Experiment No: 1

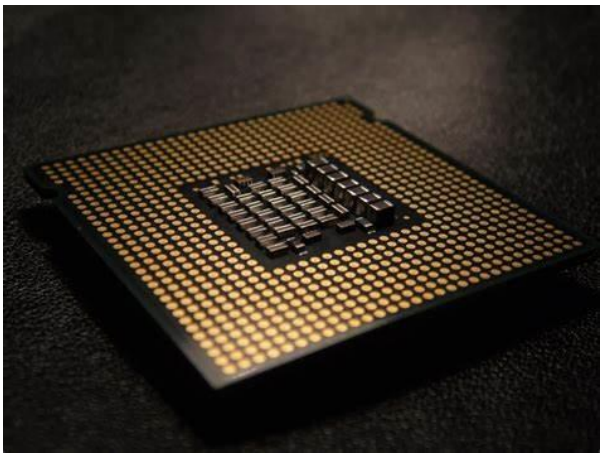
Aim: Introduction to Computer hardware: Physical identification of major components of a computer system such as mother board, RAM modules, daughter cards, bus slots, SMPS, internal storage Devices, interfacing ports. Specifications of desktopand server class computers. Installation of common operating systems for desktop and server use.

CO1: Install and configure common operating systems in virtual environment.

Procedure:

1. **CPU (Central Processing/Processor Unit)**

   Central processing unit (CPU), principal part of any digital computer system, generally composed of the main memory, control unit, and arithmetic-logic unit. It constitutes the physical heart of the entire computer system; to it is linked various peripheral equipment, including input/output devices and auxiliary storage units. In modern computers, the CPU is contained on an integrated circuit chip called a microprocessor.



2. **Hard drive**

   A computer hard drive (or a hard disk or HDD) is one kind of technology that stores the operating system, applications, and data files such a documents, pictures and music that your computer uses. The rest of the components in your computer work together to show you the applications and files stored on your hard drive.

3. **Graphics Processing Unit (GPU)**

Graphics processing technology has evolved to deliver unique benefits in the world of computing. The latest graphics processing units (GPUs) unlock new possibilities in gaming, content creation, machine learning, and more.

4. **Power Supply Unit (PSU)**

A power supply unit (PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. Modern personal computers universally use switched-mode power supplies. Some power supplies have a manual switch for selecting input voltage, while others automatically adapt to the mains voltage

5. SSD: Solid State Drive

SSDs got their name—solid state—because they use solidstate devices under the hood. In an SSD, all data is stored in integrated circuits. This difference from HDDs has a lot of implications, especially in size and performance. Without the need for a spinning disk, SSDs can reduce to the shape and size of a stick of gum (what's known as the M.2 form factor) or even as small as a postage stamp. Their capacity—or how much data they can hold—varies, making them flexible for smaller devices, such as slim laptops, convertibles, or 2 in 1s.And SSDs dramatically reduce access time since users don't have to wait for platter rotation to start up. SSDs are more expensive than HDDs per amount of storage (in gigabytes (GB) and terabytes (TB)), but the gap is closing as SSD prices decline at a faster pace that HDD prices year over year.

6. Optical Disc Drive

Optical Disc Drive (ODD) An optical disc drive (ODD) in a computer system allows you to use CDs, DVDs, and Blu-ray discs to listen to music or watch a movie. Most drives also allow you to write data to a disc, so you can create your own music CDs, video DVDs or even create of back-up copy of your important data files.

7. Motherboard

A motherboard is the main printed circuit board in general-purpose computers and other expandable systems. It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit and memory, and provides connectors for other peripherals

Parts

1.Back Panel Connectors & Ports:

Connectors and ports for connecting the computer to external devices such as display ports, audio ports, USB ports, Ethernet ports, PS/2 ports etc.

2. PCI Slots PCI:

Peripheral Component Interconnect Slot for older expansion cards such as sound cards, network cards, connector cards.

3. PCI Express x1 Slots:

Slot for modern expansion cards such as sound cards, network cards (Wi-Fi, Ethernet, Bluetooth), connector cards (USB, FireWire, eSATA) and certain lowend graphics cards.

4. PCI Express x16 Slot:

Slot for discrete graphic cards and high bandwidth devices such as top-end solid state drives.

5. Northbridge:

Also known as Memory Controller Hub (MCH). Chipset that allows the CPU to communicate with the RAM and graphics card. Beginning from Intel Sandy Bridge in 2011, this motherboard component is no longer present as it has been integrated within the CPU itself.

6. CPU Socket:

Insert CPU here.

7. ATX 12V:

Power Connector Connects to the 4-pin power cable of a power supply unit which supplies power to the CPU.

8. Front Panel USB 2.0:

Connectors Connects to USB 2.0 ports at the front or top of a computer case.

9.Front Panel Connectors:

Connects to the power switch, reset switch, power LED, hard drive LED and front audio ports of a computer case.

10. IDE Connector:

Connects to older hard drive disks and optical drives for data transfer.

11.CMOS Battery:

Supplies power to store BIOS settings and keep the real-time clock running.

12.Southbridge:

Also known as the Input/Output Controller Hub (ICH). Chipset that allows the CPU to communicate with PCI slots, PCI-Express x 1 slots (expansion cards), SATA connectors (hard drives, optical drives), USB ports (USB devices), Ethernet ports and on-board audio.

13.SATA Connectors:

Connects to modern hard disk drives, solid state drives and optical drives for data transfer.

14. Fan Headers:

Supplies power to the CPU heat sink fan and computer case fans.

15.RAM Slots:

Insert RAM here.

16. ATX Power Connector:

Connects to the 24-pin ATX power cable of a power supply unit which supplies power to the motherboard.

17.mSATA Connector:

Connects to a mSATA solid state drive. In most cases, this SSD is used as cache to speed up hard disk drives, but it's possible to re-purpose it as a regular hard drive.

18.Front Panel USB 3.0:

Connector Connects to USB 3.0 ports at the front or top of the computer case.

19.Power & Reset Button:

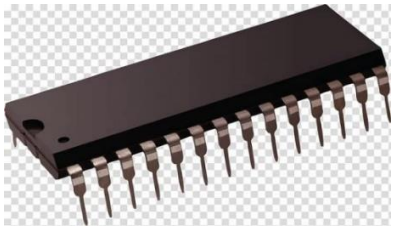
Onboard button to turn on, turn off and reboot the computer. This motherboard component is more common among high end boards.

8. RAM

Computer memory or random access memory (RAM) is your system's short-term data storage; it stores the information your computer is actively using so that it can be accessed quickly. The more programs your system is running, the more memory you'll need. RAM allows your computer to perform many of its everyday tasks, such as loading applications, browsing the internet, editing a spreadsheet, or experiencing the latest game. Memory also allows you to switch quickly among these tasks, remembering where you are in one task when you switch to another task. As a rule, the more memory you have, the better.

9. ROM

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven



Result

The program was executed and the result was successfully obtained. Thus CO2 was obtained.

Experiment No.: 2

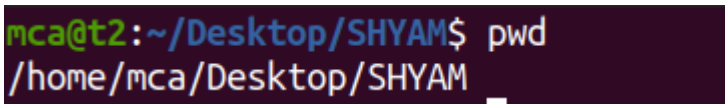
Aim : Familiarisation of Linux Commands.

CO 2: Perform System Administration task.

Procedure:

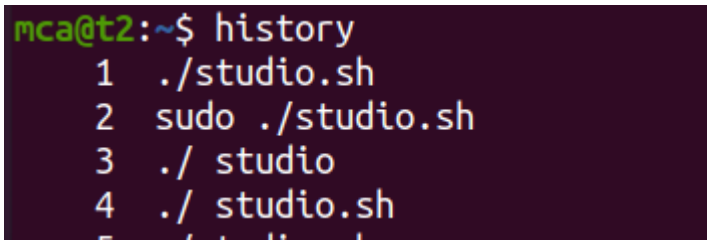
pwd (Print Working Directory)
To find out the path of the current working directory (folder) you are in.

Output Screenshot



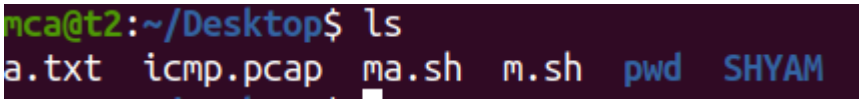
history
To review the commands you have entered before. Command number to run a command from history.

Output Screenshot

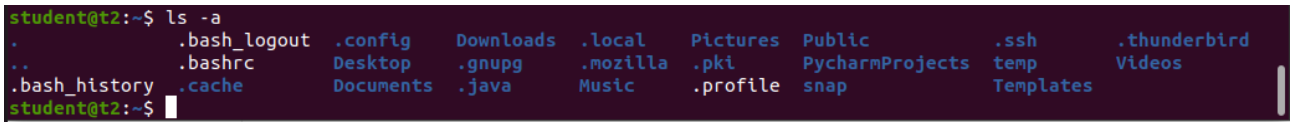


ls
The ls command is used to view the contents of a directory. By default, this command will display the contents of your current working directory.

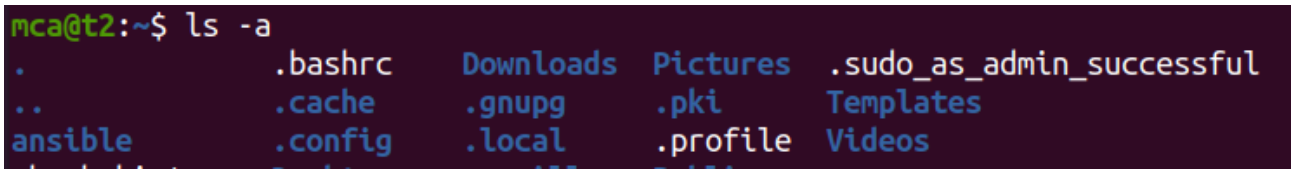
Output Screenshot



*ls -a
This will show the hidden files



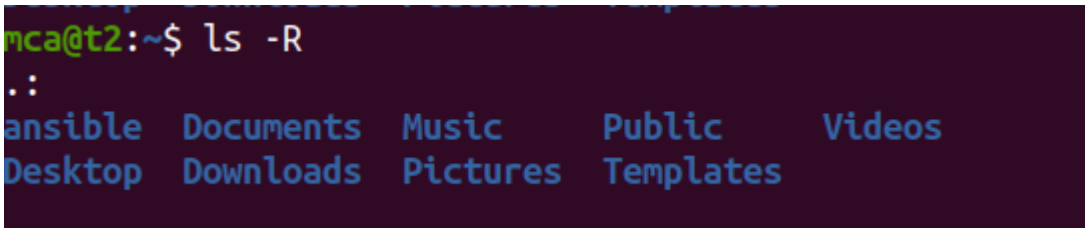
Output Screenshot



*ls -R

This will list all the files in the sub-directories as well

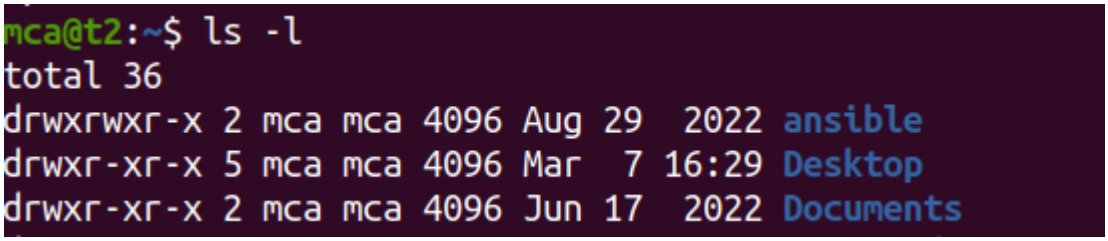
Output Screenshot



*ls –l (Long listing)

This command displays the contents of the current directory in a long listing format, one per line

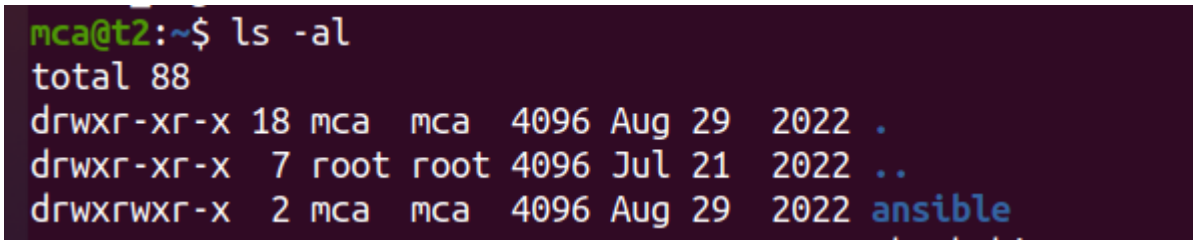
Output Screenshot



*ls -al

It will list the files and directories with detailed information like the permissions, size, owner, etc.

Output Screenshot



*ls -t

It will lists files sorted in the order of “last modified”.

Output Screenshot

```
mca@t2:~$ ls -t
Desktop   ansible    Documents  Public     Videos
Pictures  Downloads  Music      Templates
```

*ls -r
It will reverse the natural sorting order. Usually used in combination with other switches such as ls -tr. This will reverse the time-wise listing.

Output Screenshot

```
mca@t2:~$ ls -r
Videos     Public     Music      Documents  ansible
Templates  Pictures   Downloads  Desktop
```

touch
The touch command allows you to create a blank new file through the Linux command line.

Output Screenshot

```
mca@t2:~/Desktop/SHYAM$ touch xyz
```

mkdir
Use mkdir command to make a new directory. Use the p (parents) option to create a directory in between two existing directories.

Output Screenshot

```
mca@t2:~/Desktop/SHYAM$ mkdir SK
mca@t2:~/Desktop/SHYAM$ mkdir shyam
mca@t2:~/Desktop/SHYAM$ ls
record.docx  shyam  SK
```

cp file1 file2
This command is used to copy files from the current directory to a different directory.

Output Screenshot

```
student@t2:~/Shyam$ cp soccer one
student@t2:~/Shyam$ cat one
 Lewa
 Leo Messi
 Casemiro
 De Gue
 Haland
```

Cat >
To create a file.

Output Screenshot

```
student@t2:~/Shyam$ cat > DC
Batman
Superman
Aquaman
Deadpool
^Z
[1]+  Stopped                 cat > DC
```

cat>>

This command will append (add something in the last of a file) something in your already existing file.

Output Screenshot

```
student@t2:~$ cat >> xyz.txt
" K L T   6 6 6 "
^Z
[4]+  Stopped                 cat >> xyz.txt
student@t2:~$ cat xyz.txt
"S  H  Y  A  M

" K L T   6 6 6 "
```

cat filename

This command will displays the contents of a file in the terminal.

Output Screenshot

```
student@t2:~$ cat cric.txt

M S  DHONI
( C  S  K )
```

cat -n

This command will display the contents of a file in the terminal, with line numbers displayed before each line.

Output Screenshot

```
mca@t2:~/Desktop/SHYAM$ cat -n
^Z
[3]+  Stopped                 cat -n
mca@t2:~/Desktop/SHYAM$ cat -n xyz
     1  WE
     2  DN
     3  ES
     4  DAY
     5  Streaming now on NETFLIX
```

cat a b

This command displays the contents of both files in the terminal, with the contents of file "a" displayed first, followed by the contents of file "b".

Output Screenshot

```
student@t2:~$ cat cars.txt
AS RED AS A VOLKSWAGEN
student@t2:~$ cat > new.txt
^Z
[12]+  Stopped                 cat > new.txt
student@t2:~$ cat cric.txt cars.txt > new.txt
student@t2:~$ cat new.txt

 M S  DHONI
 ( C  S  K )
ROHIT SHARMA (MI)
FAF DU PLESSI (RCB)
AS RED AS A VOLKSWAGEN
```

cd

This command is used to change the current working directory to a specified directory.

Output Screenshot

```
student@t2:~$ cd shyam
student@t2:~/shyam$ pwd
```

cd ..

This command is used to change the current working directory to the previous directory.

Output Screenshot

```
student@t2:~/Shyam/SK$ cd ..
student@t2:~/Shyam$ cd ..
student@t2:~$ pwd
```

cut -b1

This command is used to extract the first byte or character of each line from a file or output, where "b" stands for "byte" and "1" refers to the first byte or character position.

Output Screenshot

```
student@t2:~/Shyam$ cut -b1 DC
B
S
A
D
```

cut -b2

Output Screenshot

```
student@t2:~/Shyam$ cut -b2 DC
a
u
q
e
```

cut –c 1,2,3

This command is used to extract the characters or column of each line from a file or output, where "c" stands for "character" and "1,2,3" refers to the column positions.

Output Screenshot

```
student@t2:~/Shyam$ cut -c 1,2,3 club
Bar
PSG
Rea
Uni
Cit
```

man

The command "man" is used to learn and understand about different commands right from the shell.

