

Creative's



INTRODUCTION TO LINUX



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I. BACKGROUND ON LINUX

Linux is a version of UNIX operating system, the original ancestor of Linux. UNIX is a command-driven operating system in which the user has to type in commands at the computer console in order to operate the computer (“Introduction to Linux, 2001). UNIX is one of the most popular operating systems worldwide because of its large support base and distribution (Grove, 1998, section 1.2). It was originally developed in the 1970’s at AT&T as a multitasking system for minicomputers and mainframes. Since then, it has grown to become one of the most widely-used operating systems.

In 1991, Linus Torvalds, a student at the University of Helsinki, sought to create a new version of UNIX; therefore, he joined forces with a group of programmers to create a new operating system—Linux. Linux is a free version of UNIX that continues to be developed by the cooperative efforts of volunteer groups of programmers, primarily on the Internet, who exchange code, report bug, and fix problems in an open-ended environment (Grove, 1998, section 1.2). As a result, the world now has a powerful, robust, and full-featured operating system that continues to change and grow.

Linux is known as an **open source** operating system and also called **free software** because everything about Linux is accessible to the public and is freely available to anyone. Since the Linux source code is available, anyone can copy, modify, and distribute this software. This allows for various companies such as SuSE, Red Hat, Caldera and others to sell and distribute Linux; however, at the same time, these companies must keep their Linux distribution code open for public inspection, comment, and changes (LeBlanc, Hoag & Blomquist, 2001, p. 298). Despite of the command-line origins of Linux, these distributing companies are working to make the **Graphical User Interface** (GUI), the primary means of user interface; thus more user friendly.

Overall, Linux is not just a simple operating system; it is an entire server and desktop environment, equipped with add-ons, GUI tools and interfaces, and supplementary programs. Although Linux distribution varies, the following list is a summary of what to expect from any version of Linux (LeBlanc, 2001, p. 300):

- File Services: NFS, Samba
- Graphics program: image manipulation, retouching, and paint capabilities
- Mail server software: SendMail, POP, and IMAP servers
- Multimedia tools: Support JPEG, GIF, PNG, TIFF, MPEG, AVI, and QuickTime video files.
- Programming tools: Linux systems supports C, C++, FORTRAN, Pascal, assembler, BASIC, perl, python, Tcl/Tk, LISP, Scheme, plus a debugger and a memory debugging
- X Windows system

II. WHERE LINUX IS USED

Linux has mostly been used in small to medium-sized companies and is now on its way to being used in larger-sized companies. “In a survey run by Networking Computer Magazine, 75% of

respondents were already using Linux and another 14% were evaluating it” (“Where is it Used?”, 2001). In addition, Linux servers account for a majority of the information available on the Internet. “A survey run by Netcraft reports that 43% of all web sites use Linux servers running the Apache Web server” (“Where is it Used?”, 2001). Indeed, Linux is truly revolutionizing the corporate world.

III. HOW LINUX IS USED

Linux is a versatile operating system that was initially the sole domain of computer science students, but now there is an estimated five to six million machines worldwide running Linux to cut costs and improve performance. Linux can be used in a myriad of ways such as: a personal workstation, as a file or print server, as the basis of an embedded system (such as a smart VCR or a robot), as a three-tier client or server, and as a turnkey system. In addition, Linux is used by Internet Service Providers (ISPs) to provide information and services to the Internet on the World Wide Web (Hall, 1999, p. 13). Let’s take a closer look at a few of these.

A. Personal Workstation

Linux is a very powerful operating system that can handle a great deal of **multitasking**. With Linux as an operating system, one can run many programs simultaneously, handle multiple users at one time, and use high quality graphics. Linux can also handle large files and programs. For example, when Linux is used with the 64-bit Digital Alpha processor, it can handle terabytes of data, which is thousands of billions of characters in size. Linux can also share files with UNIX systems, Microsoft Windows, OS/2 and other operating systems with its windowing system called X Window System (also known as X Windows, X11, or plainly X). Similar to Windows, Linux also includes an office suite application. Furthermore, if the numerous freeware programs are not enough to fulfill your needs, commercial applications such as databases, data manipulation programs, and office suites are available as well. Linux allows you to work in the same environment on your notebook computer, desktop workstation, and large server system (Hall, 1999, p. 13-14).

