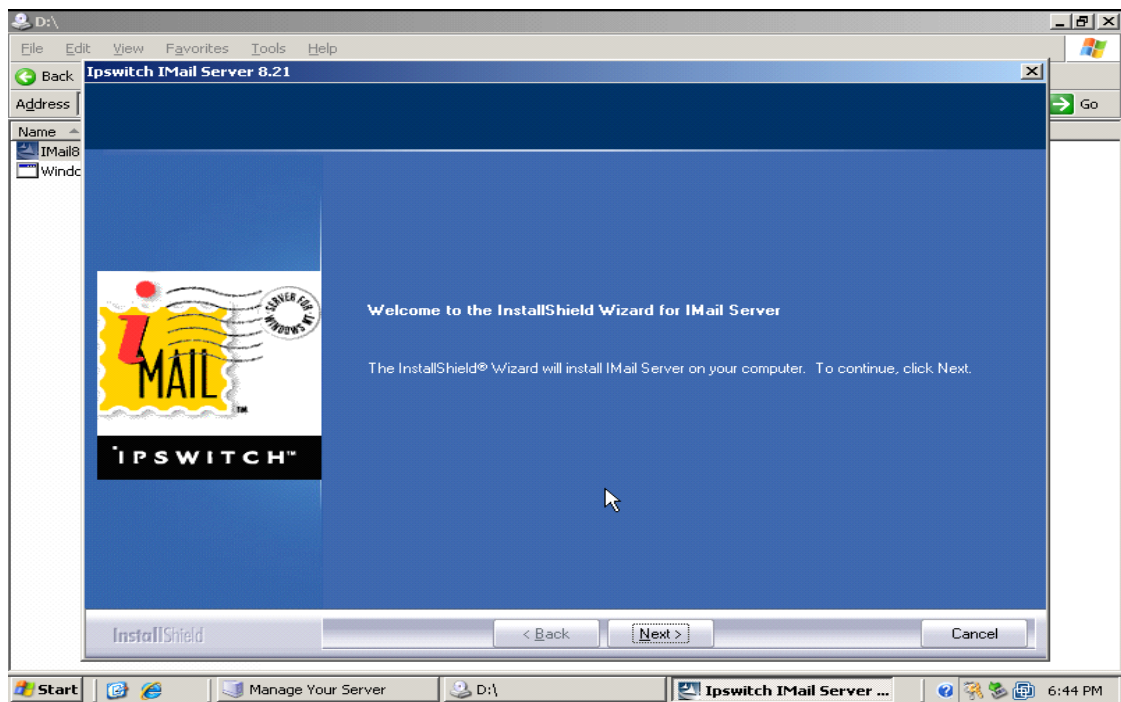

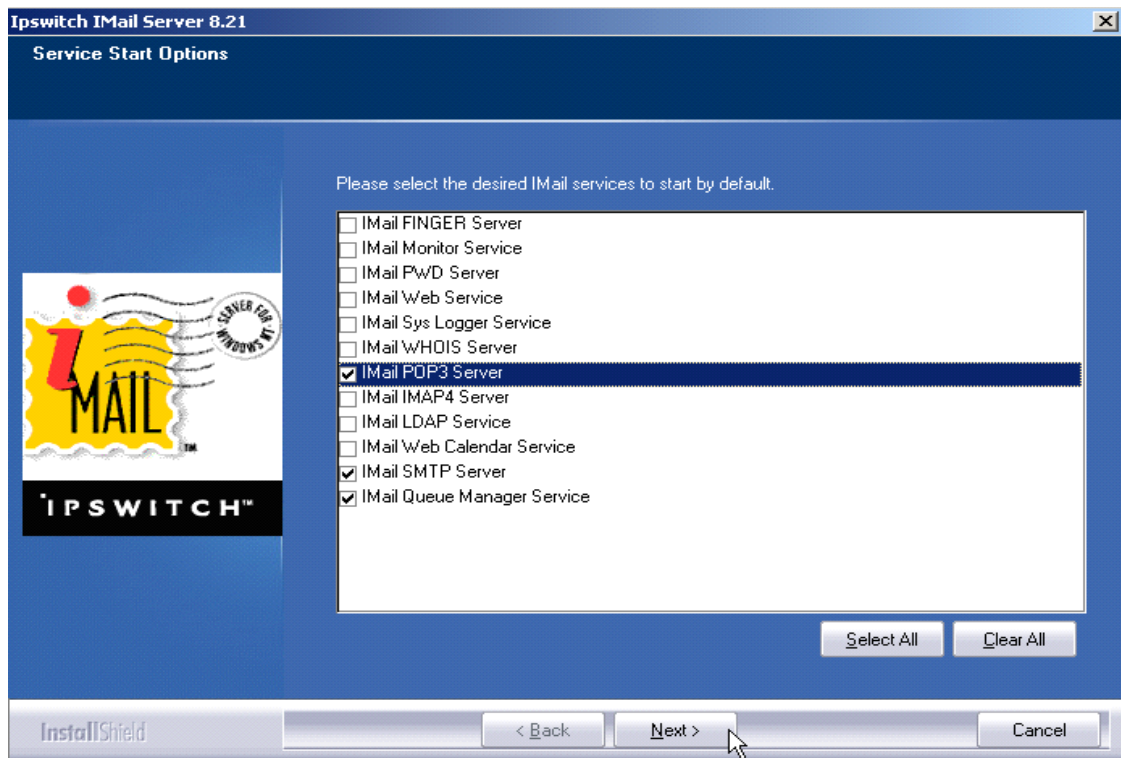**Figure 13** Initial installation of IMail application

Figure 14 Install email protocol

After installation of IMail, we can add new user by click right button- "add user" in general.com. After that, type UserID and password of creating the user email address. Figure 15 presents add users for email account.

Figure 15 add new users for email account

If user want to send email through Web, so he/she needs to apply his/her account web access. The port of web access is 8383 which is means if end-user want to send email