Output Screenshot

```
mca@t2:~$ man cut
mca@t2:~$
```

```
CUT(1)                          User Commands                          CUT(1)

NAME
       cut - remove sections from each line of files

SYNOPSIS
       cut OPTION... [FILE]...

DESCRIPTION
       Print selected parts of lines from each FILE to standard output.

       With no FILE, or when FILE is -, read standard input.

       Mandatory  arguments  to  long  options are mandatory for short options
       too.

       -b, --bytes=LIST
              select only these bytes

       -c, --characters=LIST
              select only these characters
```

"rmdir" command is used to remove or delete an empty directory in a file system from the command line or terminal

Output Screenshot.

```
mca@t2:~/Desktop/SHYAM$ ls
record.docx  shyam  SK
mca@t2:~/Desktop/SHYAM$ rmdir shyam
mca@t2:~/Desktop/SHYAM$ ls
record.docx  SK
```

tr a-z

To convert the content into lower case letters

Output Screenshot

```
mca@t2:~/Desktop/SHYAM$ cat xyz|tr A-Z a-z > output
mca@t2:~/Desktop/SHYAM$ cat output
we
dn
es
day
streaming now on netflix
mca@t2:~/Desktop/SHYAM$
```

paste – The command is used to join files horizontally

Output Screenshot

```
student@t2:~/Shyam$ paste soccer DC > merge
student@t2:~/Shyam$ cat merge
 Lewa    Batman
 Leo Messi       Superman
 Casemiro        Aquaman
 De Gue Deadpool
 Haland
```

1. read : read a line

$read

$ echo $REPLY

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ read
Hi Shyam
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ echo $REPLY
Hi Shyam
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

1.1. Read into variables

$ read var1 var2

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ read var1 var2
This is Sparta
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ echo "[$var1][$var2]"
[This][is Sparta]
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

1.2 read multiple lines using backslash

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ read
this\
> is\
> Sparta\
> ^Z
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ echo $REPLY
thisisSparta
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

1.3 $read -p : Prompt something in the screen

$read -p “something ”

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ read -p Place:
Place:Goa
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ echo "The Place is $REPLY"
The Place is Goa
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

1.4 $read - n: read only a specific length of characters

1.5 $read -s : read secure data like passwords

$read -s -p “Enter password”

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ read -s -p "Enter code"
Enter codeonworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ echo "CODE : $REPLY"
CODE : 123
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

2. $wc filename: display the details of file

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ cat > ph
Asus
MOto
Samsung
Nokia
^Z
[1]+  Stopped                 cat > ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ wc ph
 4  4 24 ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

2.1 $wc -l : To display number of lines

$wc -l profile

2.2 $wc -m : To display number of bytes

$wc -m profile

2.3 $wc -c : To display number of characters

$wc -c profile

2.4 $wc -w: To display number of words

$wc -w profile

2.5 $wc -L : Length of the longest line

$wc -l profile

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ wc ph
 4  4 24 ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ wc -l ph
4 ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ wc -m ph
24 ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ wc -c ph
24 ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ wc -L ph
7 ph
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

2.6 $more : command is used to view the text files in the command prompt, displaying

one screen at a time in case the file is large

$more myfile.txt

```
 in the past. In Greek Mythology, it is said that the concepts of
ial Intelligence may seem to be a new technology but if we do a bi
ill find that it has roots deep in the past. In Greek Mythology, i
concepts of AI were usedArtificial Intelligence may seem to be a n
f we do a bit of research, we will find that it has roots deep in
Mythology, it is said that the concepts of AI were usedArtificial
--More--(49%)
```

2.7 $more +/something : Search the pattern string

$more +/Deep myfile.txt

```
nworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ more +/the ai
rtificial Intelligence may seem to be a new technology but if we do a bit of researc
, we will find that it has roots deep in the past. In Greek Mythology, it is said th
t the concepts of AI were usedArtificial Intelligence may seem to be a new technolog
```

2.8 $more -d:help user to navigate , press space to continue, q to quit

$more -d myfile.txt

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ more -d ai
Artificial Intelligence may seem to be a new technology but if we do a bit of research, we will find t
hat it has roots deep in the past. In Greek Mythology, it is said that the concepts of AI were usedArt
ificial Intelligence may seem to be a new technology but if we do a bit of research, we will find that
 it has roots deep in the past. In Greek Mythology, it is said that the concepts of AI were usedArtifi
cial Intelligence may seem to be a new technology but if we do a bit of research, we will find that it
 has roots deep in the past. In Greek Mythology, it is said that the concepts of AI were usedArtificia
```

Grep - filter searches a file for a particular pattern of characters, and displays all lines that contain that pattern.

$grep amal hello.txt

Output:

```
student@t2:~/demo$ grep amal  hello.txt
amal jyothi
```

Grep -i -To perform case insensitive search

$grep -i Fluter file1 Output:

```
student@t2:~$ grep -i Flutter file1
Flutter 50
```

Grep -A1- To view the content searched along with one line after

$grep -A1 Fluter file1

Output:

```
student@t2:~$ grep -A1 Flutter file1
Flutter 50
React 15
```

Grep -B1 -To view the content searched along with one line Before

$grep -B1 Fluter file1

Output:

```
student@t2:~$ grep -B1 Flutter file1
C 30
Flutter 50
```

Grep -C1 -To view the content searched along with one line after & Before

$grep -C1 Fluter file1

Output:

```
student@t2:~$ grep -C1 Flutter file1
C 30
Flutter 50
React 15
```

Head - To display the first lines of files . By default, it shows the first 10 lines

$head car

Output:

```
student@t2:~$ head car
1
2
3
4
5
6
7
8
9
10
```

Head -number -To display the first n number of lines of files

$head -3 car

Output:

```
student@t2:~$ head -3 car
1
2
3
```

Tail -To display the last lines of files . By default, it shows the first 10 lines

$tail car

Output:

```
student@t2:~$ tail car
8
9
10
11
12
13
14
15
16
17
```

Tail -n - To display last n number of lines of files

$tail -3

car.txt

Output:

```
student@t2:~$ tail -3 car
15
16
17
```

Mv -**mv** stands for move. **mv** is used to move one or more files or directories from one place to another

```
student@t2:~/SHYAM$ cat > cars
VW
Honda
Toyota
Suzuki
KIA
^Z
[1]+  Stopped                 cat > cars
student@t2:~/SHYAM$ mv cars vehi
student@t2:~/SHYAM$ cat vehi
VW
Honda
Toyota
Suzuki
KIA
student@t2:~/SHYAM$ cat cars
cat: cars: No such file or directory
```

Mv -b -to create backup while moving file

```
student@t2:~/SHYAM$ cat > moto
African Twin
Royal Enfield
^Z
[2]+  Stopped                 cat > moto
student@t2:~/SHYAM$ mv -b moto vehi
student@t2:~/SHYAM$ cat vehi
African Twin
Royal Enfield
student@t2:~/SHYAM$ cat vehi~
VW
Honda
Toyota
Suzuki
KIA
```

Mv i -to display the prompt Warning message

$mv - i ipl ipl2

Output:

```
student@t2:~/SHYAM$ cat ipl
MI
RCB
student@t2:~/SHYAM$ cat ipl2
CSK
student@t2:~/SHYAM$ mv -i ipl ipl2
mv: overwrite 'ipl2'? y
student@t2:~/SHYAM$ cat ipl2
MI
RCB
student@t2:~/SHYAM$
```

Expr : Evaluate the given expression and display the result

```
student@t2:~/Desktop/SHYAM$ expr 12 + 7
19
student@t2:~/Desktop/SHYAM$ expr 12 - 3
9
student@t2:~/Desktop/SHYAM$ expr 5/5
5/5
```

df : Get a report on system disk space usage

```
student@t2:~/Desktop/SHYAM$ df
Filesystem     1K-blocks     Used Available Use% Mounted on
udev             3950476        0   3950476   0% /dev
tmpfs             797752     1760    795992   1% /run
/dev/sda6      143074460 27089996 108643872  20% /
tmpfs            3988752   108408   3880344   3% /dev/shm
tmpfs               5120        4      5116   1% /run/lock
```

du : used to checks how much space a file or dir takes in the current directory

```
student@t2:~/Desktop$ du DS
32      DS/linear search
36      DS/menu driven -arrays
72      DS
```

Create new user

```
mca@t2:~$ sudo useradd SHYAM
[sudo] password for mca:
mca@t2:~$ sudo useradd SHYAM
useradd: user 'SHYAM' already exists
```

Change password of new user

```
mca@t2:~$ sudo passwd SHYAM
New password:
Retype new password:
passwd: password updated successfully
```

Group Add

sudo groupadd -g identifier - The groupadd command creates a new group account

```
mca@t2:~$ sudo groupadd -g 666 Illuminati
mca@t2:~$
```

```
mca@t2:~$ sudo groupadd -g 666 Illuminati
[sudo] password for mca:
groupadd: group 'Illuminati' already exists
mca@t2:~$
```

7 Sudo usermod -G : Add user to group

```
mca@t2:~$ sudo usermod -G Illuminati SHYAM
[sudo] password for mca:
mca@t2:~$ id SHYAM
uid=6797(SHYAM) gid=6797(SHYAM) groups=6797(SHYAM),666(Illuminati)
mca@t2:~$
```

8. Compgen - To display all the groups

```
mca@t2:~$ compgen -g
root
daemon
bin
sys
adm
```

chmod : used to change the access permission of the file and directories.
It stands for change mod

Read – r

Write – w

Execute – x

```
mca@t2:~/SHYAM$ chmod +rwx tech
chmod: changing permissions of 'tech': Operation not permitted
mca@t2:~/SHYAM$ ls -l tech
-rw-rw-r-- 1 SHYAM mca 27 Mar 20 12:03 tech
mca@t2:~/SHYAM$
```

- (deny permissions)

```
mca@t2:~/SHYAM$ chmod -wx trip
mca@t2:~/SHYAM$ cat >> trip
bash: trip: Permission denied
```

+(allow permissions)

```
mca@t2:~/SHYAM$ chmod +rwx trip
mca@t2:~/SHYAM$ cat >> trip
Mumbai
Bangalore
^Z
[2]+  Stopped                 cat >> trip
mca@t2:~/SHYAM$ cat trip
Delhi
Chennai
Kolkota
Mumbai
Bangalore
mca@t2:~/SHYAM$
```

Chown : Used to change the file ownership or directory ownership for a user or group

And chown stands for change owner

```
mca@t2:~/SHYAM$ sudo chown SHYAM tech
[sudo] password for mca:
mca@t2:~/SHYAM$ ls
tech  trip
```

Delete user

```
mca@t2:~$ sudo userdel SHYAM
[sudo] password for mca:
mca@t2:~$ sudo userdel SHYAM
userdel: user 'SHYAM' does not exist
```

Delete group

```
mca@t2:~$ sudo groupdel Illuminati
mca@t2:~$ sudo groupdel Illuminati
groupdel: group 'Illuminati' does not exist
mca@t2:~$
```

$ip addr - to view the protocol address on a device.

```
mca@t2:~/SHYAM$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gr
oup default qlen 1000
    link/ether d8:5e:d3:1f:69:9f brd ff:ff:ff:ff:ff:ff
    inet 192.168.6.51/24 brd 192.168.6.255 scope global noprefixroute enp2s0
       valid_lft forever preferred_lft forever
    inet6 fe80::ae68:3705:7713:6972/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

$ssh [user]@[ipaddress] - secure shell

```
mca@t2:~/SHYAM$ ssh mca@192.168.6.51
ssh: connect to host 192.168.6.51 port 22: Connection refused
mca@t2:~/SHYAM$
```

sudo apt-get update

```
mca@t2:~/SHYAM$ sudo apt-get update
[sudo] password for mca:
Get:1 https://dl.google.com/linux/chrome/deb stable InRelease [1,811 B]
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://ppa.launchpad.net/maarten-fonville/android-studio/ubuntu focal InRe
lease [17.6 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:5 https://dl.google.com/linux/chrome/deb stable/main amd64 Packages [1,079 B
]
```

$ sudo apt-get install openssh-server

```
mca@t2:~/SHYAM$ sudo apt-get install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 682 not upgraded.
Need to get 1,359 kB of archives.
After this operation, 6,010 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

```
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/s
ystemd/system/ssh.service.
rescue-ssh.target is a disabled or a static unit, not starting it.
Processing triggers for systemd (245.4-4ubuntu3) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for ufw (0.36-6) ...
mca@t2:~/SHYAM$
```

$sudo ufw allow 22

$ssh mca@[remote ip] - to connect with a remote host

```
mca@t2:~/SHYAM$ sudo ufw allow 22
[sudo] password for mca:
Rules updated
Rules updated (v6)
mca@t2:~/SHYAM$
```

```
mca@t2:~/SHYAM$ ssh mca@192.168.6.52
The authenticity of host '192.168.6.52 (192.168.6.52)' can't be established.
ECDSA key fingerprint is SHA256:vN6E3Me3RPhkDreqLAsV58uYuIX4Fke/ZJj3VcDW3WA.
Are you sure you want to continue connecting (yes/no/[fingerprint])? y
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.6.52' (ECDSA) to the list of known hosts.
mca@192.168.6.52's password:
Welcome to Ubuntu 20.04 LTS (GNU/Linux 5.4.0-26-generic x86_64)
```

```
mca@t2:~$ ls
Desktop    Downloads  Pictures  swathy     Videos
Documents  Music      Public    Templates  world
```

$ssh-keygen - to generate key

```
mca@t2:~/SHYAM$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/mca/.ssh/id_rsa): mykey.txt
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in mykey.txt
Your public key has been saved in mykey.txt.pub
The key fingerprint is:
SHA256:t9vXW6AoovX3IDO6TEh/Zqgip+p/HI5pxZNMwtKQbUA mca@t2
The key's randomart image is:
+---[RSA 3072]----+
|.E+              |
| o o             |
|  =              |
| . + .           |
|  . * . S .   .  |
|   . X . . o . . |
|    B O O + .  ..|
|. o+ X B =.+  . o|
|==oo+ +.....o. ..|
+----[SHA256]-----+
```

```
mca@t2:~/SHYAM$ cat mykey.txt
-----BEGIN OPENSSH PRIVATE KEY-----
b3BlbnNzaC1rZXktdjEAAAAABG5vbmUAAAAEbm9uZQAAAAAAAAABAAABlwAAAAdzc2gtcn
NhAAAAAwEAAQAAAYEApqqRWXX4IkQZJTjVY2h7etdz97O72B68gjxBNlpmhi8hasCsA9ud
dx3DQ/4mLioCYGXO/e3r3FSufIxjUnfoiVkWYJid+OeNc/O28T3qRhM/bLuyWh5xdxoG4q
```

Result

The program was executed and the result was successfully obtained. Thus CO2 was obtained.

Experiment No.: 3

Aim: File system hierarchy in a common Linux distribution, file and device permissions, study of system configuration files in /etc, familiarizing log files for system events, user activity, network events.

CO2: Perform system administration tasks including network configurations, user creations and trouble shooting.

Procedure

- Check whether the tree is installed or not.

```
mca@u28:~$ tree

Command 'tree' not found, but can be installed with:

sudo snap install tree  # version 1.8.0+pkg-3fd6, or
sudo apt  install tree  # version 1.8.0-1

See 'snap info tree' for additional versions.
```

- If not,then install it.

  $sudo apt update

  $sudo apt install tree

```
mca@u28:~$ sudo apt update
[sudo] password for mca:
Get:1 https://dl.google.com/linux/chrome/deb stable InRelease [1,825 B]
Get:2 https://dl.google.com/linux/chrome/deb stable/main amd64 Packages [1,079 B]
Get:3 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:4 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
```

```
mca@u28:~$ sudo apt install tree
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  tree
0 upgraded, 1 newly installed, 0 to remove and 665 not upgraded.
Need to get 43.0 kB of archives.
```

- To display the directory structure of a given directory in a tree-like format.

  $tree

```
mca@u28:~$ tree
.
├── An Introduction to Local Area Networks.pdf
├── case.sh
├── cis192QuickRef.pdf
├── cpp1
├── cpp2
├── data.txt
```

```
mca@u28:~$ / bin
bash: /: Is a directory
mca@u28:~$ / etc
bash: /: Is a directory
mca@u28:~$
```

- Essential binary files which are accessible to all users.These files are betrayed for basic functioning and for various system operations and user interactions.

```
mca@u35:~$  tree /bin
/bin
├── [
├── aa-enabled
├── aa-exec
├── aconnect
├── acpi_listen
├── add-apt-repository
├── addpart
```

- Contains all other directories and files.

```
mca@u28:~$ tree /root
/root [error opening dir]

0 directories, 0 files
```

- Files required for boot process including kernel,boot loader and initial RAM disk.We want to load the OS and prepare the system for users.All the files required for booting are stored in boot directory.

