- **Linux server - Understand and use essential tools**

1. What is the minimum number of partitions you need to install Linux?

#### ANS :

#### \* / (Linux system) *****at least 15GB for the system partition***** *I recommend 50GB or even 100GB. It depends on the size of your hard drive and your needs*. \* /home (personal user data) I’ll go with 30 GB because it is only for the demonstration purpose. \* *swap (temporary storage) If you have less than 8GB of RAM,*

1. Explain About Chmod Command

ANS: The chmod command in Unix and Unix-like operating systems is used to change the access permissions of files and directories.

In Linux, each file and directory has three types of permissions:

1. **Read ®**: Allows viewing the contents of the file.
2. **Write (w)**: Allows modifying the contents of the file.
3. **Execute (x)**: Allows running the file as a program.

The chmod command can modify these permissions using either symbolic or numeric modes.

Symbolic Mode

You can add or remove permissions using symbols:

u: User

g: Group

o: Others

a: All (user, group, and others)

Operators:

+: Adds a permission

-: Removes a permission

=: Sets the exact permission

Example:

chmod u+x filename # Adds execute permission for the owner

chmod g-w filename # Removes write permission for the group

chmod o=r filename # Sets read-only permission for others

Numeric Mode

Permissions can also be set using a three-digit octal number, where each digit represents the permissions for the user, group, and others, respectively. The digits are calculated by summing the values of the permissions:

Read ® = 4

Write (w) = 2

Execute (x) = 1

Example:

chmod 755 filename # Sets rwxr-xr-x (read, write, execute for owner; read, execute for group and others)

chmod 644 filename # Sets rw-r--r-- (read, write for owner; read-only for group and others)

1. How to check Linux memory utilization

ANS:

These commands should help you monitor and manage memory usage on your Linux system effectively

**free -h**

1. · Use grep to search for specific patterns in files.

ANS: **Search for a Pattern in a File:**

\*:To search for the word "example" in a file named file.txt:

grep "example" file.txt

**\* Search for a Pattern in Multiple Files:**

To search for the word "example" in all .txt files in the current directory:

grep "example" \*.txt

\***Search Recursively in Directories:**

To search for the word "example" in all files under a directory named dir:

grep -r "example" dir/

\***Search for a Whole Word:**

To search for "example" as a whole word (not part of another word), use the -w optio grep -w

grep -w "example" file.txt

**\*Ignore Case Sensitivity:**

To search for "example" regardless of case (e.g., "Example", "EXAMPLE", etc.), use the -i option:

grep -i "example" file.txt

**\*Show Line Numbers with Matches:**

To display line numbers along with lines that match the pattern, use the -n option:

grep -n "example" file.txt

**\*Count the Number of Matching Lines:**

To count the number of lines that match the pattern, use the -c option:

grep -c "example" file.txt

**\*Use Regular Expressions:**

grep supports regular expressions, allowing more advanced pattern matching. For example, to search for lines containing "example" followed by any characters and then "test":

grep "example.\*test" file.txt

**\*Combining Options**

You can combine multiple options. For example, to search recursively for the word "example", ignoring case, and show line numbers:

grep -rni "example" dir/

1. · Get Connecting on a linux server by ssh

ANS:

SSH (Secure Shell) is a protocol used to securely connect to a remote Linux server over a network.

**SSH Client:** Ensure that you have an SSH client installed on your local machine. Most Unix-like systems (Linux ) come with ssh installed by default

**information to connect:**

# **Hostname or IP address** of the server

# **Username** for the server

#**Password** (or SSH key) for authentication

Using the Command Line:

ssh username@hostname

For example, if your username is mayur and your server’s IP address is 192.168.1.10

ssh mayur@192.168.1.10

Enter Password:

Accept the Host Key:

**Successful Connection:**

Once authenticated, you will be logged into the server, and you can start executing commands on the remote machine.

6. · Create 5 files in the /tmp directory, and then use tar and gzip to bundle and compress

the files.

