SECTION 2 OPERATING SYSTEM AND NETWORKING LAB

Structure **Page No.**

2.0 INTRODUCTION

The main operating systems involved in networking now a days are Windows 2000 and Linux. Both are having their own advantages and disadvantages. The combination of Linux and Apache makes a “strong” and "open" Web server platform, Linux works better on older, less powerful computer hardware because it requires less resources (memory or processing) as compared to Windows. The "free" nature of Linux also attracts some people/industries. Compared to Windows, Linux is virus-free and bugs-free. Windows 2000 provides the user a mature, familiar and interactive interface that is easy to learn and understand for Windows users (those are of course much higher than Linux users) and the high support of Microsoft also makes it popular among people. According to few surveys, Windows 2000 servers are less costly to run and maintain compared to Linux. But we think that a network administrator should have an expertise on both of these leading network operating systems. Even most of the network administrators are running both Linux and Windows on the server for the best networking.

This section provides you the discussions, demonstrations, and lab exercises to sharpen your skills and knowledge necessary to admin and support Windows 2000/Linux networking. It contains an overview of Windows 2000 and Linux/Unix in the beginning to develop your understanding of these operating systems. If you need any details you can always refer to the course material of MCS-022. Further, in this course you have an example to introduce you in the lab. Further, you have different lab exercises on Linux/Unix and on Windows 2000. We hope these exercises will provide you practice for administering, monitoring, and maintaining networks.

To successfully complete this section, the learner should have the following knowledge and skills prior to starting the section. S/he must have:

- studied the corresponding course material of MCS-022 and completed the assignments.
- proficiency to work with Windows/Unix interface
- knowledge of computer hardware components, including memory, hard disks, and central processing units
- knowledge of networking concepts, including network operating system, server-client relationship, and local area network (LAN).

Also, to successfully complete this section, the learner should adhere him/herself to the following:

- Before attending the lab session, the learner must have already written steps/algorithms in his/her lab record. This activity should be treated as home work that is to be done before attending the lab session.

- The learner must have already thoroughly studied the corresponding units of the course material (MCS-022) before attempting to write steps/algorithms for the problems given in a particular lab session.

- Ensure that you include comments in your lab exercises. This is a practice which will enable others to understand your program and enable you to understand the program written by you after a long time.

2.1 OBJECTIVES

- To get familiarity with the basic operations of Unix, Linux & Window 2000.
- Give exposure to network devices and configurations.
- To get exposure to networking concepts using Unix, Linux & Windows 2000.
- To perform advanced networking on Windows 2000

2.2 OVERVIEW OF WINDOWS 2000

Background to Windows

In 1981, Microsoft released their Disk Operating System which is popularly known as MS-DOS. It is a command line interface as shown in *figure1*, similar to Unix where you had to use your keyboard to run any command. But the users of MS-DOS have to remember these commands before using their computers.

Figure 1: MS-DOS a Command Line Interface

Its functionalities are very limited, also it is time consuming and boring. Because of these reasons slowly Microsoft moved in the GUI-based operating system which enabled users to navigate their computer screen by using a cursor which they could use to "point and click" instead of having to type commands and they won the prize of leadership in the field of commercial operating systems. Window 95 was a very popular architect of Microsoft but they realized that Industries/people want a more secure, network-oriented, robust and powerful operating system and so about the same time, Windows NT 4.0 *[What's a full form of NT?]* was released which looked similar to Windows 95 but had its own strength. Windows NT was aimed at high-end users such as businesses where security and performance are more important than Windows 95's graphical and sound capabilities. Windows NT (*Ok, I will tell you the full form of NT, NT stands for new technology*) made history again in the operating systems field. It became the standard for Network operating systems along with Unix/Linux. But still more specifications from industries were coming to upgrade and enhance the functionalities of Windows NT, which the gave motivation for the development of Windows 2000. Windows 2000 brought together the high-end features of Windows NT with the home user features of Windows 95/98.

In Today's Network Administrators world, Windows 2000 is a popular network operating system (NOS). As you know it was built as a successor to window NT 4.0. It was also known as Window NT 5.0, but keeping in view computational needs of the new millennium Microsoft gave the new name Windows 2000 (which also maintains the naming series with Windows 95 and 98). Before starting your administrative tasks on it, you should know about its family. Windows 2000 family is similar to Windows NT as shown in *figure 2* given below except *Datacenter server*, which is a new family member.

