LINUX

Operating System (OS):

An Operating System is system software that serves as an interface between computer hardware and the end user. It manages hardware resources and provides a platform for applications such as web browsers, office suites, text editors, and games to function. Every computing device requires at least one operating system to operate efficiently and run application software.

Linux:

Linux is a free and open-source operating system known for its robust security, stability, and flexibility. It is a multi-user, multitasking system primarily operated through a command-line interface, although graphical interfaces are also available.

Key Features of Linux:

- **Open-Source Model:** The source code of Linux is freely available for use, modification, and distribution.
- **Multi-User Capability:** Multiple users can access system resources such as memory and processing power simultaneously without interfering with each other.
- **Multitasking:** Linux can run multiple applications or processes concurrently.
- **Enhanced Security:** Built-in user permissions, encryption, and firewall features provide a secure operating environment.
- **Versatile Usage:** Widely used in servers, embedded systems, supercomputers, mobile devices, and cloud infrastructure.

Linux OS Distributions:

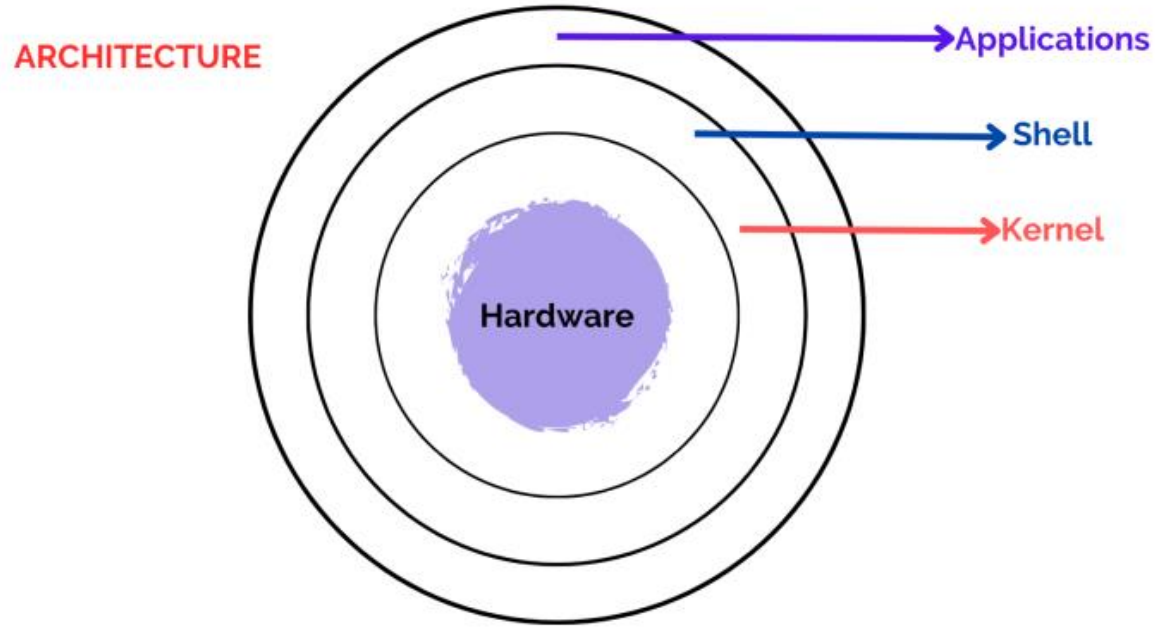
Many of the users taken the Linux OS and modified according to their requirements and released into the market with different names called Linux distributions.

- RedHat
- Ubuntu
- Debian
- Centos
- Fedora
- OpenSUSE
- Kali Linux
- Amazon Linux
- Rocky Linux

History:

On Sep 17th 1991, **Linus Torvalds** a student at the university of Helsinki, Finland, He released the first version of Linux Kernel, Known as Linux 0.01, as an open-source software.

- The Linux Kernel is written in C language
- He wrote this program specially for his own pc
- Firstly, he wanted to name it as 'Freax' but later it became 'Linux'
- Today, Supercomputers, smartphones, desktop, web servers, tablets, laptops, and home appliances like washing machines, DVD players, routers, modems, cars, refrigerators, etc. Use Linux OS.