```
mca@u28:~$ tree /boot
/boot
├── config-5.4.0-26-generic
├── efi [error opening dir]
├── grub
│   ├── fonts
│   │   └── unicode.pf2
│   ├── gfxblacklist.txt
│   ├── grub.cfg
│   ├── grubenv
│   ├── themes
│   ├── unicode.pf2
│   └── x86_64-efi
```

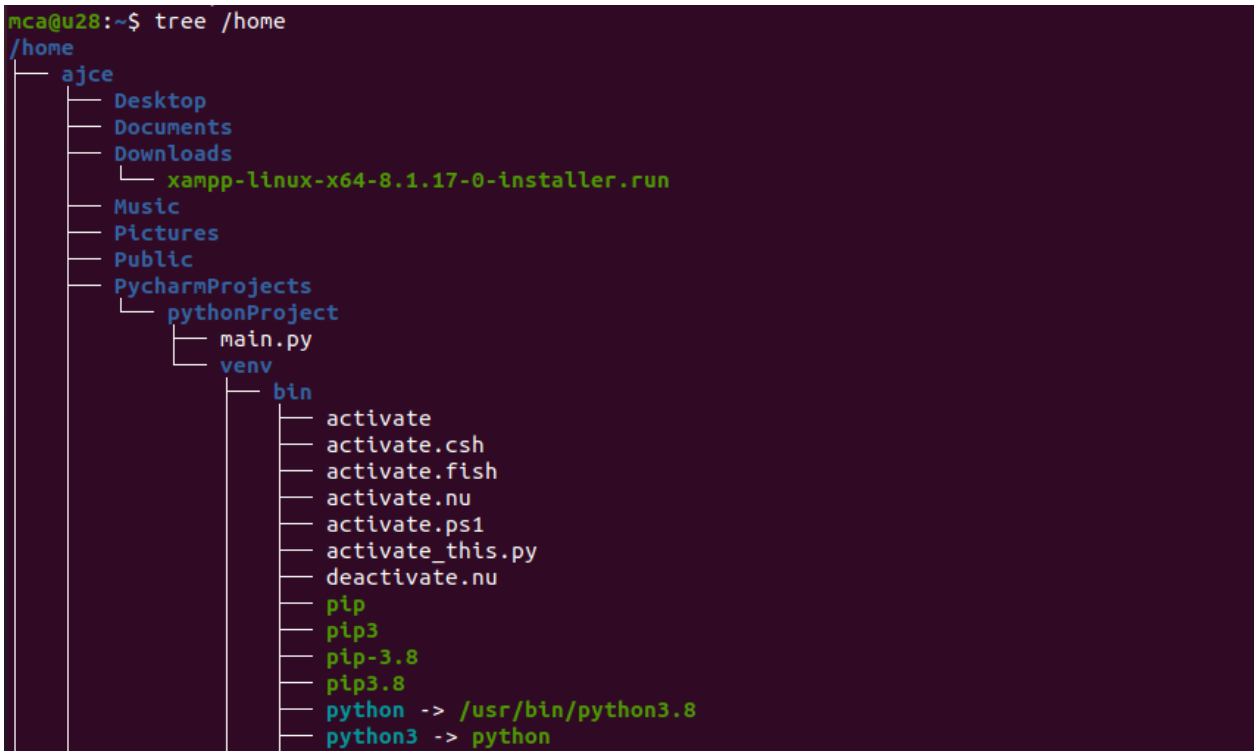
- Device files representing the physical & virtual devices such as CPU,printers,hard drives etc..

```
mca@u28:~$ tree /dev
/dev
├── autofs
├── block
│   ├── 7:0 -> ../loop0
│   ├── 7:1 -> ../loop1
│   ├── 7:10 -> ../loop10
│   ├── 7:11 -> ../loop11
```

- The system configuration files for various applications & services.Configuration files determine the behaviour,functionalities and the appearance of the software.

```
mca@u28:~$ tree /etc
/etc
├── acpi
│   ├── asus-keyboard-backlight.sh
│   ├── asus-wireless.sh
│   ├── events
```

- Home directory for the regular users.



Result:

The program was executed and the result was successfully obtained. Thus CO2 was obtained.

Experiment No.:4

Aim: Shell scripting: study bash syntax, environment variables, variables, control constructs such as if, for and while, aliases and functions, accessing command line arguments passed to shell scripts.

1. Write a shell script to count lines and words in a file
2. Shell Script to check a number is even or odd
3. Shell script to check whether a number is positive or negative
4. Shell script to find the greatest of three numbers
5. Shell Script to demonstrate String Operators
6. Shell Script to analyze people of certain age groups who are eligible for getting a suitable job if their condition and norms get satisfied using nested if statement.
7. Write a shell script to display the capital of a state using case…esac statement.
8. Write a shell script to count the number in reverse direction.
9. Write a shell script to check whether the number is palindrome or not
10. Write a shell script to check whether a given number is Armstrong or not
11. Write a shell script to check whether a number is prime or not
12. Write a shell script for factorial of a number
13. Write a shell Script to print Fibonacci series
14. Write a shell script to check if the current year is a leap year or not

CO4: Write shell scripts required for system administration.

Procedure

1.

Output

```
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ vi count.sh
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ chmod +x count.sh
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$ ./count.sh
./count.sh: line 4: /home/Shyam/abc: No such file or directory
./count.sh: line 6: $file: ambiguous redirect
./count.sh: line 6: countlines: command not found
./count.sh: line 7: $file: ambiguous redirect
./count.sh: line 7: countwords: command not found
number of lines :
umber of words :
onworks@onworks-Standard-PC-i440FX-PIIX-1996:~/Shyam$
```

2.

```
#!/bin/bash
#!/bin/bash
read -p "Enter the  number:" a

if(( $a % 2 == 0 ))
then
        echo " EVEn"
else
        echo "ODD"
fi
```

Output

```
student@t2:~/Shyam$ vi oddoreven.sh
student@t2:~/Shyam$ chmod +x oddoreven.sh
student@t2:~/Shyam$ ./oddoreven.sh
Enter the  number:7
ODD
student@t2:~/Shyam$
```

3.

```
#!/bin/bash
read -p "Enter the  number:" a

if(( $a > 0 ))
then
        echo "POSITIVE"
elif(( $a < 0 ))
then
        echo "NEGATIVe"
else
        echo "ZERO"

fi
```

Output

```
student@t2:~/Shyam$ vi pos.sh
student@t2:~/Shyam$ chmod +x pos.sh
student@t2:~/Shyam$ ./pos.sh
Enter the  number:-5
NEGATIVe
```

4

```
#!/bin/bash

read -p "Enter the first number:" a
read -p "Enter the second number:" b
read -p "Enter the third number:" c
if(( $a > $b & $a > $c ))
then
        echo "a is greatest"
elif(( $b > $a & $b > $c ))
then
        echo "b is greatest"
else
        echo "c is greatest"
fi
```

Output

```
student@t2:~/Shyam$ vi gre.sh
student@t2:~/Shyam$ chmod +x gre.sh
student@t2:~/Shyam$ ./gre.sh
Enter the first number:10
Enter the second number:20
Enter the third number:30
c is greatest
student@t2:~/Shyam$
```

5.

```
#!/bin/bash
read -p "Enter the first string :" x
read -p "Enter the seconD string :" y
if [ $x = $y ]
then
        echo "$x is equal to $y"
else
        echo "$x is not equal to $y"
fi
if [ $x != $y ]
then
        echo "$x is not equal to $y"
else
        echo "$x is equal to $y"
fi
if [ -z $y ]
then
        echo "$y 's length iS equal to 0 "
else
        echo "$y 's length is not  equal to 0 "
fi
if [ -n $x ]
then
        echo "$x 's length is not equal to 0 "
else
        echo "$x 's length is  equal to 0 "
fi
if [ $x ]
then
        echo " String ->  $x is not emptY "
else
        echo "$x is an empty string "
fi
```

Output

```
student@t2:~/Shyam$ vi stropr.sh
student@t2:~/Shyam$ chmod +x stropr.sh
student@t2:~/Shyam$ ./stropr.sh
Enter the first string :Shyam
Enter the seconD string :Krishnan
Shyam is not equal to Krishnan
Shyam is not equal to Krishnan
Krishnan 's length is not  equal to 0
Shyam 's length is not equal to 0
 String ->  Shyam is not emptY
student@t2:~/Shyam$
```

6. #!/bin/bash
echo "Enter
your age: "
read age
if ((age >= 18)); then
echo "You are eligible for job
consideration."if ((age >= 18 &&
age <= 30)); then
echo "You are in the suitable age group for
many jobs."elif ((age > 30 && age <= 40));

```
then
echo "You are in the suitable age group for mid-career
positions."else
echo "You are in the suitable age group for
senior roles."fi
else
echo "You are not eligible for job consideration
due to age."fi
```

```
Enter your age:
23
You are eligible for job consideration.
You are in the suitable age group for many jobs.
```

Output

```
student@t2:~/Desktop$ ./leap.sh
Enter the Year :- 1800
1800 is  a not Leap year
student@t2:~/Desktop$
```

7. Program

```
#!/bin/bash
read -p "Enter a number " num
temp=$num
while [ $temp -gt 0 ]
do
((rem=temp%10))
((rev=rev*10 +rem))
((temp=temp/10))
done
if [ $rev == $num ]
then
echo "number is palindrome"
else
echo "not a palindrome"
fi
```

Output:

```
mca@u32:~/newshell$ ./palin.sh
Enter a number 121
number is palindrome
mca@u32:~/newshell$ ./palin.sh
Enter a number 123
not a palindrome
mca@u32:~/newshell$
```

8.Program:

```
#!/bin/bash
read -p "Enter a Number" num
n=$num
ans=0
while [ $n -gt 0 ]
do
((r=n%10))
((ans=ans+r*r *r))
((n=n/10))
done
if [ $ans == $num ]
then
echo "number is armstrong"
else
echo "not an armstrong"
fi
```

Output

