What is Linux?

Linux is a powerful, open-source operating system that serves as the interface between computer hardware and software applications. Unlike proprietary operating systems like Windows or macOS, Linux is free to use, modify, and distribute.

Features of Linux:

1. **Multi-user Capability:** Multiple users can access the system simultaneously.

2. **Multitasking:** Supports running multiple processes concurrently.

3. **Portability:** Runs on various hardware platforms, from desktops and servers to embedded systems.

4. **Security:** Advanced security features like file permissions and SELinux ensure robust protection.

5. **Open-source Nature:** Source code is accessible, encouraging collaboration and innovation.

History of Linux

- **Unix Roots:** Linux derives from Unix, a groundbreaking OS developed at AT&T's Bell Labs in the 1970s.

- **Beginnings:** Linus Torvalds initiated the Linux project in 1991, releasing the kernel as free software under the GNU General Public License (GPL).

- **Rapid Growth:** Today, Linux powers servers, supercomputers, smartphones (e.g., Android), IoT devices, and more.

Key Events:

- **1991:** Linux kernel version 0.01 is released.

- **1994:** First stable Linux version (1.0) launched.

- **2007:** Android, based on Linux, revolutionizes mobile operating systems.

Open-source vs Proprietary Software

- **Open-source Software (OSS):**
  - Free to use and modify.
  - Community-driven development ensures transparency and rapid updates.
  - Examples: Linux, Apache, MySQL.
- **Proprietary Software:**
  - Developed and sold by corporations.
  - Access to source code is restricted.
  - Examples: Microsoft Windows, macOS.

Linux Distributions

Linux comes in a variety of distributions (distros) tailored to different purposes:

1. **Ubuntu:** User-friendly, ideal for beginners.
2. **Fedora:** Cutting-edge features for developers.
3. **Debian:** Known for stability and reliability.
4. **Red Hat Enterprise Linux (RHEL):** Designed for enterprise environments.
5. **Kali Linux:** Security tools for penetration testing and ethical hacking.

Each distro offers unique package managers, desktop environments, and system tools, providing flexibility to cater to individual needs.

comparison of Linux and Windows OS:

Cost

- **Linux:** Free to use, modify, and distribute.
- **Windows:** Paid licenses for different editions (Home, Pro, etc.).

Source Code

- **Linux:** Open-source, anyone can view and modify the code.
- **Windows:** Closed-source, code is not accessible.

Security

- **Linux:** Highly secure, less prone to viruses and malware.
- **Windows:** More vulnerable due to its popularity, requires antivirus software.

User Interface

- **Linux:** Customizable; can choose desktop environments (like GNOME, KDE).
- **Windows:** Standardized and easy-to-use GUI.

Software Availability

- **Linux:** Limited proprietary software; mostly open-source apps.
- **Windows:** Wide range of proprietary software and games available.

Performance

- **Linux:** Lightweight; works well on old hardware.
- **Windows:** Resource-intensive, needs modern hardware for smooth performance.

Community and Support

- **Linux:** Community-driven support; paid support for enterprise versions (e.g., Red Hat).
- **Windows:** Official Microsoft support.

Use Cases

- **Linux:** Ideal for servers, programming, and cybersecurity.
- **Windows:** Best for gaming, office work, and general use

families of Linux distributions.

Debian-based and **Red Hat-based** are two major families of Linux distributions. Each family has its own characteristics and is built around specific package

managers and system architectures

Debian-based OS:

- Known for stability and being user-friendly.
- Uses apt(Advanced Package Tool) packages for software installation.

Examples:

1. Debian
2. Ubuntu
3. kaliLinux

Red Hat-based OS:

- Focuses on enterprise use with strong security and performance.
- Uses yum(Yellowdog Updater, Modified) packages for software installation.

Examples:

1. Red Hat Enterprise Linux (RHEL)
2. Fedora
3. CentOS

Default Directories in Linux

- `/` : Root directory; the base of the Linux filesystem.
- `/bin` : Contains essential commands and binaries (like `ls` , `cp`).
- `/sbin` : System commands for administrators (like `reboot` , `fdisk`).
- `/home` : Stores personal files for each user (e.g., `/home/user1`).
- `/etc` : System configuration files.
- `/var` : Variable data like logs (`/var/log`) and mail.
- `/tmp` : Temporary files; cleared after reboot.
- `/usr` : Applications and user tools (like `/usr/bin` for programs).

- `/lib` : Libraries required by executables in `/bin` and `/sbin` .

- `/opt` : Optional software packages.

- `/boot` : Bootloader and kernel files for starting Linux.

- `/dev` : Files representing hardware devices (e.g., `/dev/sda` for disks).

- `/mnt` **and** `/media` : Mount points for external drives or media.

- `/proc` **and** `/sys` : Virtual filesystems with system information (e.g., `/proc/cpuinfo`).

File and Directory Commands

- To manage files and directories.

  - `ls` : List files and directories.

  - `pwd` : Show current directory path.

  - `mkdir` : Create a new directory.

  - `rm` : Remove files or directories.

  - `cp` : Copy files or directories.

  - `mv` : Move or rename files.

2. File Viewing Commands

- To read content inside files.

  - `cat` : View the entire file.

  - `less` / `more` : View file content one screen at a time.

  - `head` : Display the first few lines of a file.

  - `tail` : Display the last few lines of a file.

3. User Management Commands

- To manage users and permissions.

  - `whoami` : Show the current logged-in user.

  - `adduser` : Add a new user.

  - `passwd` : Change the user password.

- `chmod` : Change file permissions.
- `chown` : Change file ownership.

4. Process Management Commands

- To monitor and manage running processes.
    - `ps` : List active processes.
    - `top` : View system processes in real time.
    - `kill` : Terminate a specific process.
    - `htop` : An interactive process viewer.

5. Networking Commands

- To check and manage network connections.
    - `ping` : Check network connectivity.
    - `ifconfig` : View or configure network interfaces.
    - `netstat` : Display network connections.
    - `curl` / `wget` : Download files from the internet.

6. System Information Commands

- To gather system-related details.
    - `uname` : Show system information.
    - `df` : Check disk space usage.
    - `free` : Display memory usage.
    - `uptime` : See how long the system has been running.

7. Package Management Commands

- To install, update, or remove software.
    - `apt` : Used in Debian-based systems.
    - `yum` : Used in Red Hat-based systems.