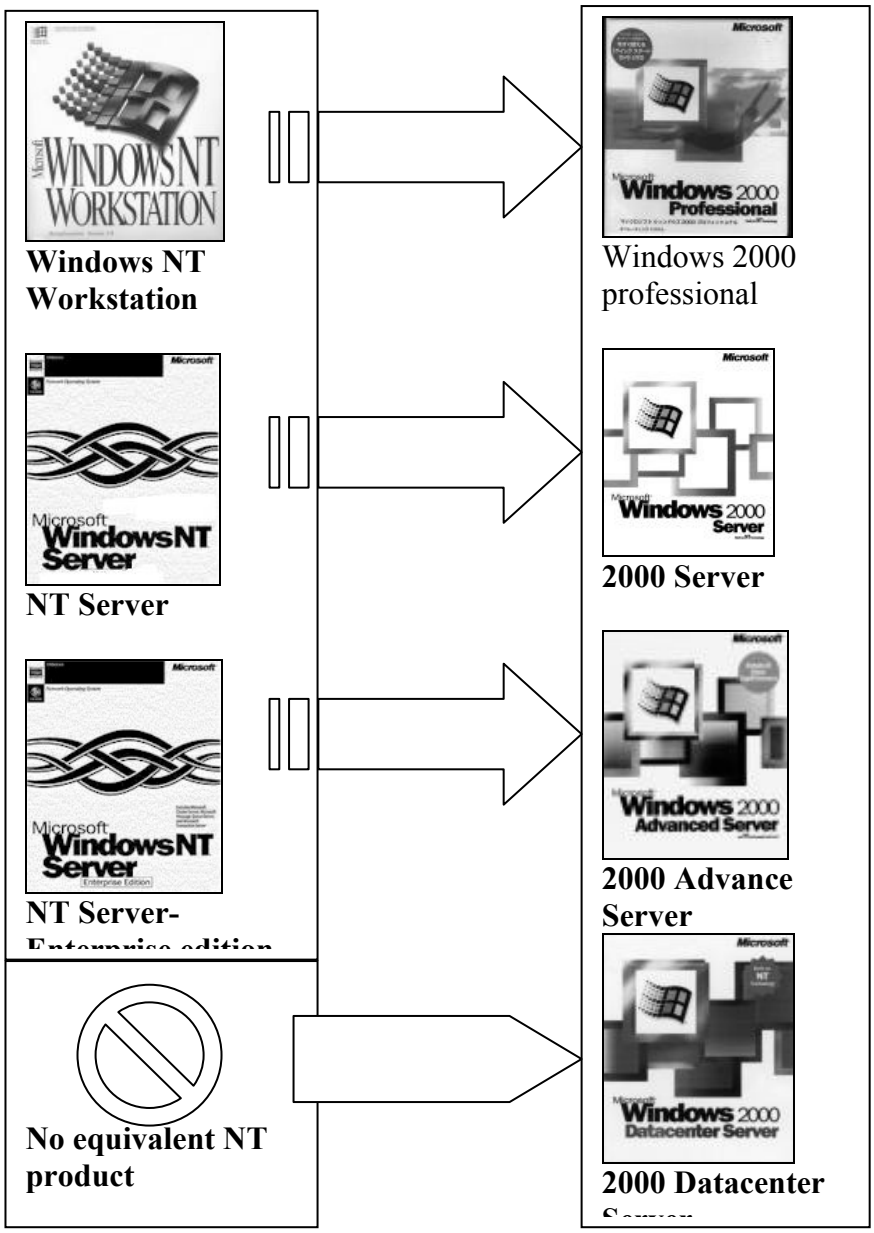

Figure 2: Similarities between Windows 2000 and Windows NT Family

As shown in the above figure Windows 2000 comes in four versions:

- Windows 2000 Professional
- Windows 2000 Server
- Windows 2000 Advances Server
- Windows 2000 **Datacenter Server**

Let me explain some of the important features of these Windows 2000 (W2K) products. If you want to known more about each product, you can open the Windows 2000 home page.

Windows 2000 Professional

Windows 2000 Professional is designed for desktop/laptop users within offices, academic institutions and other similar networked environments. It provides much greater control to network administrators than users. May be you are aware of the networking environment with Windows 95, which provides easy hands to users to change settings without any control. But with Windows 2000 professional users hand are limited to change settings.

However, Windows NT was the first NOS to boast of the same features for users as Windows 95. This has meant that many home users have also adopted W2K Professional as their OS of choice.

Windows 2000 Server

Windows 2000 Server is used on network servers, hosting a whole variety of network services often in conjunction with other pieces of Microsoft software such as:

- SQL Server – database
- ISA (Internet Security & Acceleration) Server – Internet access control
- IIS (Internet Information Server) – website hosting

It also controls who is using the network, how they can use it, provides shared file storage areas and controls connection to network printers. To the user it appears very similar to Windows 2000 Professional. However, it carries many features that desktop and laptop users would not require.