```
mca@u32:~/newshell$ ./armstrong.sh
Enter a Number153
number is armstrong
mca@u32:~/newshell$ ./armstrong.sh
Enter a Number123
not an armstrong
mca@u32:~/newshell$
```

Result

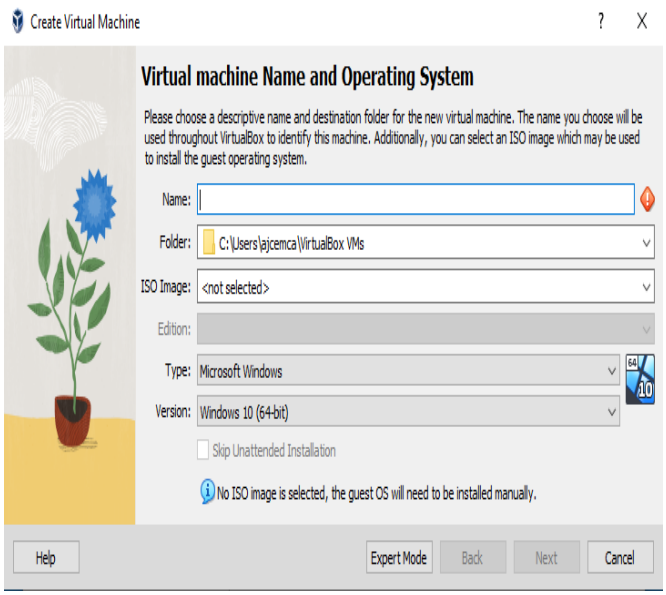
The program was executed and the result was successfully obtained Thus CO4 was obtained.

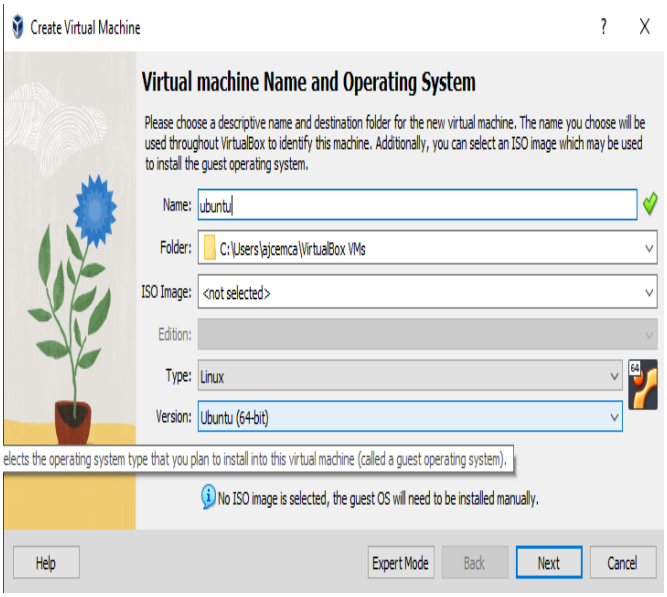
Experiment:5

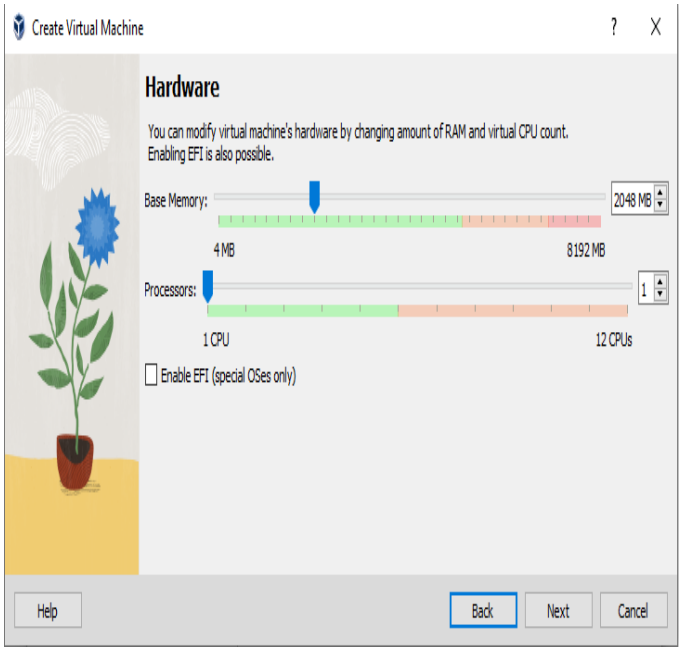
Aim:

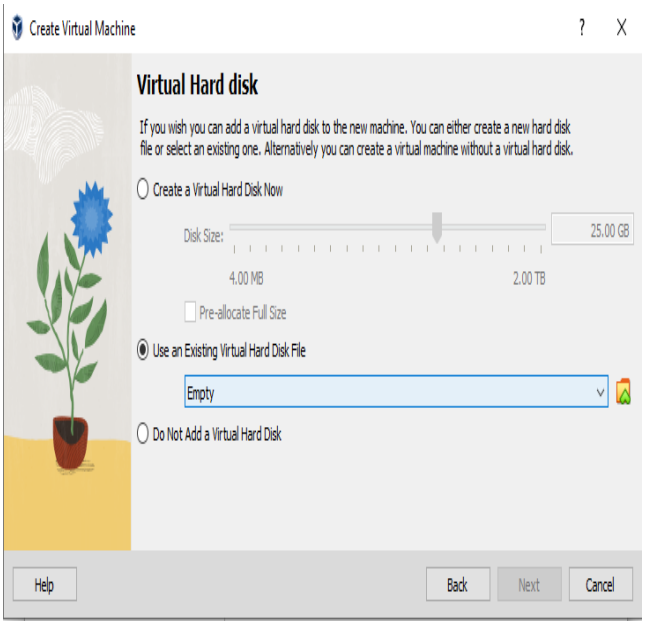
CO1: Install and configure common operating systems in virtual environment.

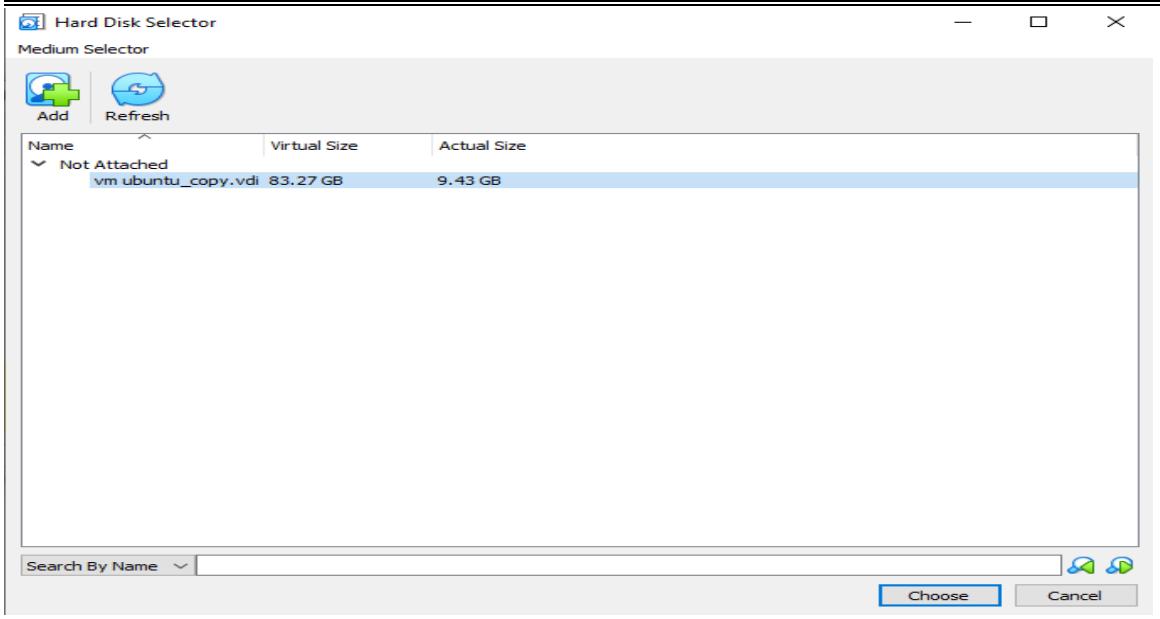
Procedure:

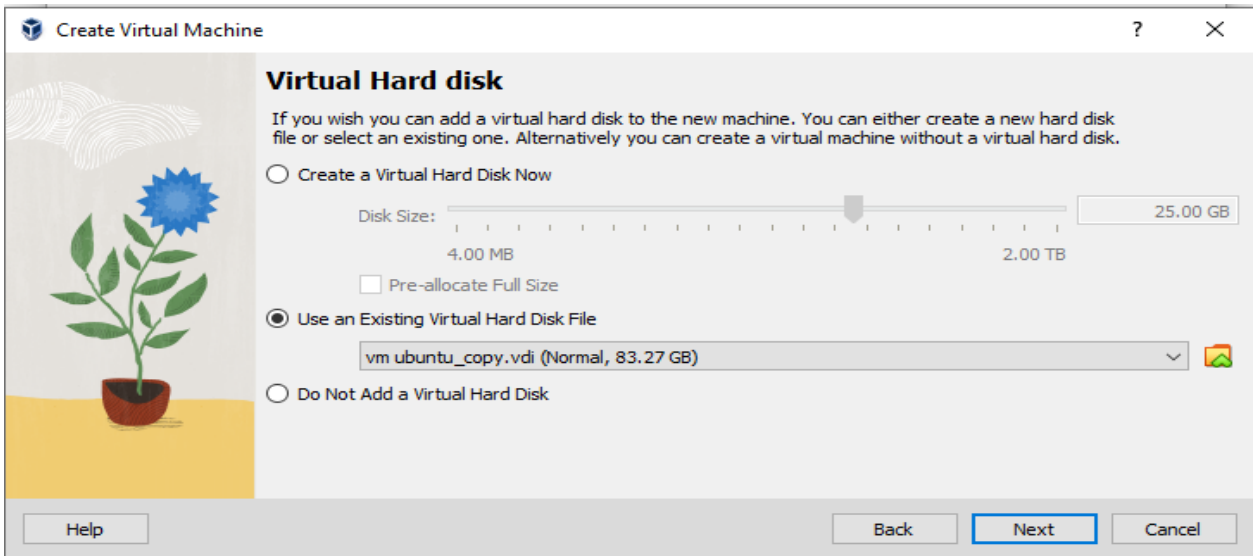


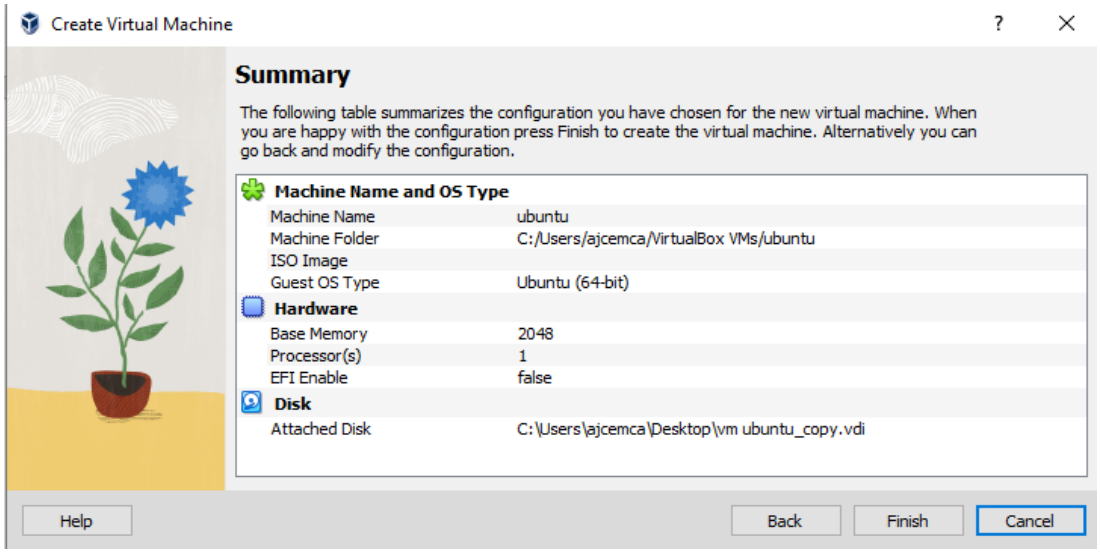


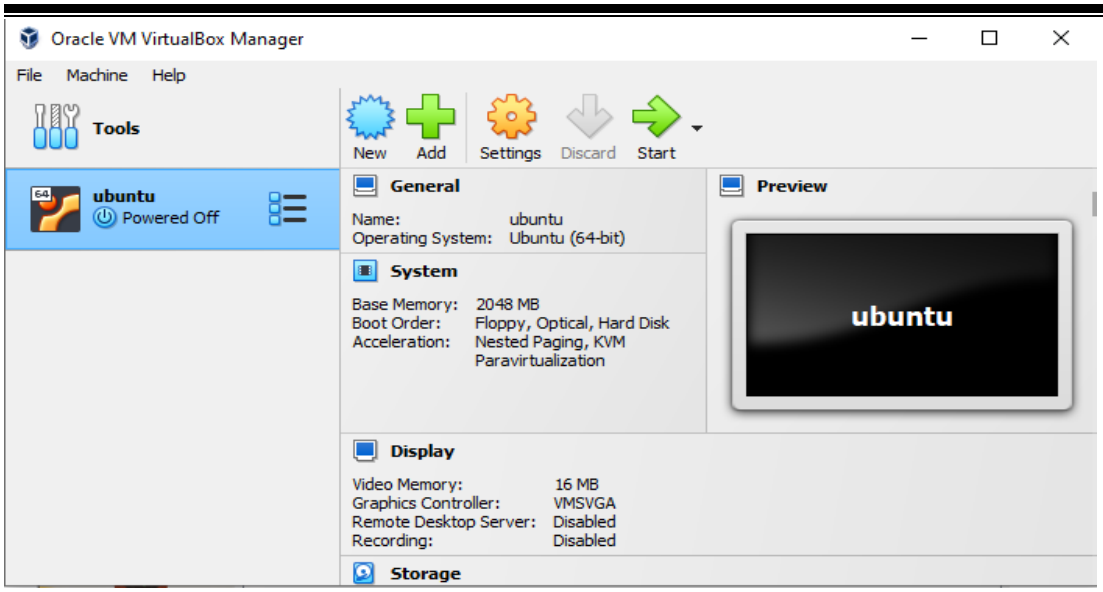


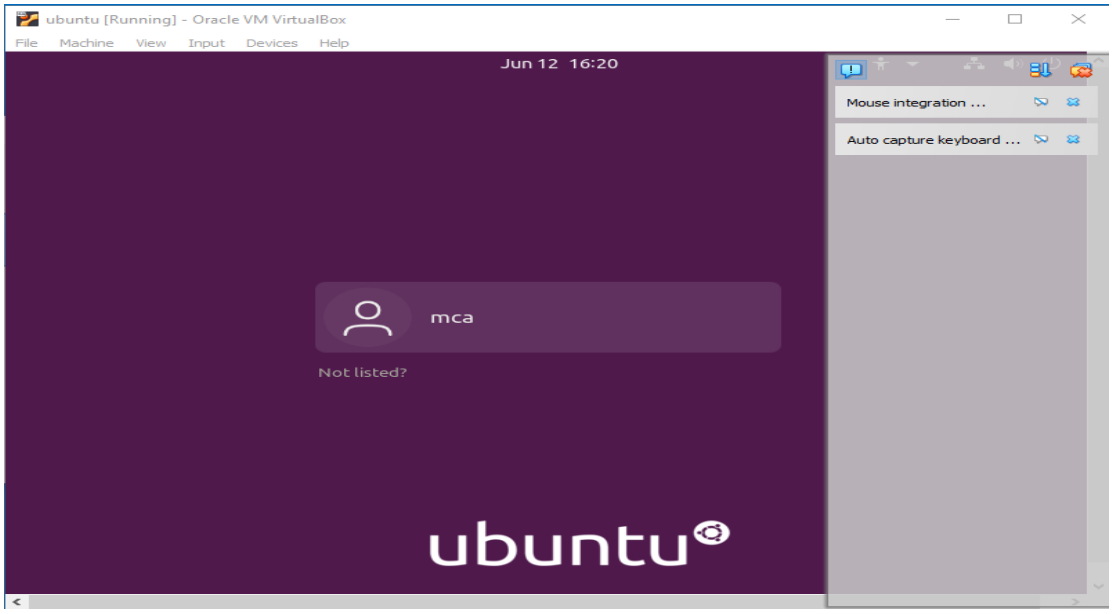


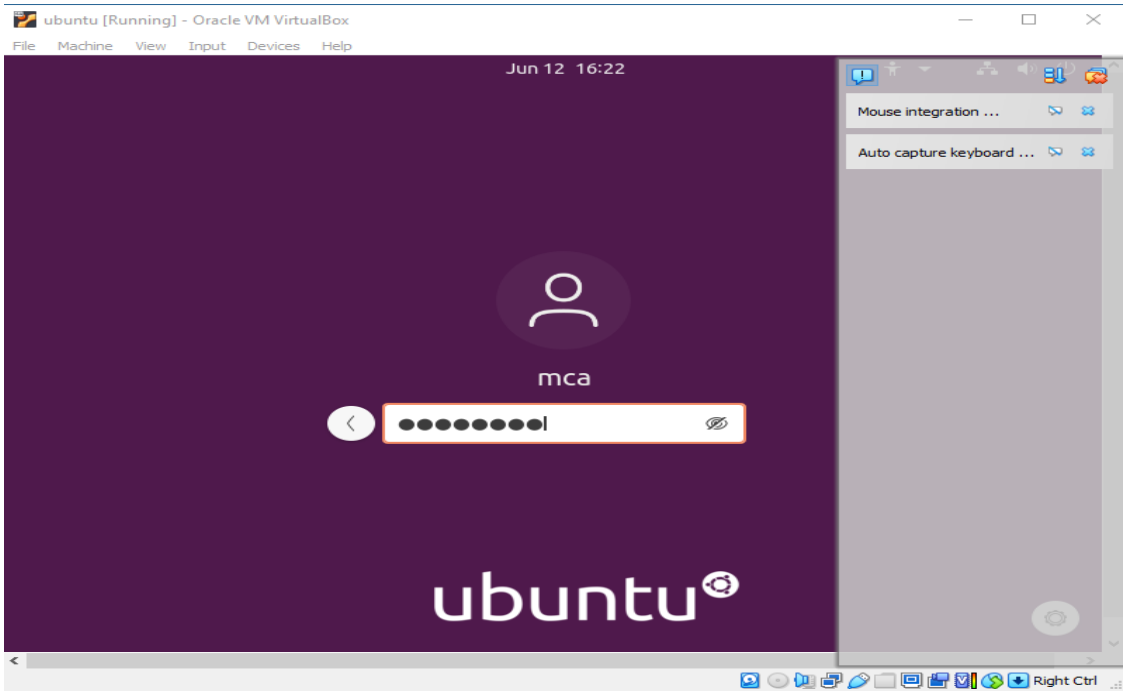

Hard Disk Selector
Medium Selector
Add
Refresh
Name
Virtual Size
Actual Size
Not Attached
vm ubuntu_copy.vdi
83.27 GB
9.43 GB
Search By Name
Choose
Cancel

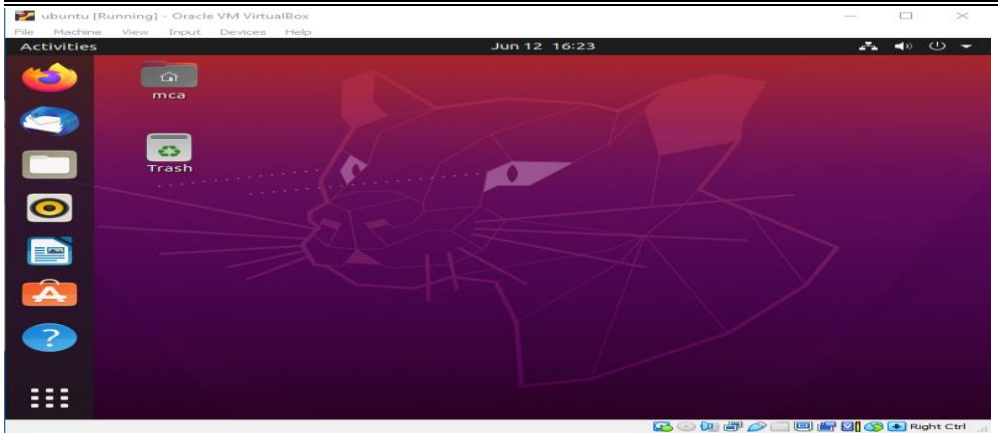

Create Virtual Machine
Virtual Hard disk
If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select an existing one. Alternatively you can create a virtual machine without a virtual hard disk.
Create a Virtual Hard Disk Now
Disk Size:
25.00 GB
4.00 MB
2.00 TB
Pre-allocate Full Size
Use an Existing Virtual Hard Disk File
vm ubuntu_copy.vdi (Normal, 83.27 GB)
Do Not Add a Virtual Hard Disk
Help
Back
Next
Cancel

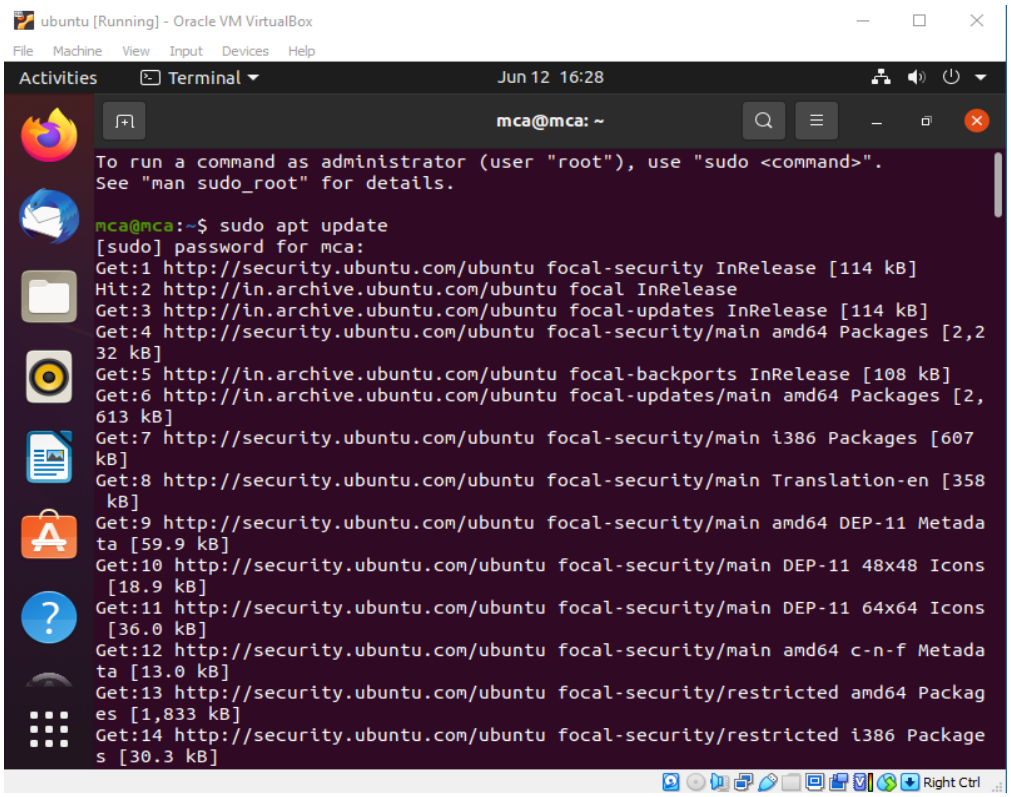

Create Virtual Machine
Summary
The following table summarizes the configuration you have chosen for the new virtual machine. When you are happy with the configuration press Finish to create the virtual machine. Alternatively you can go back and modify the configuration.
Machine Name and OS Type
Machine Name
ubuntu
Machine Folder
C:/Users/ajcemca/VirtualBox VMs/ubuntu
ISO Image
Guest OS Type
Ubuntu (64-bit)
Hardware
Base Memory
2048
Processor(s)
1
EFI Enable
false
Disk
Attached Disk
C:\Users\ajcemca\Desktop\vm ubuntu_copy.vdi
Help
Back
Finish
Cancel

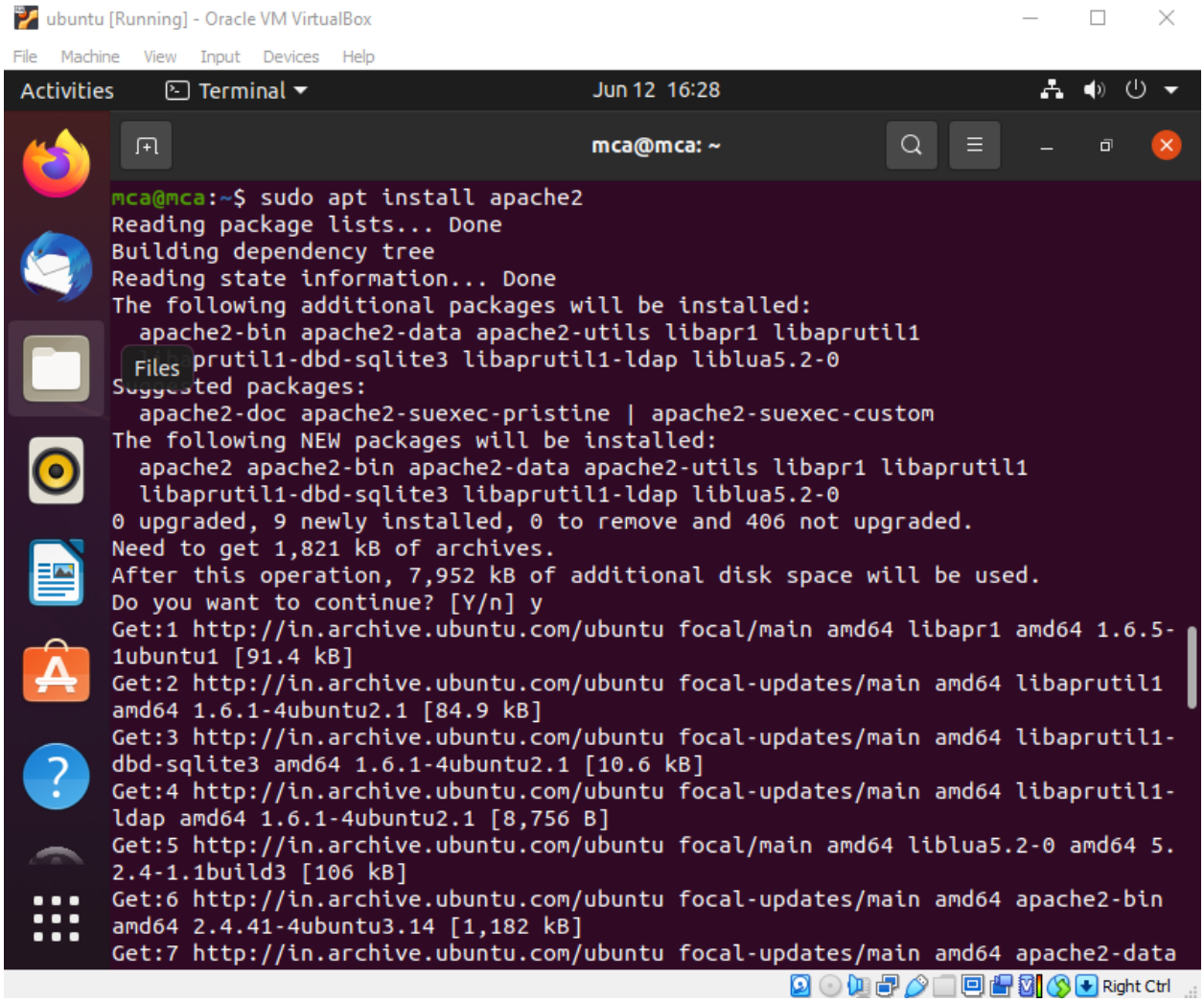

Oracle VM VirtualBox Manager
File Machine Help
Tools
New Add Settings Discard Start
ubuntu
Powered Off
General
Name: ubuntu
Operating System: Ubuntu (64-bit)
System
Base Memory: 2048 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: Nested Paging, KVM
Paravirtualization
Preview
ubuntu
Display
Video Memory: 16 MB
Graphics Controller: VMSVGA
Remote Desktop Server: Disabled
Recording: Disabled
Storage

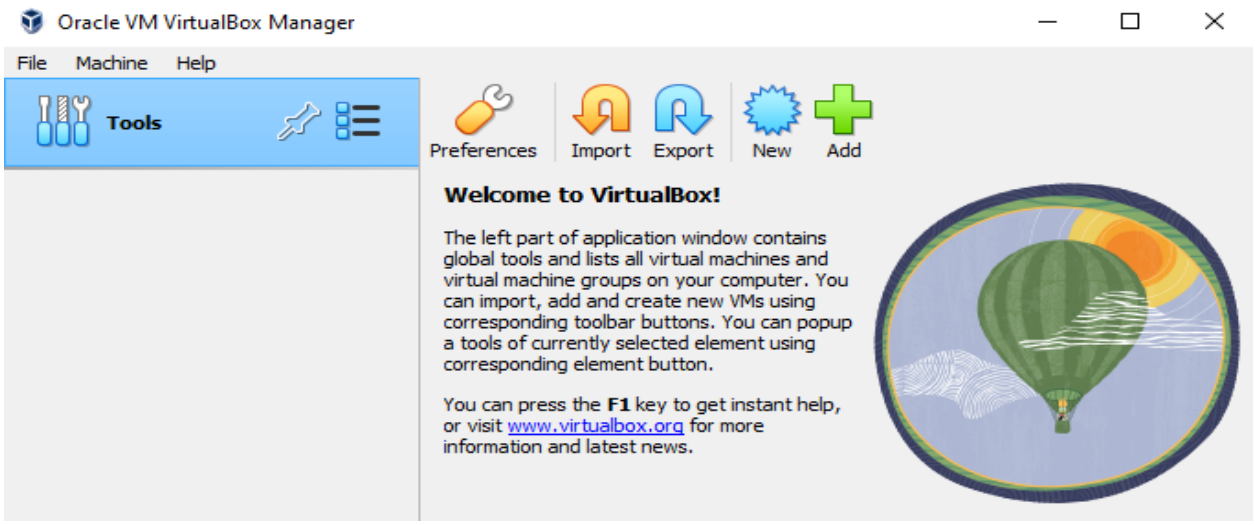

ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Jun 12 16:20
Mouse integration ...
Auto capture keyboard ...
mca
Not listed?
ubuntu


ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Jun 12 16:22
Mouse integration ...
Auto capture keyboard ...
mca
ubuntu
Right Ctrl


ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities
Jun 12 16:23
mca
Trash
Right Ctrl


ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities
Terminal
Jun 12 16:28
mca@mca: ~
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
mca@mca:~$ sudo apt update
[sudo] password for mca:
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [2,232 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [2,613 kB]
Get:7 http://security.ubuntu.com/ubuntu focal-security/main i386 Packages [607 kB]
Get:8 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [358 kB]
Get:9 http://security.ubuntu.com/ubuntu focal-security/main amd64 DEP-11 Metadata [59.9 kB]
Get:10 http://security.ubuntu.com/ubuntu focal-security/main DEP-11 48x48 Icons [18.9 kB]
Get:11 http://security.ubuntu.com/ubuntu focal-security/main DEP-11 64x64 Icons [36.0 kB]
Get:12 http://security.ubuntu.com/ubuntu focal-security/main amd64 c-n-f Metadata [13.0 kB]
Get:13 http://security.ubuntu.com/ubuntu focal-security/restricted amd64 Packages [1,833 kB]
Get:14 http://security.ubuntu.com/ubuntu focal-security/restricted i386 Packages [30.3 kB]
Right Ctrl





Result:

The program was executed and the result was successfully obtained. Thus CO1 was obtained.

Experiment:6

Aim: Installation and configuration of LAMP stack. Deploy an open source application such as phpmyadmin.

CO3: Install and manage servers for web applications.

Procedure:

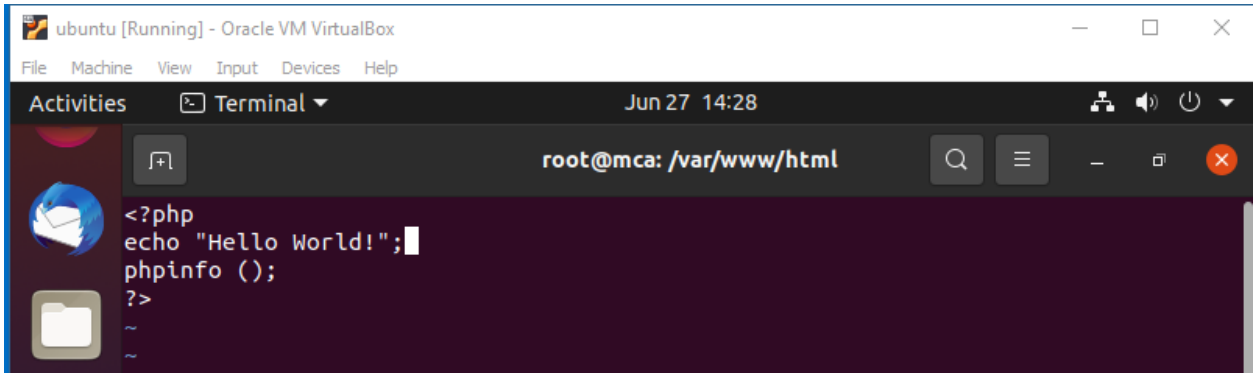
```
root@mca:/home/mca# which apache2
/usr/sbin/apache2
root@mca:/home/mca# ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
root@mca:/home/mca# cd /var
root@mca:/var# ls
backups  crash  local  log  metrics  run  spool  www
cache    lib    lock   mail  opt      snap  tmp
root@mca:/var# cd www
root@mca:/var/www# ls
html
root@mca:/var/www# cd html
root@mca:/var/www/html# ls
index.html
```

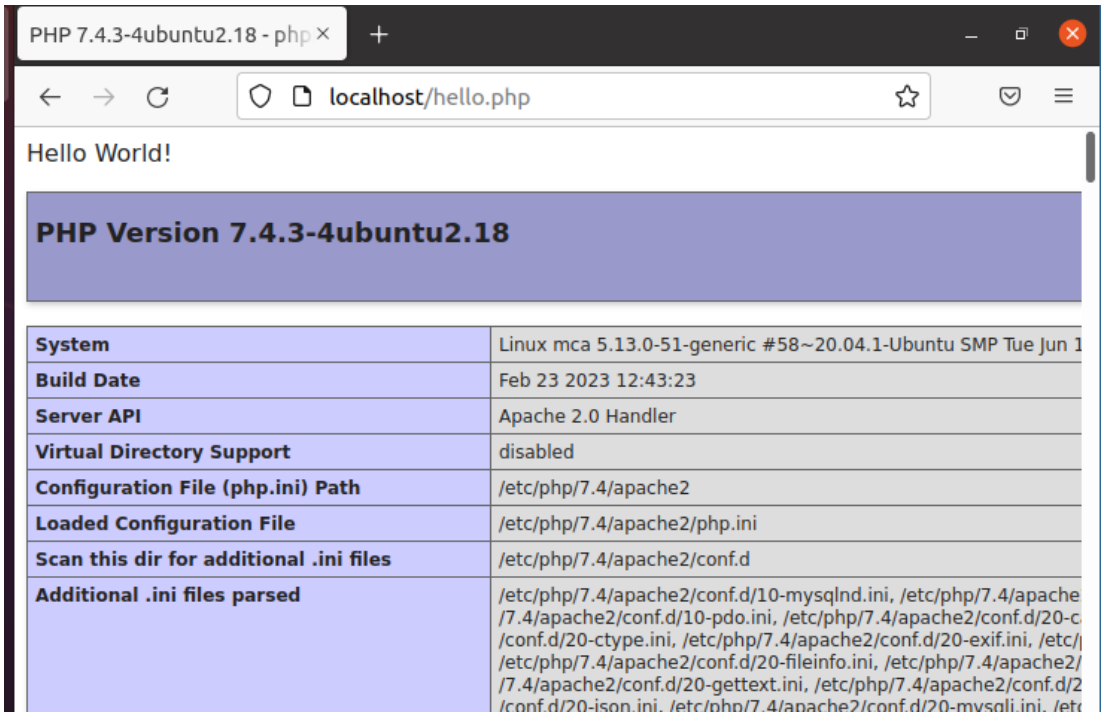
```
mca@mca:~$ sudo su
[sudo] password for mca:
root@mca:/home/mca# apt install php libapache2-mod-php php-mysql
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libapache2-mod-php7.4 php-common php7.4 php7.4-cli php7.4-common
  php7.4-json php7.4-mysql php7.4-opcache php7.4-readline
Suggested packages:
  php-pear
The following NEW packages will be installed:
  libapache2-mod-php libapache2-mod-php7.4 php php-common php-mysql php7.4
  php7.4-cli php7.4-common php7.4-json php7.4-mysql php7.4-opcache
  php7.4-readline
0 upgraded, 12 newly installed, 0 to remove and 427 not upgraded.
Need to get 4,158 kB of archives.
After this operation, 18.5 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/main amd64 php-common all 2:75
[11.9 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-commo
```