through web, he need to write down http://general.com:8383. Figure 16 presents interface log on the port 8383. Because of server has a lot of port so it can be used as different service. And port for Monitor is 8181 which used for seeing protocol open or not and also used for changing end-user information. If end-user want use Monitor on-line so he just need write down http://general.com:8181. Figure 17 presents interface log on port 8181. Construct the email server not only can be used in Web message, and also can be used in outlook.
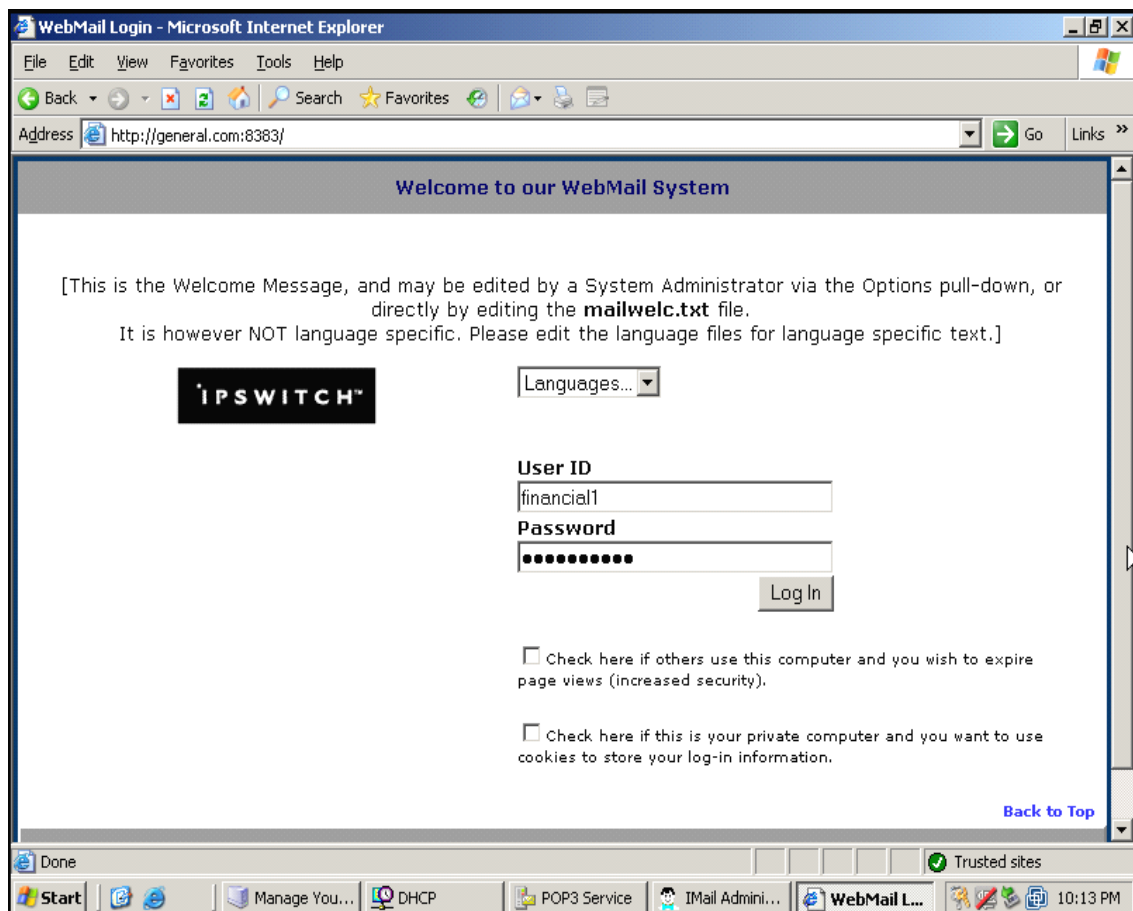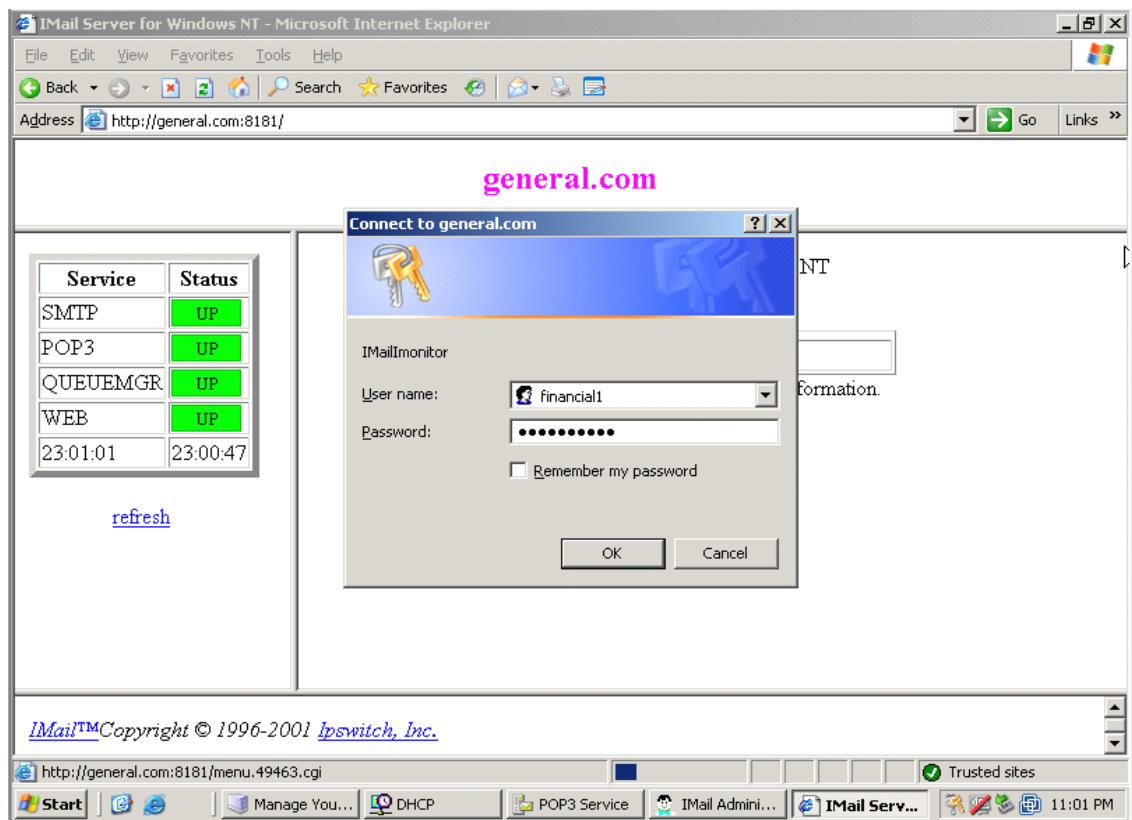

Figure 16 Testing port 8383

Figure 17 Testing port 8181

4.7 FTP server construction

Ftp server is one protocol used for transfer file from one computer to another. It is essential protocol for share file each other, the files include article, setup, data, video, picture and so on. There also has a lot of ftp application for you to choose, a mean of transfer file between local computer and network server. When user want view ftp file, he/she should log on ftp server, the user name and password should be added by ftp server administrator. We defined the domain name ftp.general.com.

