What is Operating System?

An OS is a program that controls the computer's hardware and helps users run applications.

Components of Operating System

1. **User Interface**

The User Interface is the medium through which the user communicates with the computer. For example, Graphical User Interface (GUI) and Command line interface (CLI).

- A GUI is a user-friendly interface that uses graphics to help users interact with electronic devices. GUIs use visual elements (icons, buttons, windows) for interaction
- A CLI provides a text-based method for users to operate and navigate a system by typing specific commands into a terminal or console.

2. **Kernal**

The kernel is the core of the Linux operating system. Function of kernel is controls the hardware, manages CPU, memory, and devices, and acts as a bridge between hardware and software.

Example tasks:

- Allocate memory to programs
- Control keyboard and mouse

3. **Shell**

The shell is the command-line interface that allows users to communicate with the operating system by entering commands.

4. **Hardware**

The hardware layer consists of physical components that execute commands and provide system resources.

- Includes CPU, RAM, storage, and input/output devices.

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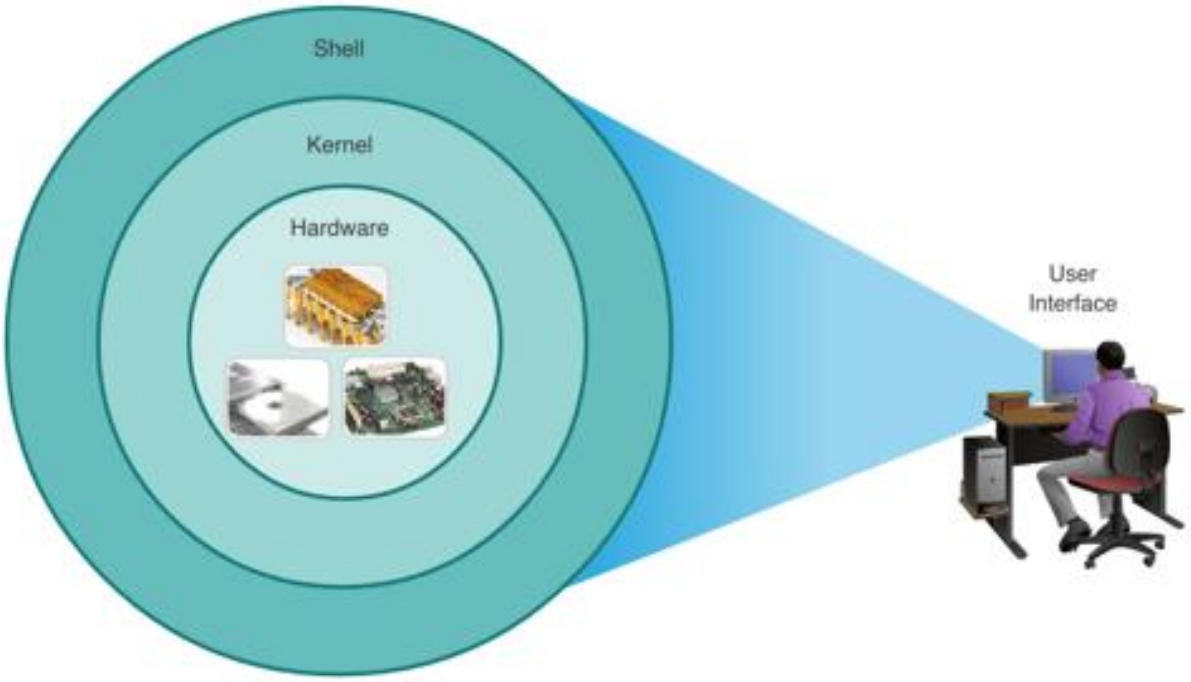


Figure 1: Component of OS

Linux Operating System

Linux is based on the UNIX operating system. It laid the foundation for many modern operating systems, including Linux.

- Linux is free and open-source, accessible to everyone.
- Offers high security and stability, making it ideal for servers and development work.
- Highly flexible and customizable to suit different users and industry needs.

The Linux Shell

Linux Shell, often known as the terminal or Command Line Interface (CLI), is where you can interact with the OS using commands.