B. File and Print Server

“Linux’s multitasking capability, virtual memory, and powerful file system allows it to work well as a file and print server for Microsoft Windows systems” (Hall, 1999, p. 14). For example, SAMBA allows PCs to communicate with file systems and with printers attached to a machine running Linux, similar to AppleTalk allowing file and print sharing for Apple computers. SAMBA was developed by Andrew Tridgell at the Australian National University in Canberra. SAMBA can support Server Message Block/NetBios on TCP/IP for file and print server operations (SAMBA. Overview of Linux. *Advanced Horizons*. 11/9/02). Additionally, Linux can also share files and printers with UNIX systems. Using Linux can help save costs because the software and the operating systems provided by these services are free and readily available (Hall, 1999, p. 14).

C. Internet/Intranet Service Provider

Both the Internet and intranets require similar services that can be delivered by Internet Service Providers (ISPs) to its customers through Linux. Linux provides services such as:

- Firewalls for security
- FTP so that files and software can be shared
- Telnet so that users can remotely log on to machines
- Web servers so that users can access Web pages
- NFS to share files over the network

Because Linux is free software and its source code is readily available, ISPs like to use Linux to deliver the services to their customers because it can be customized. When problems arise, ISPs can take advantage of this Linux free software, and use it as a tool to correct the problems, instead of having to wait for a commercial software vendor to develop software to fix the problems (Hall, 1999, p. 14).

D. Three-tier Client/Server

Three-tier client/server deals with three different data operation layers. Simply put, three-tier client/server means that most computer problems can be broken down into three separate levels:

- Data storage and retrieval
- Data manipulation
- Data presentation

In Microsoft Windows, the data presentation level consists of systems like Visual Basic running on the desktop to develop the user interface. The data manipulation level and the data storage and retrieval level consist of UNIX or older systems communicating over the network. On the other hand, a Linux system running a freely distributed web browser or a freely distributed Java system can be used at the presentation level as well. Using Linux can save companies from high operating system costs and companies can also receive required security and operating system robustness.

Linux also has sophisticated data manipulation tools that make it a good second-tier system. Linux can extract data or reports from different types of databases kept in files of older systems. But not only that, it can then sort, search, combine, process and manipulate data transferring the newly created results to the presentation level on the desktop. Furthermore, Linux has the amenities to act as a good data storage and retrieval level. Linux can work with many different commercial database packages. If you cannot afford a commercial database package, one can be ordered and used freely from Linux, such as Postgres. Basically, the purpose of the three-tier concept is to divide work logically, and once that is accomplished, put all three levels functioning on one computer – a Linux system (Hall, 1999, p. 15-16).

E. Turnkey System

A turnkey system is a computer system that has been customized for a particular application. The term comes from the idea that the end user can just turn a key and the system is ready to go. Turnkey systems include all the hardware and software necessary for the particular application. They are usually developed by *OEMs (original equipment manufacturers)* who buy a computer from another company and then add software and devices themselves (Turnkey System, 2002, Webopedia.com).

A turnkey system is put together once, and then duplicated in hundreds of different places. Examples of turnkey systems include: information kiosks, hotel reservation systems, doctor and lawyer office systems, and automotive diagnostic systems. Because Linux provides the security, protection, and stability that turnkey systems need, Linux is perfect for this type of work (Hall, 1999, p. 16).

IV. USING LINUX ON PERSONAL COMPUTERS

This section will explain how to install and run Linux on a personal computer. The first question that arises is what version of Linux to use. One option is to download the Linux **kernel** for free from the internet. The kernel is the central component of any UNIX-like operating system, including Linux. It is the part of the operating system that loads first, and it remains in main memory. Typically the kernel is responsible for memory management, process and task management and disk management (Kernel, 2001, Webopedia.com). If the user has programming abilities, the kernel can be customized to the user's needs; however, for those who are new to Linux, it is recommended to purchase, at inexpensive prices, a Linux distribution offered by various companies that have customized the kernel.

A. Linux Distributions

A Linux **distribution** is an assemblage of software with its own packaging schemes, defaults and configuration methods. The following is a list of some of the major Linux distributions (LeBlanc, 2001, p. 17)

- **Corel Linux:** This is a new Linux distribution that has made an impressive entrance. The installation process is simple and does a great job of detecting and automatically configuring many sound and video card adapters. It also comes together with Corel's WordPerfect word processing package which has been ported to run on Linux.
- **Debian GNU/Linux:** This distribution is one of the oldest and recognized favorites among advanced technical groups. It is relatively difficult to install due to the very high number of installation options.
- **OpenLinux (Caldera):** The OpenLinux distribution has shrink-wrapped software packages that include the first graphical Linux installation. This distribution allows the

user to play a game in the foreground while the computer loads software in the background during installation.