Serv-U is popular software used in FTP server construction, which has strong function and easy use. Serv-U is suitable for our enterprise and we download most new version (13.9MB) from www.serv-u.com. Figure 18 presents interface of Serv-U. From the interface, you can manage domain, manage user and upload files to Home Directory.
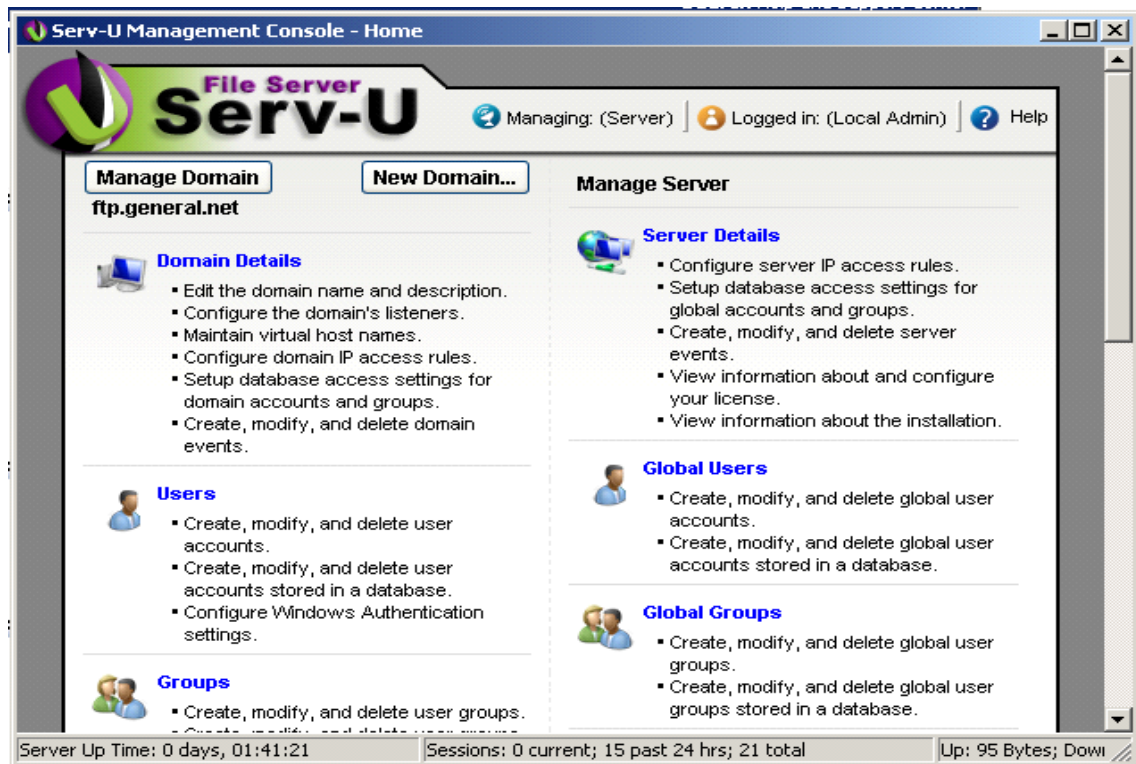
Figure 18 Interface of Serv-U

Different port define different server. and In the ftp server we define a IP address "192.168.147.129" for the FTP server, we choose Windows server 2003 IP address. After that, create UserID and password for file share, After that, the user can log on ftp server share files.

Home directory is the physical location where the user sharing files after successfully logging in to the ftp server. The name of home directory is "c:/MyFTP". Figure19 presents shared files.
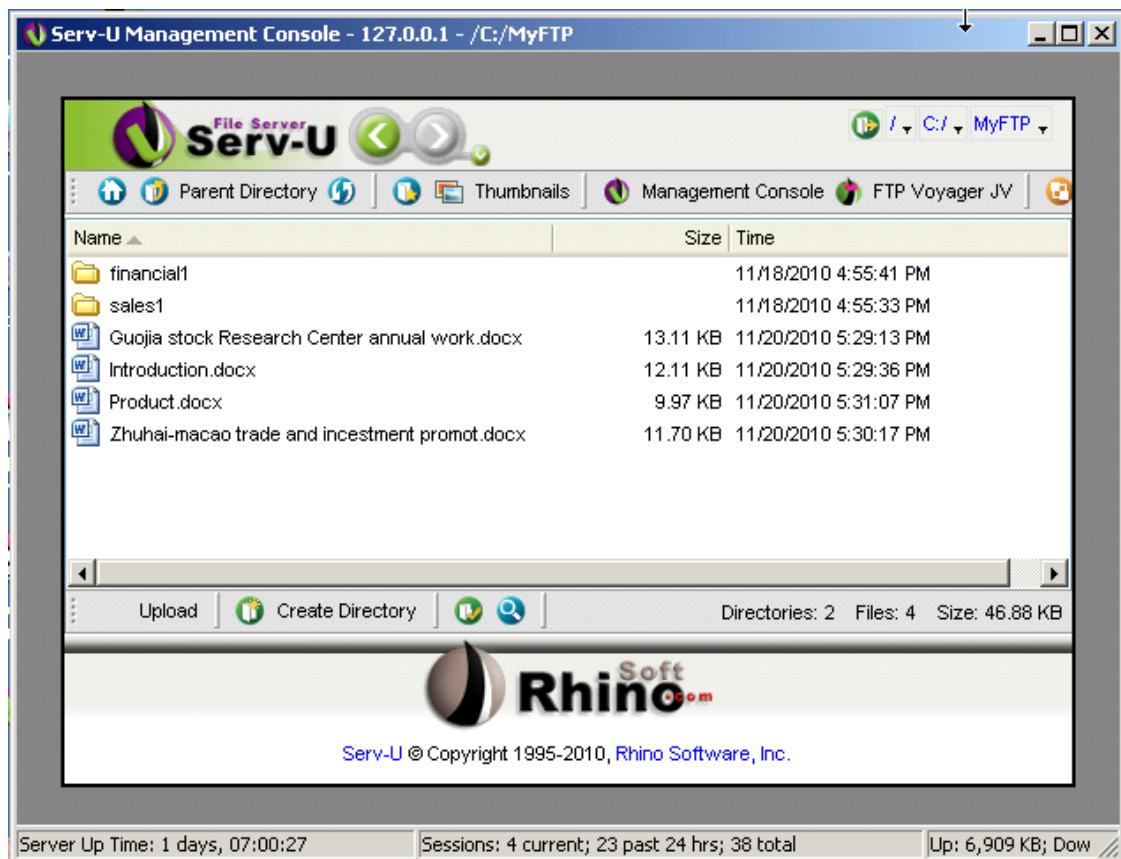
Figure 19 view shared files in FTP server

We define End-user full access to server which means read and write right. Full access means download file from FTP server and also can upload file to the server.

4.8 Printer server construction

Printer server means a lot of computers connected with one or more printers. We configure printer server because we hope all the system can share one printer.

