Unit 10 : An Introduction to Linux OS

Linux is a true 32/64-bit operating system that run on different platforms. It is a multi-user, multi-tasking and time sharing operating system. Linux is a very stable OS and is used in many application areas, such as by Internet Service Providers (ISPs) and as a network OS for providing various services. The Linux OS derived its name from its creator, Linux Torvalds. Linux started writing the Linux kernel in 1991, as a hobby, and created one of the most powerful operating systems available today. Perhaps the most important factor for the immense success of Linux is that it is free. It can be copied and redistributed without having to pay any fee or royalty.

Lesson 1 : Overview of Linux Operating System

1.1. Learning Objectives

On completion of this lesson you will be able to know:

- The History of Linux Operating System
- Features of Linux Operating System
- Privilege of Linux Operating System

1.2. A Brief history of Linux

History of Linux

All modern operating systems have their roots in 1969 when **Dennis Ritchie** and **Ken Thompson** developed the C language and the **UNIX** operating system at AT&T Bell Labs. They shared their source code with the rest of the world, including the hippies in Berkeley California. By 1975, when AT&T started selling UNIX commercially, about half of the source code was written by others. The hippies were not happy that a commercial company sold software that they had written; the resulting (legal) battle ended in there being two versions of **UNIX** in the Seventies: the official AT&T UNIX, and the free **BSD** UNIX.

In the Eighties many companies started developing their own UNIX: IBM created AIX, Sun SunOS (later Solaris), HP HP-UX and about a dozen other companies did the same. The result was a mess of UNIX dialects and a dozen different ways to do the same thing. And here is the first real root of **Linux**, when **Richard Stallman** aimed to end this era of UNIX separation and everybody re-inventing the wheel by starting the **GNU** project (GNU is Not Unix). His goal was to make an operating system that was freely available to everyone, and where everyone could work together (like in the Seventies). Many of the command line tools that you use today on **Linux** or Solaris are GNU tools.

The Nineties started with **Linus Torvalds**, a Swedish speaking Finnish student, buying a 386 computer and writing a brand new POSIX compliant kernel. He put the source code online, thinking it would never support anything but 386

hardware. Many people embraced the combination of this kernel with the GNU tools, and the rest, as they say, is history.

1.3. Features of Linux Operating System

Hierarchical File System
Linux provides a standard file structure in which system files/ user files are arranged.

Multiprogramming
Linux is a multiprogramming system means multiple applications can run at same time.

Time-Sharing
Multi-programming is made possible on the Linux system by time-sharing feature.

Multi-Tasking
A program in Linux is broken down into tasks, each task is something like reading from or writing to the disk, or waiting for input from a user. The ability of any as to handle the execution of multiple tasks is known as multi-tasking.

Multi-User
Linux is a multiuser system means multiple users can access system resources like memory, ram, and application programs at same time.

Open Source
Linux source code is freely available and it is community based development project. Multiple teams' works in collaboration to enhance the capability of Linux operating system and it is continuously evolving.

Licensing
Linux is copyrighted under the GNU General Public License. The licensing for Red Hat Linux states that a person can make any number of copies of the software and distribute it freely or charge a price for it. One can freely download Linux from the Internet for use.

1.4. The Advantage of Linux Operating System

Cost
The most important advantage of using Linux is the fact that it is free to obtain. Linux distribution can be installed on any number of computers, without paying a single penny.

Reliability
Users on the Linux operating system work consistently with the Linux server, without reporting any operating system failures.

Backward Compatibility
Linux is perfect for those old computers with barely any processing power or memory. There are endless possibilities to find old 386 or 486 computers with barely any RAM run Linux without any issue.

Simple Upgrade and Installation Process
The installation procedure of most Linux versions is menu-driven. It includes the ability to upgrade from prior versions. The upgrade process preserves the existing configuration files and maintains a list of its actions during installation.

GUI Interface
The graphical interface for Linux is the X Window system. It is divided into two sub systems consisting of a server and a client. Linux has a number of graphical user interfaces called Desktop Environments, such as K Desktop Environment (KDE) and GNU Object Model Environment (GNOME), both of which are versions of the X Window system. They run on the X server.

Excellent Security Features
Security - Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data. This is the reason why many Internet Service Providers (ISPs) are replacing their current OS with Linux systems.

1.5. Exercises

1.5.1. Multiple choice questions

a. The UNIX operating system was first developed at

(i) Berkeley
(ii) AT & T Bell laboratories
(iii) Sun Microsystems
(iv) Microsoft corporation

b. Who has invented Linux?

(i) Richard Mathew Stallman
(ii) Prof. Andy Tanenbaum
(iii) Linus Torvalds
(iv) Jon Maddog Hall

1.5.2. Questions for short answers

a) Who is Linus Torvalds? Mention his contribution in the history of Linux.
b) When UNIX was invented and who were the inventors?
c) What do you mean by Samba?
d) What is the Utility of CRON Scheduler?
e) Why does ISP (Internet Service Provider) prefer Linux to other OS?

1.5.3. Analytical questions

a) Narrate history of UNIX.
b) Discuss some features of Linux OS.
c) Mention the advantages of Linux OS.

