



**POLITECNICO
DI TORINO**

Introduction to Linux

Operating Systems – Sarah Azimi



Before Linux

- In 80's, Microsoft DOS was the dominated OS for PC
- Apple MAC was better, but expensive.
- UNIC was much better, but much much more expensive.
- People were looking for a UNIX based system, which is cheaper and can run on PC.
- DOS, MAC and UNIX were **proprietary**, i.e., the **source code of their kernel is protected**.
- No modification is possible without paying high license fee.

Beginning of Linux

- A famous professor Andrew Tanenbaum, developed Minix, a simplified version of UNIX that runs on PC.
- Minix is for class teaching only. No intension for commercial use.

Linus Torvalds

- In 1991, a second-year student of Computer Science at the university of Helsinki, developed the preliminary kernel of Linux, known as Linux version 0.0.1.
- Soon more than a hundred people joined the Linux camp. Then hundreds of thousands.
- It was licensed under GNU General Public License, this ensuring that the source codes will be free for all to copy, study and to change.



Linus Torvalds

Linux Today

- Linux has been used for many computing platforms.
 - PC, supercomputers,....
 - Not only character user interface but graphical user interface is available.

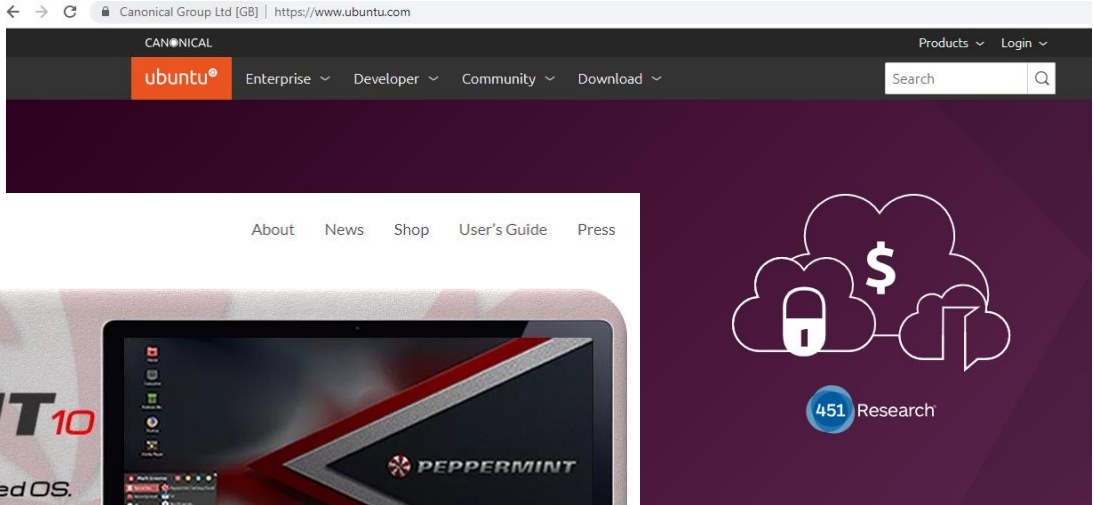
Linux Distributions

- Red Hat Linux
 - One of the original Linux distribution. The commercial, non-free version is Red Hat Enterprise Linux, which is aimed at big companies using Linux servers and desktops in a big way.
- Debian GNU/Linux
 - A free software distribution. Popular for use on servers. However, Debian is not what many would consider a distribution for beginners, as it is not designed with ease of use in mind.
- **Ubuntu**
 - One of the free and most incredibly easy to use free distributions of Linux.

Virtual Machines and Virtualization

- Enables a single PC or server to simultaneously run multiple operating systems or multiple sessions of a single OS.
- A machine can host numerous applications, including those that run on different operating systems, on a single platform.
- Host operating system can support a number of virtual machines (VM)
 - Each has the characteristics of a particular OS and, in some versions of virtualization, the characteristics of a particular hardware platform.

What to do now?