The installation of printer server was illustrated in virtual machine to implement the Intranet construction in our research. Figure20 presents launch the printer wizard by clicking item-"Print server".
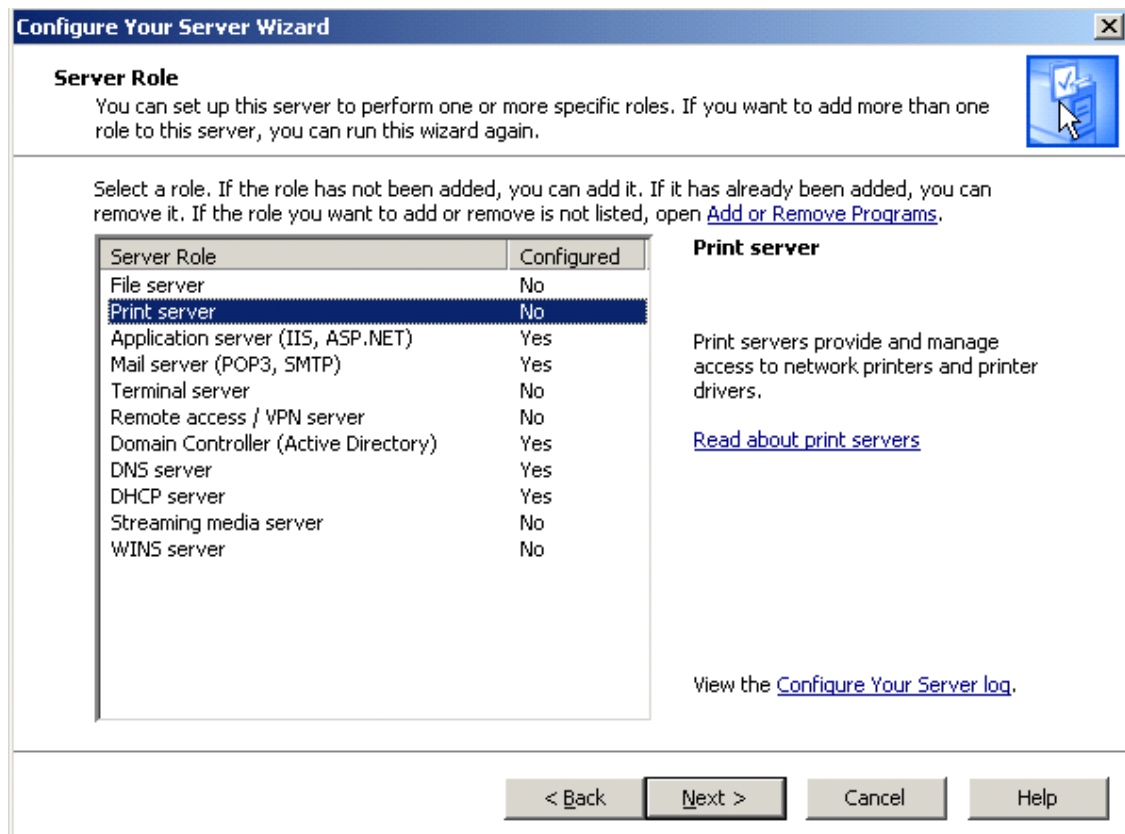
Figure 20 Configure print server

We have one print already connected with my computer, so we choose first one"Local printer attached to this computer". Figure21 presents windows server 2003 choose local printer to this computer.
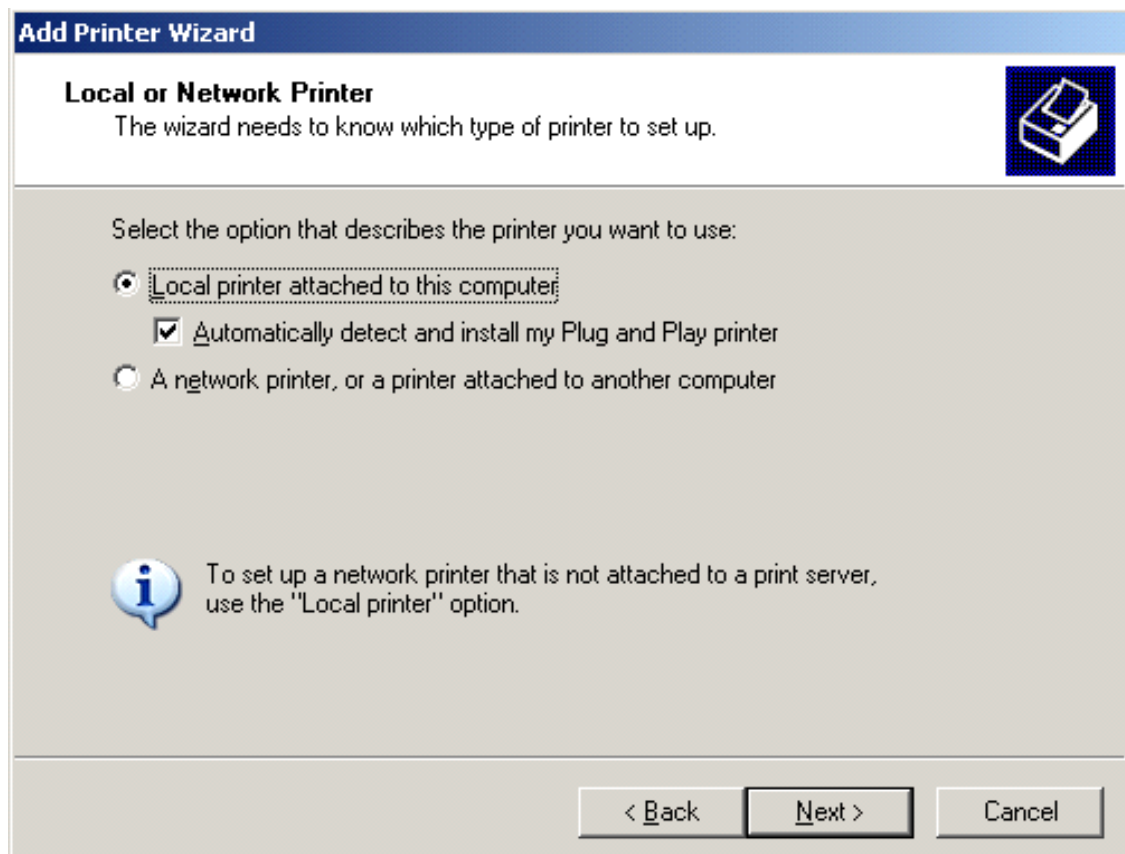
Figure 21 Choose local printer attached to this computer

Before we choose printer, we need first install printer driver to windows server 2003. and after that, we can write down printer name and shared printer name. Figure 22 presents success configure shared printer in Windows server 2003.
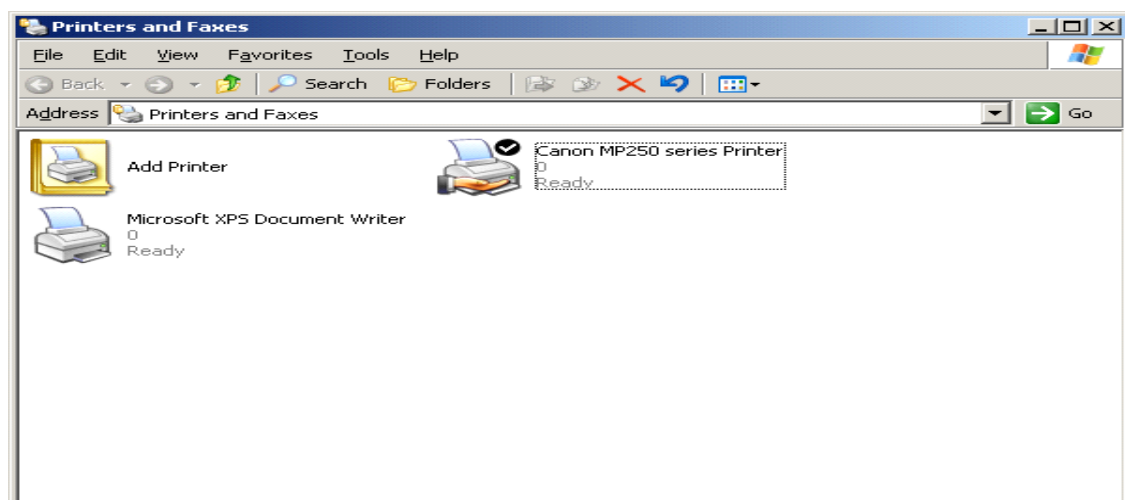
Figure 22 Success configure printer

After configure server printer, we can start configure local area network computer

printer. Firstly, add printer for local computer. Secondly, choose network printer because the computer already connected with server 2003. Thirdly, the figure23 presents connect with network printer -canon MP250.

