Unit 3. Introduction of Linux

Introduction of Linux versions
Components of Linux
Comparison of Windows and Linux

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❖ Introduction of Linux

In the simple language Linux is an operating system (OS). We all are familiar with other operating systems like Microsoft windows, Apple Mac OS, iOS, Google android, etc, just like them Linux is also an operating system.

An operating system is software that enables communication between computer hardware and software. It conveys input to get processed by the processor and brings output to the hardware to display it. This is the basic function of an operating system. Although, it performs many other important tasks, let's not talk about that.

Linux is around us since mid 90s. It can be used from wristwatches to supercomputers. It is everywhere in our phones, laptops, PCs, cars and even in refrigerators. It is very much famous among the developers and normal computer users.

Open Source Operating System

- Most OS come in a compiled format means the main source code has run through a program called compiler that translates the source code into a language which is known to the computer.
- Modifying this compiled code is really a tough job. On the other hand, open source is completely different. The source code is included with the compiled version and allows modification by anyone having some knowledge.
- It gives us freedom to run the program, freedom to change the code according to our use, freedom to redistribute its copies and freedom to distribute copies which are modified by us.
- In short, Linux is an operating system that is "for the people, by the people".

❖ History and Evolution of Linux

- In 1991, **Linus Torvalds** a student at the University of Helsinki, Finland, thought to have a freely available academic version of Unix started writing its own code. Later this project became the Linux kernel.
- He wrote this program especially for his own PC as he wanted to use Unix 386 Intel computer but couldn't afford it.
- He did it on MINIX using GNU C compiler. GNU C compiler is still the main choice to compile Linux code but other compilers are also used like Intel C compiler.
- He started it just for fun but ended up with such a large project. Firstly he wanted to name it as 'Freax' but later it became 'Linux'.
- He published the Linux kernel under his own license and was restricted to use as commercially. Linux uses most of its tools from GNU software and are under GNU copyright. In 1992, he released the kernel under GNU General Public License.

❖ Linux Today

Today, supercomputers, smart phones, desktop, web servers, tablet, laptops and home appliances like washing machines, DVD players, routers, modems, cars, refrigerators, etc use Linux OS.

❖ **What is the difference between UNIX and Linux?**

You may have heard of Unix, which is an operating system developed in the 1970s at Bell Labs by Ken Thompson, Dennis Ritchie, and others. UNIX and Linux are similar in many ways, and in fact, Linux was originally created to be similar to Unix. Both have similar tools for interfacing with the systems, programming tools, file system layouts, and other key components. However, Unix is not free. Over the years, a number of different operating systems have been created that attempted to be "unix-like" or "unix-compatible", but Linux has been the most successful, far surpassing its predecessors in popularity.

❖ Basic Features

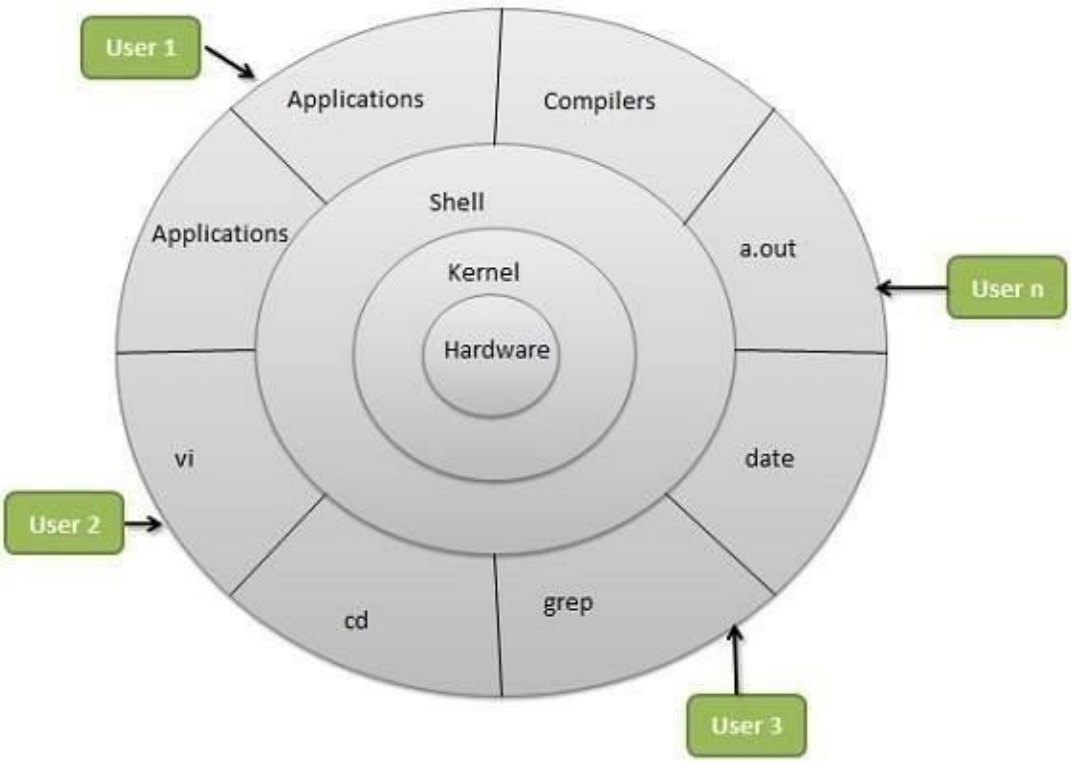
Following are some of the important features of Linux Operating System.