ANS: Create Files:

cd /tmp

touch file1.txt file2.txt file3.txt file4.txt file5.txt

Create Tar Archive:

tar -cvf files.tar file1.txt file2.txt file3.txt file4.txt file5.txt

Compress with gzip:

gzip files.tar

1. Describe the root account

ANS: The root account is a critical component of Unix-like operating systems, providing full control and access to the system. It is designed for administrative tasks that require high-level permissions. Proper management and cautious use of the root account are essential for maintaining system security and stability.

**ROOT IS A Superuser:**

* The root account is often referred to as the superuser. It has unrestricted access to all files, commands, and resources on the system. This means it can perform any operation, including modifying system files, changing system configurations, installing and removing software, managing user accounts, and more.

1. What is shell?

ANS:

In the context of Linux, a shell is a command-line interface (CLI) used to interact with the operating system. It allows users to enter text commands to perform a variety of tasks such as navigating the file system, managing files and directories, running programs, and controlling processes.

**Types of Shells**:

# **Bash (Bourne Again SHell)**: The most commonly used shell in Linux, known for its scripting capabilities and ease of use.

# **Zsh (Z Shell)**: An extended Bourne shell with many improvements, including themes and plugins.

#**Ksh (Korn Shell)**: An older shell that combines features of the Bourne shell and the C shell.

# **Tcsh (Tenex C Shell)**: An enhanced version of the C shell (csh) with additional features.

Functions of the Shell:

**Command Execution**: Users can type commands to be executed by the operating system.

**Scripting**: Shells support scripting, allowing users to write and execute scripts to automate tasks.

**File Manipulation:** Commands for creating, deleting, copying, moving, and editing files and directories.

**Process Control**: Commands to manage running processes, including starting, stopping, and monitoring processes.

1. What is Linux?

ANS:Linux is a open-source Unix-like operating systems based on the Linux kernel.

Linux is known for its stability, security, and flexibility, making it popular for servers, desktops, and embedded systems.

# **Open Source**: The source code is freely available and can be modified and distributed by anyone.

# **Kernel**: The core component, managing hardware resources and system calls.

# **Distributions (Distros)**: Variants of Linux, such as Ubuntu, Fedora, Debian, and CentOS, each offering different software and configurations.

# **Shell**: A command-line interface for interacting with the system.

# **Package Management**: Tools for installing, updating, and managing software, like APT for Debian-based systems and YUM for Red Hat-based systems.

# **Security**: Known for strong security features, including user permissions and firewalls.

# **Community Support**: A large, active community contributing to development, support, and documentation.

1. What is Bash?

ANS:

Bash is an integral part of the Linux and Unix ecosystems, providing users and administrators with a powerful tool for system management and automation

Bash (Bourne Again SHell) is a Unix shell and command language

It is widely used as the default login shell for most Linux distributions

# **Command Language**: Provides a command line interface for interacting with the operating system, allowing users to execute commands, run scripts, and manage system processes.

# **Scripting**: Supports scripting, enabling automation of tasks through shell scripts. Bash scripts can include control structures, variables, and functions.

# **Compatibility**: Compatible with the Bourne shell (sh) and includes many enhancements and additional features.

# **Built-in Commands**: Comes with a wide range of built-in commands for file manipulation, text processing, system monitoring, and more.

# **Job Control**: Supports job control, allowing users to manage background and foreground processes.

# **Command History**: Maintains a history of executed commands, enabling users to recall and reuse previous commands.

# **Aliases**: Allows users to create shortcuts for longer commands or sequences of commands.

11. You have a new empty hard drive that you will use for Linux. What is the first

step you use.

* Steps prefixed with a “$” (dollar sign) represents the CLI prompt
* Steps prefixed with a “#” (number sign) represents the CLI prompt with elevated user permissions
* The text after the “$” or “#” is to be entered at the CLI
* A new internal disk drive (hard disk drive, solid state drive, etc.) is already installed into my computer system
* The new disk drive will be represented by the device name of /dev/sdb
* The new disk drive will be configured to have one primary partition with ext4 as the file system
* The new disk drive will be automatically mounted at each boot using the /etc/fstab
* The new disk drive will have a mount point of “/mnt/data”

#I will following commands, lsblk or fdisk to get device name for the new disk drive.

