Introduction to Linux

1. Introduction

- Linux is a **Unix-like operating system** that is free and open-source.
- It is widely used in **research computing, cloud environments, and personal use.**
- Linux distributions include **Ubuntu, CentOS, Fedora, and Debian.**

2. Basics of Linux and Shell

- The **shell** is a command-line interface (CLI) that allows users to interact with the OS.
- **Common shells:**
    - bash (Bourne Again Shell) - Default for many Linux distributions.
    - zsh, tcsh, ksh - Alternative shell environments.
- **Logging in via SSH:**
    - ssh username@server_address
- **Basic Shell Commands:**
    - pwd – Print working directory.
    - ls – List directory contents.
    - cd – Change directory.
    - mkdir – Create a new directory.

3. Linux File System Structure

- **Hierarchy Overview:** Starts from the root directory /
- **Important directories:**
    - /home/ – User home directories.
    - /bin/ – Essential binaries (commands like ls, cat).
    - /etc/ – System configuration files.
    - /var/ – Variable data (logs, cache, etc.).
    - /usr/ – User-installed applications.

4. File and Directory Commands

- ls -l – Long listing format.
- ls -a – Show hidden files.
- cp source destination – Copy files.

- mv oldname newname – Rename or move files.
- rm filename – Remove files.
- rmdir directory – Remove an empty directory.
- rm -r directory – Remove a directory and its contents.

5. File Permissions and Ownership

- **Permission Types:** Read (r), Write (w), Execute (x).
- **View Permissions:** ls -l
    - Example: -rw-r--r-- 1 user group 1234 Jan 1 12:00 file.txt
- **Change Permissions:**
    - chmod 755 script.sh – Change file permissions.
    - chown user:group filename – Change ownership.

6. Processes and Job Control

- **Check Running Processes:**
    - ps – View running processes.
    - top – Real-time process monitoring.
- **Managing Processes:**
    - kill PID – Terminate a process.
    - fg – Bring a background job to the foreground.
    - bg – Resume a job in the background.

7. File Redirection and Pipes

- **Redirecting Output:**
    - command > file – Redirect output to a file (overwrite).
    - command >> file – Append output to a file.
    - command 2> error.log – Redirect error messages.
- **Pipes (|)**
    - command1 | command2 – Send the output of one command to another.
    - Example: ls -l | grep ".txt"

8. Searching and Filtering Text

- grep "pattern" filename – Search for text in a file.
- find /path -name "*.txt" – Find files by name.
- awk '{print $1}' file.txt – Extract the first column from a file.

9. Editing Files

- **Common Editors:**
    - nano filename – Simple text editor.
    - vim filename – Advanced editor.
    - emacs filename – Another powerful editor.

10. Environment Variables and Customization

- echo $HOME – Print the value of an environment variable.
- export VAR=value – Set a new environment variable.
- alias ll="ls -la" – Create command shortcuts.