- **Red Hat:** Red Hat is the first company to mass market the Linux operating system. They have validated Linux by packing the GNU/Linux tools in shrink wrapped packages and have included valued-added features to their product such as: telephone support, training, and consulting services.
- **Slackware:** Of all of the surviving Linux distributions, Slackware has been around the longest. The installation interface had remained the same since its beginning, until a couple of years ago.
- **SuSE:** This distribution derives from Germany. SuSE works closely with the XFree86 project (the free X graphical server component of all Linux distributions). As a result, they have a terrific graphical configuration tool called SaX.
- **TurboLinux:** This distribution provides a great graphical desktop environment along with a few tools for configuring the system. TurboLinux has lead the way in the turnkey installations by providing CD installations exclusive to Server, Workstation, and Clusters.

V. PREPARING COMPUTER FOR LINUX

Before the user begins to install Linux operating system, one must follow certain pre-installation steps as well as knowing the computer hardware. Before attempting to install Linux, the user should know: (1) the computer's hardware and networking information, (2) method to use for Linux installation, and (3) target hard drive Linux will reside on. Additionally, the user should make sure that he or she has all the necessary software components to install Linux

The user should document critical items of the following hardware components before installation of Linux (LeBlanc, 2001, p. 20).:

- **CD-ROM drive:** Document the type of CD drive in your computer system either: IDE or SCSI.
- **Mouse:** Note the brand and model number on the mouse. If it is a serial mouse, note the serial port it is attached to. Also, note the number of buttons (2 or 3) and whether it has a wheel.
- **Video card:** Document the brand and model number of the video card or interface and the video memory and supported resolutions.
- **Network card:** Document manufacturer and model number: ISA or PCI architecture. In addition, you need to know the interrupt, I/O port, base memory, and DMA channel parameters. If not using DHCP (Dynamic Host Configuration Protocol),

know the Internet Protocol address, network mask, default gateway, and DNS server values your computer is using.

- **Modem:** Document model number. If it is an external modem, note serial port it is attached to. If it is internal modem, make note of whether it is PCI or ISA, the interrupt, I/O port, base memory, and DMA channels. Also, document maximum communication rate and whether it has the ability to send and/or receive fax documents. Windowmen or software modem will probably not work with Linux.
- **Printer:** Document printer attachment point. If it is connected to computer, note the parallel port it is attached to. If printer is directly connected to network, document its IP information. Also, take note of the manufacturer, model number, memory, and language capabilities of the printer.

VI. INSTALLING LINUX: SuSE DISTRIBUTION

After researching the different Linux distribution packages, our group decided to work with SuSE Linux because it is said to be user friendly to new Linux users. We purchased the SuSE Linux distribution to have hands-on experience with this operating system which was new to all members of our group. As novices installing Linux on a computer, our outlook on the installation process was rather pessimistic as we anticipated encountering problems with the process. How different is Linux compared to other operation systems such as Windows? For example, if Windows locks up during the installation process, why should Linux be any different?

A. Hardware Requirements

When installing an operating system, it is important to know the hardware requirements to ensure compatibility. So now that we have a good understanding of our hardware components, let us take a closer if our hardware can meet the following requirements to install SuSE Linux:

- SuSE Linux will support an Intel: Pentium 1-4 and an AMD: “Duran”, “Athlon”, “Athlon XP”, and “Athlon MP” processors.
- Minimum of 64 MB or up to 128 MB of main memory.
- Hard drive with a minimum of 400 MB up to 3 GB or more
- Sound card for audio.
- Video card - It is important to note that SuSE Linux is not compatible with older versions of video cards such as the nVidia: Geforce 2/3/4 and the ATI: Radeon 7500 and 8500.
- Mouse - The mouse is not a necessary requirement for installation, but compared to the keyboard it is much easier for maneuvering.