$ lsblk

# fdisk -l

**Create Partition:**

**1)Change disk partition with fdisk. (# fdisk /dev/sdb)**

**2) Set disk label type.** **Choose one of the desire disk label type. Most will use GPT (g).**

**Command (m for help): g**

**3)Create new partition. # fdisk /dev/sdb**

**4)change partition type. Command (m for help): t**

**5)Verify changes. Command (m for help): p**

**6)Save changes and exit**. Command (m for help): w

12. Write the Linux command to show the current working directory.

ANS:

To current working directory in Linux, can use the (**pwd** )command. This stands for "present working directory."

13. write the Linux command to get help with various options.

ANS:

To get help with various options for a command in Linux, you can use the --help option or the man (manual) command

**Using --help**: For example, to get help with the ls command: **ls –help**

**Using man (manual)**: For example, to get the manual page for the ls command**: man ls**

14. Write the Linux command! to display what all users are currently doing.

ANS:

To display what all users are currently doing on a Linux system, you can use the w command. This command shows who is logged in and what they are doing.

15. write the Linux command to get information about the operating system.

ANS:

To get information about the operating system in Linux, you can use several commands

**uname -a**

16. Write the Linux command to create a hard link of a file.

ANS: **The  *ln*  command creates hard links**

17. Write the Linux command to create a soft link of a file as well as Directory.

ANS: **use the ln -s command with Linux command to create a soft link of a file as well as Directory**

18. Write the Linux command! to search for specific pattern in a file.

ANS: grep

19. Write the Linux command to show the use of basic regular expressions using

ANS: grep

ANS: The “grep” command stands for global regular expression print. grep command is used to find a word as it filters the content of a file which makes search easy. This command is generally used with pipe **(|)**.

Module :2- Linux server - Operate running systems

20. View running processes with ps.

ANS: **Basic Usage**:

* ps

This command shows the processes running in the current terminal.

**View All Processes**:

* ps -A

or

* ps -e

[These commands list all running processes on the system](https://www.geeksforgeeks.org/ps-command-in-linux-with-examples/)

**Detailed Information**:

* ps -ef

[This command provides a more detailed view, including the user who started the process, the process ID (PID), and the command that started the process](https://www.ibm.com/docs/en/aix/7.2?topic=processes-command-check-process-status-ps-command)

**Filter by User**:

* ps -u username

[Replace username with the actual username to see processes started by a specific user2](https://www.howtogeek.com/448271/how-to-use-the-ps-command-to-monitor-linux-processes/).

**View Processes in a Tree Format**:

* ps -e --forest

[This command shows the processes in a hierarchical tree format](https://www.howtogeek.com/448271/how-to-use-the-ps-command-to-monitor-linux-processes/)

21. Terminate processes with kill.

ANS: This command lists all available signals that you can send to processes.

\* Kill -l

\* kill PID

\* kill -s

Replace SIGNAL with the signal you want to send (e.g., SIGTERM, SIGKILL, SIGSTOP) and PID with the process ID.

22. Use top or htop to monitor system resources and processes.

ANS:

**top**

**This command provides a real-time view of system processes, showing information such as CPU and memory usage, process ID (PID), and more.**

* **Features:**
  + **Comes pre-installed on most Linux distributions.**
  + **Displays processes sorted by CPU usage by default.**
  + **Allows you to kill processes by typing k and entering the PID.**
  + **Limited to keyboard navigation.**

**htop**

* **Features:**
  + **Needs to be installed manually on most systems:**

**$ sudo apt install htop**

* + **Provides a colorful, interactive display.**
  + **Supports mouse interactions and scrolling.**
  + **Displays processes in a tree format for better visualization.**
  + **Allows easy process management, including killing processes with F9.**

23. · Configure one of your lab COMPUTERS to boot to the CLI using systemd, and reboot

ANS:

1. **Open a Terminal**:
   * You can do this from your current GUI or by accessing a terminal directly.
2. **Set the Default Target to Multi-User**:
   * This target is equivalent to the CLI mode.

sudo systemctl set-default multi-user.target

1. **Reboot the System**:
   * This will apply the changes and boot the system into CLI mode.

sudo reboot

**Assignment:**

**Linux**

Server to confirm that you were successful.