Windows 2000 Advanced Server

Windows 2000 Advanced Server includes all features of Windows 2000 Server but also boasts of additional features for organisations requiring larger scale processing like with additional scalability and reliability features, such as clustering, used by businesses for running transaction-intensive applications such as large e-commerce stores and running in the most demanding scenarios.

Windows 2000 Datacenter

Windows 2000 Datacenter Server is the most powerful and functional server operating system offered by Microsoft till now. Windows 2000 Datacenter Server is specifically designed for organisations which require the highest levels of availability and scalability. It is the best operating system for running mission-critical DBMS, ERP (enterprise resource planning) softwares, and high-volume real-time transaction processing.

Example: Installing and Configuring TCP/IP

We want to show one exercise to you so that you can understand what exactly you should do in your lab session. A very important thing is that before coming to the lab session what all you must prepare so you will not waste much of your computer time in labs. This demo exercise is about installation and configuration of TCP/IP. Generally TCP/IP is installed as a part of the Windows 2000 set up process, but you can install it manually also.

Installing TCP/IP

You follow these steps one by one to install TCP/IP in your computer. If it is already installed you can Uninstall it (with the permission of Lab administrator) and then try to install it again.

1. Open the Network and Dial-Up Connections folder as given below in Figure 3:

Start>Setting >Network an Dial-up connections

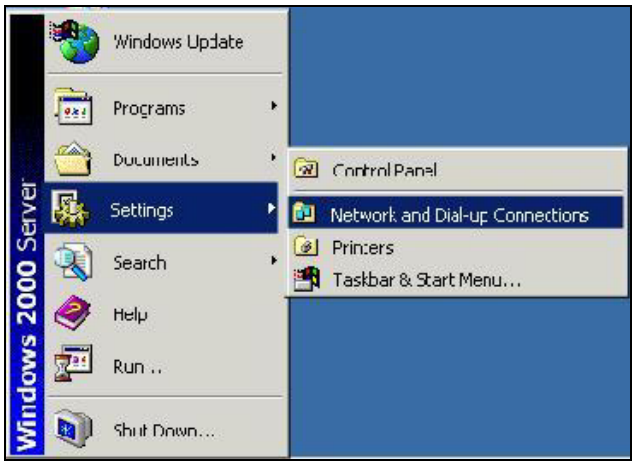

Figure 3: Opening Network and Dial-Up Connections Folder

2. As shown below in Figure 4, right click the Local Area Connection icon and choose the properties.

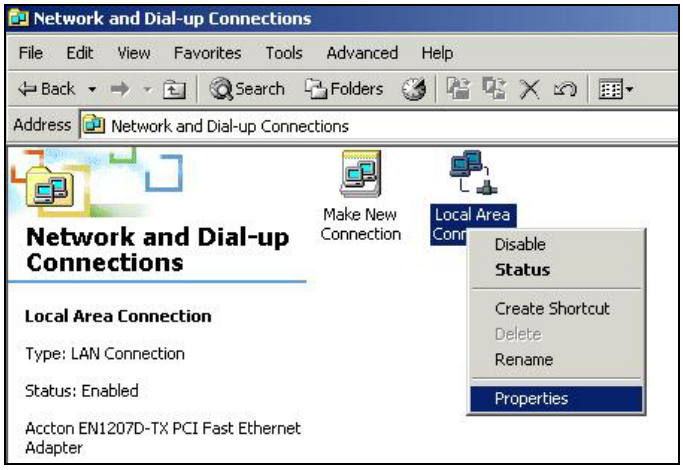

Figure 4: Opening Local Area Connection Properties

The Local Area Connection Properties dialog box appears, as shown in Figure 4. Now Click the **Install…** button, you will see the Select Network Component Type dialog box. Select protocol and click the **Add…** button as demonstrated in Figure 5.

