**Assignment 2**

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**1. What is Linux?**

**Ans:** Linux is a free and open-source family of operating systems developed by Linus Torvalds in 1991. It is known for its resilience, flexibility, reliability, security, and efficiency. The source code of Linux is openly accessible, allowing anyone to view, modify, and contribute to its development. This openness has led to a strong global community continuously improving the system. Linux is used across various devices, including personal computers, mobile phones, servers, and supercomputers. Its cost-effectiveness and customizable nature make it a popular choice for individuals and organizations alike.

**2. Explain the basic features of the Linux OS**

**Ans:** The basic features of Linux OS are:

**i. Kernel -** The Linux kernel is the core part of the operating system. It manages system resources and allows hardware and software to communicate. The kernel handles process management, memory management, hardware interaction, and system calls.

**ii. Open Source -** Linux is open-source, meaning its source code is freely available for anyone to view, modify, and distribute. This promotes collaboration and transparency and allows users to tailor the OS to their specific needs.

**iii. Distributions -** Linux distributions (or distros) are various versions of Linux that come with different software packages, system management tools, and user interfaces. Popular distributions include Ubuntu, Fedora, Debian, CentOS, and Arch Linux. Each distribution is designed for different use cases, from servers and desktops to embedded systems and IoT devices.

**iv. Command Line Interface (CLI) -** Linux is known for its powerful command-line interface (CLI), which allows users to perform tasks by typing commands. This is especially useful for system administrators and developers, as it enables precise control over the system.

**v. Security and Stability -** Linux is often praised for its security and stability. It's less prone to malware and viruses compared to some other operating systems, largely due to its design and the active role of the open-source community in identifying and fixing vulnerabilities.

**vi. Use Cases -** Linux is versatile and is used in various environments, from personal computers and servers to mobile devices (like Android, which is based on the Linux kernel), networking equipment, and supercomputers.

**vii. Community and Support -** The Linux ecosystem is supported by a vast community of developers, contributors, and users who provide support, develop software, and contribute to the documentation and code base.

**3. Define the basic components of Linux.**

**Ans:** The basic components of Linux are:

**i. Kernel:** The kernel is the core component of Linux. It manages system resources, including the CPU, memory, and peripheral devices. It handles system calls from applications, enabling them to communicate with the hardware, and manages multitasking, process scheduling, memory allocation, and device drivers.

**ii. System Libraries:** System libraries are collections of pre-written code that applications use to perform standard tasks, such as input/output operations or memory management. The most crucial library in Linux is the GNU C Library (glibc), which provides the standard C library functionality.

**iii. System Utilities:** System utilities are basic programs that perform individual, specialized tasks. They provide functionality for managing the system, including file management, system monitoring, and disk management tools. Examples include commands like `ls` for listing directory contents, `cp` for copying files, and `ps` for displaying running processes.

**iv. Shell:** The shell is a command-line interface (CLI) that allows users to interact with the operating system by typing commands. It acts as an intermediary between the user and the kernel. Popular shells include Bash (Bourne Again Shell), Zsh (Z Shell), and Fish (Friendly Interactive Shell).

**v. User Space:** User space refers to the environment where user applications run, separate from the kernel. This separation prevents user programs from directly accessing critical kernel components, enhancing security and stability. The user space includes all applications, libraries, and utilities that users interact with, such as web browsers, text editors, and graphical user interfaces (GUIs).

**vi. File System:** The file system is the method Linux uses to organize and store files on storage devices. It provides a hierarchical structure to store files and directories and manages access permissions. Common Linux file systems include ext4, XFS, and Btrfs. The file system also ensures data integrity and security through mechanisms like journaling and access controls.

**vii. Graphical Server:** The graphical server (or X server) provides the graphical environment for Linux, enabling graphical user interfaces (GUIs) to be displayed on the screen. The X server communicates with the hardware (like graphics cards) to render windows, icons, and other visual elements. Modern alternatives to the X server include Wayland, which aims to provide a more efficient and secure graphical environment.