1) **Portable** – Portability means software can works on different types of hardware in same way. Linux kernel and application program supports their installation on any kind of hardware platform.
2) **Open Source** – Linux source code is freely available and it is community based development project. Multiple teams work in collaboration to enhance the capability of Linux operating system and it is continuously evolving.
3) **Multi-User** – Linux is a multiuser system means multiple users can access system resources like memory/ ram/ application programs at same time.
4) **Multiprogramming** – Linux is a multiprogramming system means multiple applications can run at same time.
5) **Hierarchical File System** – Linux provides a standard file structure in which system files/ user files are arranged.
6) **Shell** – Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs. etc.
7) **Security** – Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data.

❖ The architecture of Linux Operating System

The architecture of a Linux System consists of the following layers –

1) **Hardware layer** – Hardware consists of all peripheral devices (RAM/ HDD/ CPU etc).
2) **Kernel** – It is the core component of Operating System, interacts directly with hardware, provides low level services to upper layer components.
3) **Shell** – An interface to kernel, hiding complexity of kernel's functions from users. The shell takes commands from the user and executes kernel's functions.
4) **Utilities** – Utility programs that provide the user most of the functionalities of an operating systems.



❖ The benefits of Linux OS <u>OR</u> Why Use Linux?

1) The main advantage of Linux was that programmers were able to use the Linux Kernel to design their **own custom** operating systems.
2) With time, a new range of user-friendly OS's stormed the computer world. Now, Linux is one of the most popular and widely used Kernel, and it is the backbone of popular operating systems like **Debian, Knoppix, Ubuntu, and Fedora.**
3) Nevertheless, the list does not end here as there are thousands of OS's based on Linux which offer a **variety of functions** to the users.
4) Being open-source, anyone with programming knowledge can **modify** it.
5) The Linux operating systems now offer millions of programs/applications to choose from, most of them **free**!
6) Once you have Linux installed **you no longer need an antivirus**! Linux is a **highly secure** system. More so, there is a global development community constantly looking at ways to enhance its security. With each upgrade, the OS becomes more secure and robust
7) Linux is the OS of choice for **Server environments** due to its stability and reliability (Mega-companies like Amazon, Facebook, and Google use Linux for their Servers).
8) A Linux based server could run non-stop without a reboot for years on end.

Introduction of Linux versions

❖ **What is a Linux Distribution?**

Well, now as you know that Linux is open-source, free to use kernel. It is used by programmers, organizations, profit and non-profit companies around the world to create Operating systems to suit their individual requirements.

To prevent hacking attempts, many organizations keep their Linux operating systems private. Many others make their variations of Linux available publicly so the whole world can benefit at large. These versions/ types /kinds of Linux operating system are called Distributions.

The latest example of one of the most popular Smartphone-based Linux Distribution is Android!

