## Linux Introduction

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.

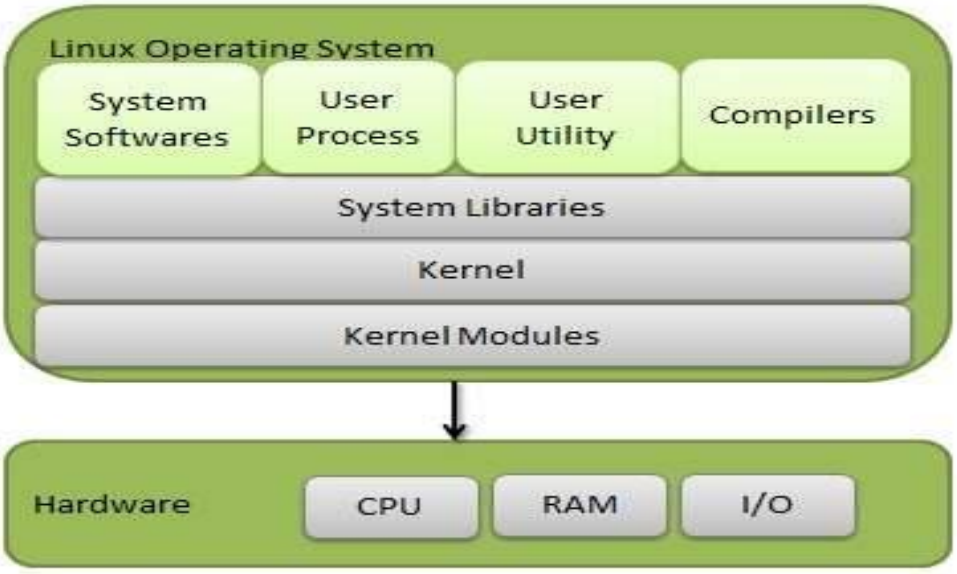
### Components of Linux System

Linux Operating System has primarily three components

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.

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.

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 processes 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.

## Basic Features

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

Portable – Portability means software can work on different types of hardware in same way. Linux kernel and application programs supports their installation on any kind of hardware platform.

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.

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

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

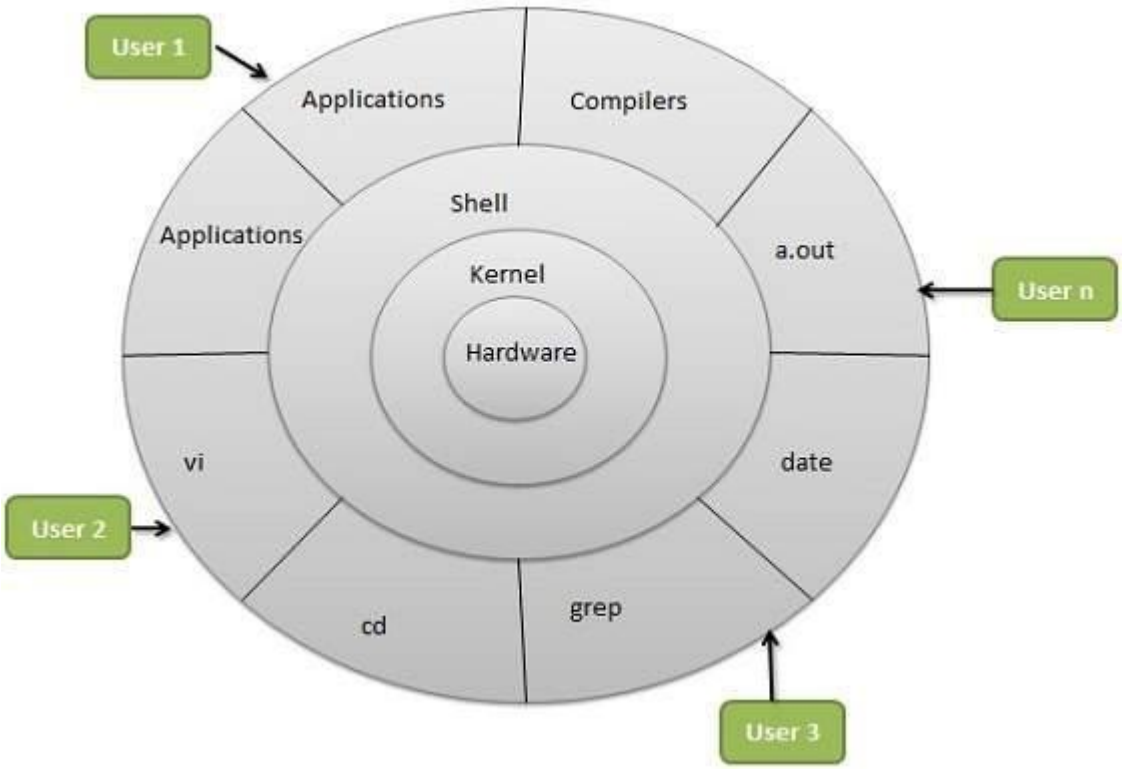
Hierarchical File System – Linux provides a standard file structure in which system files/ user files are arranged.