**viii. Desktop Environment:** The desktop environment is a collection of software that provides a graphical interface for interacting with the Linux system. It includes window managers, panels, file managers, and other tools that offer a user-friendly experience. Popular desktop environments include GNOME, KDE Plasma, XFCE, and LXDE.

**ix. Init System:** The init system is the first process that runs when Linux boots up. It initializes the system, starts essential services, and manages system processes. Common init systems include SysVinit, Upstart, and systemd (the most widely used today).

**4. What are the major differences between Linux and Windows?**

**Ans:** Here are the major differences between Linux and Windows:

**i. Source Code:** Linux is open-source; Windows is proprietary.

**ii. Cost:** Linux is usually free; Windows requires a license.

**iii. Customization:** Linux offers extensive customization; Windows is more standardized.

**iv. Security:** Linux is considered more secure due to fewer malware targets and its open-source nature; Windows is more frequently targeted by malware.

**v. User Interface:** Linux has multiple desktop environments; Windows has a consistent GUI.

**vi. Software Management:** Linux uses package managers; Windows uses executable files and the Microsoft Store.

**vii. Command Line:** Linux relies heavily on the command line; Windows primarily uses a GUI but also includes PowerShell.

**viii. File System:** Linux uses multiple file systems like ext4; Windows primarily uses NTFS.

**ix. Support:** Linux has community-driven support; Windows has official Microsoft support.

**x. Use Cases:** Linux is popular for servers and development; Windows is popular for personal and business use.

**5 . Elaborate all the file permissions in Linux.**

**Ans:** In Linux, file permissions control who can read, write, or execute a file. These permissions are defined for three categories of users: the ‘owner’ of the file, the ‘group’ associated with the file, and ‘others’ (everyone else). Here’s a brief overview of each permission type and what they mean:

**i. Read (r):** Allows viewing or reading the file's content and allows listing the contents of the directory.

**ii. Write (w):** Allows modifying or deleting the file and allows creating, deleting, or renaming files within the directory.

**iii. Execute (x):** Allows running the file as a program or script and allows entering the directory and accessing files and subdirectories, assuming read permissions are also granted.

**6. How to create a file in linux**

**Ans:** These are the following ways by which we can create a file in linux:

**i. touch [filename]:** This creates an empty file named `filename` if it does not already exist. If the file does exist, `touch` updates its timestamp.

**ii. echo ["some text"] > [filename]:** This creates a file named `filename` and writes "some text" into it. If the file already exists, this command will overwrite its contents.

**iii. echo ["some text"] >> [filename]:** This appends "some text" to the end of `filename` if it already exists, or creates it if it does not.

**iv. cat > [filename]:** This creates a new file named `filename` and allows you to enter text. Press `Ctrl+D` to save and exit.

**v. cat >> [filename]:** This appends input to an existing file named `filename`.

**vi. nano [filename]:** opens the Nano text editor, allowing you to create and edit a file named `filename`. After editing, save with `Ctrl+O` and exit with `Ctrl+X`.

**vii. vim [filename]:** opens the Vim text editor. To start inserting text, press `i`. After editing, press `Esc`, then type `:wq` to save and exit.

**7. What is the chmod command in Linux, and how do you use it?**

**Ans**: The `chmod` command in Linux is used to change the file and directory permissions. It allows you to set who can read, write, or execute a file. We can use this command by two methods:

**i. Symbolic Method:** Uses letters to represent permissions. Example:

- `chmod u+x filename`: Adds execute permission for the user (owner) of the file.

- `chmod g-w filename`: Removes write permission for the group.

**ii. Numeric Method:** Uses numbers to set permissions. Each permission type has a numeric value `read (r) = 4`, `write (w) = 2`, and `execute (x) = 1`. Example:

-`chmod 755 filename` sets the permissions to `rwxr-xr-x` (owner can read, write, execute; group and others can only read and execute).