Figure 23 Connect network printer

5 OUTPUT ANALYSES AND EVALUATION

5.1 Practical output

The output of this research were analysed from two parts consisting of designed framework and virtual network. The framework was designed based on the sufficient analysis of current resources and user requirements in the company. During the research, it formulated a series of questionnaires to receive the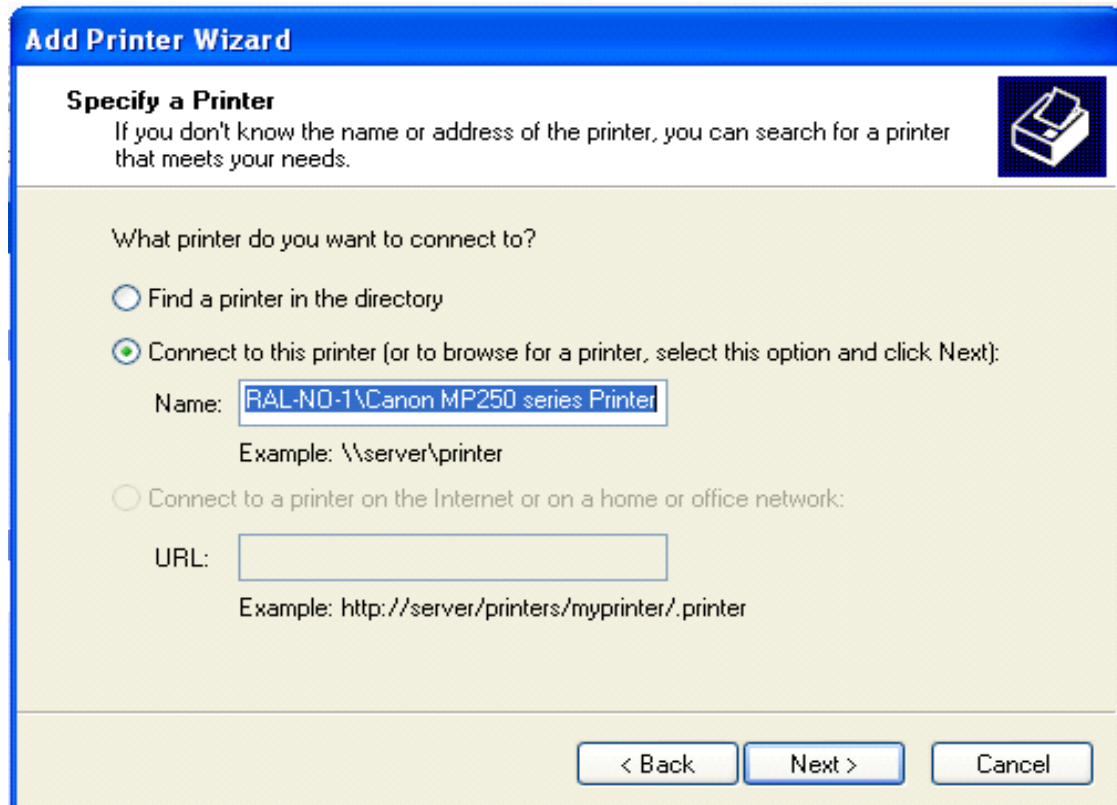 current status of the IT resources and problems existing in the case company. Then, comprehensive and contended user requirements were documented with discussion on results (see chapter 2). On the basis of the requirement report, the research designed the framework of the Intranet for the case company with the consideration of the hardware planning and the software planning. To be specified, the hardware design planned from the aspects of wiring system, topology structure and physical devices. And the software design was taken into consideration with server's operation system. In addition, the security strategy and the advices of IT group and out-sourcing list were planned in designed framework as well. Taking an overview of the designed product, the designed Intranet was completely satisfied the users requirements and owned the considerable value to be the blueprint for realizing the Intranet build in future.

From the aspect of implementing virtual LAN, the Intranet system could service the functions with sharing the files and printers, sending email in LAN and managing the users and applications in centralized mode. Due to limited of devices, in the virtual LAN, this research just established two departments as end users to reduce the complexity of the example test in LAN. The testing results of the pilot implementation through the virtual Intranet performed the services provided by the Intranet were satisfying the users requirements. However, this thesis had a missing to test the Intranet's stability and speed. Although, in the designed framework, this research already formulated these two properties as the Intranet designed principles, in the

practical experiment, the stability and speed tests were ignored due to the limited scale of the virtual users and servers, the limited time, and the limited knowledge to support. However, the missing was not influent on the designed output and realized services providing in the virtual Intranet.

The highlight of the research output is the recording and presenting the intranet's construction, functions and services by video format. This kind of output presentation gave a particular and comprehensive vision to our case company and readers. It recorded the processes of research work in more details and introduced the functions and results of our research framework in a macroscopic view with more credibility and assessability.

5.2 Result evaluation

The result analysis can help to evaluate the research work from the aspects of value, credibility and quality. It is also a way to recognize the problems happened during the research. Firstly, there is a table17 to describe the system functions and properties among user requirement, designed framework and pilot networking.

Table 10 Features comparison table in the Intranet

	User requirements	Designed framework	Pilot networking
Files sharing	Available	Available	Available
Printers sharing	Available	Available	Available
Internal Email	Available	Available	Available
Speed	Fast	Fast	Unknown
Stability	Stable	Stable	Unknown
Cost	Economic	Economic	Low
Security	High	High	High
Service period	7*24 h	7*24 h	7*24 h

Through the above comparison table, the designed framework were absolutely satisfying the user requirements. Though a bit flaw was existing in the pilot networking, lacking the test of the speed and stability, the researchers hope to complete these tasks in future research. Meanwhile, if the designed Intranet to be built in future, it is a reminder to test the speed and stability of the Intranet in realization.

Besides, this research report presented to the case company in November 2010 gained high-level approve by the CEO and IT manager. They regarded the designed framework of the Intranet with high value to refer and they praised the rigorous networking plan. According to the designed framework, they planned to implement it as their next developing strategy to improve the IT in the company.

6 CONCLUSIONS

6.1 Framework

It is of essential importance to define the designed Intranet illustrated by the structural figures in chapter 3. The framework expresses the wiring system, topology and internal structures configured in operating system. This thesis is one kind of the Intranet system design; it was hard to construct the entity as the output, whereas drawing framework to present is easier to be understood by the users and readers. The models form to the framework could aid in making the system building more graphical to learn and use.

The framework was created underlying the users' requirements by using Microsoft Visio tool to model the structure of the Intranet. This thesis not only considered the hardware design but also made advice to software configuration for Intranet installing Windows Server 2003 as server's operating system. In addition, on the basis of the security principle, the designed framework was considered the security strategy as well.