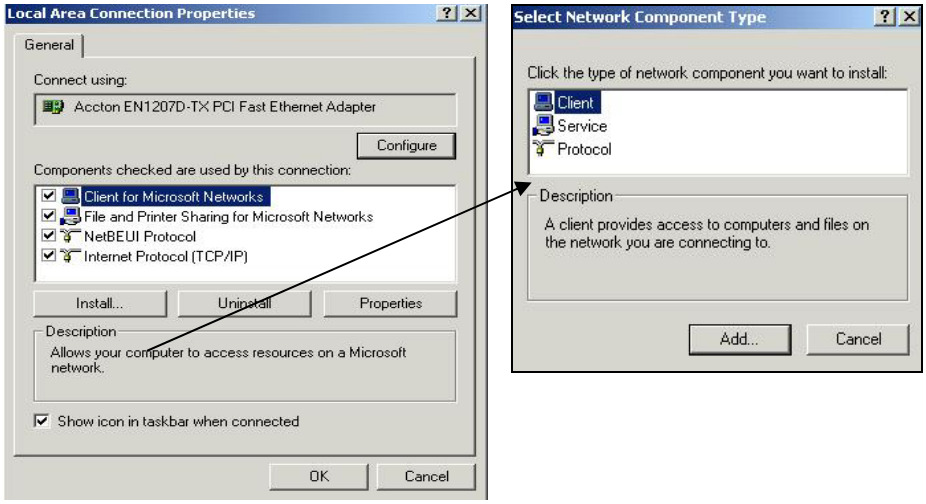

Figure 5: Select Network Component Type and Add Protocol

3. The Select Network Protocol dialog box appears in Figure 6. Choose Internet Protocol (TCP/IP), and then click the OK button.

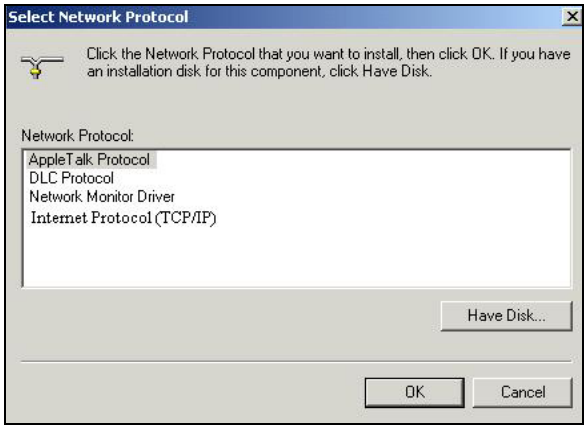

Figure 6: Select Network Protocol Dialog Box

4. If computer ask, insert your Windows 2000 CD and click OK.

5. Click the close button in the Local Area Connection Properties dialog box.

Remember, when you install TCP/IP, it defaults to using DHCP for automatic configuration. But it is always useful to know (specially for network administrator) how to manually configure a TCP/IP connection. Let us see the configuration of the example.

Configuring TCP/IP Settings

Follow these steps to add a second IP address to your existing NIC.

Note: In the given exercise you should assume that you're not using DHCP on the NIC, because you cannot assign additional addresses to a DHCP-enabled NIC.

1. First you select an IP Address, which is not currently in use by another device (e.g., I am selecting "192.162.6.142" in this example). Also ensure that you know the correct subnet mask to use with that IP address (e.g., 255.255.255.0 in this example).

2. Open the Network and Dial-Up Connections folder (Start>Settings>Network

and Dial-UP Connections) similar to the previous example right click the Local Area Connection icon and choose the properties command and Local Area Connect Properties dialog box appears as shown in given Figure 7.

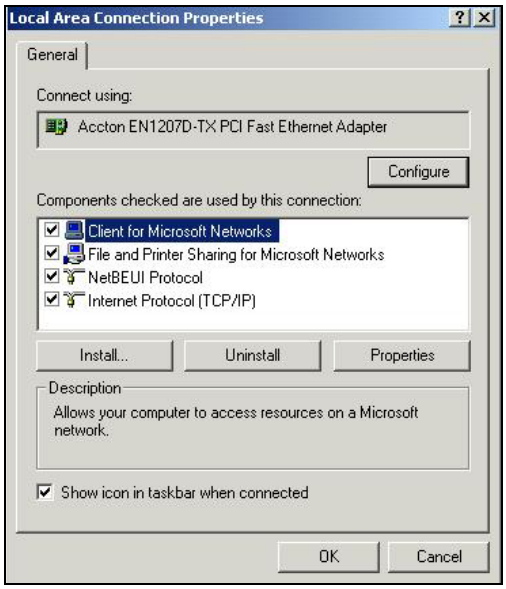

Figure 7: Local Area Connect Properties Dialog Box

3. Select Internet Protocol (TCP/IP) in the Components list, and then click the **Properties** button. The Internet Protocol (TCP/IP) Properties dialog box will appear. (Here in Figure 8 you can see that you can obtain IP address and DNS server automatically if you are a new client). We want to manually configure it so we will move to Advanced setting..