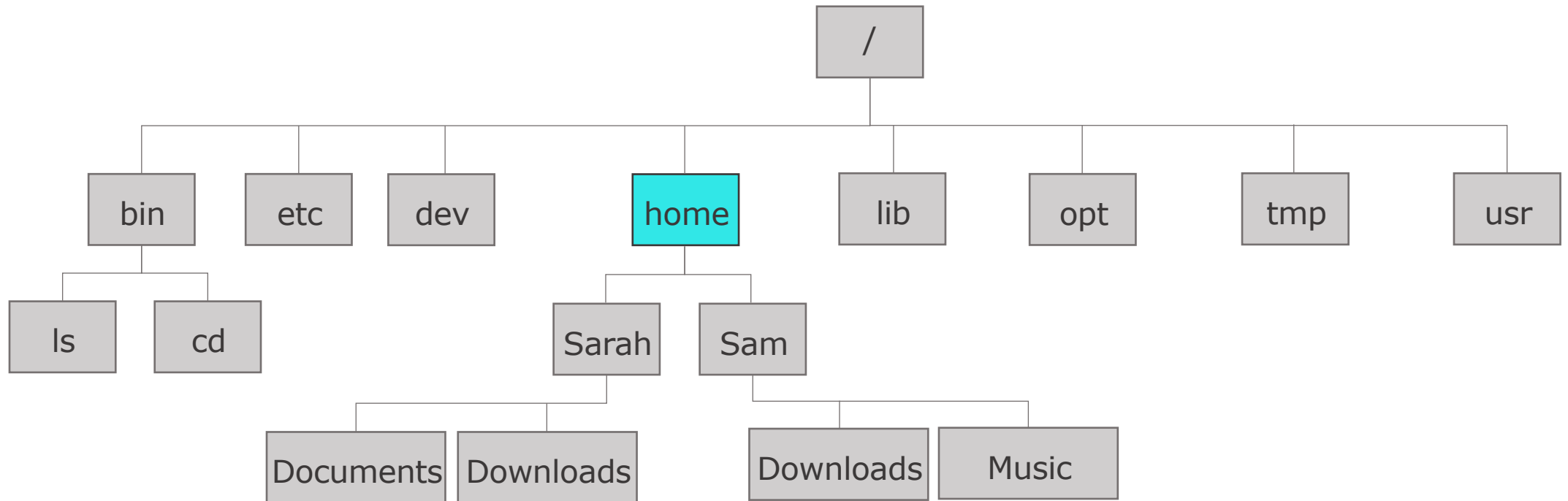


Online Manual

- All Linux commands have an online documentation
 - **man <command>**
 - **whatis <command>**

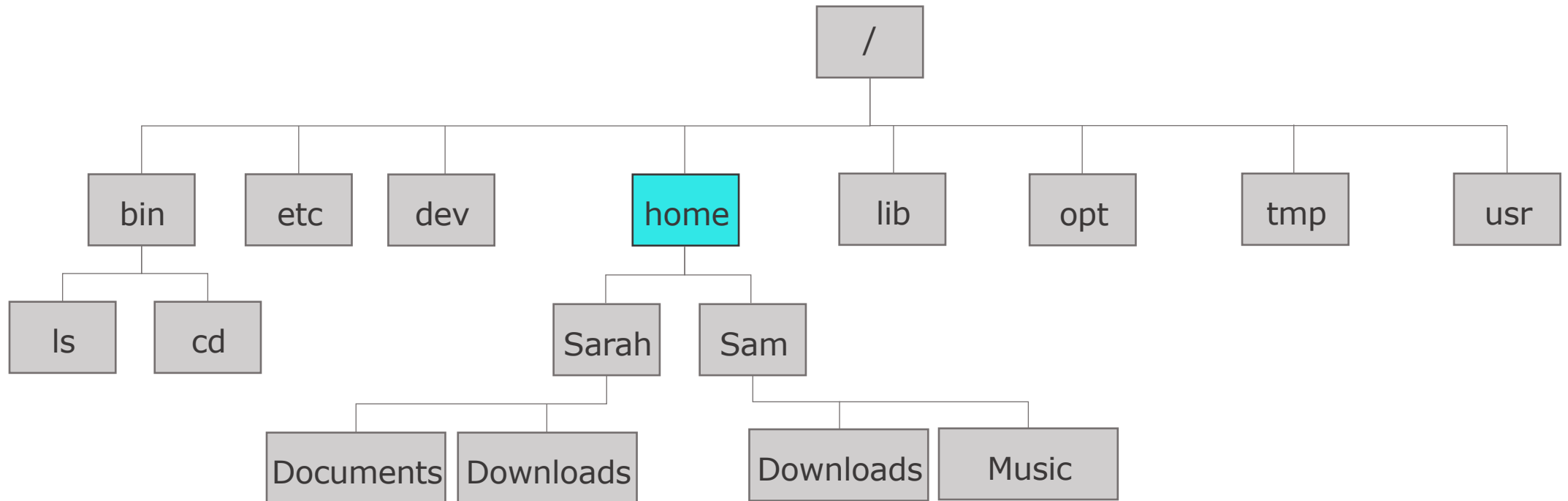
Directory Tree

- When you log on the Linux OS using your username, you are automatically located in your home directory.
- **Home** Every user gets her own folder in here, named for her logic account. So, the user who logs in with Sarah, has the directory `/home/sarah`, where all her personal files are kept.