Here, are a few popular Linux Distributions (also called Linux Distro)

Linux Distribution	Name	Description
	**Arch**	This Linux Distro is popular amongst Developers. It is an independently developed system. It is designed for users who go for a do-it-yourself approach.
	**CentOS**	It is one of the most used Linux Distribution for enterprise and web servers. It is a free enterprise class Operating system and is based heavily on Red Hat enterprise Distro.
	**Fedora**	Another Linux kernel based Distro, is supported by the Fedora project, an endeavor by Red Hat. It is popular among desktop users. Its versions are known for their short life cycle.
	**Debian**	Debian is a stable and popular non Commercial Linux distribution. It is widely used as a desktop Linux Distro and is user oriented. It strictly acts within the Linux protocols.
	**Gentoo**	It is a source based Distribution which means that you need to configure the code on your system before you can install it. It is not for Linux beginners, but it is sure fun for experienced users.
	**LinuxMint**	It is one of the most popular Desktop Distributions available out there. It launched in 2006 and is now considered to be the fourth most used Operating system in the computing world.

	**Ubuntu**	This is the third most popular desktop operating system after Microsoft Windows and Apple Mac OS. It is based on the Debian Linux Distribution, and it is known as its desktop environment.
	**Slackware**	Slackware is one of the oldest Linux kernel based OS's. It is another easy desktop Distribution. It aims at being a 'Unix like' OS with minimal changes to its kernel.
	**RedHat enterprise**	Another popular enterprise based Linux Distribution is Red Hat Enterprise. It has evolved from Red Hat Linux which was discontinued in 2004. It is a commercial Distro and very popular among its clientele.
	**OpenSUSE**	It is an easy to use and a good alternative to MS Windows. It can be easily set up and can also run on small computers with obsolete configurations.

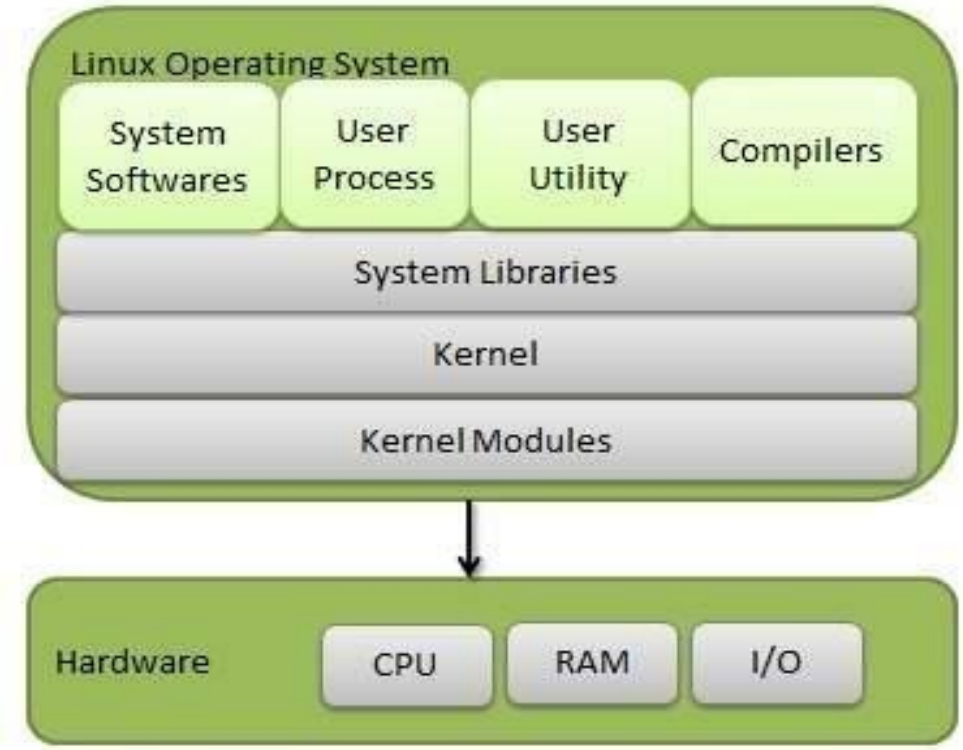
Components of Linux

Linux is one of popular version of UNIX operating System. It is open source as its source code is freely available. It is free to use. Linux was designed considering UNIX compatibility. Its functionality list is quite similar to that of UNIX.

Components of Linux System

Linux Operating System has primarily three components

1. **Kernel** – Kernel is the core part of Linux. It is responsible for all major activities of this operating system. It consists of various modules and it interacts directly with the underlying hardware. Kernel provides the required abstraction to hide low level hardware details to system or application programs.
2. **System Library** – System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features. These libraries implement most of the functionalities of the operating system and do not requires kernel module's code access rights.
3. **System Utility** – System Utility programs are responsible to do specialized, individual level tasks.