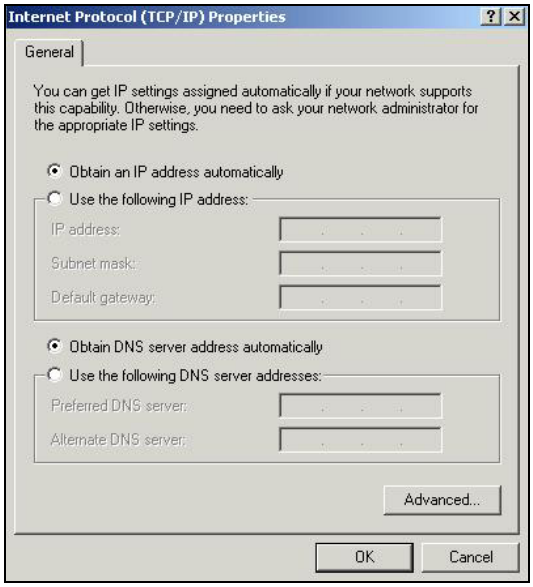

Figure 8: Internet Protocol (TCP/IP) Properties Dialog Box

4. The Advanced TCP/IP properties dialog box will appear when you click the **Advanced …** button. The screenshot is given below in Figure 9.

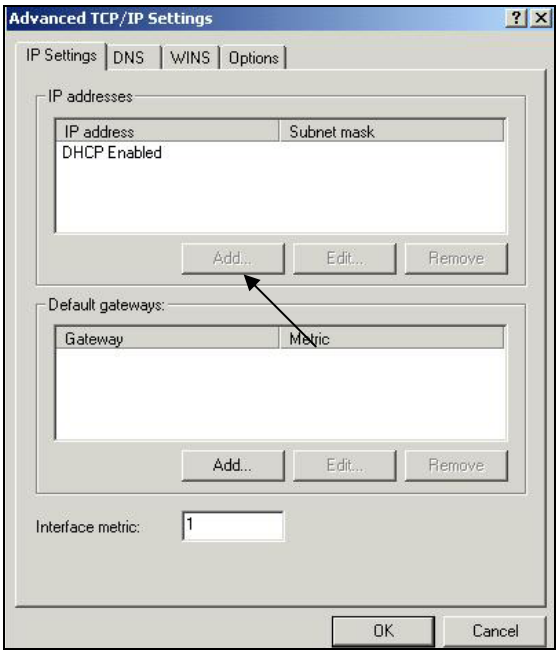

Figure 9: Advanced TCP/IP Settings Dialog Box

5. Click the **Add…** button in the IP Addresses control group. The TCP/IP Address dialog box will appear. In that you type the IP address and subnet mask we selected in Step 1.

6. Click the OK button in the Advanced TCP/IP Settings dialog box. Then similarly click the OK in the Internet Protocol (TCP/IP) Properties dialog box and in the Local Area Connection properties dialog box.

2.3 OVERVIEW OF UNIX AND LINUX

Even after thirty years of its creation Unix is still regarded as one of the most versatile, flexible and powerful operating systems in the computer world. Before you start swimming in your Unix shell, you must find out why people still regard as powerful. As you know (refer to MCS –011 lab) it was created at Bell Labs in 1970 written in the C programming language, which was developed at the same time. It supports large numbers of simultaneous users, runs with few alterations on many hardware platforms (provides some platform independence) and of course it was and is a simple, elegant, and easy to use (at least compared to its predecessors) operating system. In the early 1980s, the two strands of Unix development – AT&T and Berkeley –continued in parallel. The Berkeley strand got a major boost from Sun Microsystems, which used the Berkeley code as the basis for its Sun OS operating system. The AT&T strand was picked up by companies such as IBM and Hewlett-Packard.

Linux is a relatively new Unix flavor derived from the work of **Linus Torvalds**, who was interested to develop a Unix for academic use. He wrote the basics of the operating system himself. His work attracted followers around the world and, with cooperative effort, they wrote a complete Unix system. Early versions of Linux were primitive, but version 2 and above are powerful and efficient having an amazing range of features. Linux is one of the many versions of the Unix operating system. Working on Linux means working on one of the flavors of Unix. From our System Administrator's point of view, Linux has some striking advantages. The main advantage which separates its category from Unix is that **Linux is absolutely free,** you need not spend even the cost CD it can be entirety free downloadable from the Internet. (No registration fees, no costs per user, free updates, and freely available

source code). It is **portable** (means can be configured on any processor like Intel, Solaris, etc), **dual-bootable,** fast, reliable, secure and versatile. These properties make it popular among the System Administrators. While working on it you may realize many more important features and advantages of Linux. May be you will also contribute to development of Linux. Most of the exercises are command line based but similar exercises you can try on your GUI based Linux.