Module :3- Linux server - Configure local storage Assignment

24. Learn about different filesystem types (e.g., ext4, NTFS).

1. ANS: **NTFS (New Technology File System)**:
   * Developed by Microsoft and introduced in 1993 with Windows NT 3.1.
   * Offers advanced features like file permissions, encryption, and compression.
   * Suitable for Windows system drives.
   * **Journaling**: Yes.
   * **Maximum File Size**: Extremely large (up to 16 exabytes).
   * **Pros**: Robust, supports large files, and provides security features.
   * **Cons**: Not natively supported on other operating systems.
2. **ext4 (Fourth Extended File System)**:
   * Widely used in the Linux ecosystem.
   * Successor to the ext3 file system.
   * Divides the file system into block groups for efficient data organization.
   * **Journaling**: Yes.
   * **Maximum File Size**: Very large (up to 16 terabytes).
   * **Pros**: Reliable, good performance, and native to Linux.
   * **Cons**: Limited compatibility with non-Linux systems.

25. Manage disk partitions and filesystems using tools like fdisk, mkfs, and mount.

ANS:

1. fdisk:
   * fdisk is a command-line utility for managing disk partitions.
   * Use it to create, delete, and modify partitions on your storage devices.
   * Example usage:
   * # List available disks

fdisk -l

* + # Create a new partition (e.g., /dev/sdb1)

fdisk /dev/sdb

* + # Delete a partition

fdisk /dev/sdb -d 1

1. mkfs:
   * mkfs (make filesystem) is used to create a filesystem on a partition.
   * You can specify the filesystem type (e.g., ext4, NTFS) when formatting a partition.
   * Example usage:
   * # Create an ext4 filesystem on /dev/sdb1

mkfs.ext4 /dev/sdb1

* + # Create an NTFS filesystem on /dev/sdc1

mkfs.ntfs /dev/sdc1

1. mount:
   * mount is used to attach a filesystem to a directory in the Linux file hierarchy.
   * After creating a filesystem, mount it to access its contents.
   * Example usage:
   * # Mount /dev/sdb1 to /mnt/mydata

mount /dev/sdb1 /mnt/mydata

* + # Unmount a filesystem

umount /mnt/mydata

26. create a 2048MB partition and verify if the partition has been created.

ANS:

* + Open a terminal and run:
  + sudo fdisk -l
  + This command lists all partitions on your system. Note down the disk you want to partition (e.g./dev/sda).

1. **Enter Command Mode**:
   * To create a partition, enter the following command (replace /dev/sda with your chosen disk):

sudo fdisk /dev/sda

* + You’ll enter the command mode.

1. **Create the Partition**:
   * Press n to create a new partition.
   * Choose either primary (p) or logical (l) partition type.
   * Specify the starting and ending sectors (press ENTER for default values).
   * For a 2048 MB partition, you can use the default values or specify the size (e.g., +2048M).
2. **Set Partition Type (Optional)**:
   * By default, the partition type is set to “Linux filesystem.”
   * If needed, press t to change the type and select the appropriate code (e.g., 83 for Linux ext4).
3. **Write Changes**:
   * Press w to write the changes to the disk.
4. **Verify**:
   * Run sudo fdisk -l again to verify the new partition.

27. Why LVM is required?

ANS:

**\*Dynamic Volume Management**:

* + LVM allows you to create logical volumes (LVs) that span multiple physical volumes (PVs).
  + You can dynamically resize, extend, or shrink LVs without unmounting or disrupting services.
  + This flexibility is especially useful for servers and systems with changing storage needs.

28. How can you find out how much memory Linux is using?

ANS:

\*free**Command**:

* + The free command provides information on total, used, free, shared, buffer/cache, and available RAM and swap space at the moment you run the command.
  + Example usage (in mebibytes):

free -m

* + Output example:

Total Used Free Shared Buff/Cache Available

Mem: 1987 927 80 79 980 811

Swap: 1521 651 869

29. What is a typical size for a swap partition under a Linux system?

ANS:

If your RAM is less than 2 GB, allocate twice the RAM size for swap.

If your RAM is between 2 GB and 4 GB, allocate half the RAM size for swap.