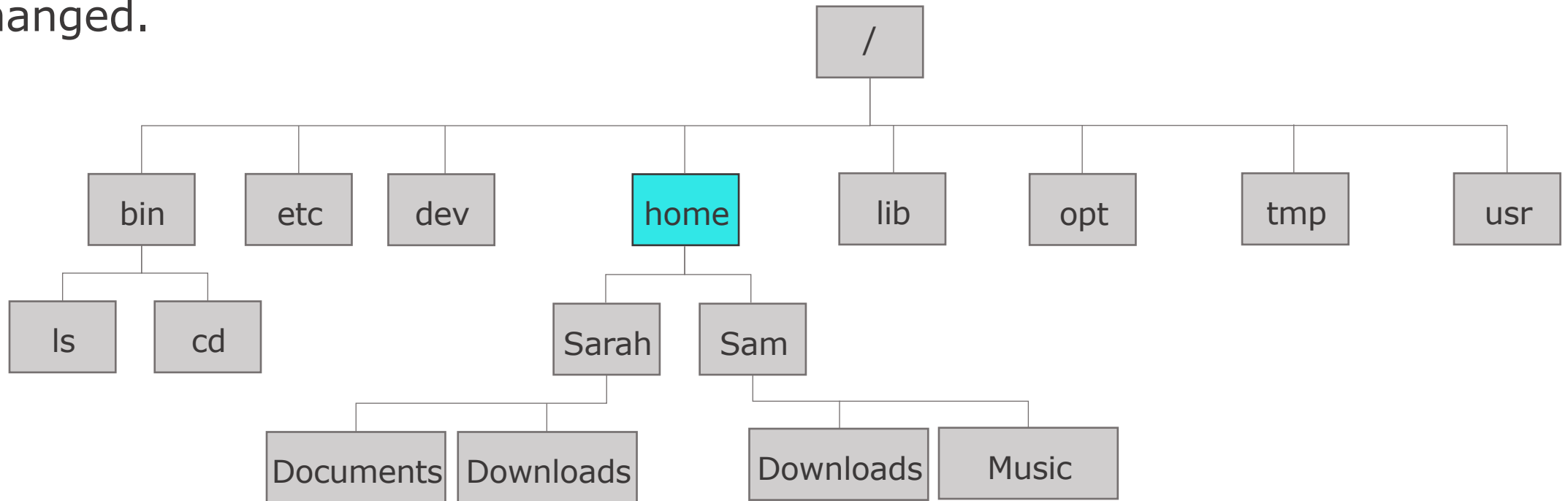
Directory Tree

- When you log on the Linux OS using your username, you are automatically located in your home directory.
- **/bin** Important Linux commands available to the users.
- **/dev** All device drivers. Device drivers are the files that your Linux system uses to talk to your hardware.
- **/etc** System Configuration files.



Directory Tree

- When you log on the Linux OS using your username, you are automatically located in your home directory.
- **/lib** System libraries. Libraries are just bunches of programming code that the programs on your system use to get things done.
- **/tmp** Temporary files and storage space. Don't put anything here that you need.
- **/usr** Programs and data that can be shared across many systems and don't need to be changed.



Basic Commands

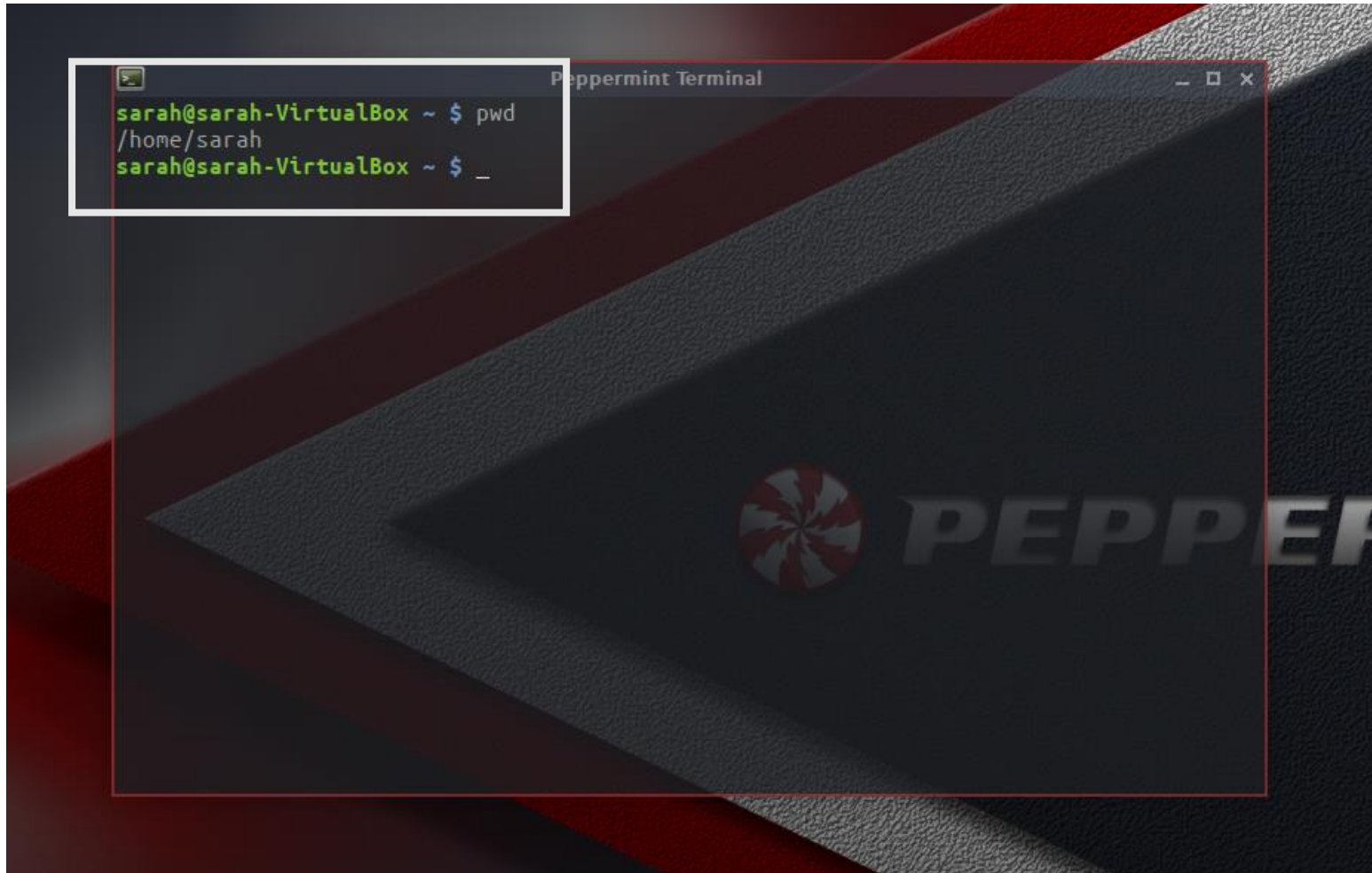
- **pwd** To know which directory you are in. it gives an absolute path.
- **ls** To know what files are in the directory you are in.
- **cd** To go to a directory
- **mkdir** To create a new directory
- **rmdir** To delete an empty directory
- **rm** To delete files and directories
- **touch** To create a file (from an empty txt file to an empty zip file)
- **man** To know more about a command and how to use it.
- **cp** To copy files
- **mv** To move files through the command lines
- **cat** To display the contents of a file
- **nano, vi** The text editors in Linux (The nano command is a good editor)