Session 1: Network Configuration

This session is your first introduction with Windows 2000. You can try different commands available in Windows 2000 for system and network administrator. Let us start:

Exercise 1: Run the following commands and write the use of each command:

ipconfig	ping	telnet	diskperf	netdiag
netstat	pathping	ftp/tftp	fc	sfc
nbtstat	rcp	lpr	tracert	verifier
nslookup	route	lpq	net session	drivers
nettime	rsh	chkdsk	hostname	net account

Exercise 2: Use **arp** command to find your Ethernet physical address.

Exercise 3: Modify the routing table using **ipxroute.**

//Use the Netsh.exe tool in Windows 2000 to perform the Exercise 4-9//

Exercise 4: View the TCP/IP settings.

Exercise 5: Configure interfaces

Exercise 6: Configure routing protocols

Exercise 7: Configure filters

Exercise 8: Configure routes

Exercise 9: Configure remote access

Exercise 10: Use **winchat** command and communicate with your friend sitting on a different machine of Windows 2000.

Session 2: Linux/Unix Operating Systems

In this session you will get introduced to Linux/Unix and you can perform different operations based on the course material you studied in MCS-022.

Exercise 1: First try to execute the following commands on your operating system and write down the results and use of each command.

- man (find manual help)
- cd
- ls, ls -a (try to find out other options of ls using man)
- cd .
- pwd
- cd ..
- ls -al
- ls -al | more
- cat passwd

- cd –
- chmod

We hope you will stop here and you will keep digging more and more commands but do it after the session.

Exercise 2: Try to explore the filesystem, write what is there in /bin, /usr/bin, /sbin, /tmp and /boot. Find and list the devices that are available in your system.

Exercise 3: Make your own subdirectories called uni and linu in your home directory, *Made?* Ok, now delete the subdirectory called uni.

Exercise 4: Create a file called ignou.txt that contains the words "hello I am student of IGNOU". Now copy this file and paste to other director. *Copied?* Can you move the file also from one directory to another?

Exercise 5: In the previous question you have a file *ignou.txt*; change its permission to rwxrwxr-x. You can try different possibilities to changes in its permissions. One possibility may be rwxr-xr-x permissions. Find out what are the different commands available that can be used to change the permissions of a file/files.

Exercise 6: Display the names of all files in the home directory using *find* .Can you display the names of all files in the home directory that are bigger than 500KB.

Exercise 7: Display a sorted list of all files in the home directory that contain the word ignou inside them. Hint: Use *find* and *grep* and *sort*. Can you use *locate* to find all filenames that contain the word ignou?

Exercise 8: Use *egrep* to try to find out which lines in an ignou.txt file are satisfied by the regular expression given: **(^[0-9]{1,5}[a-zA-z]+$)|none** and check the result with different combinations of lines.

Exercise 9: Change your password and write down the restrictions for given password.

Exercise 10: Open ignou.txt using vi editor, go to the end of the file and type in the following paragraph:

*In 1971 Bell Labs releases the first Unix **operting** system. Then 1985 Richard Stallman releases his GNU ("GNU is Not Unix") Manifesto thus starting the open **sourci** revolution. He wanted to **creat** an open-source version of Unix **Unix** . Stallman's Free Software Foundation eventually created the GNU General Public License (GPL) which is basically an anti-copyright also referred to as a*

Now you correct spelling errors in the first three lines and remove the extra "Unix" in the 3rd line of the paragraph. Add the words *"copyleft"* to the end of the paragraph. Replace the string "GNU is Not Unix" with a string “Unix is not a GNU”. Save the file and quit. Repeat the same exercise with emacs also. Write down the differnces between both editors ,also write which one you find easier and why.

Session 3: Linux/Unix Operating Systems

Exercise 1: Find the files (with full path) in your home directory those name are starting with the character ‘s’ and redirect the output into a file redirecting.txt and if you receive any error message on execution of the command redirect into errors.txt.

Exercise 2: Execute sleep 25 in the foreground, suspend it with Ctrl-z and then put it into the background with *bg*. show all process running in background, bring any process back into the foreground with *fg*. Repeat the same exercise using *kill* to

terminate the process and use *&* for sending into background. (You need to see different options of the kill command)

Exercise 3: Combine the commands *cat nonexistent* and *echo helloIGNOU* using suitable operators. Now reverse the order of the commands and try.

Exercise 4: Write a shell script, which returns the PID of a process and accept the name of the process.