If your RAM is more than 4 GB, 2 GB of swap is generally sufficient

30. What is the maximum file size on the ext4 file system?

ANS:

The **ext4 filesystem** in Linux can theoretically support volumes up to **64 zebibytes (ZiB)** and single files up to **16 tebibytes (TiB)** with the standard 4 KiB block size. [However, due to a limitation in the extent format, the practical limit for file size is **1 exbibyte (EiB)**](https://en.wikipedia.org/wiki/Ext4). So, for most practical purposes, you can work with files up to 16 TiB in size on ext4.

31. What is the maximum file size on the xfs file system

ANS:

[support **up to 300 TiB** for XFS file systems](https://access.redhat.com/solutions/1532). Keep in mind that limitations imposed by the host operating system can affect this limit. [XFS is a 64-bit file system and theoretically supports a maximum file system size of **8 exbibytes minus one byte (263 − 1 bytes)**, y](https://en.wikipedia.org/wiki/XFS)

**Module: 4-**

**Linux server - Manage user and**

**Groups and working with file systems**

32. Manage users and groups with commands like useradd, userdel, groupadd, and passwd

ANS:

1. **useradd**: Creates new user accounts.
2. **userdel**: Deletes existing user accounts.
3. **groupadd**: Creates new groups.
4. **groupdel**: Deletes existing groups.
5. **usermod**: Modifies existing user accounts.
6. **passwd**: Creates and changes passwords.

33. Explain different file system types in Linux?

ANS:

EXT4 File System

This is the fourth generation of the EXT file system. This was the default file system in LINUX. It provides the following features.

It supports file systems up to 1EiB.

It supports a file up to 16TiB in size.

It supports unlimited directories.

It uses a series of contiguous physical blocks on the hard disk known as extents. The extents are used to improve the performance of very large files.

XFS (X-File System) File System

This file system was developed by Silicon Graphics for their version of UNIX. Later, it was adopted by most Linux distributions including RHEL. It was the default file system . This file system is based on 64-bit extent. It uses journaling for metadata operations. It supports file systems and files of sizes up to 8EiB. The only drawback of this system is that it does not support the shrink feature like EXT3 and EXT4.

VFAT (Virtual File Allocation Table) File System

This is the enhanced version of the legacy FAT file system. It was developed in 1995 for Windows 95. By default, Linux does not use this file system for any of its operations. If required, it can read and write files written in this format. This support was added in Linux so a user can exchange data between Linux and Windows using an external device such as a USB drive or compact disk.

NTFS File System

This is the enhanced version of VFAT. This file system is the default file system on the Windows system. Just like VFAT, Linux can read and write files written in this format but it does not use this format for any of its purpose.

SWAP Space

Swap space is used as a temporary memory. It can be allocated as a separate swap partition, LVM partition, or a file (file is used only to extend the available swap space). Swap space is used only if a shortage of physical memory occurs. In a shortage situation, the system moves recently unused data from memory to swap space. When required, the system moves back this data from swap to memory. It is a convenient method to improve kernel memory usage.

LVM (Logical Volume Manager)

The classical partition scheme is fixed in nature. It means that once created, the partition size cannot be changed later. We are not allowed to add additional space in a partition that is filled up with data. Similarly, we cannot shrink a partition that has a lot of unused free space. LVM not only solves this issue but also provides several other advantages over the classical approach. It supports many advanced features for stability and security.

RAID

RAID is a mechanism to combine multiple disk drives into an array to achieve performance and redundancy. The array of disks will appear as a single logical storage unit or drive in the computer. RAID enhances the data access speed and increases data storage capacity using a single virtual disk.

There are two types of RAID; software RAID and hardware RAID. Hardware RAID is built from independent hard disks and a raid controller device. It does not use any system resources. Software RAID is built from attached hard disks. It uses all resources from the system.

34. Explain File Permission groups in Linux?

ANS:

Three file permissions types apply to each class of users:

* The read permission.
* The write permission.
* The execute permission.