- **Kernel Mode vs User Mode**

Kernel component code executes in a special privileged mode called **kernel mode** with full access to all resources of the computer. This code represents a single process, executes in single address space and do not require any context switch and hence is very efficient and fast. Kernel runs each process and provides system services to processes, provides protected access to hardware to processes.

Support code which is not required to run in kernel mode is in System Library. User programs and other system programs works in **User Mode** which has no access to system hardware and kernel code. User programs/ utilities use System libraries to access Kernel functions to get system's low level tasks.

Comparison of Windows and Linux

Windows:

Windows may be a commissioned OS within which ASCII text file is inaccessible. It's designed for the people with the angle of getting no programming information and for business and alternative industrial users. It's terribly straightforward and simple to use.

The distinction between Linux and Windows package is that Linux is completely freed from price whereas a window is marketable package and is expensive. Associate operating system could be a program meant to regulate the pc or computer hardware Associate behaves as an treater between user and hardware.

Linux:

Linux could be a free and open supply OS supported operating system standards. It provides programming interface still as program compatible with operating system primarily based systems and provides giant selection applications. A UNIX operating system additionally contains several severally developed parts, leading to UNIX operating system that is totally compatible and free from proprietary code.

Following is the Differences between Linux and Windows

1. Linux is **open source** operating system whereas Windows OS is **commercial.**
2. Linux has access to source code and alters the code as per user need whereas Windows does not have access to source code.
3. Linux will **run faster** than windows latest editions even with a modern desktop environment and features of the operating system whereas windows are slow on older hardware.
4. Linux distributions don't collect user data whereas Windows collect all the user details which lead to privacy concern.
5. Linux is **more reliable** then windows as in Linux we can kill application if they hung through x kill command whereas, in windows, we need to try multiple times to kill it.
6. Linux supports a wide variety of **free software's** than windows but windows have a large collection of video game software.
7. In Linux software cost is almost free as all programs, utilities, complex applications such as open office are free but windows also have many free programs and utilities but most of the programs are commercial.
8. Linux is **highly secure** because it's easy to identify bugs and fix whereas Windows has a large user base and becomes a target for developers of **viruses and malware**.
9. Linux is used by corporate organizations **as servers** and operating system for security purpose at Google, Facebook, twitter etc. whereas windows are mostly used by **gamers and business users**.
10. Linux and windows have same **priority** over hardware and driver support in the present situation