```
root@mca:/home/mca# php -v
PHP 7.4.3-4ubuntu2.18 (cli) (built: Feb 23 2023 12:43:23) ( NTS )
Copyright (c) The PHP Group
Zend Engine v3.4.0, Copyright (c) Zend Technologies
    with Zend OPcache v7.4.3-4ubuntu2.18, Copyright (c), by Zend Technologies
root@mca:/home/mca#
```

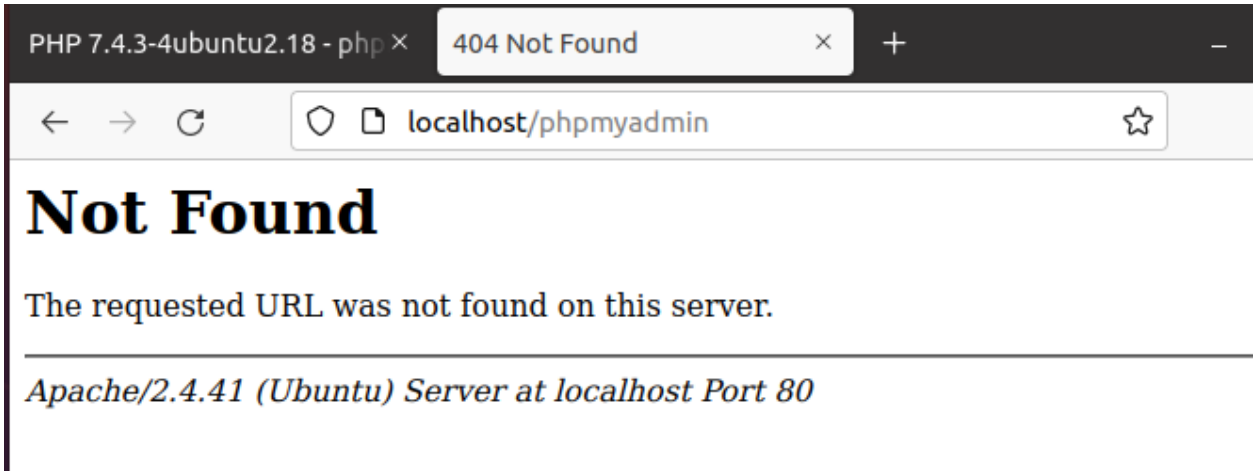
```
root@mca:/home/mca# cd /var
root@mca:/var# cd www
root@mca:/var/www# ls
html
root@mca:/var/www# cd html
```

```
root@mca:/var/www/html# vi hello.php
```





```
root@mca:/home/mca# apt install phpmyadmin -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  dbconfig-common dbconfig-mysql icc-profiles-free javascript-common
  libjs-jquery libjs-openlayers libjs-sphinxdoc libjs-underscore libonig5
  libzip5 php-bz2 php-curl php-gd php-google-recaptcha php-mbstring
  php-phpmyadmin-motranslator php-phpmyadmin-shapefile
  php-phpmyadmin-sql-parser php-phpseclib php-psr-cache php-psr-container
  php-psr-log php-symfony-cache php-symfony-cache-contracts
  php-symfony-expression-language php-symfony-service-contracts
  php-symfony-var-exporter php-tcpdf php-twig php-twig-extensions php-xml
  php-zip php7.4-bz2 php7.4-curl php7.4-gd php7.4-mbstring php7.4-xml
  php7.4-zip
Suggested packages:
  php-dbase php-libsodium php-mcrypt php-gmp
  php-symfony-service-implementation php-imagick php-twig-doc
  php-symfony-translation php-recode php-gd2 php-pragmarx-google2fa
  php-bacon-qr-code php-samyoul-u2f-php-server
Recommended packages:
  php-mcrypt
The following NEW packages will be installed:
  dbconfig-common dbconfig-mysql icc-profiles-free javascript-common
  libjs-jquery libjs-openlayers libjs-sphinxdoc libjs-underscore libonig5
```