Starting the "terminal"

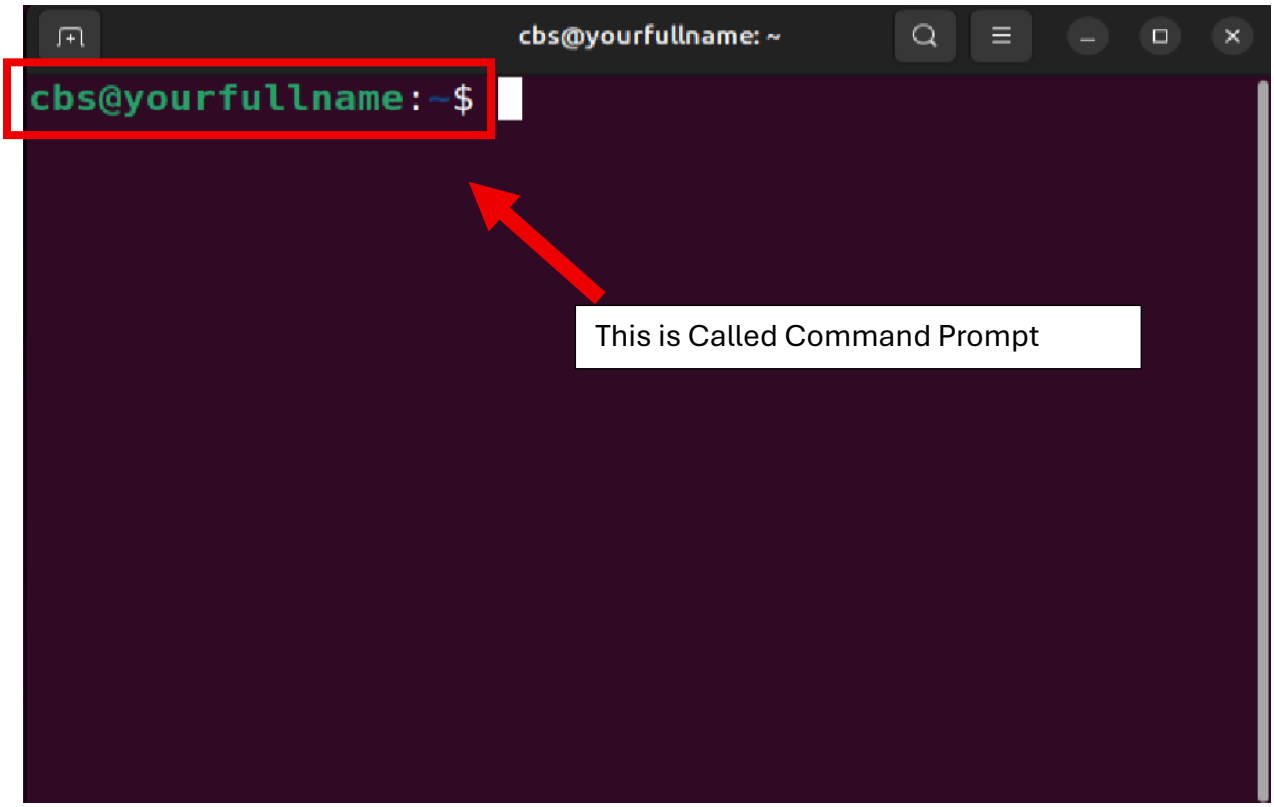


Figure 3: Command Prompt

By searching for it as in Figure (2) or clicking the Linux menu as in Figure (2). Once started a terminal window will show up as in Figure (3).

- The green text shown as "cbs@yourfullname:" represents a user named 'cbs' logged into a Linux OS on the machine named "yourfullname".
- The current location (known as directory, which a folder), is shown after the colon sign (:)
    - Currently the tilde symbol is shown (~), which means you are at the "Home Directory" The home directory is the default location on your system where your user files are stored for the current user.

Basic user management

Command	**Purposed**
whoami	Displays the current logged-in username. **For example, cbs.**
hostname	Displays the name of the computer (machine name). **For example, yourfullname.**