For our project, SuSE Linux was installed into a 14.1 inch Dell Latitude CPi notebook with:

- Intel Pentium II 366 Mhrz CPU,
- 128 MB of main memory
- IBM 6.0 GB hard drive

- SAMSUNG CD-ROM
- MagicMedia 256AV sound card
- NeoMagic MagicMedia 256AV video card.

B. Initializing Installation

The SuSE Linux package comes with 3 CDs. The first CD is the installation CD, which holds all files needed to install the OS. The other two CDs hold extra files for games, office suites, etc.; these files are not necessary for the initial installation process. The installation CD is self-bootable which does not require a floppy disk. The CD first opens with a boot screen to start the installation process. Within 10 to 15 minutes the files are loaded.

SuSE Linux, like other Linux distributions, can be installed as the only operating system on the computer; however, it can also share the hard disks with other operating systems. If the computer already has Windows operating system installed and your computer has several **partitions**, the user can install SuSE Linux on one of the additional partitions. If the previous operating system consists of a single partition that occupies the entire hard disk, SuSE Linux can resize it, provided that the computer has a “FAT” file system, which is the case with Windows 95, 96, 98, and ME. Windows NT, 2002, and XP uses a partition with a HTFS file system that cannot be resized by SuSE Linux. In this case, the user can choose to reinstall Windows and select “FAT” as file system, which can be now resized during the Linux installation (Haefner, S. et al., 2002, p. 4).

C. Configuring Your System

After the installation process of the files is complete, the next step is configuring the system. These steps involved:

1. Selecting a language
2. Choosing automatic or manual partitioning
3. Type of software to install
4. Choosing which drive to boot from
5. Adjusting the time settings
6. Configuring the hardware aspect of the system
7. Creating the root password (for the Administrator), as well as the user name and password for users
8. Hardware configuration

D. Creating User Account

Once the configuration is done, the entire installation process is completed. The final step before using the Linux operating system is to create a user login account to access the system. Linux is a true **multiuser system**: files and settings of multiple users are managed while keeping them separate which allows those different users to access the system at the same time (Haefner, S. et al., 2002, p. 10). For the system to function smoothly, each user needs to have a user account and password, which allows them to log in and out of the system. This provides protection for each user as data may not have access to others. The user account is created during the Linux

installation process. Accounts can be created or deleted through the root. Once the system recognizes one as a valid user, the system is ready to be used.

VII. WORKING WITH LINUX: SuSE DISTRIBUTION

The following section explains the directory structure of the Linux operating system and an overview of how to perform common tasks like using applications. Additionally, it introduces the Linux shell system and how to use the bash to perform computer operations.

A. Graphical User Interface

Graphical User Interfaces (GUIs) are becoming more important for Linux. Linux uses the X Window System, or simple X, which is the standard GUI for UNIX machines. The interface of X is controlled largely by the **window manager** (Grove, 1998, section 1.4.2). This user friendly program is in charge of the placement of windows, the user interface for resizing and moving them, changing windows to icons, and appearance of window frames. In other words, it is a full desktop environment. The two biggest GUI contenders for Linux are GNOME and KDE. The KDE is the standard desktop for SuSE Linux.

B. Linux Applications

Once the user is familiar with navigating the KDE GUI, it is time to explore the numerous applications Linux has to offer. Unlike Windows operating system, Linux distributions such as SuSE already come with all the programs and applications needed. Programs for the SuSE Linux include:

- OpenOffice: word processing, spreadsheets, drawing
- Adobe Acrobat Reader
- Konqueror: The KDE File Manager and Web Browser
- Kmail: The KDE Mail Application
- Evolution: An Email and Calendar Program
- Sound Applications
- TV, Video, Radio, and Webcam
- K3b: The KDE Burning Application
- Digital Cameras
- Kooka: Scanning Application
- Graphics with the GIMP
- Shell system

It is useful to note that the Linux operating system allows the user to continue to use old files that were created in different operating systems. Standard program in Linux such as StarOffice and the GIMP can handle most file formats that the user has previously utilized; whether it is for word processing documents, pictures, or video data (Haefner, S. et al., 2002, p. 4). SuSe Linux allows the user to work with old files without difficulty.