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.

Security – Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data.

## Architecture

The following illustration shows the architecture of a Linux system –




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

Hardware layer – Hardware consists of all peripheral devices (RAM/ HDD/ CPU etc).

Kernel – It is the core component of Operating System, interacts directly with hardware, provides low level services to upper layer components.

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.

Utilities – Utility programs that provide the user most of the functionalities of an operating systems.

## Flavour / Distributions of Linux: -

Linux has a number of different versions to suit any type of user. From new users to hard-core users, you'll find a "flavor" of Linux to match your needs. These versions are called distributions (or, in the short form, "distros"). Nearly every distribution of Linux can be downloaded for free, burned onto disk (or USB thumb drive), and installed (on as many machines as you like).

Popular Linux distributions include:

## LINUX MINT: -

Linux Mint is a community-driven Linux distribution based on Ubuntu (which is in turn based on Debian), bundled with a variety of free and open-source applications. It can provide full out-of-the-box multimedia support for those who choose to include proprietary software such as multimedia codecs.

## MANJARO: -

Manjaro Linux Open Source operating system is, and always will be, provided free of charge. The Manjaro project is backed up by Manjaro Gmbh & Co, KG, an Open Source driven company.

## DEBIAN: -

Debian is a computer operating system composed of software packages released as free and open source software and packaged by a group of individuals called the Debian Project. It is licensed primarily under the GNU General Public License along with other free software licenses.

Debian GNU/Linux, which includes the GNU OS tools and Linux kernel, is a popular and influential Linux distribution. It is distributed with access to repositories containing thousands of software packages ready for installation and use.

Popular free programs such as LibreOffice and Firefox web browser are available for Debian. It focuses on stability and security and is used as a base for many other distributions.

## UBUNTU: -

Ubuntu is a Debian-based Linux operating system and distribution for personal computers, smartphones, and network servers. The Ubuntu project is publicly committed to the principles of open-source software development. People are encouraged to use free software, study how it works, improve upon it, and distribute it.

Ubuntu is popular because of its robust user interface; you can easily work with Ubuntu from desktop or from the command line. Ubuntu is a favorite platform for Linux stacks; AWS has hundreds of application stacks and application servers based on Ubuntu.

## ANTERGOS: -

The purpose of Antergos is to provide a modern, elegant and powerful operating system based on one of the best Linux distributions out there, Arch Linux. Antergos is easy to use and very customizable It is open source, free and based on the fast and lightweight Arch Linux. Antergos uses the official Arch Linux package repositories and the AUR (user-submitted packages) along with its own software repositories. As with other GNU/Linux systems, Antergos is virtually free of viruses and spyware

## SOLUS: -

Solus is an operating system that is designed for home computing. Every tweak enables us to deliver a cohesive computing experience. Solus provides a multitude of experiences that enable you to get the most out of your hardware.

From our flagship Budgie experience for modern devices to the more traditional MATE experience for lower-end devices, Solus aims to provide the best experience for your device.

## FEDORA: -

Fedora is the free version of Red Hat, whose RHEL (Red Hat Enterprise Linux) has been a commercial product since 2003. Because of that close connection, Fedora is particularly strong on enterprise features, and it often offers them before RHEL does.

## ELEMENTARY OS: -

A Linux Distro for Windows and macOS Users. Elementary OS is a Ubuntu-based GNU/Linux distribution, which started as a theme and application set for Ubuntu which later turns out to be an independent Linux distribution. It inherits the legacy of Ubuntu OS and shares Ubuntu's software Center for package management.

## OPENSUSE: -

Each distribution has a different take on the desktop. Some opt for very modern user interfaces (such as GNOME and Elementary OS's Pantheon), whereas others stick with a more traditional desktop environment (opens USE uses KDE).

## Red Hat Enterprise Linux: -

Red Hat Enterprise Linux (RHEL) is a Linux distribution developed by Red Hat and targeted toward the commercial market. Red Hat Enterprise Linux commercial development has made possible military-grade security technologies to prevent intrusions and protect your data. Amazon EC2 running Red Hat Enterprise Linux provides a dependable platform to deploy a broad range of applications. By running RHEL on EC2, you can leverage the cost effectiveness, scalability and flexibility of Amazon EC2, the proven reliability of Red Hat Enterprise Linux, and AWS premium support with back-line support from Red Hat. Amazon EC2 running Red Hat Enterprise Linux provides seamless integration with existing Amazon EC2 features including Amazon Elastic Block Store (EBS), Amazon Cloud Watch, Elastic-Load Balancing, and Elastic IPs.