It is inevitable that one problem existed in the designed framework. The designed models were drawn as IT designer, the problem raised was that if the architect could understand it or not from the view of IT designer. Furthermore, this thesis shows that most of end users owned limited IT knowledge, therefore, to some extent, this framework with plenty of IT expressions might be hard to be understood by normal staff in the case company.

6.2 Pilot implementation

The experimental study in this thesis undertook the pilot implementation for testing the designed Intranet. It improves the creditability of the thesis with the visible framework connected in virtual platform. The output of the pilot implementation was illustrated by a series of figures. Additionally, in order to make the designed framework to be more easily accepted and understood by users, one video collected the steps and processes of the implementation was made to show the functions and operations among the pilot Intranet.

This pilot implementation presents the entire processes and operation of the Intranet. It started from the OS installation and configuration with Windows Server 2003. AD, DNS and DHCP were configured after the server's within the OS. To highlight the functions of the Intranet system, installation and configuration of the Printer server, FTP server and Email server were taken into account. Besides, this thesis not merely executed the pilot connection and construction, while testing the functions and services provided by these servers were performed as well.

During this phase of the research, it is remarkable challenge to ensure the pilot networking is valid and performed. The first problem emerged was that the laptop used to build the virtual Intranet could not execute multiple virtual machines with low CPU. The result of the first pilot implementation was a failure because of the laptop's system crush. To solve this problem, it was unavoidable to exceed the budget of our research cost with purchasing a new desk computer with higher configuration consisted of 512M RAM and 500G memory. Underlying strong support by the desk computer's physical platform, the virtual machines established successful in VMware software.

While, another problem in the pilot implementation was that there are not all the end users to be connected into the Intranet. The reason for that it would be a huge project in realization in future, whereas it is not necessary to consider and establish all the users during the pilot implementation. Establishing the examples of the end users can reduce the complexity of the Intranet system. At the same time, the weakness of this small scale of the pilot Intranet was that the speed and stability of the realized Intranet could

not be tested and evaluated in this thesis.

6.3 Technologies

Depending on the design and implementation of the Intranet infrastructure, we used a series of software involved in Microsoft Office Project and Microsoft Office Excel to manage the process and implementation of this research project in an efficient and effective way. In addition Microsoft Office Visio contributed to the modeling and structuring in the phase of Intranet design. Furthermore, VMware software was applied to execute pilot networking.

6.4 Future

Future work after this thesis includes more technical challenges such as configuring the workstation, multiple servers and network security protocols. In architecture area, the complex wiring system and devices connection may be studied in details. There may be set up both knowledge and ability training to end users in use of the Intranet.

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Questionnaire 1   Appendix 1

The current status of IT resources ´owned by the case company

(This questionnaire aims to investigate the current status of the enterprise computer and the network. The subject of the interview through the email to answer these questions is the IT manager in the case company. The result of the questionnaire is used for the analysis of the current IT resources existed in the case company.)

1. How many computers does the enterprise have?

2. What is the type of the computers used in the enterprise? (multiple selection)
PC machine（） Workstation（）　Server（）

3. How many computers are used to PC machine?

4. How many computers are used to workstation? (if have)

5. How many computers are used to server? (if have)

6. What is the way to link the Internet?
Dialing（）ISDN（）（）ADSL（）DDN（special line）（）Broadband IP（）Others（list）（）

7. Who are the main users using the computers?
Normal employees （）　Middle-level managers （　）　Leaders（　）　Others (list) （　）

8. What are these PC used to?（multiple selection）
Office Automation ( ) Professional software application ( )　Communication（　） The Internet（　）Web site development（　）

9. Does the enterprise have the specific computer technology department or persons?
Both（　）　Persons（　）None（　）

10. What is the average level of IT do the staff in the case company have?
Basic Operation( )　Proficient ( )

Thanks a lot to answer this questionnaire!

The respondent's personal information for keeping contact:

Name：	Position （Department）：	Address：	Postcode：
Fax：	Mobile：	Email：	Tel：

Thanks again for cooperation and support!

The respondent's personal information for keeping contact:

Name：	Position （Department）：	Address：	Postcode：
Fax：	Mobile：	Email：	Tel：

Thanks again for cooperation and support!

Questionnaire 2   Appendix 2

The current application status of the network and the needs of Intranet

(This questionnaire aims to investigate the current application status and the objectives of the main users in the case company. The subjects are the five managers charged five different departments to investigate by email. The results of the investigation is used for analysing the user requirement and supporting the design stage.)

1. Which department do you belong?
Administrative department ( ) R&D department ( ) Financial department ( ) Sales department ( ) HR department ( )

2. How many employees in your department?

3. How many computers existed in your department?

4. What are these computers used for?　（multiple selection）
Office Automation（OA）（） Financial Management （） Human Management （） Manufacture （） Technology （） Design （） Logistic （） Business Management （） Intranet （） The Internet （） Web site Development （）

5. What are the needs of the enterprise Intranet?　（multiple selection）
OA （）　Financial Management （）　Human Management （）　Manufacture （） Technology Development （）　Design （）　Logic Management （）　Business Management（）　Internal Email System（）　Web Site Development（）　Management Information System（MIS）　（）　Enterprise Resource Plan（ERP）（）　Customer

Relation Management（CRM）（） Computer Assist Design（CAD）（） Supply Chain Management（SCM）（） Others（specify:

6. What are the requirements of the enterprise intranet? （multiple selection）

Stability ( ) Efficiency ( ) Security ( ) Speed ( ) Others (specify):

7. What kind of network knowledge owned by employees in your department?

Basic of Computer Knowledge （ ） Official Automation (OA) （ ） Financial Computerization（） Construction of the Enterprise Web Site （） Maintaining of the Enterprise Intranet （） Implementation of the Enterprise Information Management System （） Developing Strategy of the Network Economy ( ) Planing Strategy of the Networking Market（） E-commerce and Operational mode（） Others（specify):

Thanks a lot to answer this questionnaire!

The respondent's personal information for keeping contact:

Name：	Position（Department）：	Address：	Postcode：
Fax：	Mobile：	Email：	Tel：

Thanks again for cooperation and support!

Questionnaire 3   Appendix 3

The investment plan and the scale of the intranet construction

(This questionnaire manages the budget of the intranet construction based on the scale and capital plan. Thanks to the IT manager as the interview subject to answer this questionnaire to provide the info about the intranet construction plan. The results offer an investment analysis to formulate the scale of the intranet.)

1. Could you describe the status of the infrastructure building?

2. What is the scope of the intranet construction plan?
Whole plant area () main building () others (list)

3. How much budget does the enterprise plan to invest for establishing the enterprise informationization?
Under 10000 （) under 20000 （) under 50000 （) under 100000 （) other（list) （under 1000000）none （)

4. Which way does the enterprise plan to adopt to make implementation of the enterprise informationization?
Planing and implementing by itself( ) consulting from other company and then implementing by itself ( ) outsourcing （)

5. What kind of network knowledge owned by employees does the enterprise expect?
Basic of computer knowledge （ ） Official Automation (OA) （ ）　　Financial computerization （） Construction of the enterprise web site 　（） Maintaining of the enterprise Intranet 　（） Implementation of the enterprise information management system （） Developing strategy of the network economy （） Planing strategy of the networking market （） E-commerce and operational mode （） Others（instruction）　（）

6. Which way of the employee training does the enterprise expect?
Whole-day training ( ) Part-time training ( ) on-line training() others (list) 　（）

7. How many IT staff does the company want to recruit?

The respondent's personal information for keeping contact:

Name：	Position （Department）：	Address：	Postcode：
Fax：	Mobile：	Email：	Tel：

Thanks for cooperation and support!