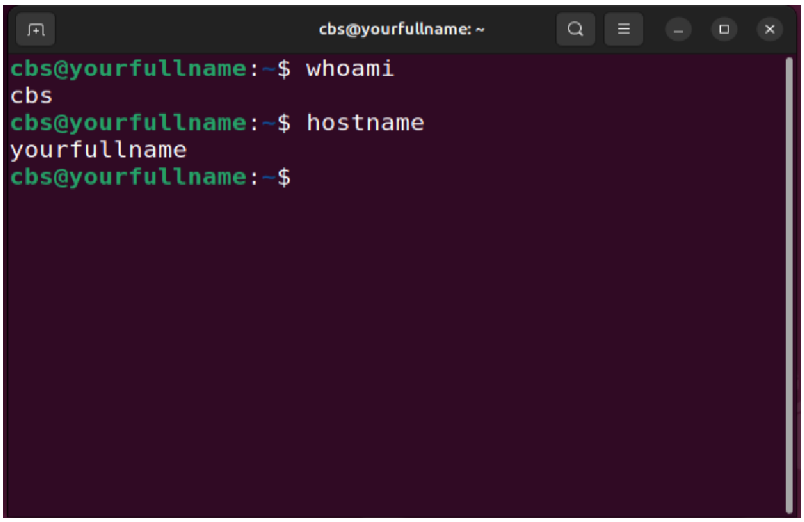


Figure 4: Linux Identity Commands

File System

The Linux File System is a structured method of storing and organizing data on a Linux machine as in Figure (3). It arranges files in a hierarchical directory format starting from the root directory /.

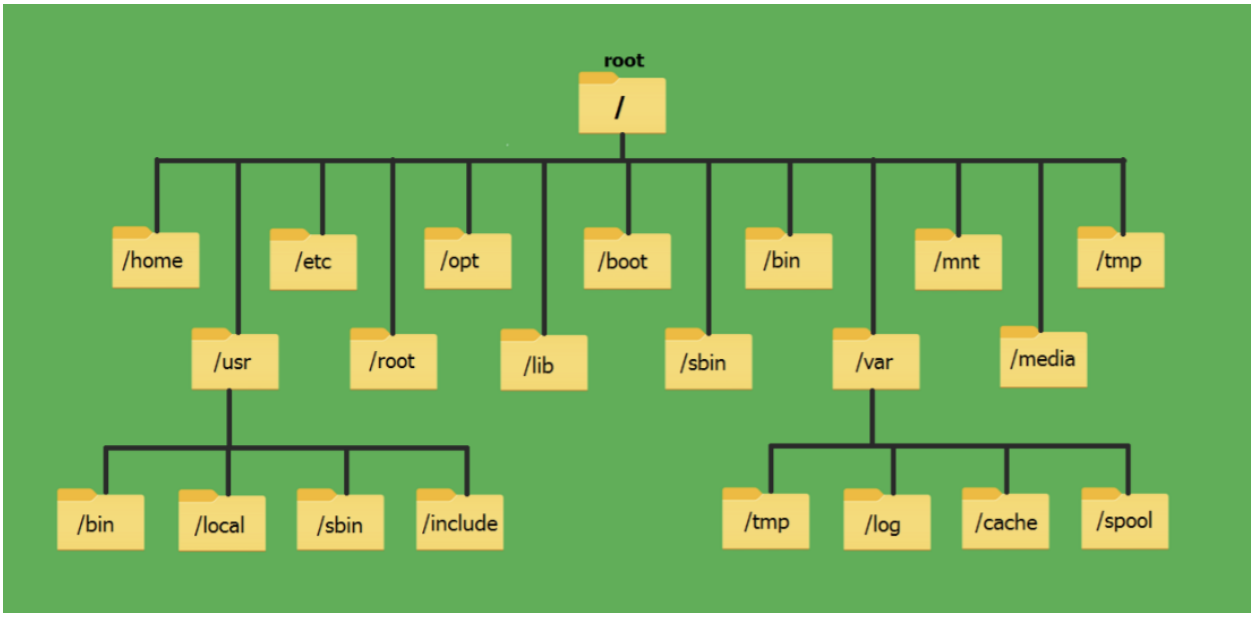


Figure 5: File System Hierarchical

Here's a clear explanation of the hierarchy and common directories:

1. **Root Directory /**
   - The top-most directories in the Linux file system.
   - All other directories branch out from /
   - Example: /home, /etc, /usr, /var all reside under /.

2. **Important Directions under / (you don't need to memorize, each week we will study one of them)**

Directory	Purpose
/home	User home directories, e.g., /home/ (User)
/etc	System configuration files, e.g., network, users, services
/bin	Essential binary executables (commands) for all users, e.g., ls, cp, mv
/bin	Essential shared libraries needed by binaries in /bin and /sbin
/usr	User programs and applications, e.g., /usr/bin for binaries, /usr/lib for libraries
/var	Variable data like logs, databases, mail spools
/tmp	Temporary files, cleared on reboot
/dev	Device files representing hardware, e.g., /dev/sda, /dev/tty
/proc	Virtual filesystem containing process and kernel information
/sys	Virtual filesystem representing kernel objects and hardware devices
/mnt	Temporary mount points for external devices
/media	Default mount points for removable media (USB, CD/DVD)
/opt	Optional software packages and third-party applications
/srv	Data for services provided by the system, e.g., web server files