Basic Commands

- **sudo** Stands for "SuperUser Do". if you want any command to be done with administrative or root privileges, you can use the sudo command.
- **apt-get** To install packages. This requires root privileges, so use the sudo command with it.
- **df** To see the available disk space in each of the partitions in the system.
- **du** To see the disk usage of a file in your system.
- **chmod** To change permission granted to a file.
- **chown** To change the owner and the group owner of a file.
- **echo** To print a string of text to the terminal window.
- **ps** To list the running processes.
- **hostname** To know your name in your host or network.

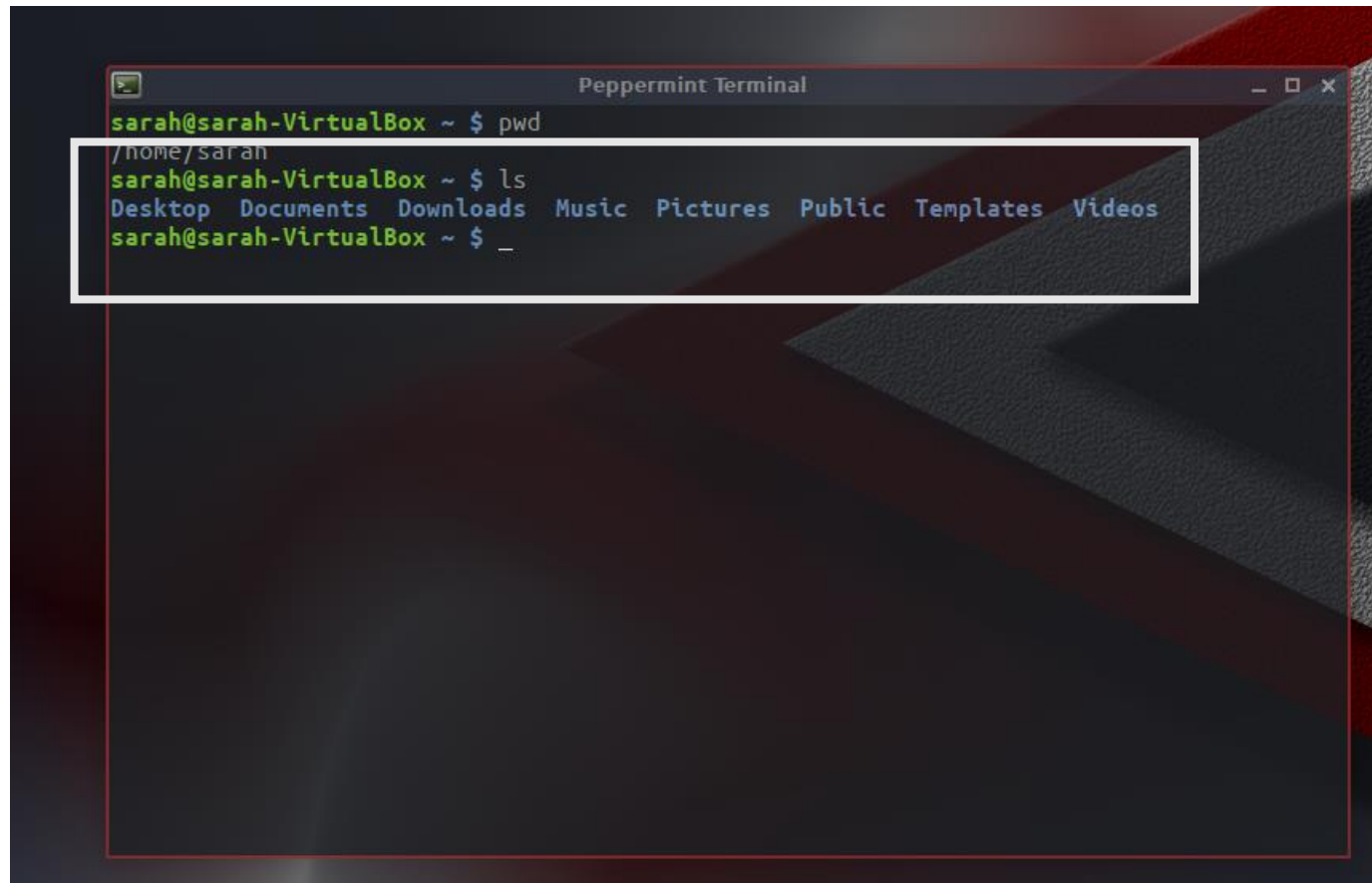
Basic Commands

- **pwd** To print the current working directory.



Basic Commands

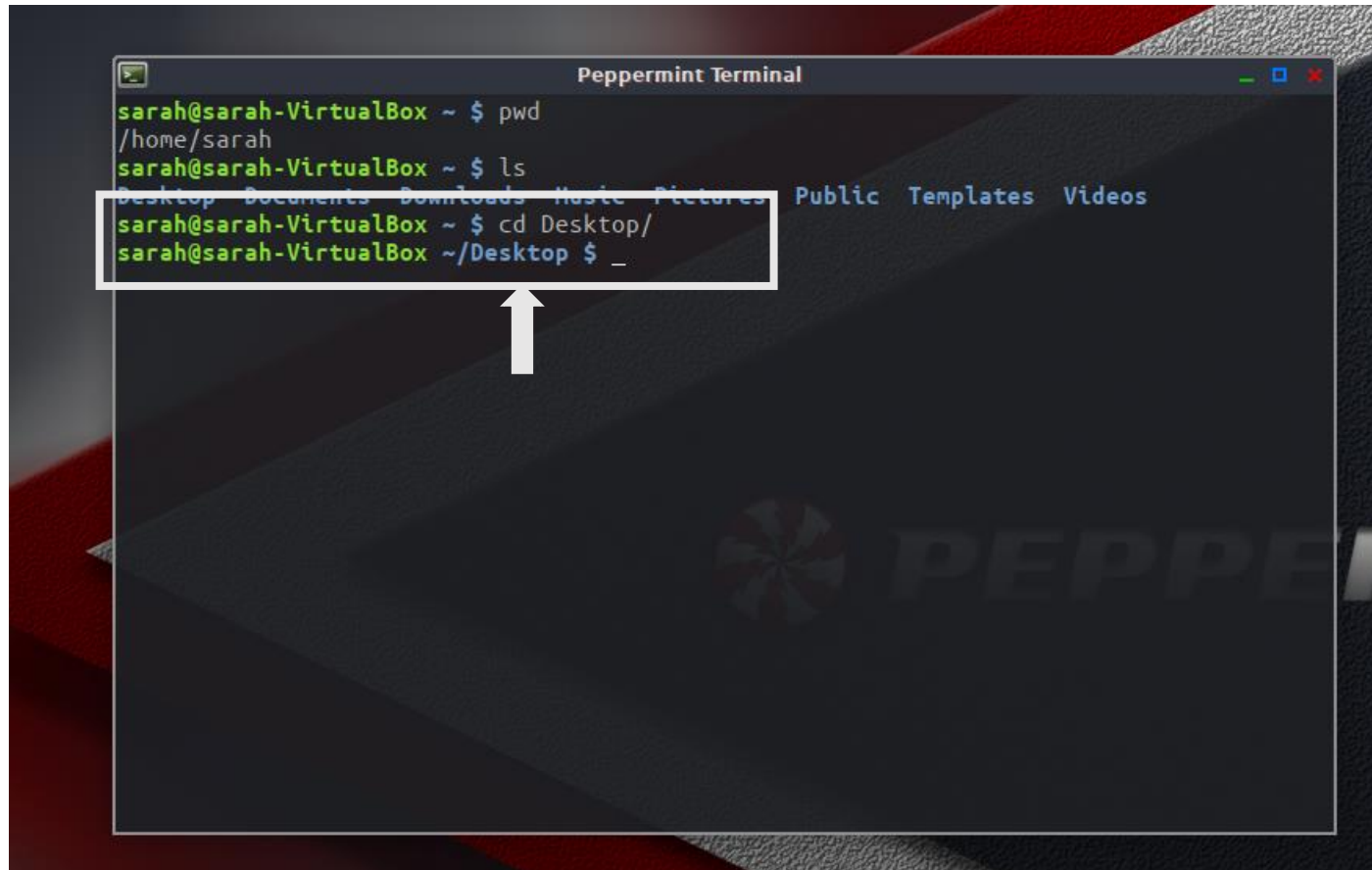
- **ls** To list the contents of a directory.