Exercise 5: Use ping to find the round-trip delay to www.ignou.ac.in

Exercise 6: Send a message to all users which are online. Make provision so that you can send messages to other users but others cannot. Use talk to send messages.

Exercise 7: Print a file ignou.txt, and then send multiple files to a printer. Write the command you will execute to remove any file from print queue.

Exercise 8: Send a mail to yourself, and include ignou.txt inside the mail. Read the mail you have sent to yourself. Save the piece of message and file into some folder. Reply to yourself.

Exercise 9: Use telnet and ftp to get connected with other remote machine. Write the problems you encounter during connection with remote machine.

Exercise 10: Use the ls command and grep to display all names starting with "s".

Session 4: System Administration using Unix & Linux

Please do the following exercise with extra care when you are using the root account. If you have any doubt you must clarify it before executing any command.

Exercise 1: Use *finger* or *who* to get a list of users on the machine.

Exercise 2: Add different users, set their passwords and define permissions. Check whether you are able to change the passwords of all users or not.

Exercise 3: Delete the user, which just now you have added.

Exercise 4: Set the execution time of two jobs so that it can run automatically tomorrow one at 11:00 a.m. and another at 1:00 p.m. After this setting, how can you change the time of execution of the job?

Exercise 5: Try to access your account available at a remote machine. Download some file from that machine to your machine.

Exercise 6: Create a *cron* job that sends you a message after every 5 minutes.

Exercise 7: Restart any system daemon like the web server *httpd*.

Exercise 8: Write a message to inform all users that "they should shut down their machine after completing the lab exercises".

Exercise 9: Monitor the log time of users using xargs.

Exercise 10: Eliminate file names from all users home directories containing bad characters and whitespace.

Session 5: Windows 2000: Introduction to Networking

Exercise 1: Use different system tools and administrative tools. Write down the function of each tool in you lab notebook.

Exercise 2: Add different users and groups. Also configure their permissions.

Exercise Install and configure a local printer

Exercise 3: Connect and configure your computer with a Local Network Printer.

Exercise 4: Install and Configure. Windows 2000 Active Directory and Domain Controller.

Exercise 6: Create a Hierarchical Directory Tree.

Exercise 7: Share any folder available in your directory, also configure its share permissions for different users.

Exercise 8: Install and Configure TCP/IP.

Exercise 9: Install a caching DNS server and find out how it reduces the network traffic.

Exercise 10: Configure a DNS server as a root name server.

Exercise 11: Implement delegated zones for a Domain Name Server.

Session 6: Windows 2000: Server Management

Exercise 1: Install and Configure Windows 2000 Client

Exercise 2: Install and Configure Windows 2000 Server

Exercise 3: Set your printer on sharing and assign print permissions according to different users, configuring printer priorities for different groups.

Exercise 4: Install and Configure the DHCP Server Service.

Exercise 5: Configure Windows 2000 Client to use DHCP, DNS, and WINS.

Exercise 6: Configuring a Windows Client as a VPN Client.

Exercise 7: Implement Dfs (Distributed file system) replication.

Exercise 8: Install and configure Microsoft Certificate server (MCS).

Exercise 9: Install the Network Monitor Driver and show how to capture data with network monitor.

Exercise 10: Implement different kind of servers like File Server, Print Server, and Application Server. Learn different routine administration tasks for each kind of server.

Session 7: Windows 2000: Advanced Networking

Exercise 1: Implement different Groups in a Workgroup and in a Domain also.

Exercise 2: Show how you can enhance the feature and strength of file and print servers with Active Directory.

Exercise 3: Install the routing and remote access services for IP Routing

Exercise 4: Install the RIP and OSPF protocols.
Exercise 5: Configure web-based printer.

Exercise 6: Install and configure Terminal Services.

Exercise 7: Create a Remote Access Policy. Show how you can change the Remote Access Logging setting.

Exercise 8: Install the routing and remote access services as VPN server. Create a VPN Remote Access policy also.

Exercise 9: Install and configure a Web server.

Exercise 10: Create two global groups and configure so that users from both groups should be able to access some command folders.

Session 8: Windows 2000: Security

Exercise 1: Enable and configure IPsec policy on local computer.(also Enable and configure IPsec policy for an entire domain.)

Exercise 2: Protect client machine by using Internet Connection Firewall (ICF)

Exercise 3: Configure TCP/IP packet filter.

Exercise 4: Monitor the IP Routing status.

Exercise 5: Customize and configure IPsec policy and rules for transport mode on the local computer.