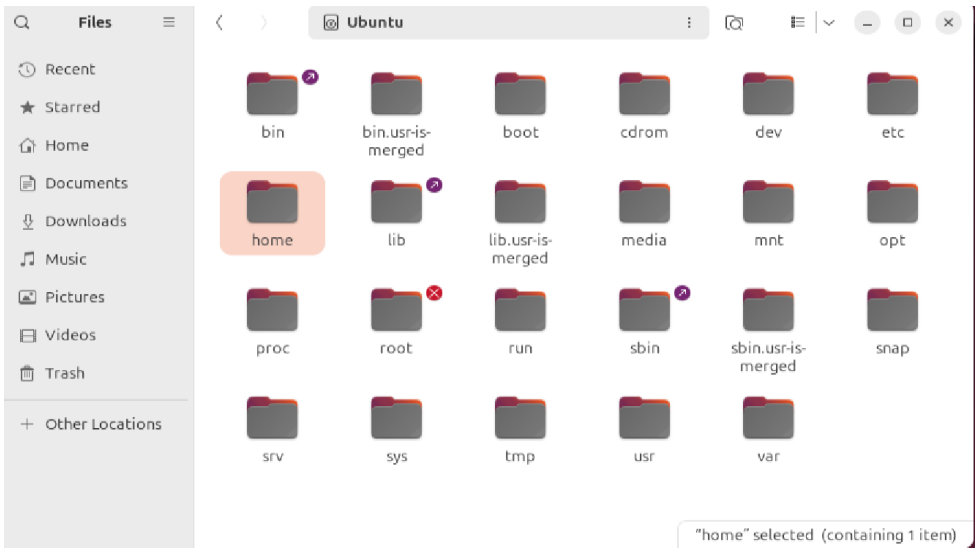


Figure 6: GUI File System

File System Navigation Commands in Linux

Imagine telling someone the full address to find your house. Similarly, you can do the same by giving the complete path to the folder. For example, as shown in figure (7) you want to access the Desktop folder inside the username folder.