The structure of the buildings   Appendix 4

Building 1

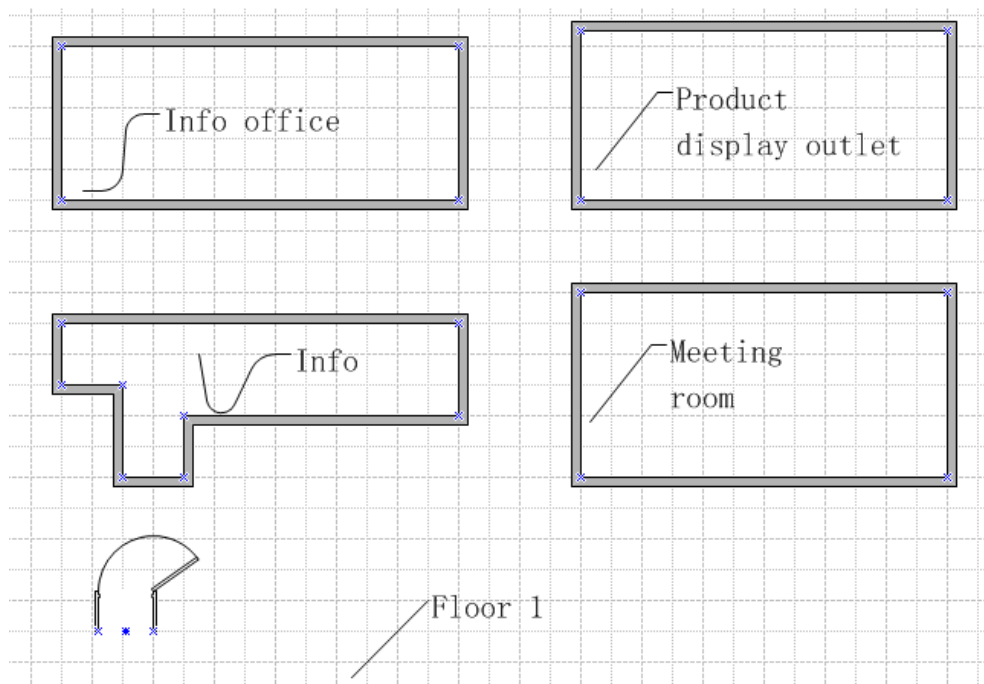figure 1 - 4 are the structures for each floor in building 1.

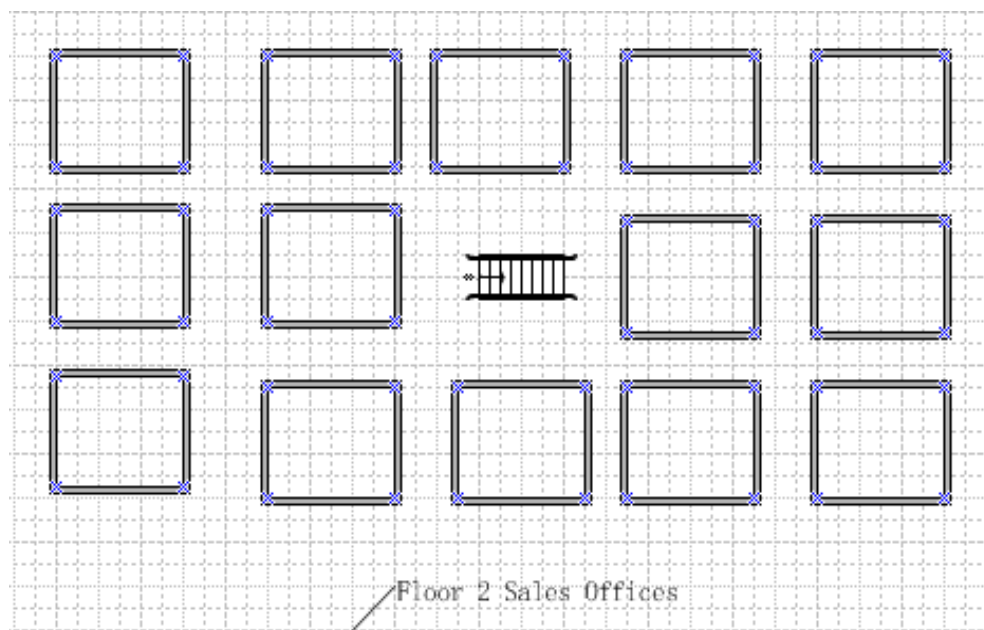**Figure** 1 The first floor structure in building 1