Exercise 6: Configure IPsec for tunnel mode. (Note: You need separate computers to which you have administrative access)

Exercise 7: Audit the IPsec logon activities and event. (Note: you can use two IP capable computers that are able to communicate to each other with there administrative access)

Exercise 8: Install the network monitor application. Show the use of capture filter and display filter with the help of your own examples.

Exercise 9: Configure PPTP packet filter such that it will block every packet stream except PPTP stream.

Exercise 10: Implementing Server Security by using Security Templates

Session 9: Windows 2000: Network Management

Exercise 1: Create a Group Policy Object (GPO) and Console.

Exercise 2: Configuring Software Deployment Settings.

Exercise 3: Configuring Remote and Removable Storage

Exercise 4: Setup the filter options for Advanced users and groups

Exercise 5: Backup and restore all files in a domain.

Exercise 6: Protect Data by Using Encrypting File System (EFS) and Recover Encrypted Data with a Data Recovery Agent.

Exercise 7: Establishing Intrusion Detection for Public Servers
Exercise 8: Configure the administrator account user profile to restrict the dial-up access.

Exercise 9: Use the *Registry Editor* to view and search for information in any registry. Show how to add a value in a registry. Save the registry to some text file.

Exercise 10: Enable network connectivity between NetWare, Macintosh, and Unix networks.

Session 10: Windows 2000: Troubleshooting

Exercise 1: Recover a Windows 2000 Server that Does Not Start

Exercise 2: Troubleshoot the "NTLDR Is Missing" Error Message in machine.

Exercise 3: What you should do when you find that the drive letter (e.g. c:/ drive, A:/ drive) changes after you restart your computer.

Exercise 4: Back up the recovery agent Encrypting File System (EFS) private key.

Exercise 5: Encrypt Files and Folders on a Remote Windows 2000 Server

Exercise 6: If you cannot print to a network printer after adding Internet connection sharing, how will you resolve it?

Exercise 7: When you install Modem, how to enable/disable call waiting on computer.

Exercise 8: If you are having trouble getting a dial-up connection and you want to change the modem speed or you want to check the modem's response how you will check do it. If you are having noisy channel and you are not able to connect write down the series of steps you will be following to detect and correct it.

Exercise 9: When you use a dial-up remote access service (RAS) connection to browse the Internet or to a private network, your computer may hang and return a Stop error: “Stop 0x0000000A". Resolve this problem.

Exercise 10: When you attempt to view a web page and receive an error message "Not accepting cookies", how will you resolve it?

2.4 SUMMARY

In this section you have studied a brief introduction of Windows 2000 and Linux/Unix and the differences between the two. It contains the history as well as the technical description of both network operating systems. It contains different lab exercises to provide you hand-on experience on Linux and Windows 2000. The starting session was about manual configuration of Windows 2000 components, the next two sessions you worked on Linux/Unix operating system, other sessions were about the Windows server management and advance networking includes virtual network and remote access. We have given the main focus on network security issue which is becoming

one of the major challenges for the network administrator now a days. In the last of the sessions you completed lab exercises on the troubleshooting of real time problems or most expected problems generally faced by network and system administrators. After completing all theses lab exercised and MCS-022 course, you will have not only theoretical knowledge but in depth hand on experience also which will definitely serve in real time networking. The next section you are going to study in this course will be related to MCS-023 Relational Database management system where you will design and implement different databases according to the specifications given in the lab exercises.

2.5 FURTHER READING

Following are the books and website references with you can use for learning more in details.

Books

- "The ultimate windows 2000 system administrator's guide" by Robert Williams, Robert A. Williams, Mark Walla. Addison Wesley Publications.
- Unix concepts and applications by Sumitabha Das, Tata McGraw Hill Publications
- Windows 2000 the complete reference by Ivens, Kathy, Tata McGraw Hill Publications
- Inside windows 2000 server by Boswell, Techmedia Publications.
- A user guide to Unix system by Thomas, Tata McGraw Hill Publications.
- A practical guide to Linux by Sobell, Pearson Education Publication

Reference material and tutorials on web

http://www.microsoft.com/windows2000/techinfo/default.asp
http://www.microsoft.com/windows2000/
http://www.tldp.org/.
http://members.fortunecity.com/pcmuseum/windows.htm
http://www.businessweek.com/1997/16/b352372.htm
http://www.perl.com/pub/a/2000/10/begperl1.html.
http://pegasus.rutgers.edu/~elflord/unix/intro.html
http://www.infosyssec.com/infosyssec/win2000.htm
http://www.yolinux.com/TUTORIALS/
http://www.unixcities.com/
http://www.greatcircle.com/tutorials/ieusa.html