

The background of the slide is composed of several large, overlapping triangles in various colors: red, orange, yellow, green, blue, and purple. The triangles are arranged in a way that they fill the entire frame, with some overlapping others. The colors are vibrant and the shapes are sharp.

# **Understanding Linux Concepts**

Naveen L S

# History of Linux

- Linux is a free and open-source operating system that was developed by Linus Torvalds in 1991. Torvalds, a computer science student at the University of Helsinki, began working on the Linux kernel as a personal project, inspired by the Unix operating system and dissatisfied with the licensing restrictions of other operating systems available at the time.
- The Linux kernel is the core component of the operating system, responsible for managing hardware resources and providing essential functionality such as memory management and process scheduling. The kernel was originally released under the GNU General Public License, which allowed other developers to use and modify the code.
- Over time, a community of developers grew around the Linux kernel, contributing to the development of other key components of the operating system, such as the shell, utilities, and libraries. These components were often developed separately from the kernel, and were typically released under various open-source licenses.

# Linux Components

- Linux is composed of various components that work together to create a functional operating system. These components include the kernel, libraries, utilities, graphical systems, and package management systems.
- 1) **Kernel:** The Linux kernel is the core component of the operating system. It interacts directly with the hardware, manages system resources such as memory and processes, and provides essential functionalities like device drivers, file system support, and networking capabilities.
  - 2) **Libraries:** Linux provides a set of libraries that offer precompiled functions and code for common tasks. These libraries include the GNU C Library (glibc), which provides low-level system functions, as well as other libraries for graphics, network programming, database access, and more. These libraries enable developers to build applications without having to implement every function from scratch.
  - 3) **Utilities:** Linux offers a wide range of command-line utilities for performing various tasks. These utilities include file management tools (e.g., ls, cp, rm), text processing tools (e.g., grep, sed, awk), system administration tools (e.g., systemctl, useradd, passwd), and networking tools (e.g., ping, ifconfig, ssh). Command-line utilities are highly flexible and can be combined to perform complex operations.

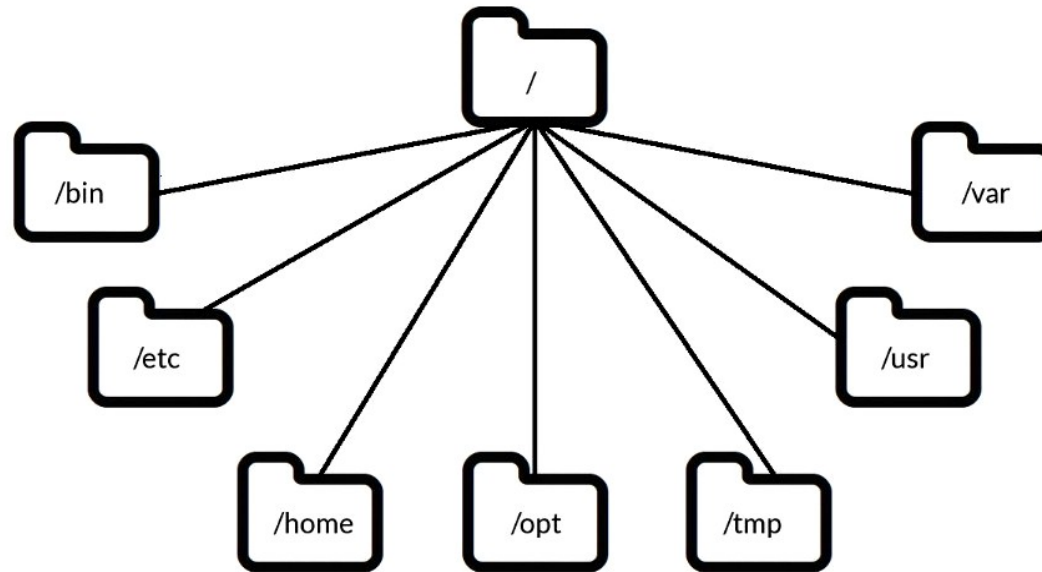
- 4) **Graphical Systems:** Linux supports multiple graphical systems, the most widely used being the X Window System. X provides the framework for creating graphical user interfaces (GUIs) and manages the display and input devices. On top of X, desktop environments such as GNOME, KDE, XFCE, and others provide a complete user interface with windows, menus, icons, and various applications.
  - 5) **Package Management Systems:** Linux distributions utilize package management systems to simplify the installation, upgrade, and removal of software. These systems handle software dependencies, ensuring that all required libraries and components are present. Common package management tools include APT (used by Debian and Ubuntu), DNF (used by Fedora), Pacman (used by Arch Linux), and Zypper (used by openSUSE).
  - 6) **File Systems:** Linux supports multiple file systems, including ext4 (the most common), XFS, Btrfs, and many more. The file system manages how data is organized, stored, and accessed on storage devices. Each file system has its own features, performance characteristics, and supported file sizes.
  - 7) **Shells:** Linux shell is a command-line interface that allows users to interact with the operating system. Shells interpret and execute commands, provide features like command completion and scripting capabilities, and allow for task automation through shell scripting.
- These components work together to create a fully functional Linux operating system. The modularity and flexibility of Linux enable users to customize and configure their systems according to their specific needs, whether it's a lightweight server, a desktop workstation, or an embedded device.