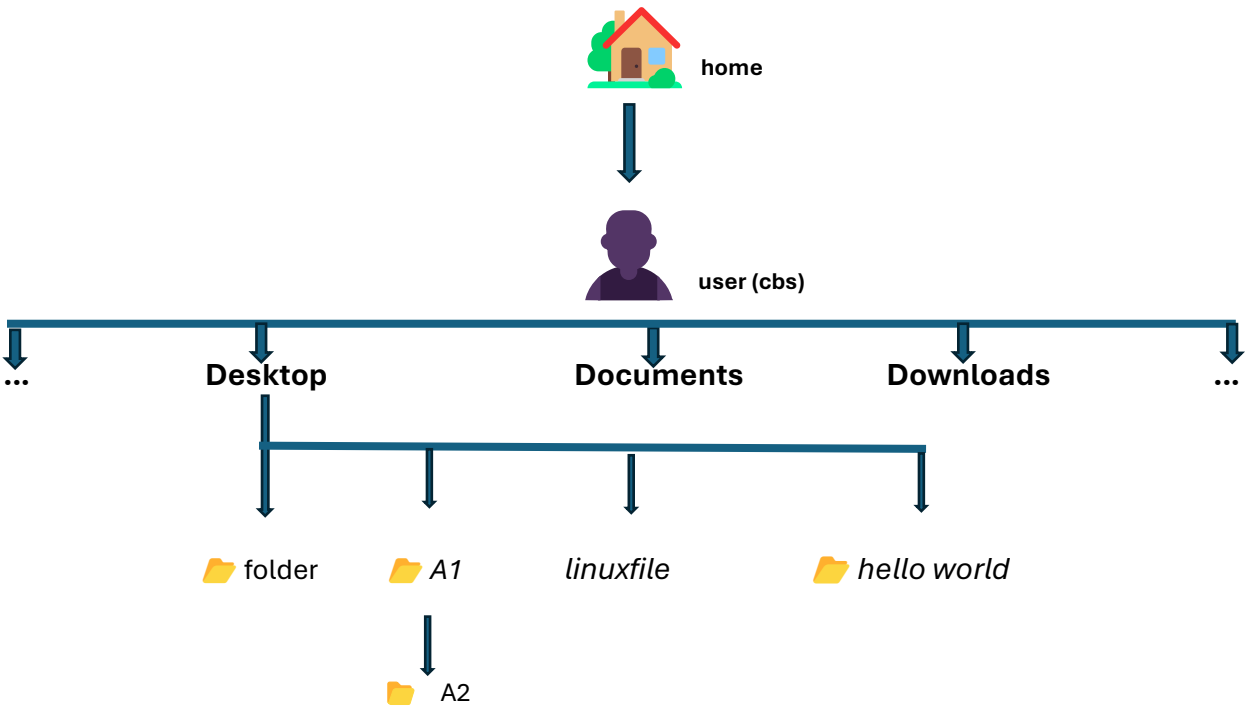


Figure 7: Directory Structure

1. Pwd: **print working directory**

   The pwd command shows the current location in the system.

```
cbs@yourfullname:~$ pwd
/home/cbs
```

2. ls: **list files and directories.**

   The ls command is used to list the files and directories in the current directory**.**

```
cbs@yourfullname:~$ ls
Desktop    Downloads  Pictures  Templates
Documents  Music      Public    Videos
```

3. cd: **change directory**

   The cd command is used to move between folders.

- **Case 1:** change directory to download.

```
cbs@yourfullname:~$ cd Downloads
cbs@yourfullname:~/Downloads$
```

- **Case 2:** Go back home directly.

```
cbs@yourfullname:~/Downloads$ cd ..
```

- **Case 3:** Change directory to Desktop and print current directory .

```
cbs@yourfullname:~$ cd Desktop
cbs@yourfullname:~/Desktop$ pwd
/home/cbs/Desktop
```

4. mkdir: **make directory**

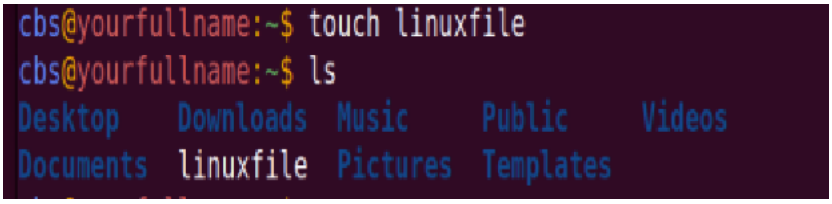
- The mkdir command allows you to create new folders within your existing file system.

```
cbs@yourfullname:~/Desktop$ mkdir folder1
```

- Creating folders with space.

```
cbs@yourfullname:~/Desktop$ mkdir "hello world"
```

5. touch: The touch command allows you to create new files.



cd Command

Commands	Purpose
cd /	Change directory to the root directory.
cd ~	Change directory to my home directory.

File Manipulation Commands

Commands	Purpose
cp	Copy files or folsers
rm	Remove file
rmdir	Remove empty folders
mv	Move file (or rename)
ln	Create a link between two files
Whereis	Locate the path of a cmd's binary/src code/manual
Locate/find	Locate a file in the directory tree
tree	The tree command in Linux is used to display the directory structure in a hierarchical (tree-like) format.

File Content Commands

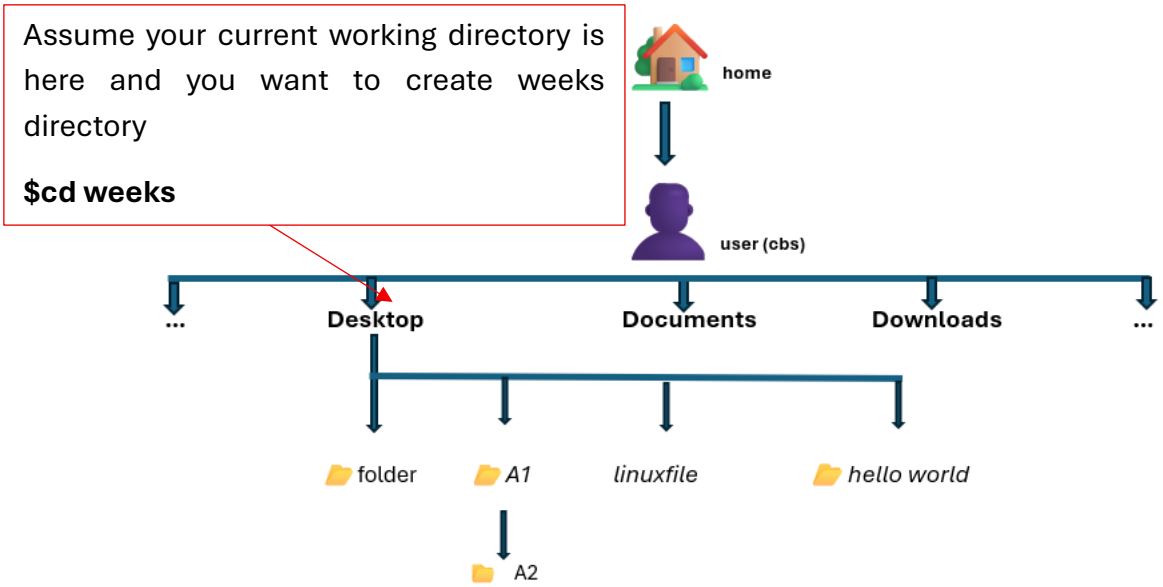
Commands	Purpose
cat	Show the content of a file
nano	Edit file
Head	shows the **first 10 lines** of a file.
tail	Shows the **last 10 lines** of a file.
grep	Search for text patterns in files