```
root@mca:/home/mca# systemctl start apache2
root@mca:/home/mca# systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor pres>
     Active: active (running) since Tue 2023-06-27 14:05:58 IST; 29min ago
       Docs: https://httpd.apache.org/docs/2.4/
    Process: 12625 ExecReload=/usr/sbin/apachectl graceful (code=exited, statu>
   Main PID: 10556 (apache2)
      Tasks: 7 (limit: 2295)
     Memory: 13.9M
     CGroup: /system.slice/apache2.service
```

```
root@mca:/home/mca# apt update
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Fetched 336 kB in 3s (125 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
427 packages can be upgraded. Run 'apt list --upgradable' to see them.
root@mca:/home/mca# apt install phpmyadmin -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
phpmyadmin is already the newest version (4:4.9.5+dfsg1-2).
0 upgraded, 0 newly installed, 0 to remove and 427 not upgraded.
root@mca:/home/mca# systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor pres>
     Active: active (running) since Tue 2023-06-27 14:05:58 IST; 32min ago
```

```
root@mca:/home/mca# service apache2 status
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor pres>
     Active: active (running) since Tue 2023-06-27 14:05:58 IST; 33min ago
       Docs: https://httpd.apache.org/docs/2.4/
    Process: 12625 ExecReload=/usr/sbin/apachectl graceful (code=exited, statu>
   Main PID: 10556 (apache2)
      Tasks: 7 (limit: 2295)
     Memory: 14.0M
     CGroup: /system.slice/apache2.service
```

```
root@mca:/home/mca# service phpmyadmin status
Unit phpmyadmin.service could not be found.
```

```
root@mca:/home/mca# vi /etc/apache2/apache2.conf
```

```
# (the actual bytes sent including headers) instead of %b (the size of the
# requested file), because the latter makes it impossible to detect partial
# requests.
#
# Note that the use of %{X-Forwarded-For}i instead of %h is not recommended.
# Use mod_remoteip instead.
#
LogFormat "%v:%p %h %l %u %t \"%r\" %>s %O \"%{Referer}i\" \"%{User-Agent}i\""
vhost_combined
LogFormat "%h %l %u %t \"%r\" %>s %O \"%{Referer}i\" \"%{User-Agent}i\"" combin
ed
LogFormat "%h %l %u %t \"%r\" %>s %O" common
LogFormat "%{Referer}i -> %U" referer
LogFormat "%{User-agent}i" agent

# Include of directories ignores editors' and dpkg's backup files,
# see README.Debian for details.

# Include generic snippets of statements
IncludeOptional conf-enabled/*.conf
Include /etc/phpmyadmin/apache.conf
# Include the virtual host configurations:
IncludeOptional sites-enabled/*.conf

# vim: syntax=apache ts=4 sw=4 sts=4 sr noet
```

```
root@mca:/home/mca# systemctl restart apache2
root@mca:/home/mca# vi /etc/apache2/apache2.conf
root@mca:/home/mca#
```

```
root@mca:/home/mca# mysql
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.33-0ubuntu0.20.04.2 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
```
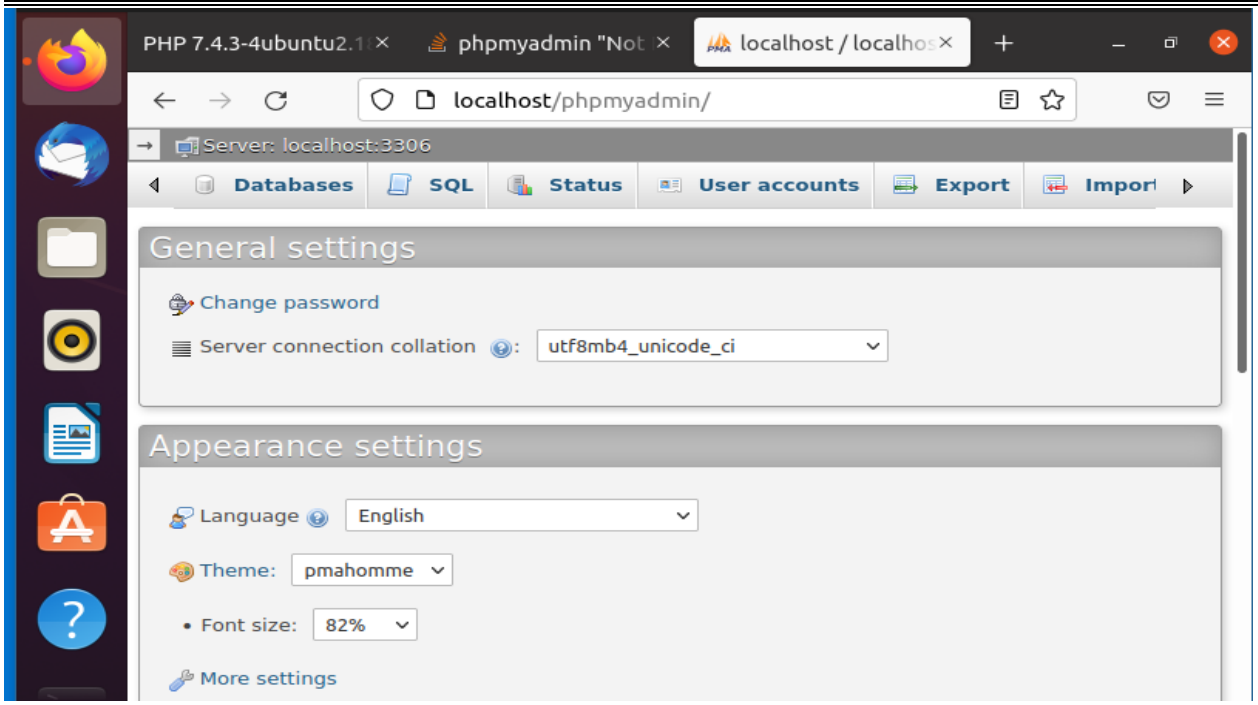

```
mysql> SHOW DATABASES;
+--------------------+
| Database           |
+--------------------+
| DATA               |
| information_schema |
| mysql              |
| performance_schema |
| sys                |
+--------------------+
5 rows in set (0.28 sec)
```

```
mysql> select user,authentication_string,plugin,host from mysql.user;
+------------------+------------------------------------------------------------
------------+-----------------------+-----------+
| user             | authentication_string
            | plugin                | host      |
+------------------+------------------------------------------------------------
------------+-----------------------+-----------+
s.*KS6TCE3ivVL69y.PKm.G.SyUyd5uVgOip8TXiALVG7oC | caching_sha2_password | local
host |
| mysql.infoschema | $A$005$THISISACOMBINATIONOFINVALIDSALTANDPASSWORDTHATMUSTN
EVERBRBEUSED | caching_sha2_password | localhost |
| mysql.session    | $A$005$THISISACOMBINATIONOFINVALIDSALTANDPASSWORDTHATMUSTN
EVERBRBEUSED | caching_sha2_password | localhost |
| mysql.sys        | $A$005$THISISACOMBINATIONOFINVALIDSALTANDPASSWORDTHATMUSTN
EVERBRBEUSED | caching_sha2_password | localhost |
| root             |
            | auth_socket           | localhost |
+------------------+------------------------------------------------------------
------------+-----------------------+-----------+
5 rows in set (0.01 sec)

mysql> alter user root@localhost identified with caching_sha2_password by "sani
la";
Query OK, 0 rows affected (0.29 sec)

mysql>
```




```
root@mca:/home/mca# apt install mysql-server -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libaio1 libcgi-fast-perl libcgi-pm-perl libevent-core-2.1-7
  libevent-pthreads-2.1-7 libfcgi-perl libhtml-template-perl libmecab2
  mecab-ipadic mecab-ipadic-utf8 mecab-utils mysql-client-8.0
  mysql-client-core-8.0 mysql-server-8.0 mysql-server-core-8.0
Suggested packages:
  libipc-sharedcache-perl mailx tinyca
The following NEW packages will be installed:
  libaio1 libcgi-fast-perl libcgi-pm-perl libevent-core-2.1-7
  libevent-pthreads-2.1-7 libfcgi-perl libhtml-template-perl libmecab2
  mecab-ipadic mecab-ipadic-utf8 mecab-utils mysql-client-8.0
  mysql-client-core-8.0 mysql-server mysql-server-8.0 mysql-server-core-8.0
```

```
root@mca:/home/mca# systemctl status mysql
● mysql.service - MySQL Community Server
     Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor preset>
     Active: active (running) since Wed 2023-06-21 16:01:24 IST; 2min 13s ago
   Main PID: 3364 (mysqld)
     Status: "Server is operational"
      Tasks: 37 (limit: 2295)
     Memory: 360.4M
     CGroup: /system.slice/mysql.service
             └─3364 /usr/sbin/mysqld

Jun 21 16:01:23 mca systemd[1]: Starting MySQL Community Server...
Jun 21 16:01:24 mca systemd[1]: Started MySQL Community Server.
lines 1-12/12 (END)
```

```
root@mca:/home/mca# mysql
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.33-0ubuntu0.20.04.2 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> CREATE DATABASE DATA;
Query OK, 1 row affected (0.03 sec)
```

```
mysql> SHOW  DATABASES;
+--------------------+
| Database           |
+--------------------+
| DATA               |
| information_schema |
| mysql              |
| performance_schema |
| sys                |
+--------------------+
5 rows in set (0.00 sec)

mysql> USE DATA;
Database changed
```

```
mysql> CREATE TABLE DATATABLE(ID INT,NAME VARCHAR(50));
Query OK, 0 rows affected (0.05 sec)

mysql>
```

Result:

The program was executed and the result was successfully obtained. Thus CO3 was obtained

Experiment:7

Aim: Build and install software from source code, familiarity with make and cmake utilities expected.

Write a program to find factorial of a number using make utility.
Write a program to add two numbers using cmake utility.
CO4: Write shell scripts required for system administration.

Procedure:

```
mca@s45:~$ make --version

Command 'make' not found, but can be installed with:

sudo apt install make        # version 4.2.1-1.2, or
sudo apt install make-guile  # version 4.2.1-1.2
```

```
mca@s45:~$ sudo apt install make
[sudo] password for mca:
Reading package lists... Done
Building dependency tree
Reading state information... Done
Suggested packages:
  make-doc
The following NEW packages will be installed:
  make
0 upgraded, 1 newly installed, 0 to remove and 663 not upgraded.
Need to get 162 kB of archives.
After this operation, 393 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu focal/main amd64 make amd64 4.2.1-1.2
[162 kB]
Fetched 162 kB in 1s (109 kB/s)
Selecting previously unselected package make.
(Reading database ... 153306 files and directories currently installed.)
Preparing to unpack .../make_4.2.1-1.2_amd64.deb ...
Unpacking make (4.2.1-1.2) ...
Setting up make (4.2.1-1.2) ...
Processing triggers for man-db (2.9.1-1) ...
```

main.cpp

```
#include<iostream>
#include "functions.h"
int main()
{
print_hello();
std::cout << std::endl;
std::cout <<"The factorial of 5 is "<< factorial(5)<< std::endl;
return 0;
}
```

function1.cpp

```
#include "functions.h"
int factorial(int n)
{
```

```
   if(n!=1)
   {
      return(n*factorial(n-1));
   }
   else return 1;
}
```

function2.cpp

```
#include<iostream>
#include "functions.h"
void print_hello()
{
   std::cout <<"hello world";
}
```

functions.h

```
void print_hello();
int factorial(int n);
```

```
mca@u35:~/Downloads/samplemake$ make
g++ main.cpp  function1.cpp function2.cpp -o hello
mca@u35:~/Downloads/samplemake$ LS
LS: command not found
mca@u35:~/Downloads/samplemake$ ls
function1.cpp  function2.cpp  functions.h  hello  main.cpp  Makefile
mca@u35:~/Downloads/samplemake$ ./hello
hello world
the factorial of 5 is 120
mca@u35:~/Downloads/samplemake$
```

```
mca@u45:~$ cmake --version
```

```
mca@u45:~$ sudo apt install cmake
Reading package lists... Done
Building dependency tree
Reading state information... Done
cmake is already the newest version (3.16.3-1ubuntu1.20.04.1).
The following packages were automatically installed and are no longer required:
  linux-headers-5.4.0-26 linux-headers-5.4.0-26-generic
  linux-image-5.4.0-26-generic linux-modules-5.4.0-26-generic
  linux-modules-extra-5.4.0-26-generic
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 317 not upgraded.
```

main.cpp

```
#include<iostream>
#include "add.h"
int main()
{
std::cout << "Sum of the given numbers is " << add(30,10)<<"\n";
```

```
return 0;
}
```

add.cpp

```
#include "add.h"
int add(int a, int b)
{
return a + b;
}
```

add.h

```
#pragma once
int add(int a, int b);
```

CMakeLists.txt

```
cmake_minimum_required(VERSION 3.16.3)
project("The numbers")
add_executable(a.out main.cpp add.cpp)
```

```
mca@u35:~$ cd Documents
mca@u35:~/Documents$ cd cmakefile
mca@u35:~/Documents/cmakefile$ ls
add.cpp  add.h  CMakeLists.txt  main.cpp
```

```
mca@u35:~/Documents/cmakefile$ cmake .
-- The C compiler identification is GNU 9.4.0
-- The CXX compiler identification is GNU 9.4.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: /home/mca/Documents/cmakefile
mca@u35:~/Documents/cmakefile$ make
Scanning dependencies of target a.out
[ 33%] Building CXX object CMakeFiles/a.out.dir/main.cpp.o
[ 66%] Building CXX object CMakeFiles/a.out.dir/add.cpp.o
[100%] Linking CXX executable a.out
[100%] Built target a.out
mca@u35:~/Documents/cmakefile$ ./a.out
Sum of the given numbers is 40
```

Result:

The program was executed and the result was successfully obtained. Thus CO4 was obtained.

Experiment:8

Aim: Introduction to command line tools for networking IPv4 networking, network commands: ping route traceroute, nslookup, ip.

CO5: Acquire skill sets required for a DevOps.

Procedure:

ifconfig : It provides information about the network interfaces on your system, including their IP addresses, MAC addresses, network masks, and other relevant details.

```
mca@u7:~/Shyam$ ifconfig
enp5s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.6.177  netmask 255.255.255.0  broadcast 192.168.6.255
        inet6 fe80::6351:f60:aede:a720  prefixlen 64  scopeid 0x20<link>
        ether 0c:9d:92:0f:6c:01  txqueuelen 1000  (Ethernet)
        RX packets 152248  bytes 185212839 (185.2 MB)
        RX errors 0  dropped 44  overruns 0  frame 0
        TX packets 44570  bytes 9680439 (9.6 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 1201  bytes 114768 (114.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1201  bytes 114768 (114.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Ping: Used to identify the connectivity between the host and server.Used for detecting devices on a network and for trouble shoot problems.

```
mca@u7:~/Shyam$ ping google.com
PING google.com (142.250.182.78) 56(84) bytes of data.
64 bytes from maa05s20-in-f14.1e100.net (142.250.182.78): icmp_seq=1 ttl=248 time=15.9 ms
64 bytes from maa05s20-in-f14.1e100.net (142.250.182.78): icmp_seq=2 ttl=248 time=15.8 ms
^C
--- google.com ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 15.828/15.880/15.933/0.052 ms
mca@u7:~/Shyam$
```

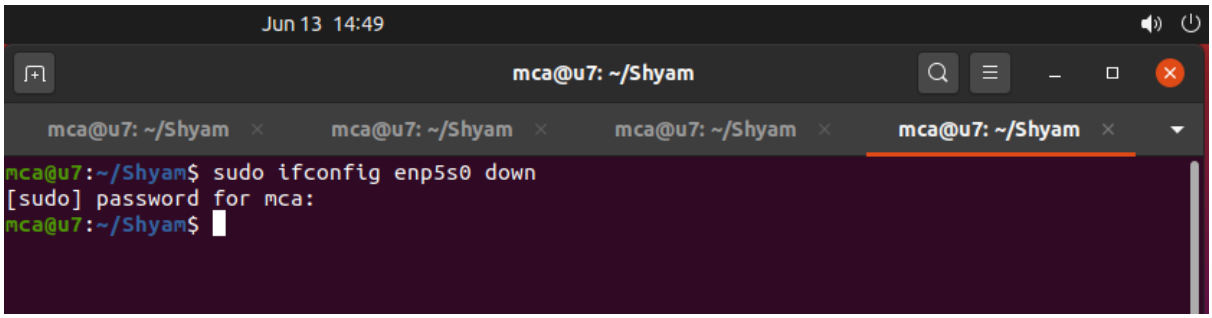
If we want to check for the connectivity of another server running on the same network then we can use ping the corresponding ip address.