# Differences between Linux and Other operating systems

- 1) **Open-source nature:** Linux is open-source, meaning its source code is freely available, allowing users to modify, distribute, and customize it as per their requirements. This fosters a collaborative development environment and enables a wide range of distributions tailored for specific needs.
- 2) **Cost:** Most Linux distributions are free to download and use. This is in contrast to proprietary operating systems like Windows and macOS, which often require purchasing a license or device that includes the operating system.
- 3) **Software availability:** Windows and macOS have extensive software support from commercial vendors and developers, offering a wide range of applications and games. Linux has a significant collection of open-source software and many popular applications, but certain commercial software may not be readily available or require additional configuration.
- 4) **User interface:** Linux provides a wide range of user interface options, including GNOME, KDE, Xfce, and more. Users can choose the one that suits their preferences. In contrast, Windows and macOS have their predefined interfaces (though some customization options are available).

- 5) **Hardware support:** Windows and macOS are designed to work on a specific range of hardware configurations. Linux, on the other hand, has a broad range of hardware compatibility, making it adaptable to various devices, including servers, desktops, laptops, embedded systems, and even smartphones.
- 6) **Command-line interface (CLI):** Linux offers a powerful command-line interface (CLI), providing users with advanced control over the system. This allows experienced users to automate tasks, perform administrative functions, and access a vast array of powerful command-line tools.
- 7) **Security:** While no operating system is entirely immune to security threats, Linux is often considered more secure due to its open-source nature. The large user and developer community actively reviews and enhances security measures, making it less susceptible to malware and exploits. Additionally, Linux distributions often provide regular security updates.
- 8) **Customization and flexibility:** Linux offers high levels of customization and flexibility. Users can modify and configure various aspects of the operating system to suit their needs, such as the desktop environment, package management, and system behavior. This level of control is not as readily available in Windows and macOS.

# Linux file hierarchy and directory structure



- The base of the Linux/Unix file system hierarchy begins at the root and everything starts with the root directory. These are the common top-level directories associated with the root directory :
- **/bin**: Contains essential binaries (executable files) for system users and basic system commands.
- **/boot**: Contains files related to the booting process, such as the Linux kernel, boot loader configurations, and initial RAM disk.
- **/dev**: Contains device files that represent physical and virtual devices.
- **/etc**: Contains system-wide configuration files.
- **/home**: Contains home directories for individual users.
- **/lib**: Contains shared library files required by the system and essential binaries in /bin and /sbin.
- **/media**: Mount point for removable media devices.
- **/mnt**: Mount point for temporarily mounted filesystems.
- **/opt**: Optional directory for third-party software installations.
- **/proc**: Virtual file system that provides information about running processes and system resources.



- **/root**: Home directory for the root user (the superuser).
  - **/run**: Contains runtime data, such as process IDs and communication sockets.
  - **/sbin**: Contains system binaries (executable files) used for system administration.
  - **/srv**: Contains site-specific data served by the system.
  - **/sys**: Virtual file system that provides information about the system's hardware devices.
  - **/tmp**: Directory for temporary files.
  - **/usr**: Contains user-related programs, libraries, and documentation.
  - **/var**: Contains variable data, such as log files, system databases, and spool directories.
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- To check the Linux directories open the terminal and execute **sudo -s** followed by system password to give root privilege.