**8. How do you create a user account?**

**Ans:** To create a new user we have to use `adduser` or `useradd` command. Only root user have the permission to create user so for creating a new user account either we have to do it by using rootuser or by sudoer user. `adduser` is often preferred for its simplicity and the additional setup steps it provides, such as creating the home directory and configuring initial settings. While we have to setup all things manually when we use `useradd` command. Example:

**By using `useradd`:**

sudo useradd -m -s /bin/bash john

sudo passwd john

**By using `adduser`:**

sudo adduser alice

**9. What is the find command, and how do you use it**

**Ans:** The `find` command in Linux searches for files and directories based on various criteria.

**i. Search by Name:**

- `find /path -name "filename"`: Finds files named `filename` in `/path`.

**ii. Search by Type:**

- `find /path -type f`: Finds files.

- `find /path -type d`: Finds directories.

**iii. Search by Size:**

- `find /path -size +10M`: Finds files larger than 10 MB.

**iv. Search by Modification Time:**

- `find /path -mtime -7`: Finds files modified in the last 7 days.

**v. Execute a Command:**

- `find /path -name "filename" -exec command {} \;`: Executes `command` on found files.

**10. Explain mkdir command with example**

**Ans:** mkdir command is use to create new directory or multiple directories simultaneously. Example:

- `mkdir new\_folder`

- `mkdir folder1 folder2 folder3`

**11. What is ls command with example**

**Ans:** The `ls` command in Linux lists files and directories in a directory. These are the common options available for listing the files and directories:

* -l: Long format, showing detailed information (permissions, owner, size, etc.). Example: ls -l
* -a: Includes hidden files (those starting with `.`). Example: ls -a
* -h: Human-readable file sizes (e.g., KB, MB). Example: ls -h
* -r: Recursively lists subdirectories. Example: ls -r

**12. How to remove a directory**

**Ans:** We can remove a directory by using `rmdir [filename]` command. If the directory contains files and subdirectory then we have to use `rm -r [filename]`.

**13. Explain cat command with example**

**Ans: `**cat` is use to concatenate and display the contents of the files or multiple files simultaneously. The common options available with this command are:

* **-n**: Number the lines of output.Example: `cat -n filename`
* **-b**: Number non-blank lines only. Example: `cat -b filename`
* **-E**: Show $ at the end of each line. Example: `cat -E filename`

**14. What is the grep command used for in Linux?**

**Ans:** The `grep` command in Linux searches for specific patterns within files and outputs the lines that contain those patterns. It is a powerful tool for filtering and processing text.

`grep 'pattern' filename`: Searches for pattern in filename and displays matching lines.

These are the common options available with this command:

* **-i**: Ignore case (case-insensitive search).
  + grep -i 'pattern' filename
* **-r** or **-R**: Recursively search through directories.
  + grep -r 'pattern' directory/
* **-n**: Show line numbers with the output lines.
  + grep -n 'pattern' filename
* **-v**: Invert match (show lines that do not match the pattern).
  + grep -v 'pattern' filename
* **-l**: List only the names of files with matching lines.
  + grep -l 'pattern' \*.txt
* **-c**: Count the number of matching lines.
  + grep -c 'pattern' filename

**15. What is systemctl command?**

**Ans:** The `systemctl` command in Linux is used to manage and control the systemd system and service manager. It allows you to interact with system services, check their statuses, and modify their behavior. Usage of this command:

**i. Start a service:** `sudo systemctl start [service\_name]`; starts the specified service.

**ii. Stop a service:** `sudo systemctl stop [service\_name]`; stop the specified service.

**iii.** **Restart a service:** `sudo systemctl restart [service\_name]`; restarts the specified service.

**iv. Check status of service:** `systemctl status [service\_name]`; check the status of specified service.

**v. Enable a service:** `sudo systemctl enable [service\_name]`; Enable the specified service.

**vi. Disable a service:** `sudo systemctl disable [service\_name]`; Disable the specified service.

**vii. List all active services:** `sudo systemctl list-units –type=service`; Lists all the active services.