A screenshot of a terminal window titled "Peppermint Terminal". The terminal shows a user named "sarah" at a machine named "sarah-VirtualBox". The user enters the command "pwd", and the output is "/home/sarah". Then, the user enters the command "ls", and the output lists the contents of the home directory: "Desktop Documents Downloads Music Pictures Public Templates Videos". The prompt "sarah@Sarah-VirtualBox ~ \$" is shown at the end of the line.

```
sarah@sarah-VirtualBox ~ $ pwd
/home/sarah
sarah@sarah-VirtualBox ~ $ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
sarah@sarah-VirtualBox ~ $ _
```

Basic Commands

- **cd** To enter the directory x.



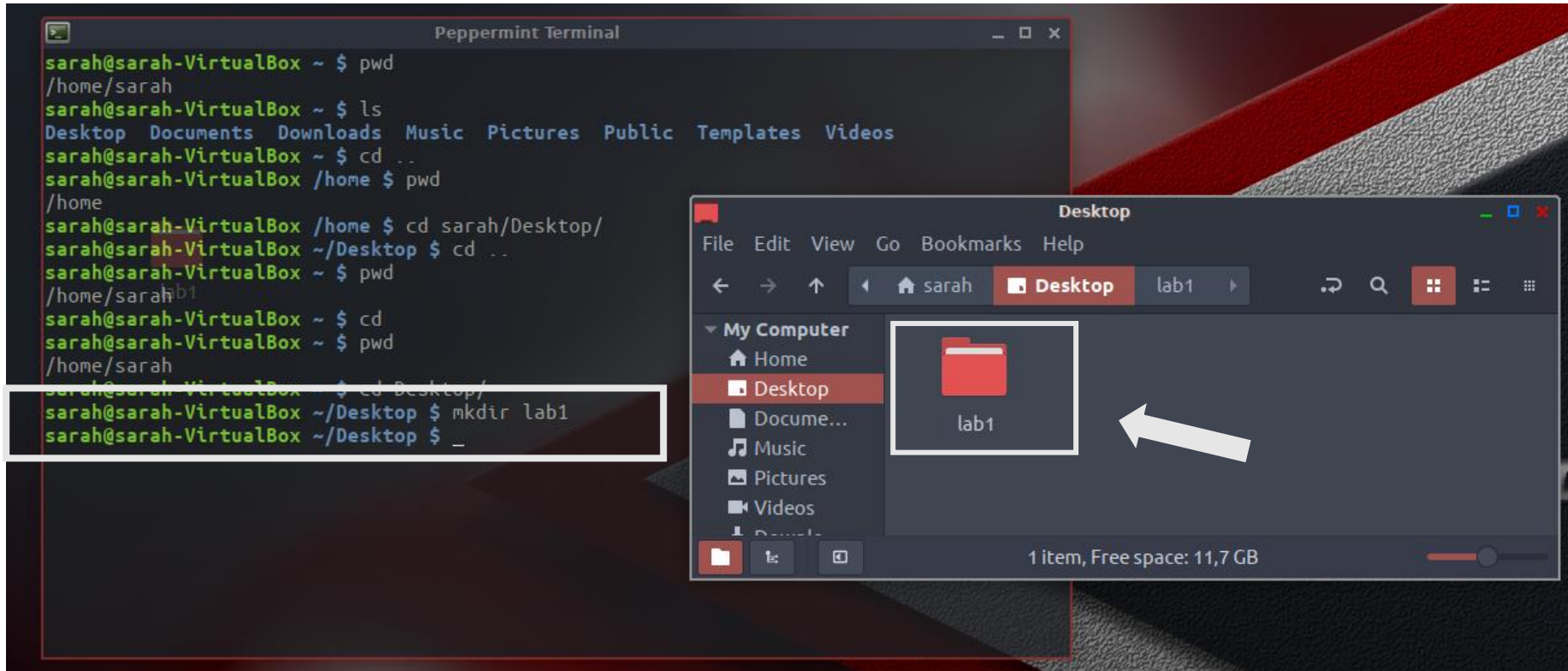
The screenshot shows a terminal window titled "Peppermint Terminal" with a dark background and light green text. The terminal displays the following commands and output:

```
sarah@sarah-VirtualBox ~ $ pwd
/home/sarah
sarah@sarah-VirtualBox ~ $ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
sarah@sarah-VirtualBox ~ $ cd Desktop/
sarah@sarah-VirtualBox ~/Desktop $ _
```

A white rectangular box highlights the last two lines of the terminal output, and a white arrow points upwards from below the box towards the `cd Desktop/` command.

Basic Commands

- **mkdir** To create a new directory.



Basic Commands

- **cp** To copy files and directories (absolute and relative paths).

The image shows a terminal window and two file manager windows. The terminal window displays the following commands and output:

```
sarah@sarah-VirtualBox ~ $ pwd
/home/sarah
sarah@sarah-VirtualBox ~ $ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
sarah@sarah-VirtualBox ~ $ cp /home/sarah/Desktop/lab1/ex1.txt /home/sarah/Desktop/lab2/ex1copy.txt
sarah@sarah-VirtualBox ~ $ _
```

An arrow points from the text "Absolute path" to the command `cp /home/sarah/Desktop/lab1/ex1.txt /home/sarah/Desktop/lab2/ex1copy.txt`.