Getting Help Commands

Commands	Purpose	Example
man	Shows the manual pages for a command. These are detailed, structured documents maintained by the system.	man [command_name], for example: man cp
info	Shows detailed documentation about commands, often more structured than man.	info [command_name], for example: info ls
--help	Provides a quick summary of a command's usage and options directly in the terminal.	[Command_name] --help for example: ls --help

Absolut and Relative Pathname in Linux

Linux mainly uses two types of paths: Absolute Path and Relative Path



1. Relative Path

A relative path defines the location of a file or directory with respect to the current working directory. It does not start from the root directory.

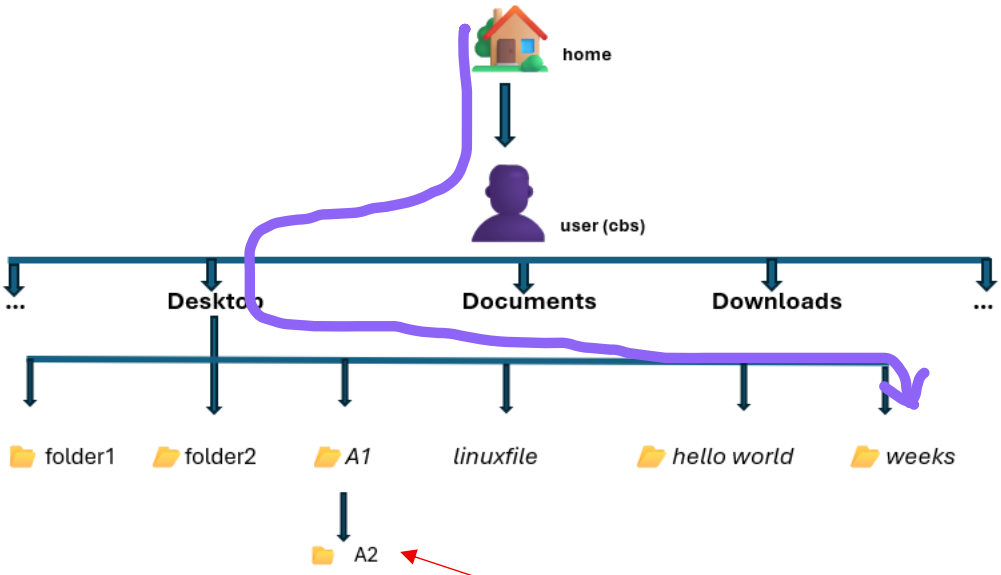
```
cbs@yourfullname:~/Desktop$ mkdir weeks
```

2. Absolute Path

A relative path defines the location of a file or directory with respect to the current working directory. It does not start from the root directory.

This path tells Linux:

- Start from /
- Go to home
- Enter User
- Move to Desktop



Assume your current working directory is here and you want to create week1 directory in weeks directory

$mkdir /home/cbs/Desktop/weeks/week1

and verify whether the directory is created or not

$ls /home/cbs/Desktop/weeks/week1

Output

```
cbs@yourfullname:~/Desktop/A1/A2$ mkdir /home/cbs/Desktop/weeks/week1
cbs@yourfullname:~/Desktop/A1/A2$ ls  /home/cbs/Desktop/weeks/
week1
```

Note: Your current directory is A2 while you can create a week1 directory in weeks directory using absolute path, The full path to a file or folder, starting from the root directory (/ in Linux).