C. Working with the Shell

There are times where using command-line tools may prove to be much more efficient and flexible to execute certain tasks in Linux than using GUIs. For this reason, Linux users have the option of utilizing the **shell**, a program that reads and executes commands from the user (Grove, 1998, section 1.4). Additionally, many shells provide features like job control, managing several processes at once, input and output redirection, and a command language for writing **shell scripts**. A shell script is a program in the shell's command language which is similar to that of the MS-DOS batch file. The default shell used in Linux is the bash shell (LeBlanc, Hoag & Blomquist, 2001, p. 179). The basics of using shell bash at the command prompt simply involves typing a command. A command consists of several elements; one element is always the name of the command, which is followed by parameters or options.

D. Files, Folders, and Directories

To use the shell efficiently, it is useful to have some knowledge about the file and directory structures of Linux. Directories can be thought as electronic folders where files, programs, and subdirectories are stored.

Unlike Windows, which separates storage drives such as hard disk or floppy disk under the names A:, C:, D:, and so on, Linux incorporates all drives directly in the system's directory structure (Haefner, S. et al., 2002, p.7). As a result, drives are not accessible through names like "C:."; now they can be accessed by using folders or directories to tell the user where data is located.

The place where the entire directory tree begins is called the **root directory**. The root directory is identified by a slash (' / '). Root is one of the several users on the Linux system, which as mentioned before, is a multiuser system. The root is responsible for the entire Linux system, making sure it runs reliably, that infrastructure works, that all programs are up to date, and that none of the users "transgress" the rights of the others (Haefner, S. et al., 2002, p.7). Additionally, the root has the "master key" for the entire Linux system and has access to the main directory and all its subdirectories. Users should only log into the root if it is required for certain functions like creating a new user account or installing new programs.

The Linux file system is then subdivided into many branches known as subdirectories. The following Diagram 1.1 shows the standard directory tree in Linux with the home directories of abc, linux, and bill (Haefner, S. et al., 2002, p.297). Table 1.1 provides a short description of these standard directories.