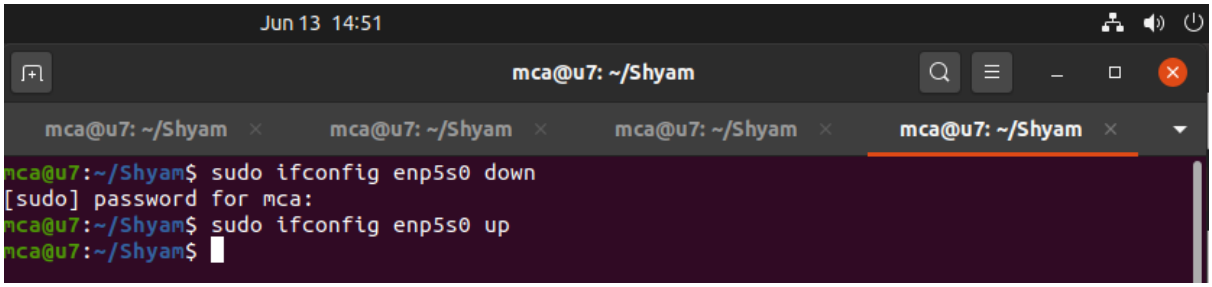
```
mca@u7:~/Shyam$ ping 192.168.6.176
PING 192.168.6.176 (192.168.6.176) 56(84) bytes of data.
64 bytes from 192.168.6.176: icmp_seq=1 ttl=64 time=0.152 ms
64 bytes from 192.168.6.176: icmp_seq=2 ttl=64 time=0.194 ms
64 bytes from 192.168.6.176: icmp_seq=3 ttl=64 time=0.205 ms
64 bytes from 192.168.6.176: icmp_seq=4 ttl=64 time=0.198 ms
```

Traceroute:traceroute command in Linux prints the route that a packet takes to reach the host. This command is useful when you want to know about the route and about all the hops that a packet takes

$ traceroute google.com

```
mca@u7:~/Shyam$ traceroute google.com
traceroute to google.com (142.250.182.78), 30 hops max, 60 byte packets
 1  _gateway (192.168.6.100)  0.721 ms  0.684 ms  0.652 ms
 2  136.232.57.109 (136.232.57.109)  1.555 ms  1.563 ms  1.734 ms
 3  172.20.97.57 (172.20.97.57)  14.642 ms  14.733 ms  14.803 ms
 4  172.27.9.126 (172.27.9.126)  16.443 ms  16.401 ms  16.656 ms
 5  172.27.9.125 (172.27.9.125)  16.081 ms  16.275 ms  16.426 ms
 6  172.27.109.51 (172.27.109.51)  16.383 ms  16.409 ms  16.349 ms
```





$ nslookup
The nslookup command is a tool used to query Domain Name System (DNS) servers and retrieve information about a specific domain or IP address.

```
mca@u7:~/Shyam$ nslookup google.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 142.250.182.78
Name:   google.com
Address: 2404:6800:4007:81f::200e

mca@u7:~/Shyam$
```

Result:

The program was executed and the result was successfully obtained. Thus CO5 was obtained.

Experiment:9

Aim: Analyzing network packet stream using tcpdump and wireshark. Perform basic network service tests using nc.

CO5: Acquire skill sets required for a DevOps.

Procedure:.

$ sudo tcpdump
It is used to capture the packets of current network interface.

```
mca@u7:~/Shyam$ sudo tcpdump
[sudo] password for mca:
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:11:55.932371 IP 192.168.6.93.50673 > 239.255.255.250.1900: UDP, length 137
15:11:55.934593 IP u7.35850 > dns.google.domain: 11065+ [1au] PTR? 250.255.255.239.in-addr.arpa. (57)
15:11:55.951072 IP dns.google.domain > u7.35850: 11065 NXDomain 0/1/1 (114)
15:11:55.951254 IP u7.35850 > dns.google.domain: 11065+ PTR? 250.255.255.239.in-addr.arpa. (46)
15:11:55.967640 IP dns.google.domain > u7.35850: 11065 NXDomain 0/1/0 (103)
```

$ sudo tcpdump -D
It is used to capture packets from available interfaces.

```
mca@u7:~/Shyam$ sudo tcpdump -D
[sudo] password for mca:
1.enp5s0 [Up, Running]
2.lo [Up, Running, Loopback]
3.any (Pseudo-device that captures on all interfaces) [Up, Running]
4.bluetooth-monitor (Bluetooth Linux Monitor) [none]
5.nflog (Linux netfilter log (NFLOG) interface) [none]
6.nfqueue (Linux netfilter queue (NFQUEUE) interface) [none]
mca@u7:~/Shyam$
```

$ sudo tcpdump -i (interface)
It is used to capture packets from a particular interface.

```
mca@u7:~/Shyam$ sudo tcpdump -i enp5s0
[sudo] password for mca:
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:21:49.337880 ARP, Request who-has 192.168.6.108 tell _gateway, length 46
15:21:49.338557 IP u7.37200 > dns.google.domain: 51582+ [1au] PTR? 108.6.168.192.in-addr.arpa. (55)
15:21:49.353939 IP dns.google.domain > u7.37200: 51582 NXDomain 0/0/1 (55)
15:21:49.354083 IP u7.37200 > dns.google.domain: 51582+ PTR? 108.6.168.192.in-addr.arpa. (44)
```

$ sudo tcpdump -c n -i enp5s0
It is used to capture n packets from a particular interface.

```
mca@u7:~/Shyam$ sudo tcpdump -c 5 -i enp5s0
[sudo] password for mca:
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:23:31.806835 STP 802.1s, Rapid STP, CIST Flags [Learn, Forward, Agreement], length 102
15:23:31.888874 ARP, Request who-has 192.168.6.145 tell _gateway, length 46
15:23:31.890594 IP u7.55355 > dns.google.domain: 30675+ [1au] PTR? 145.6.168.192.in-addr.arpa. (55)
15:23:31.898412 ARP, Request who-has 192.168.6.134 tell _gateway, length 46
15:23:31.898427 ARP, Request who-has 192.168.6.109 tell _gateway, length 46
5 packets captured
26 packets received by filter
0 packets dropped by kernel
mca@u7:~/Shyam$
```

$ sudo tcpdump -A -i interface
To display in ASCII format.

```
mca@u7:~/Shyam$ sudo tcpdump -A -i enp5s0
[sudo] password for mca:
Sorry, try again.
[sudo] password for mca:
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:27:22.565685 ARP, Request who-has 192.168.6.128 tell _gateway, length 46
..........kT....d.............................
15:27:22.571269 IP u7.35711 > dns.google.domain: 22578+ [1au] PTR? 128.6.168.192.in-addr.arpa. (55)
```

$ sudo tcpdump -XX -i interface
To display in Hexadecimal format

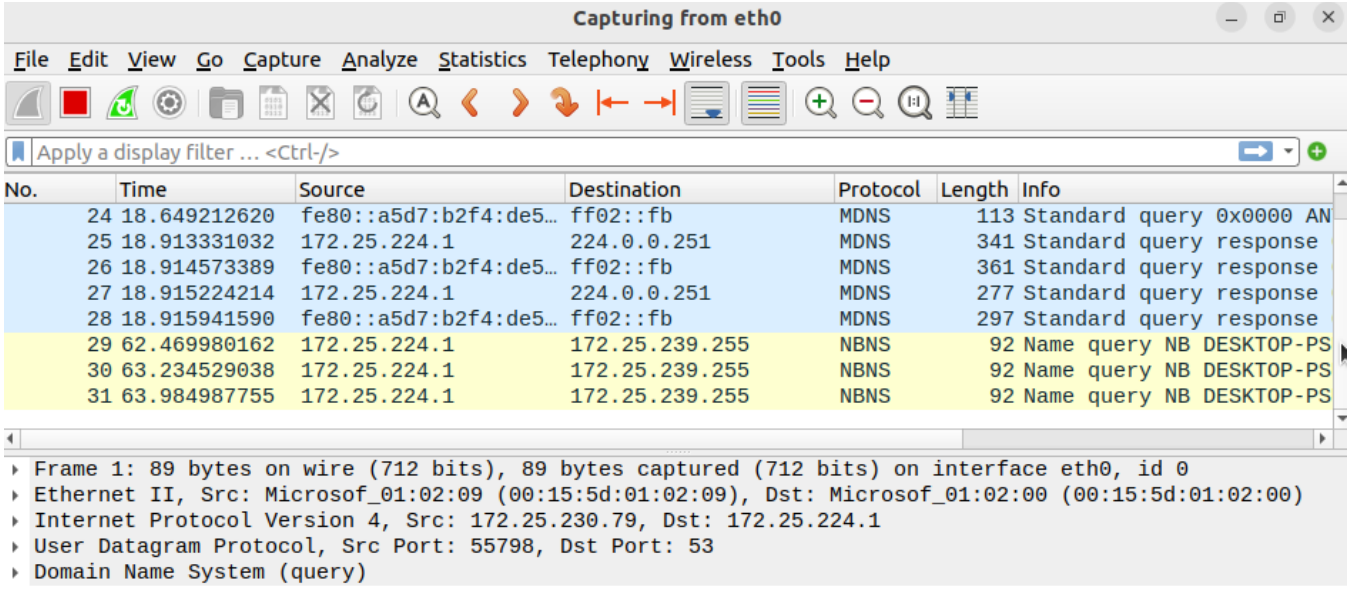
```
mca@u7:~/Shyam$  sudo tcpdump -XX -i enp5s0
[sudo] password for mca:
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
15:33:27.331202 IP6 fe80::3cc0:6374:b947:c12a > ff02::1:ff57:ff97: ICMP6, neighbor solicitation, who
 has fe80::10e6:6cd:3f57:ff97, length 32
        0x0000:  3333 ff57 ff97 0862 66c7 ce4d 86dd 6000  33.W...bf..M..`.
        0x0010:  0000 0020 3aff fe80 0000 0000 0000 3cc0  ....:.........<.
        0x0020:  6374 b947 c12a ff02 0000 0000 0000 0000  ct.G.*..........
        0x0030:  0001 ff57 ff97 8700 cded 0000 0000 fe80  ...W............
        0x0040:  0000 0000 0000 10e6 06cd 3f57 ff97 0101  ..........?W....
        0x0050:  0862 66c7 ce4d                           .bf..M
15:33:27.332592 IP u7.57790 > dns.google.domain: 42081+ [1au] PTR? 7.9.f.f.7.5.f.f.1.0.0.0.0.0.0.0
.0.0.0.0.0.0.0.0.0.0.2.0.f.f.ip6.arpa. (101)
```

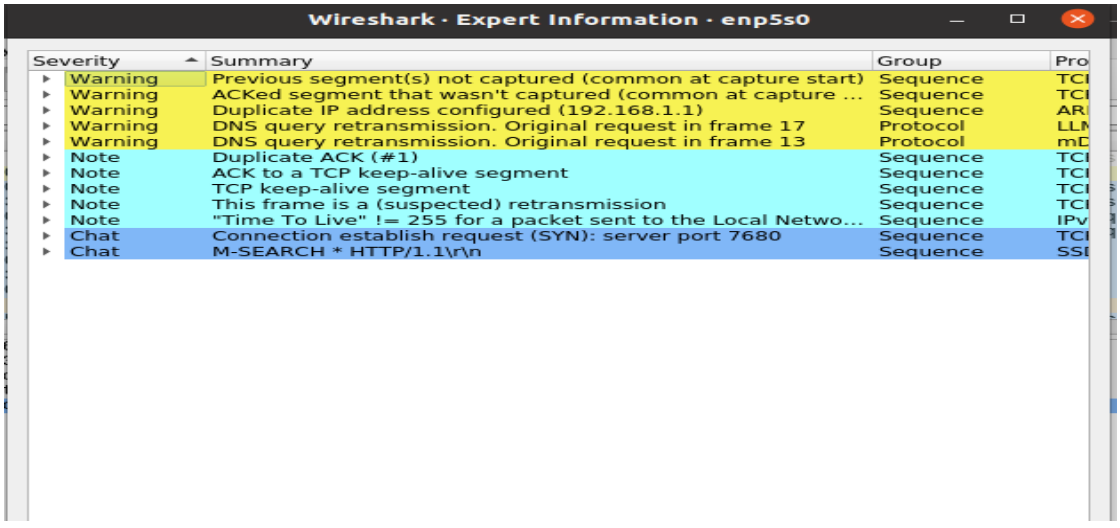
$ sudo tcpdump -w ab.pcap -i interface

```
mca@u7:~/Shyam$ sudo tcpdump -w ab.pcap -i enp5s0
[sudo] password for mca:
tcpdump: listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
^Z
[1]+  Stopped                 sudo tcpdump -w ab.pcap -i enp5s0
mca@u7:~/Shyam$ ls
ab.pcap
mca@u7:~/Shyam$ sudo tcpdump -w ab.txt -i enp5s0
tcpdump: listening on enp5s0, link-type EN10MB (Ethernet), capture size 262144 bytes
^Z
[2]+  Stopped                 sudo tcpdump -w ab.txt -i enp5s0
mca@u7:~/Shyam$ ls
ab.pcap  ab.txt
mca@u7:~/Shyam$
```

Install wireshark

```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libbcg729-0 libc-ares2 libdouble-conversion3 liblua5.2-0 libmd4c0 libminizip1 libpcre2-16-0
  libqt5core5a libqt5dbus5 libqt5gui5 libqt5multimedia5 libqt5multimedia5-plugins
  libqt5multimediagsttools5 libqt5multimediawidgets5 libqt5network5 libqt5printsupport5 libqt5svg5
  libqt5widgets5 libsmi2ldbl libsnappy1v5 libspandsp2 libssh-gcrypt-4 libwireshark-data libwireshark1
  libwiretap12 libwsutil13 libxcb-xinerama0 libxcb-xinput0 qt5-gtk-platformtheme qttranslations5-l10n
  wireshark-common wireshark-qt
Suggested packages:
```





Result:

The program was executed and the result was successfully obtained. Thus CO5 was obtained.

Experiment:10

Aim: Installation of KVM and perform basic KVM Commands.

CO3: Install and manage servers for web applications.

Procedure:

```
root@u35:/home/mca# egrep -c '(vmx|svm)' /proc/cpuinfo
6
root@u35:/home/mca#
```

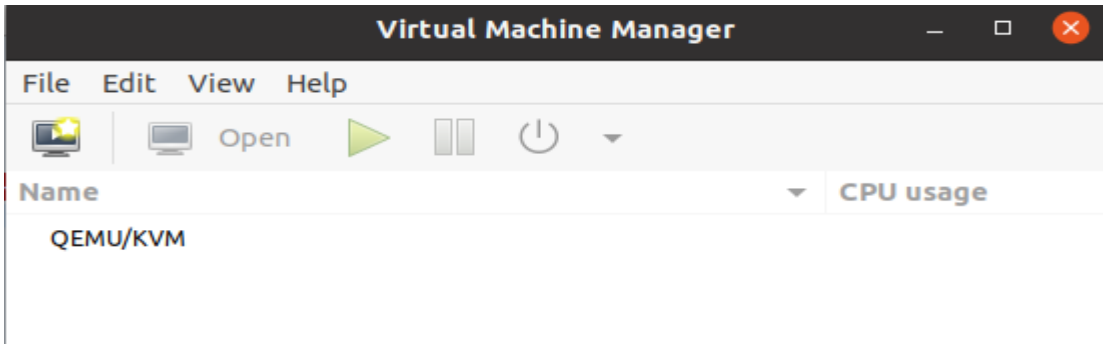
```
root@u35:/home/mca# sudo apt-get install qemu-kvm libvirt-daemon-system libvirt-clients bridge-utils virt-manager
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  cpu-checker dmeventd gir1.2-appindicator3-0.1 gir1.2-gtk-vnc-2.0
  gir1.2-libosinfo-1.0 gir1.2-libvirt-glib-1.0 gir1.2-spiceclientglib-2.0
  gir1.2-spiceclientgtk-3.0 i965-va-driver ibverbs-providers
  intel-media-va-driver ipxe-qemu ipxe-qemu-256k-compat-efi-roms libaio1
  libcacard0 libdevmapper-event1.02.1 libdrm-amdgpu1 libfdt1 libgovirt-common
  libgovirt2 libgtk-vnc-2.0-0 libgvnc-1.0-0 libibverbs1 libigdgmm11 libiscsi7
  libllvm12 liblvm2cmd2.03 libnss-mymachines libnss-systemd libosinfo-1.0-0
  libpam-systemd libphodav-2.0-0 libphodav-2.0-common libpmem1 librados2
  librbd1 librdmacm1 libreadline5 libslirp0 libspice-client-glib-2.0-8
  libspice-client-gtk-3.0-5 libspice-server1 libsystemd0 libusbredirhost1
  libusbredirparser1 libva-x11-2 libva2 libvirglrenderer1 libvirt-daemon
  libvirt-daemon-driver-qemu libvirt-daemon-driver-storage-rbd
  libvirt-daemon-system-systemd libvirt-glib-1.0-0 libvirt0 libxml2-utils lvm2
  mesa-va-drivers msr-tools osinfo-db ovmf python3-distutils python3-lib2to3
  python3-libvirt python3-libxml2 qemu-block-extra qemu-system-common
  qemu-system-data qemu-system-gui qemu-system-x86 qemu-utils seabios
```