Below the terminal, two file manager windows are shown. The left window, titled "lab1", shows a file named "ex1.txt". The right window, titled "lab2", shows a file named "ex1copy.txt".

Below the file managers, another terminal window is shown with the following commands and output:

```
sarah@sarah-VirtualBox ~ $ cd Desktop/lab1/
sarah@sarah-VirtualBox ~/Desktop/lab1 $ ls
ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ cd
sarah@sarah-VirtualBox ~/Desktop $ cp ./lab1/ex1.txt ./lab2/ex1copy.txt
sarah@sarah-VirtualBox ~/Desktop $ rm ./lab2/ex1copy.txt
sarah@sarah-VirtualBox ~/Desktop $ cd lab1/
sarah@sarah-VirtualBox ~/Desktop/lab1 $ cp ex1.txt ../../lab2/ex1copy.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ _
```

Two arrows point from the text "Relative path" to the commands `cp ./lab1/ex1.txt ./lab2/ex1copy.txt` and `cp ex1.txt ../../lab2/ex1copy.txt`.

Basic Commands

- **chmod** To modify the access right of the file.

To whom permissions apply:

u >> owner (file's owner)

g >> group (users who are members of the file's group)

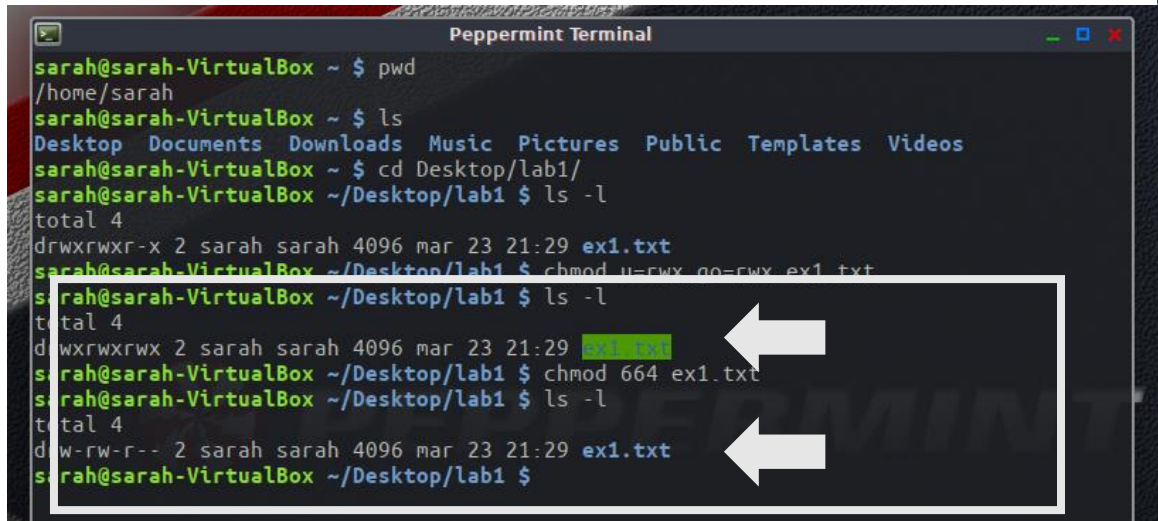
o >> others (who are neither the owner or member of file's group)

Access rights are:

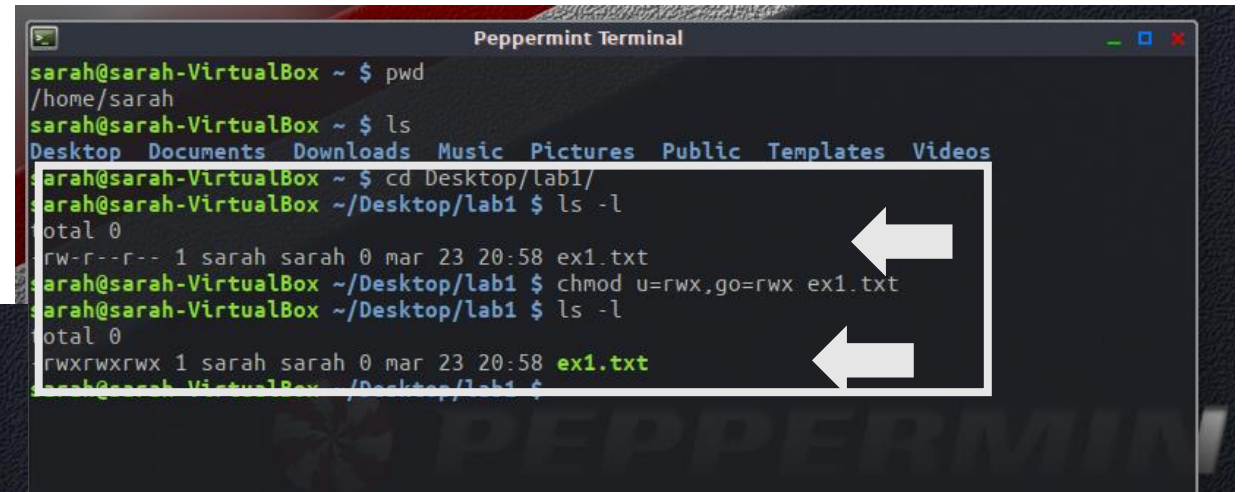
read >> r

write >> w

executable >> x



```
sarah@sarah-VirtualBox ~ $ pwd
/home/sarah
sarah@sarah-VirtualBox ~ $ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
sarah@sarah-VirtualBox ~ $ cd Desktop/lab1/
sarah@sarah-VirtualBox ~/Desktop/lab1 $ ls -l
total 4
drwxrwxr-x 2 sarah sarah 4096 mar 23 21:29 ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ chmod u=rwx,go=rwx ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ ls -l
total 4
d-w-rw-rwx 2 sarah sarah 4096 mar 23 21:29 ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ chmod 664 ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ ls -l
total 4
-rw-rw-r-- 2 sarah sarah 4096 mar 23 21:29 ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $
```



```
Peppermint Terminal
sarah@sarah-VirtualBox ~ $ pwd
/home/sarah
sarah@sarah-VirtualBox ~ $ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
sarah@sarah-VirtualBox ~ $ cd Desktop/lab1/
sarah@sarah-VirtualBox ~/Desktop/lab1 $ ls -l
total 0
-rw-r--r-- 1 sarah sarah 0 mar 23 20:58 ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ chmod u=rwx,go=rwx ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $ ls -l
total 0
-rwxrwxrwx 1 sarah sarah 0 mar 23 20:58 ex1.txt
sarah@sarah-VirtualBox ~/Desktop/lab1 $
```

Access rights are:

read >> 4

write >> 2

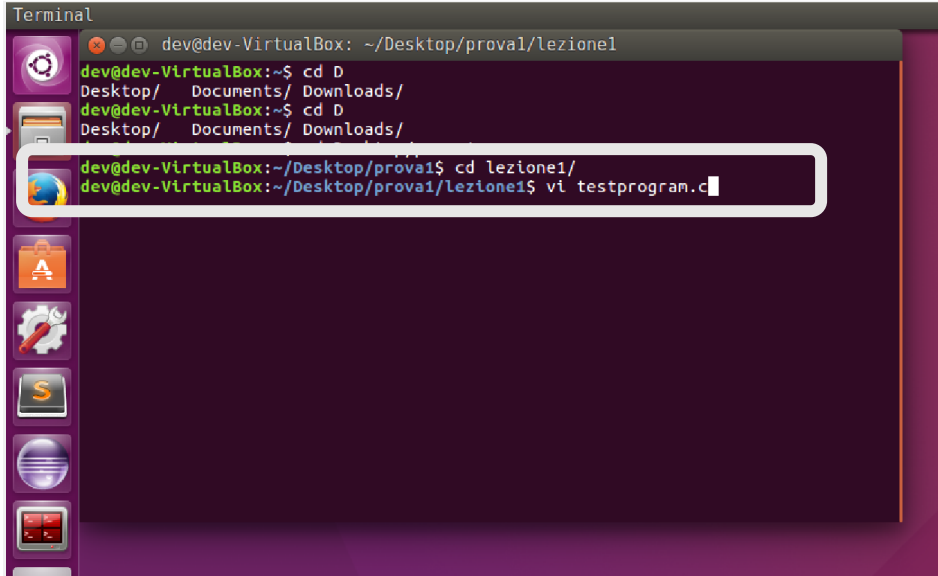
executable >> 1

without right >> 0

Basic Commands

- **gcc** To compile and execute a code C in Linux

Using an editor to create a file

A terminal window titled 'Terminal' with the prompt 'dev@dev-VirtualBox: ~/Desktop/prova1/lezione1'. The user enters 'cd D' twice, then 'cd /'. Finally, they enter 'vi testprogram.c', which is highlighted by a white rectangular box.

```
dev@dev-VirtualBox: ~/Desktop/prova1/lezione1
dev@dev-VirtualBox:~$ cd D
Desktop/  Documents/ Downloads/
dev@dev-VirtualBox:~$ cd D
Desktop/  Documents/ Downloads/
dev@dev-VirtualBox:~/Desktop/prova1$ cd /
dev@dev-VirtualBox:~/Desktop/prova1/lezione1$ vi testprogram.c
```

Write a simple C program

A terminal window titled 'Terminal' with the prompt 'dev@dev-VirtualBox: ~/Desktop/prova1/lezione1'. The user has entered C code, which is highlighted by a white rounded rectangle. At the bottom, a white box with the text 'Save and Exit' has an arrow pointing to the terminal's status bar.

```
dev@dev-VirtualBox: ~/Desktop/prova1/lezione1
1 #include<stdio.h>
2 int main(void)
3 {
4     printf ("Hello!This is a test program.\n");
5     return 0;
6 }
```

Save and Exit

.c[+] [FORM] [=ur] [POS=0006,0005][100%] [LEN=6]

Basic Commands

- **gcc** To compile and execute a code C in Linux

Generate an executable file using:

```
gcc program-name.c -o program-name
```

Launch the executable file using:

```
./program-name
```