Diagram 1.1

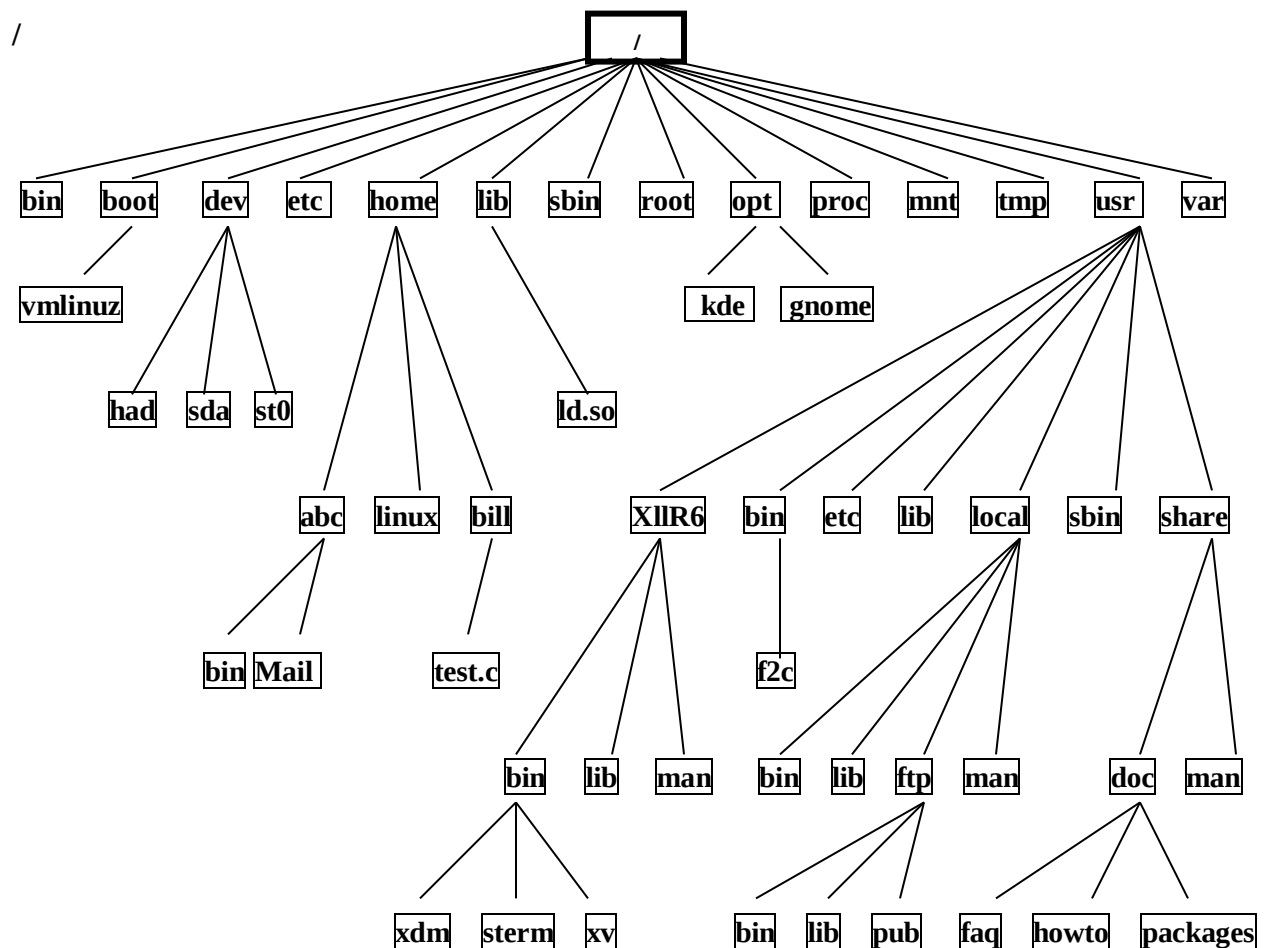


Table 1.1 Overview of Important Directories

Directory	Description
/	Root directory, starting point of the directory tree
/home	(private) directories of users
/dev	Device files that represent hardware components
/etc	Important files for system configuration
/etc/init.d	Boot scripts
/usr/bin	Generally accessible programs
/bin	Program needed early in the boot process

/usr/sbin	Programs reserved for the system administrator
/sbin	Program reserved for the system administrator and needed for booting
/sbin/init.d	Boot scripts
/usr/include	Header files for the C compiler
/usr/include/g++	Header files for the C++ compiler
/usr/share/doc	Various documentation files
/usr/man	System manual pages (man pages)
/usr/src	Source code of system software
/usr/src/linux	Kernel source code
/tmp	Temporary files
/var/tmp	Large temporary files
/usr	Contains all application programs
/var	Configuration files (e.g., those linked from /usr)
/var/log	System log files
/var/adm	System administration data
/lib	Shared libraries (for dynamically linked programs)
/proc	Process file system
/usr/local	Local, distribution-independent extensions
/opt	Optional software, larger add-on program packages (such as KDE, GNOME, Netscape)

VIII. CONNECTING TO THE INTERNET

Using the Internet has become a primary, mundane activity in most of our lives. Whether we use it to send e-mail or use it to look up information, the Internet has been a household and corporate necessity. Setting up an Internet connection on your Linux system involves a few steps:

- (1) Finding an Internet Service Provider,
- (2) Connecting your modem,
- (3) Finding a serial line, and
- (4) Setting up the network software.

A. Finding an ISP

To set up your Internet connection, first you must search for a good Internet Service Provider

(ISP). You want to search for an ISP that can handle not just Windows and Windows NT products, but one that can also handle UNIX and Linux accounts. It is important to find an ISP that provides great technical help and one that has not overused local access numbers. Once you have found an ISP, you must let them know that you have a Linux system and are interested in “PPP services, with e-mail and newsgroups” (Hall, 1999, p. 266). Other important services your ISP should have include: providing access numbers to your local calling area, having the capability to host Web pages, filtering junk e-mail, and charging a flat rate for unlimited service. (Hall, 1999, p. 265-267).

B. Connecting Your Modem

Secondly, it is necessary to have at least one of the following devices to use Linux with the Internet:

- A serial modem
- An ISDN line
- A broadband connector (such as Ethernet, FDDI, a cable modem, or ATM) (Hall, 1999, p. 267).

For the remainder of this section, we will assume that you are connecting the system to the Internet using a serial modem and a telephone line. Modems have three main functions that include: (a) converting digital information into analog that go across telephone lines (and vice versa), (b) dialing the telephone number and connecting with a modem at the destination end, and (c) negotiating the speed to use with the destination modem when transferring bits of information. (Hall, 1999, p. 267-268). Once you have connected your modem, next you must find the serial line.