Lesson 2 : Structure and Comparison of Linux

2.1. Learning Objectives

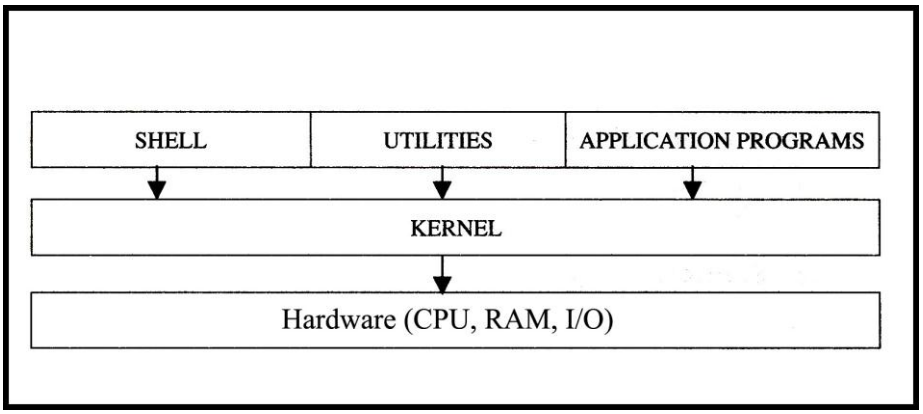
On completion of this lesson you will be able to know:

- About Linux Architecture
- Difference between Linux and UNIX
- Difference between Linux and Windows
- About distribution of Linux

2.2. Linux Architecture

The Linux operating system consists of three main software components as shown below:

Linux Architecture



Components of the Linux OS

Kernel
The kernel is a program that constitutes the central core of a computer operating system. It has complete control over everything that occurs in the system. Since the kernel communicates directly with the hardware, the parts of the kernel must be customized to the hardware features of each system. However, the kernel does not deal directly with a user. Instead, the login process starts up a separate, interactive program, called the shell, for each user.

Shell
A shell is a program that provides the traditional, text-only user interface for Linux and other Unix-like operating systems. Its primary function is to read commands that are typed into a console (i.e., an all-text display mode) or terminal window (an all-text window) in a GUI (graphical user interface) and then execute (i.e., run) them. The features of the shell will be discussed in lesson 2 unit 4.

Linux Utilities and Application Programs

The Linux utilities or commands are a collection of programs that service day-to-day processing requirements. These programs are invoked through the shell, which is itself another utility. Apart from the utilities provided as part of the Linux operating system, more than a thousand Linux-based application programs, like database management systems, word processors, and various other programs are available from independent software vendors.

2.3. Linux as compared to UNIX

Linux was developed considering UNIX as a reference model. This is why; the basic architecture and most of the features of Linux and UNIX are the same. Actually, Linux is also considered another version of UNIX. The main difference between Linux and UNIX is that Linux is FREE. Various distributors of Linux charges a price, which is quite low as compared to other operating systems.

The Linux operating system requires at least 850 MB hard disk space, 64MB Memory for Red hat Linux 9.0.

Comparison between Linux and UNIX

Feature	Linux	Unix
Shell Available	bash, pdksh, tcsh zsh, ash	Bourne, korn, C
Variants	Red Hat, Caldera, Debain, LinuxPPC, SUSE	AT&T, MULTICS, BSD, SCO, HP-Ux, IRIX, Ultrix, Sun Solaris
Licensing	Freely Distributed	Expensive licensing

2.4. Linux as compared to Windows

Most of the organizations having small, medium, or large networks require a few basic services such as file and print services, E-mail access, Internet access, and Intranet services. Most of the tasks that you are wanting to execute on a Windows machine can also be executed on a Linux machine.

The following table compares some of the common applications used on the Linux and Windows operating systems.

Comparison between Linux and Windows

Service	Linux	Windows
Web Server	Apache	Internet Information Server
Email Server	Send mail	Microsoft Exchange
Relational Database	Sybase /MYSQL	Microsoft SQL Server
Proxy Server	Squid Object Cache	Windows Pro Server
Backup Server	BRU	Included with Windows

2.5. The distributor of Linux

A Linux **distribution** is collection software of (usually open source) software on top of a Linux kernel. A distribution (or short, distro) can bundle server software, system management tools, documentation and many desktop applications in a **central secure software repository**. A distro aims to provide a common look and feel, secure and easy software management and often a specific operational purpose.
Let's take a look at some popular distributions.

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Red Hat

Red Hat is a billion dollar commercial Linux Company that puts a lot of effort in developing Linux. They have hundreds of Linux specialists and are known for their excellent support. They give their products (Red Hat Enterprise Linux and Fedora) away for free. While **Red Hat Enterprise Linux** (RHEL) is well tested before release and supported for up to seven years after release, **Fedora** is a distro with faster updates but without support.

Ubuntu

Canonical started sending out free compact discs with **Ubuntu** Linux in 2004 and quickly became popular for home users (many switching from Microsoft Windows). Canonical wants Ubuntu to be an easy to use graphical Linux desktop without need to ever see a command line. Of course they also want to make a profit by selling support for Ubuntu.

Debian

There is no company behind **Debian**. Instead there are thousands of well organised developers that elect a Debian Project Leader every two years. Debian is seen as one of the most stable Linux distributions. It is also the basis of every release of Ubuntu. Debian comes in three versions: stable, testing and unstable. Every Debian release is named after a character in the movie Toy Story.

2.6. Exercises

2.6.1. Multiple choice questions

a. Web server on Linux is called

(i) Extensive Scan apache
(ii) internet information server (IIS)
(iii) BRU
(iv) Squid Object Cache

b. How many bytes of hard disk are required at least to install Linux Operating Systems?

(i) 500 MB
(ii) 850 MB
(iii) 300 MB
(iv) 1000 MB

2.6.2. Questions for short answers

a. Draw a block diagram of Linux OS Architecture
b. Note the functions of Shell.
c. List the Linux utilities and application programs

2.6.3. Analytical questions

a. What is Kernel? Describes the functions of Kernel.
b. Compare The Linux to UNIX.
c. What are the services distinguish Linux from Windows?
d. Describes the distributors namely REDHAT and Ubuntu.