KERNEL:

It is the core or the heart of the Operating system. It is the central part that manages and facilitates communication between the computer's hardware and software.

SHELL:

A shell that allows users to interact with the OS.

- Command Line Interface (CLI): Executes the command provided by user and display the output in terminal.
- Executes the process provided by the user in graphical way and output is displayed in the graphical windows.

COMMAND:

- It is an instruction/request given to the OS by a user.
- It tells computer to perform a particular task.

TERMINAL:

- It is a text-based interface that allows you to interact with the operating system by typing commands.
- It is a way for you to communicate with the Linux machines

Linux File System Hierarchy

- / – Root directory
- /home – User directories
- /etc – Configuration files
- /bin – Essential binaries
- /var – Log files
- /tmp – Temporary files
- /dev – Device files
- /proc – Kernel and process info

If you are using AWS EC2 instances - By default, we are in ec2-user, but if we want to perform any action, we should be in root user because, root is the ultimate king of Linux, root has full permissions, so that we can run any command anywhere.

To login as root user: **sudo** -i

Here sudo: super user do

to logout from root user and go back to ec2-user: **exit**

In Linux we have different types of commands

- **SYSTEM COMMANDS**
- **HARDWARE COMMANDS**
- **FILE COMMANDS**
- **FOLDER COMMANDS**
- **PERMISSION COMMANDS**
- **USER COMMANDS**
- **GROUP COMMANDS**
- **OWNER COMMANDS**
- **SEARCH COMMANDS**

- **NETWORKING COMMANDS**

System Commands:

Command	Description
uname	Used to get type of OS
uname -r	Used to get kernel version of our OS
uname -a	Used to get full info about OS
clear or ctrl+l	Used to clear screen
uptime	Used to get since how long our system is in running state
uptime -p	Used to get only screen up time
hostname	Used to get private dns name of our system
hostname -I	used to get private ip of our system
hostnamectl set-hostname "Suresh"	Used to change hostname
ip addr or ip route or ifconfig	Used to get Private IP
who	Used to see how many users have been login to our system
whoami	Used to get the current user
ps	Used to see the running processes in system
kill -9 PID	Used to kill a process
sudo timedatectl set-timezone Asia/kolkata	Used to change the timezone to IST
timedatectl	Used to check the available timezones
date	Shows system date and timestamp
date+"%d"	Prints day of the month(01-31)
date+"%m"	Prints the month of the year 01-12
date+"%y"	prints only the last two digits of year
date+"%H"	Prints the hour 00-23
date+"%M"	Prints the Minute of the hour 00-59
date+"%S"	Prints the current seconds count in the minute 00-60
date+"%D"	Prints date in MM/DD/YY
date+"%F"	Prints only the Full date as YYYY-MM-DD
date+"%A"	Prints the day of the week Saturday-Sunday
date+"%B"	Prints the month between Jan-Dec

Hardware Commands:

Command	Description
lscpu	Displays information about the CPU architecture
lsblk -a	Lists the information about all the block devices attached to the system
free	Displays system memory(RAM) details in kb
free -m	Displays system memory(RAM) details in mb
df -h	Report files system disk space usage in human readable languages

File Commands:

Command	Description
touch filename	Used to create a file
touch file1 file2 file3	Used to create multiple files
touch file{1..5}	Used to create multiple files in order
rm file1	Used to remove file with permissions
rm -f file2	Used to remove file without permission (-f means forcefully)
rm -f file1 file2 file3	Used to remove multiple files
rm -f file{1..5}	Used to remove multiple files
rm -f*	Used to remove all files
rm -f*.txt	used to delete all files with .txt extension
rm -f a*	Used to delete files which are started with "a" letter

Folder Commands:

Command	Description
mkdir foldername	Used to create a folder
mkdir folder1 folder2	Used to create multiple folders
mkdir folder{1..5}	Used to create multiple folders in order
rmdir foldername	Used to delete empty folder
rmdir folder1 folder2	Used to delete multiple folders
rmdir folder{1..5}	Used to delete multiple folders
rmdir *	Used to delete all empty folders
rm -rf*	Used to remove all the files & folders - also it is used to remove non empty folders

mkdir folder1/folder2	Used to create folder2 inside folder1
ll folder1	Used to get list of files/folders which are present in folder1
touch folder/file.txt	used to create file inside folder
mkdir -p folder1/folder2/folder3	Used to create parenting folder(folder inside folder) automatically
List the files	
ll	used to get list of files with full info about files/folders in order(A-Z)
ls	used to get list of files with only file/folder names
ll -t	Used to see list of files based on modification/creation time
ll -r	Used to see the files in reverse order(Z-A)
ll -a	Used to see all files including hidden
Change Directory	
Command	**Description**
cd foldername	Used to change directory
cd -	Used to go to previous folder
cd ../	Used to go to one folder back
cd ../../	Used to go to two folders back

Copy Command:

Syntax: cp source destination

Command: cp file1 file2

- By using above command, the data from file1 copies into file2. But the problem is it will overwrite the data present in file2
- To overcome this issue, we will use cat command.

Syntax: cat source_file >> destination_file

Move Command:

Syntax: mv source destination

Command: mv file1 file2

- This is also called renaming a file.

Cat Commands:

Cat command is used to read the data from a file, it is also used to append the data in a file.

- Cat filename**:** Used to read data from file
- Cat > filename : Used to overwrite the data
- Cat >> filename: Used to append the data
- cat -n filename : prints the data with line numbers
- head filename : used to print top 10 lines
- tail filename: used to print last 10 lines
- head -n 12 filename: used to print first 12 lines of file
- sed -n '15,30p' filename: used to print 15-30 lines of file

Note: Cat command is used to append the data, but here the problem is, it is not possible to modify the data. To avoid this issue we can use editor in Linux.

There are 2 types of editors in Linux

1. Vim editor
2. Nano editor

Vim editor:

It has 3 modes,

1. Command mode
2. Insert mode
3. Save & quit mode

To open any file in vim editor: vim filename or vi filename

Command Mode:

It is the default mode in vim editor, it is used to perform some actions like copy the data, delete the data and we can undo and redo the changes as well.

Command	Description
gg	Used to go to 1st line of the file
G	Used to go to last line of the file
M	Used to go to middle of the file
4gg	Used to go to 4th line of the file

:25	Used to go to 25th line of the file
:set number	Used to set numbers to lines in the file
yy	Used to copy the line
4yy	Used to copy 4 lines starting from cursor position
p	Paste the copied content
10p	Used to paste copied content 10 times
dd	Used to delete the line
3dd	Used to delete the 3 lines from the cursor
u	Used to undo the changes
ctrl+r	Used to redo the changes
:%s/old/new/	Used to replace
/word	Used to search for a word in file
?word	Used to search for a word in file

Insert mode:

This mode is used to insert the data or make any modifications to the file

- To go to insert mmode: i
- To go back to command mode: esc
- To go to the ending of the line: A
- To go to the starting of this line: I
- To create a new line above the cursor: O
- To create a new line below the cursor: o

Save &quit mode:

This is used to save the data and quit from vim editor

- To save the data - :w
- To quit from vi editor - :q
- To quit forcefully - :q!
- To save & quit at a time - :wq
- To save & quit forcefully at a time - :wq!

User commands:

Cat/etc/passwd: Used to get list of users

Useradd username: Used to add user

NOTE:

- whenever we add any user, then folder will gets created in **/home directory**
- Whenever we add any user, then group also created automatically

Userdel username: used to delete user

NOTE:

- Whenever we delete any user, then folder will not gets deleed in **/home directory**
- Whenever we delete any user, then group will gets deleted

Userdel -r username: used to remove the user along with folder

Useradd -M username: used to create a user without folder

Su -username: used to switch to another user

Passwd username: used to set a password to user

Group commands:

Cat/etc/group: used to get list of groups

Groupadd group_name: used to add a group

Groupdel group_name: used to delete group

Usermod -a -G group user: used to add a user in a group

GREP (Global Regular Expresion Print):

It is used to search for a word in a file

Syntax: grep “word” filename

- Grep “word” filename: used to search for a word in a file
- Grep -n “word” filename: used to print the data along with line numbers
- Grep -c “word” filename: used to print no of occurances of a word
- Grep -I “word” filename: used to search for a case-sensitive

Owner Commands:

- Chown user filename: Used to change the user of a file
- Chgrp group file: used to change group of a file
- Chown user:group filename: used to change user and group at a time

- Chown user:group file1 file2 file3: used to change user and group to multiple files
- Chown user:group folder: used to change owner to folder only
- Chown user:group folder/*: Used to change owners to files only in folder
- Chown -R user:group folder: used to change owners to file and folder at a time

Permission Commands:

- Chmod 745 filename: Used to change the permission of a file
- Chmod 777 file1 file2 fie3: used to change permissions to multiple files
- Chmod 654 folder: used to change permissions to folder only
- Chmod 567 folder/*: used to change permissions t files only in folder
- Chmod -R 123 folder: used to change permissions to file and folder at a time

Search commands:

It is used to search for file, there are 2 types

1. Find command
2. Locate command

Find Command:

Syntax: find path -name file_name

- Find . -name file: used to find a file in current directory
- Find /proc/ -name filename: Used to find a file in proc directory
- Find . -type d -name folder: Used to find a folder in current directory
- Find . -type f -name <file1.txt>: used to find a file in current directory
- Find . -type f -perm 777: finds all the files whose permissions are 777 in the current directory.
- Find . -type f! -perm 777: finds all the files whose permissions are NOT 777 in the current directory.
- Find / -user <username>: finds all the files specific user owned in /directory
- Find / -group groupname: finds all the files specifc group owned in /directory

Locate Command:

Syntax: locate filename

Note: If you are using locate command, we have to update the db of linux before performing locate command.

Find vs locate: Find commands will search as per the path that we mentioned in command, but locate command will search for a file on entire database.

Network Commands:

Command	Description
Basic Network Configuration	
ip a or ip addr	Show IP addresses of all interfaces
ip link	Show network interfaces
ip route	Show routing table
ifconfig	Legacy tool to view/set IP addresses
ip link set eth0 up/down	Enable or disable interface
hostname	Show or set system hostname
hostname -I	Show IP addresses assigned to the host
nmcli	Manage NetworkManager (used in many distros)
Network Connectivity	
ping <host>	Send ICMP echo requests
traceroute <host>	Show route packets take to a host
mtr <host>	Dynamic network diagnostic tool (ping + traceroute)
curl <url>	Fetch data from a URL
wget <url>	Download files from the web
telnet <host> <port>	Check connectivity to a specific port
nc <host> <port>	Netcat, for testing TCP/UDP connections
DNS Tools	
nslookup <domain>	Query DNS records
dig <domain>	Detailed DNS query
host <domain>	Simple DNS lookup
Port and Socket Analysis	
ss -tuln	Show listening ports and associated services
netstat -tuln	Legacy tool to view open ports
lsof -i	List open files related to network connections
ss -s	Summary of current socket usage

Network Management	
ip link add <name> type bridge	Create a new bridge interface
ip link delete <name>	Delete a network interface
ethtool <interface>	Display or change Ethernet device settings
iwconfig	Configure wireless interfaces (deprecated, use 'iw')
nmcli device status	Show status of network interfaces
Network Monitoring	
iftop	Real-time bandwidth usage per connection
nload	Visual interface for traffic monitoring
vnstat	Network traffic monitor
ip -s link	Show interface stats
tcpdump	Capture and analyze network packets
wireshark	GUI tool for packet analysis
Firewall & Security	
iptables -L	List firewall rules (legacy)
ufw status	Show UFW firewall status (Ubuntu)
firewalld-cmd --list-all	Show Firewalld rules (RHEL/CentOS)
nmap <host>	Scan open ports on a host