C. Finding the Serial Line

Thirdly, to find the serial line for your Linux system, you must rearrange your settings by going to the Control Panel to configure the modem. By using the Modemtool (8) program, you can tell Linux which serial line has an attached modem. To do this, you log on to the program and highlight the line showing the device with the modem attached (Hall, 1999, 268-271). The final step is setting up the networking software.

D. Setting Up the Networking Software

Finally, once you have established an account with an ISP and have connected your modem, next you have to tell Linux what process you will be doing when connecting to the Internet:

1. Execute PPP (Point-to-Point Protocol)
2. Dial your modem to connect to the ISP
3. Make the connection
4. Negotiate the speed at which the modems will communicate
5. Log on to the ISP’s system with your username and password

6. Start the PPP services to create an IP to flow over the serial line

To set up the networking software you must configure the settings in Network Configurator by filling out the fields with information such as your DNS number, the telephone number for the ISP, the logon name for the account, and the password. Also, you must make sure the PPP connection stays connected and that it has all the names and passwords of the PPP accounts. In addition it is advisable to set up the networking connection to redial the modem to remake a connection if the line is busy. Now you are ready to go. Just log on as a regular user, type this command at the console: `/sbin/ifup ppp0` and your modem will connect to the Internet. Now you can use it just like you would in a Windows Operating System. To disconnect from the Internet, just type in the command: `/sbin/ifdown ppp0` and you are done (Hall, 1999, p. 271-277).

IX. WHY USE LINUX

A Linux operating system has thousands of dollars worth of software for no cost or minimal cost (through purchasing one of the Linux distribution packages). Linux is a complete operating system that is:

- **Stable** – the crash of an application is much less likely to bring down the operating system under Linux
- **Reliable** – Linux servers are often up for hundreds of days compared with the regular reboots required with a Windows system
- **Extremely powerful**

X. LINUX VS. WINDOWS

Comparing these two operating systems, the comparison does not only address the level of popularity between them, but also what each offers to users, small companies, and corporations. There are numerous differences between Linux and Windows. The differences can be organized into three main categories

- **Financial Differences**
- **Technical Differences**
- **End-User Differences**

First, let's address financial differences. When purchasing windows, the price ranges from \$50 to \$300, and can sometimes be even more expensive. Compared to Windows, Linux costs practically nothing. As mentioned earlier, it is free and the kernel can easily be downloaded to your PC through the Internet and then customized. Alternatively, various Linux distributions are available at low-cost prices.

The following table shows a summary of different price ranges with Linux and Windows: -

<u>COST</u>		
	Linux	Windows

Online Downloads	Free	Not Available
Retail Price, CD	\$50	\$300

Secondly, talking about technical differences. Updating with the latest technology is necessary. No big company wants to lose its competitive edge because of technology. For that reason, upgrading your operating system is critical. Windows has developed several different kinds of operating systems, with each version increasing in size and speed compared to its predecessor. This all sounds great, however, they don't upgrade as fast as Linux. For example, Windows 95 came out three years after Windows 3.11, while the major distributors of Linux are upgrading their operating systems every six months or so.

If a corporation desires to be constantly on top of technology, there is one problem they may face; will my new operating system be compatible with my old operating system? All of the important, relevant information of the company has been stored and maintained on the old operating system, the last thing they want to do is get a new operating system that is not compatible with the old one. No company wants to take the risk of losing any important information. Unfortunately, Windows does not make it a priority to maintain backward-compatibility with older systems when it releases new operating systems. It is technically possible to do it, however, it would cost too much. Linux on the other hand, is backward compatible.

Linux and Windows both support dynamic caching. Caching stores recently used information in memory, so it is readily available if needed again. The result of which is much faster disk access for Linux and Windows, because the information is often already in the cache. Linux, like Windows, has full multi-user support. Local users, modem users, and network users can all simultaneously run text and graphics programs. This is a powerful feature for business environments that is matched by Windows.

Linux has an interface to run commercial applications designed for other Intel Unix systems like SCO UNIX. But the quality of applications is still a problem. For example, there is no commercial word processor for Linux, which matches the quality for Windows. This kind of glaring inadequacy can preclude the use of Linux (Thompson, 1994, "Practical Results" section).

Lastly, a little about end-user differences, Windows is compelling because it is a solid system that offers freedom from the single CPU Intel world. But, it ends up locking users into **proprietary software**; software that is owned by an entity and whose source code is not available. (Stutz, 2001, 10). Linux does not pose this danger. Applications written for Linux can be ported to any of the dozens of other UNIX systems available. Betting on an "open" technology from Microsoft is still a risky game. Linux offers freedom from this kind of entrapment.