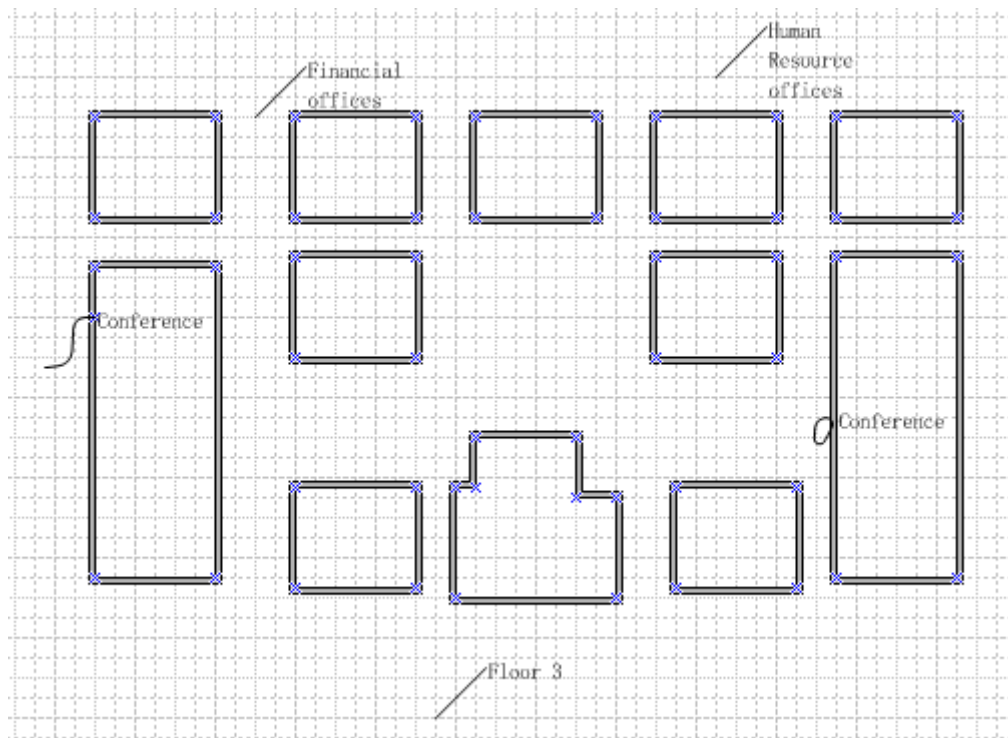**Figure** 2 The second floor structure in building 1
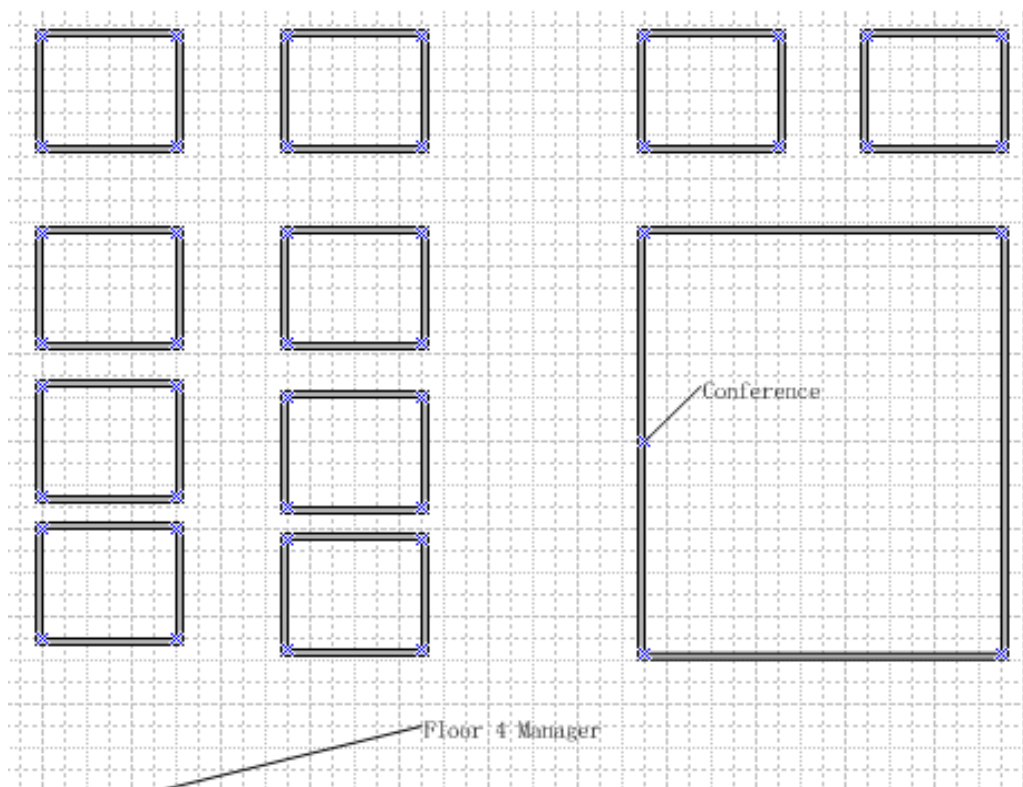
Figure 3 The third floor structure in building 1

Figure 4 The fourth floor structure in building 1

Building 2

Figure 5 - 6 are the structures for each floor in building 2.

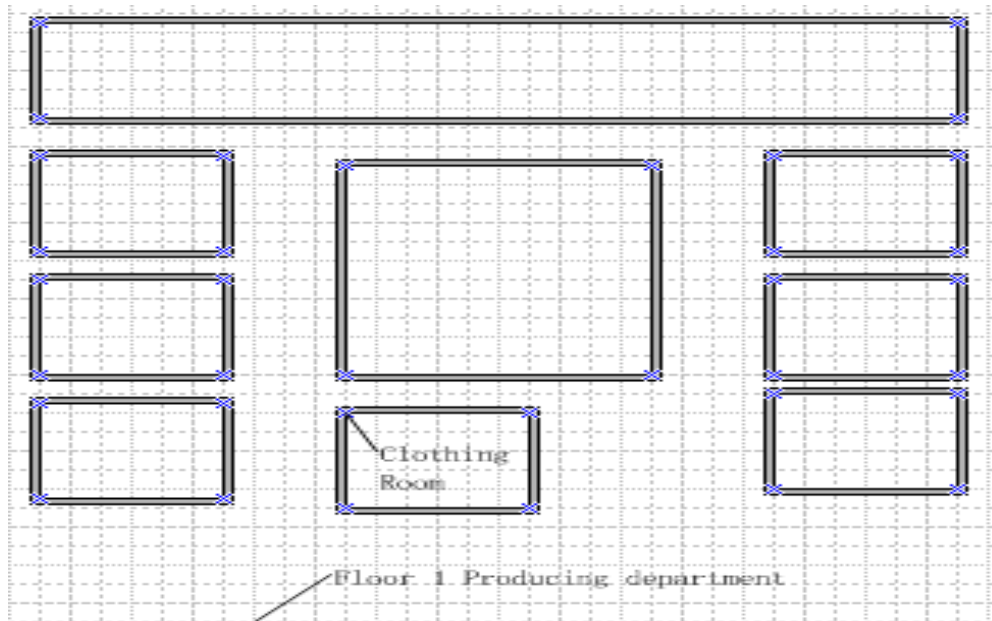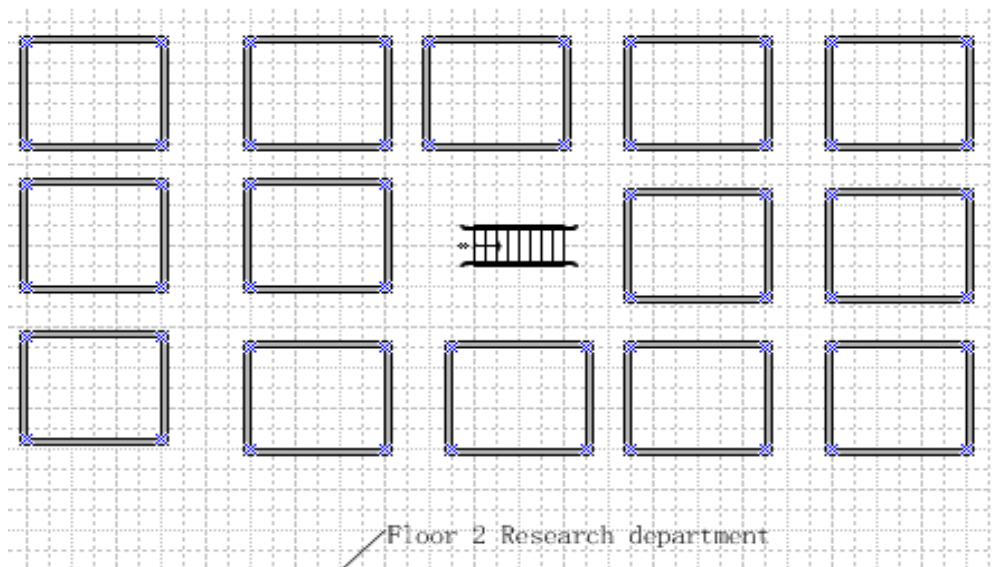**Figure** 5 The first floor structure in building 2

Figure 6 The second floor structure in building 2