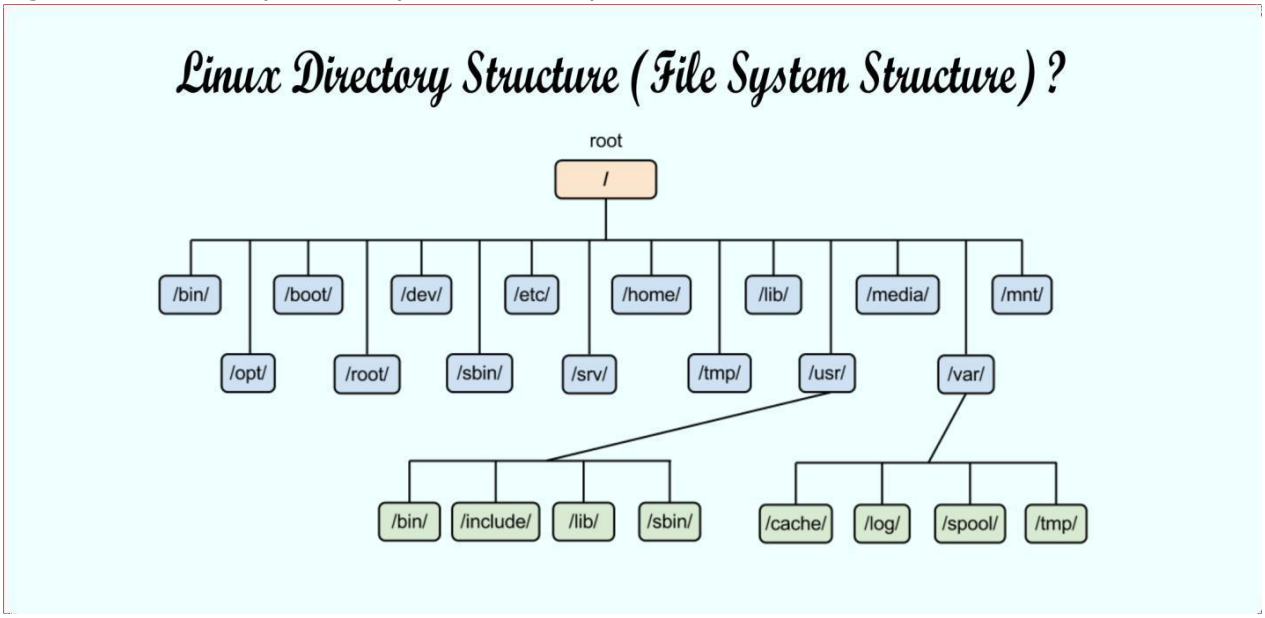
Linux vs. Windows: Comparison

1) Windows Vs. Linux File System

In Microsoft Windows, files are stored in folders on different data drives like C: D: E:
But, in Linux, files are ordered in a tree structure starting with the root directory.

This root directory can be considered as the start of the file system, and it further branches out various other subdirectories. The root is denoted with a forward slash '/'.

A general tree file system on your Linux may look like this.



Types of Files

In Linux and UNIX, everything is a file. Directories are files, files are files, and devices like Printer, mouse, keyboard etc. are files.
Let's look into the File types in more detail.

1. **General Files**
   General Files also called as Ordinary files. They can contain image, video, program or simply text. They can be in ASCII or a Binary format. These are the most commonly used files by Linux Users.
2. **Directory Files**
   These files are a warehouse for other file types. You can have a directory file within a directory (sub-directory).You can take them as 'Folders' found in Windows operating system.
3. **Device Files:**
   In MS Windows, devices like Printers, CD-ROM, and hard drives are represented as drive letters like G: H:. In Linux, there are represented as files. For example, if the first SATA hard drive had three primary partitions, they would be named and numbered as /dev/sda1, /dev/sda2 and /dev/sda3. Note: All device files reside in the directory /dev/

All the above file types (including devices) have permissions, which allow a user to read, edit or execute (run) them. This is a powerful Linux/Unix feature. Access restrictions can be applied for different kinds of users, by changing permissions.

2) Windows Vs. Linux: Users

There are 3 types of users in **Linux**.
1. Regular
2. Administrative (root)
3. Service

i. Regular User

A regular user account is created for you when you install Ubuntu on your system. All your files and folders are stored in /home/ which is your home directory. As a regular user, you do not have access to directories of other users.

ii. Root User

Other than your regular account another user account called root is created at the time of installation. The root account is a superuser who can access restricted files, install software and has administrative privileges. Whenever you want to install software, make changes to system files or perform any administrative task on Linux; you need to log in as a root user. Otherwise, for general tasks like playing music and browsing the internet, you can use your regular account.

iii. Service user

Linux is widely used as a Server Operating System. Services such as Apache, Squid, email, etc. have their own individual service accounts. Having service accounts increases the security of your computer. Linux can allow or deny access to various resources depending on the service.

Note:

1. You will not see service accounts in Ubuntu Desktop version.
2. Regular accounts are called standard accounts in Ubuntu Desktop

In Windows, there are 4 types of user account types.

1) Administrator
2) Standard
3) Child
4) Guest

3) Windows Vs. Linux: File Name Convention

In Windows, you cannot have 2 files with the same name in the same folder. While in Linux, you can have 2 files with the same name in the same directory, provided they use different cases.

4) Windows Vs. Linux: HOME Directory

For every user in Linux, a directory is created as /home/

Consider, a regular user account "tom". He can store his personal files and directories in the directory "/home/tom". He can't save files outside his user directory and does not have access to directories of other users. For instance, he cannot access directory "/home/jerry" of another user account "Jerry". The concept is similar to C:\Documents and Settings in Windows. When you boot the Linux operating system, your user directory (from the above example /home/tom) is the **default working directory**. Hence the directory "/home/tom is also called the **Home directory** which is a misnomer.

5) Windows Vs. Linux: Other Directories

In Windows, System and Program files are usually saved in C: drive. But, in Linux, you would find the system and program files in different directories. For example, the boot files are stored in the /boot directory, and program and software files can be found under /bin, device files in /dev. Below are important Linux Directories and a short description of what they contain.