So, far it may sound that Linux is the perfect operating system, but it is not. Linux also has its number of problems. For example, as a new user to Linux, having the complete information to download the operating system is really important. Unfortunately, some distributors either give too little information not allowing new users to know if the correct steps are being taken, or give

too much information making new users confused and frustrated with the complex jargon behind downloading software.

Getting help when a user is unable to solve a problem is always the number one thing that should be easily accessible. However, Linux does not make it easily convenient to attain technical help. The user is expected to be comfortable with the UNIX system, since they have to go through the Internet for help. If they don't know what they are typing they may end up getting something they did not ask for. For example, to get directory the user may want to type "dir." That would be the logical thing to do; however, it will not work. After using the operating system, the user will find out that the correct word to type is either "man" or "locate." Linux uses different commands compared to Windows, and so, it is essential that users of Linux learn the necessary and common commands to easily navigate the system.

XI. LINUX VS. WINDOWS NT IN THE COMMERCIAL ARENA

In our fast paced competitive technological environment any new development creates competition. Similarly, Linux and Windows NT are on a head to head competition. Several times Windows and Linux were put to competitive task in a highly stressful controlled scientific comparison.

Linux and NT were used side by side as servers for rigorous comparable small business operations in a given real world day-to-day operation. Both operating systems simultaneously handled the daily workload for several small business operations that include surfing web sites, emailing, and other basic functions of servers such as file and print services.

Linux worked fine on the previous generation platform, which was left over when NT server was introduced. Therefore, it made the best use of a 200Mhz Pentium with 64 Mbytes of Memory. However, NT used a 300Mhz Pentium II with 256 Mbytes of Memory. Even with the hardware disadvantage, Linux supported a community of users roughly three times the size of NT's. (Tibbetts and Bernstein, 1999, "Why Operating" section)

According to the evaluation published in Information Week, the most significant difference has to do with system administration. Linux is a far tougher environment to master. Getting started requires learning a lot about multi-user issues that are built into the very foundations of Unix-file permissions, user groups, and other arcane topics. But this up-front investment pays off in considerable leverage, since all Linux products and infrastructure use these same rules and metaphors of server governance. NT requires much less effort to get a starter server up, running, and reasonably configured. But as you add an E-mail server, then a Web server, then a news server, those ugly multi-user issues rear their heads. The problems are simpler to grasp, but you have to solve them for each and every subsystem. Under NT, managing the shared community is more a product burden than an operating system burden.

NT presents itself through consistent graphical interfaces, wizards, and easy-to-grasp metaphors. But over time, as the server chores become more customized and more demanding, NT cannot handle it. In contrast, Linux is a textual interface (with X-Window dressing added later), and this can make it extremely frustrating for users who are not "regular-expression minded." But for

complex jobs, especially those that require repetitive scripting, Linux gives those willing to work at it a succinct and powerful set of tools.

Concluding, both operating systems are considered robust, however, both have strengths and weaknesses that are directly traceable to their heritage. NT evolved from the PC world to make life as easy as possible for the **non-programmer**, whereas Linux started from a multiuser, programmer-based culture. Therefore, Microsoft Windows dominates the PC Operating System market and runs over 90% of the world's desktop computers but certainly doesn't prove that it is the best operating system.

XII. CONCLUSION

As one can see, Linux is to be on par with the best, but the question really is “when is it best to use Linux and when should some other operating system be preferred.” The decision depends entirely on the application.

Deciding what operating system is easier to use all depends on the user. Windows tends to be more popular with individuals; however, it is all about familiarizing yourself with the operating system. After actually giving Linux a chance, any user can decide that it is easier to use than Windows. One thing to remember is that Linux is free, so anyone can always go to the Internet and download software to experiment with the OS. If a user does end up disliking it, he/she can go back to using Windows. It's that easy.

Now you have seen that it is possible to set up your system to run more than one operating system on your computer. If you are contemplating using Linux this can be very handy; it let's you still keep Windows 95/98/ME/2000/XP and use Linux. This will require creating partitions on your Hard Disk, which can be done creating a multi boot system. Documentation that accompanies most Linux distributions will explain how to create a 'multi-boot' system.

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