## Centos: -

The CentOS Project is a community-driven, free software effort focused on delivering a robust open source ecosystem. CentOS is derived from the sources of Red Hat Enterprise Linux (RHEL), and it aims to be functionally compatible with RHEL.

For users, CentOS offers a consistent, manageable platform that suits a wide variety of deployments. For open source communities, it offers a solid, predictable base to build upon, along with extensive resources to build, test, release, and maintain their code.

AWS has several CentOS Amazon Machine Images (AMIs) that you can launch to take advantage of the stability and widespread use of CentOS.

## SUSE Enterprise Linux: -

Some of the above server distributions are free (such as Ubuntu Server and CentOS) and some have an associated price (such as Red Hat Enterprise Linux and SUSE Enterprise Linux). Those with an associated price also include support.

# LINUX COMMANDS

## 1) System

| | |
|---|---|
| uname | Displays Linux system information |
| uname -r | Displays kernel release information |
| uptime | Displays how long the system has been running including load average |
| hostname | Shows the system hostname |
| hostname -i | Displays the IP address of the system |
| last reboot | Shows system reboot history |
| timedatectl | Displays current system date and time |
| cal | Query and change the System clock |
| w | Displays currently logged in users in the system |

## 2) Hardware

| | |
|---|---|
| dmesg | Displays bootup messages |
| cat /proc/cpuinfo | Displays more information about CPU e.g model, model name, cores, vendor id |
| cat /proc/meminfo | Displays more information about hardware memory e.g. Total and Free memory |
| lshw | Displays information about system's hardware configuration |
| free -m | Displays free and used memory in the system (-m flag indicates memory in MB) |
| lspci -tv | Displays PCI devices in a tree-like diagram |
| lsusb -tv | Displays USB devices in a tree-like diagram |

## 3)Users

| | |
|---|---|
| id | Displays the details of the active user e.g. uid, gid, and groups |
| last | Shows the last logins in the system |
| who | Shows who is logged in to the system |
| groupadd “admin” | Adds the group ‘admin’ |
| adduser “Sam” | Adds user Sam |
| userdel “Sam” | Deletes user Sam |
| usermod | Used for changing / modifying user information |

# 4) File Commands

| | |
|---|---|
| ls -al | Lists files – both regular & hidden files and their permissions as well |
| pwd | Displays the current directory file path |
| mkdir ‘directory_name’ | Creates a new directory |
| rm file_name | Removes a file |
| rm -f filename | Forcefully removes a file |
| rm -r directory_name | Removes a directory recursively |
| rm -rf directory_name | Removes a directory forcefully and recursively |
| cp file1 file2 | Copies the contents of file1 to file2 |
| cp -r dir1 dir2 | Recursively Copies dir1 to dir2. dir2 is created if it does not exist |
| mv file1 file2 | Renames file1 to file2 |
| touch file_name | Creates a new file |
| cat > file_name | Places standard input into a file |
| more file_name | Outputs the contents of a file |
| gpg -c file_name | Encrypts a file |

| | |
|---|---|
| gpg -d file_name.gpg | Decrypts a file |

# 5) Network

| | |
|---|---|
| ipaddress show | Displays IP addresses and all the network interfaces |
| ifconfig | Displays IP addresses of all network interfaces |
| ping  host | ping command sends an ICMP echo request to establish a connection to server / PC |
| whois domain | Retrieves more information about a domain name |
| dig domain | Retrieves DNS information about the domain |
| dig -x host | Performs reverse lookup on a domain |
| host google.com | Performs an IP lookup for the domain name |
| hostname -i | Displays local IP address |
| wget file_name | Downloads a file from an online source |
| netstat -pnltu | Displays all active listening ports |

| | |
|---|---|
| tar -cf home.tar home<:code> | |
| tar -xf files.tar | Extract archive file ‘files.tar’ |
| tar -zcvf home.tar.gz source-folder | Creates gzipped tar archive file from the source folder |
| gzip file | Compression a file with .gz extension |
| rpm -i pkg_name.rpm | Install an rpm package |
| rpm -e pkg_name | Removes an rpm package |
| dnf install pkg_name | Install package using dnf utility |

# 14) GREP

‘grep’ command stands for global regular expression print

| | |
|---|---|
| grep value filename | To search a value |
| grep -v value filename | To ignore the value |
| grep -i value filename | To search the value |
| Cat filename \| grep value | To search the value on file |

# 15) SED

Linux ‘sed’ command stands for stream editor.

| | |
|---|---|
| sed ‘=’ filename | To print line numbers with content |
| sed -n ‘5,9p’ filename | To print 5 to 9 lines |
| sed ‘5,9p’ filename | To paste 5 to 9 lines |
| echo abc \| sed ‘s/abc/def/’ | To replace abc with def |
| sed -e ‘s/abc/def/; s/def/ghi/’ file | To replace multiple things |
| ed ‘3c\changed’ filename | To change the 3rd line |