To view the file permissions, use the [ls](https://linuxize.com/post/how-to-list-files-in-linux-using-the-ls-command/) command:

ls -l filename

rw-r--r-- 12 linuxize users 12.0K Apr 28 10:10 filename

|[-][-][-]- [------] [---]

| | | | | | |

| | | | | | +-----------> 7. Group

| | | | | +-------------------> 6. Owner

| | | | +--------------------------> 5. Alternate Access Method

| | | +----------------------------> 4. Others Permissions

| | +-------------------------------> 3. Group Permissions

| +----------------------------------> 2. Owner Permissions

+------------------------------------> 1. File Type

**of Permissions on Files**

| Permission | Character | Meaning on File |
| --- | --- | --- |
| **Read** | - | The file is not readable. You cannot view the file contents. |
|  | r | The file is readable. |
| **Write** | - | The file cannot be changed or modified. |
|  | w | The file can be changed or modified. |
| **Execute** | - | The file cannot be executed. |
|  | x | The file can be executed. |
|  | s | If found in the user triplet, it sets the setuid bit. If found in the group triplet, it sets the setgid bit. It also means that x flag is set. When the setuid or setgid flags are set on an executable file, the file is executed with the file’s owner and/or group privileges. |
|  | S | Same as s, but the x flag is not set. This flag is rarely used on files. |
|  | t | If found in the others triplet, it sets the sticky bit. It also means that x flag is set. This flag is useless on files. |
|  | T | Same as, t but the x flag is not set. This flag is useless on files. |

35. How do you switch from one desktop environment to another, such as

switching from KDE to Gnome?

ANS:

* On **Fedora** or Red Hat-based systems, use:

sudo dnf install @gnome-desktop

* **Log Out** of your current session.
* **Select GNOME** at the login screen:
  + Click on the gear icon or the session menu next to your username.
  + Choose “GNOME” or “Ubuntu” (which uses GNOME).
* **Log In** to your new GNOME session.

36.What are the kinds of permissions under Linux

ANS:

In Linux, file permissions are crucial for maintaining system security and controlling access to files and directories. There are three types of permissions, each of which can be assigned to three categories of users:

**Types of Permissions**

1. **Read ®**: Allows viewing or copying the contents of a file.
2. **Write (w)**: Allows modifying the contents of a file.
3. **Execute (x)**: Allows running a file if it is an executable.

**Categories of Users**

1. **Owner**: The user who owns the file.
2. **Group**: A set of users who share the same permissions.
3. **Others**: All other users on the system.

**Example**

When you list files with ls -l, you’ll see something like this:

-rwxr-xr--

This breaks down as:

* -: File type (e.g., - for a regular file, d for a directory).
* rwx: Permissions for the owner (read, write, execute).
* r-x: Permissions for the group (read, execute).
* r--: Permissions for others (read only).

**Changing Permissions**

You can change permissions using the chmod command. For example:

chmod 755 filename

[This sets the permissions to rwxr-xr-x, meaning the owner can read, write, and execute, while the group and others can only read and execute](https://linuxhandbook.com/linux-file-permissions/)

37. What are the different modes when using vi editor?

ANS:

The vi editor, a classic text editor in Unix and Linux systems, operates in several distinct modes. Here are the primary modes you’ll encounter:

**1. Command Mode**

* **Default Mode**: When you open vi, it starts in this mode.
* **Function**: Allows you to navigate the file, delete text, copy and paste, and perform other commands.
* **Switching**: Press Esc to ensure you’re in Command mode.

**2. Insert Mode**

* **Function**: Enables you to insert and edit text.
* **Switching**: Enter this mode by pressing i (for insert), a (for append), or o (to open a new line below the current line).
* **Exiting**: Press Esc to return to Command mode.

**3. Visual Mode**

* **Function**: Used for selecting text, which can then be manipulated (cut, copy, paste).
* **Switching**: Enter this mode by pressing v in Command mode.
* **Types**:
  + **Visual Line Mode**: Press V to select entire lines.
  + **Visual Block Mode**: Press Ctrl+v to select a block of text.

**4. Command-Line Mode (Last Line Mode)**

* **Function**: Allows you to execute commands such as saving, quitting, and searching.
* **Switching**: Enter this mode by pressing : in Command mode.
* **Examples**:
  + :w to save the file.
  + :q to quit vi.
  + :wq to save and quit.