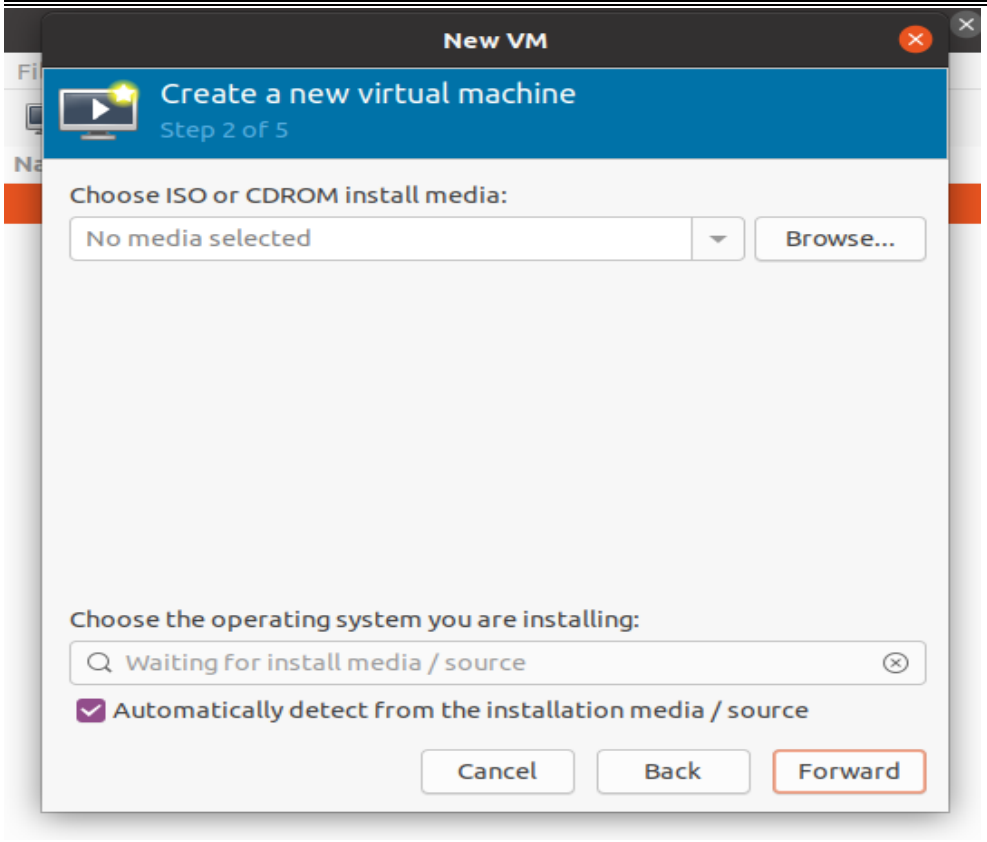
```
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 systemd-times
yncd amd64 245.4-4ubuntu3.22 [28.1 kB]
```

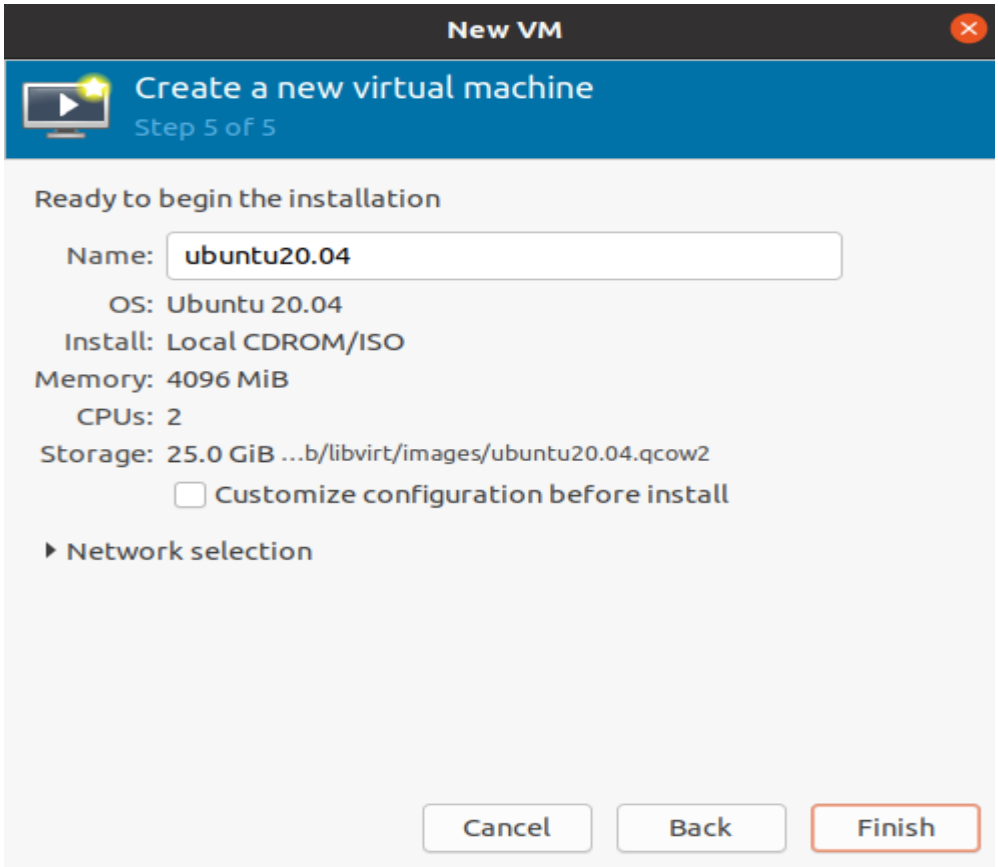
```
root@u35:/home/mca# sudo modprobe vhost net
root@u35:/home/mca# lsmod |grep vhost
vhost                  49152  0
```

```
root@u35:/home/mca# echo "vhost_net" |sudo tee -a /etc/modules
vhost_net
root@u35:/home/mca# virt-manager

Command 'virt-manager' not found, but can be installed with:

apt install virt-manager

root@u35:/home/mca# apt install virt-manager
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  gir1.2-appindicator3-0.1 gir1.2-gtk-vnc-2.0 gir1.2-libosinfo-1.0
  gir1.2-libvirt-glib-1.0 gir1.2-spiceclientglib-2.0 gir1.2-spiceclientgtk-3.0
  i965-va-driver intel-media-va-driver libdrm-amdgpu1 libgovirt-common
  libgovirt2 libgtk-vnc-2.0-0 libgvnc-1.0-0 libigdgmm11 libllvm12
```

```
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/main amd64 gir1.2-appindicator3-0.
1 amd64 12.10.1+20.04.20200408.1-0ubuntu1 [3,448 B]
Get:2 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 libgvnc-1.0-0 amd64
 1.0.0-1build1 [56.4 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 libgtk-vnc-2.0-0 am
d64 1.0.0-1build1 [25.9 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 gir1.2-gtk-vnc-2.0
```




New VM
Create a new virtual machine
Step 2 of 5
Choose ISO or CDROM install media:
No media selected
Browse...
Choose the operating system you are installing:
Waiting for install media / source
Automatically detect from the installation media / source
Cancel
Back
Forward


New VM
Create a new virtual machine
Step 5 of 5
Ready to begin the installation
Name: ubuntu20.04
OS: Ubuntu 20.04
Install: Local CDROM/ISO
Memory: 4096 MiB
CPUs: 2
Storage: 25.0 GiB ...b/libvirt/images/ubuntu20.04.qcow2
Customize configuration before install
Network selection
Cancel
Back
Finish

```
mca@u35:~/Desktop$ sudo virsh
Welcome to virsh, the virtualization interactive terminal.

Type:  'help' for help with commands
       'quit' to quit

virsh # list
 Id   Name          State
----------------------------
 2    ubuntu20.04   running

virsh #
```

```
virsh # nodeinfo
CPU model:           x86_64
CPU(s):              6
CPU frequency:       800 MHz
CPU socket(s):       1
Core(s) per socket:  6
Thread(s) per core:  1
NUMA cell(s):        1
Memory size:         7989888 KiB

virsh #
```

sudo apt update

```
mca@u37:~$ sudo apt-get update
[sudo] password for mca:
Get:1 https://dl.google.com/linux/chrome/deb stable InRelease [1,825 B]
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:4 https://dl.google.com/linux/chrome/deb stable/main amd64 Packages [1,081 B]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
```

sudo apt install qemu-kvm libvirt-daemon-system libvirt-clients bridge-utils

```
mca@u37:~$ sudo apt install qemu-kvm libvirt-daemon-system libvirt-clients bridge-utils
Reading package lists... Done
Building dependency tree
Reading state information... Done
libvirt-clients is already the newest version (6.0.0-0ubuntu8.16).
libvirt-daemon-system is already the newest version (6.0.0-0ubuntu8.16).
The following packages were automatically installed and are no longer required:
  gir1.2-appindicator3-0.1 gir1.2-gtk-vnc-2.0 gir1.2-libosinfo-1.0 gir1.2-libvirt-glib-1.0 gir1.2-spiceclientglib-2.0
```

virsh list --all :- To verify

```
mca@u37:~$ virsh list --all
 Id   Name          State
----------------------------
 1    ubuntu20.04   running
```

sudo apt install virt-manager

```
mca@u37:~$ sudo systemctl enable --now libvirtd
```

sudo systemctl enable --now libvirtd

```
mca@u37:~$ sudo systemctl enable --now libvirtd
```

sudo virt-manager

```
mca@u37:~$ sudo virt-manager
[sudo] password for mca:
mca@u37:~$
```

1. sudo virsh list

```
mca@u7:~/Shyam$ sudo virsh list
 Id   Name    State
----------------------
 3    Shyam   running
```

2. sudo virsh list –all

```
mca@u7:~/Shyam$ sudo virsh list --all
 Id   Name            State
-------------------------------
 3    Shyam           running
 -    ubuntu20.04-2   shut off
```

3. sudo virsh nodeinfo

```
mca@u7:~/Shyam$ virsh nodeinfo
CPU model:           x86_64
CPU(s):              6
CPU frequency:       3873 MHz
CPU socket(s):       1
Core(s) per socket:  6
Thread(s) per core:  1
NUMA cell(s):        1
Memory size:         7977496 KiB
```

4. sudo virsh help list

```
mca@u7:~/Shyam$ virsh help list
  NAME
    list - list domains

  SYNOPSIS
    list [--inactive] [--all] [--transient] [--persistent] [--with-snapshot] [--wi
--state-running] [--state-paused] [--state-shutoff] [--state-other] [--autostart]
ve] [--uuid] [--name] [--table] [--managed-save] [--title]

  DESCRIPTION
    Returns list of domains.
```

5. sudo virsh start <vmname>

```
mca@u7:~/Shyam$ virsh start Shyam
Domain Shyam started
```

6. sudo virsh reboot <vmname>

```
mca@u7:~/Shyam$ virsh reboot Shyam
Domain Shyam is being rebooted
```

7. sudo virsh dominfo <vmname>

```
mca@u7:~/Shyam$ virsh dominfo Shyam
Id:             3
Name:           Shyam
UUID:           3f978065-ffd2-417b-b7bd-cdd32979473b
OS Type:        hvm
State:          running
CPU(s):         2
```

8. sudo virsh suspend <vmname>

```
mca@u7:~/Shyam$ virsh suspend Shyam
Domain Shyam suspended
```

9. sudo virsh resume <vmname>

```
mca@u7:~/Shyam$ virsh resume Shyam
Domain Shyam resumed
```

10.sudo virsh shutdown <vmname>

```
mca@u7:~/Shyam$ virsh shutdown Shyam
Domain Shyam is being shutdown
```

11.sudo virsh destroy <vmname>

```
mca@u7:~/Shyam$ virsh destroy Shyam
Domain Shyam destroyed

mca@u7:~/Shyam$ virsh list --all
 Id   Name            State
--------------------------------
 -    Shyam           shut off
 -    ubuntu20.04-2   shut off
```

12.sudo virsh undefine --domain <vmname> --remove-all-storage

```
mca@u7:~/Shyam$ sudo virsh undefine --domain Shyam --remove-all-storage
[sudo] password for mca:
Domain Shyam has been undefined
Volume 'vda'(/var/lib/libvirt/images/Shyam.qcow2) removed.

mca@u7:~/Shyam$ virsh list --all
 Id   Name            State
--------------------------------
 -    ubuntu20.04-2   shut off
```

Result:

The program was executed and the result was successfully obtained. Thus CO3 was obtained.

Experiment:11

Aim: Docker, installation and deployment.

CO3: Install and manage servers for web applications.

Procedure:

apt update
Yum install Update -y

root@ip-172-31-42-7:/home/ec2-user

```
Microsoft Windows [Version 10.0.19045.3086]
(c) Microsoft Corporation. All rights reserved.

C:\Users\ajcemca\Downloads>ssh -i "newkeypr.pem" ec2-user@ec2-13-127-43-42.ap-south-1.compute.amazonaws.com
The authenticity of host 'ec2-13-127-43-42.ap-south-1.compute.amazonaws.com (13.127.43.42)' can't be established.
ECDSA key fingerprint is SHA256:pvW1Atv1Q8fLSkg8K8HmJoV910AK51SQW7AT+1s2ee0.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-13-127-43-42.ap-south-1.compute.amazonaws.com,13.127.43.42' (ECDSA) to the list of known hosts.

       __|  __|_  )
       _|  (     /   Amazon Linux 2 AMI
      ___|\___|___|

https://aws.amazon.com/amazon-linux-2/
[ec2-user@ip-172-31-42-7 ~]$ sudo su
[root@ip-172-31-42-7 ec2-user]# apt update
bash: apt: command not found
[root@ip-172-31-42-7 ec2-user]# yum  update -y
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
No packages marked for update
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# which docker
/usr/bin/which: no docker in (/sbin:/bin:/usr/sbin:/usr/bin)
[root@ip-172-31-42-7 ec2-user]#
```

Yum install docker -y

```
[root@ip-172-31-42-7 ec2-user]# yum install docker -y
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
amzn2-core
Resolving Dependencies
--> Running transaction check
---> Package docker.x86_64 0:20.10.23-1.amzn2.0.1 will be installed
--> Processing Dependency: runc >= 1.0.0 for package: docker-20.10.23-1.amzn2.0.1.x86_64
--> Processing Dependency: libcgroup >= 0.40.rc1-5.15 for package: docker-20.10.23-1.amzn2.0.1.x86_64
--> Processing Dependency: containerd >= 1.3.2 for package: docker-20.10.23-1.amzn2.0.1.x86_64
--> Processing Dependency: pigz for package: docker-20.10.23-1.amzn2.0.1.x86_64
--> Running transaction check
---> Package containerd.x86_64 0:1.6.19-1.amzn2.0.1 will be installed
---> Package libcgroup.x86_64 0:0.41-21.amzn2 will be installed
---> Package pigz.x86_64 0:2.3.4-1.amzn2.0.1 will be installed
---> Package runc.x86_64 0:1.1.7-1.amzn2 will be installed
--> Finished Dependency Resolution

Dependencies Resolved
```

```
Installed:
  docker.x86_64 0:20.10.23-1.amzn2.0.1

Dependency Installed:
  containerd.x86_64 0:1.6.19-1.amzn2.0.1        libcgroup.x86_64 0:0.41-21.amzn2        pigz.x86_64 0:2.3.4-1.amzn2.0.1        runc.x86_64 0:1.1.7-1.amzn2

Complete!
[root@ip-172-31-42-7 ec2-user]#
```

```
================================================================================================================================================
 Package                              Arch                          Version                                Repository                          Size
================================================================================================================================================
Installing:
 docker                               x86_64                        20.10.23-1.amzn2.0.1                   amzn2extra-docker                   41 M
Installing for dependencies:
 containerd                           x86_64                        1.6.19-1.amzn2.0.1                     amzn2extra-docker                   27 M
 libcgroup                            x86_64                        0.41-21.amzn2                          amzn2-core                          66 k
 pigz                                 x86_64                        2.3.4-1.amzn2.0.1                      amzn2-core                          81 k
 runc                                 x86_64                        1.1.7-1.amzn2                          amzn2extra-docker                  2.9 M

Transaction Summary
================================================================================================================================================
Install  1 Package (+4 Dependent packages)

Total download size: 72 M
Installed size: 272 M
Downloading packages:
(1/5): libcgroup-0.41-21.amzn2.x86_64.rpm                                                                  |  66 kB  00:00:00
(2/5): pigz-2.3.4-1.amzn2.0.1.x86_64.rpm                                                                   |  81 kB  00:00:00
(3/5): containerd-1.6.19-1.amzn2.0.1.x86_64.rpm                                                            |  27 MB  00:00:00
(4/5): docker-20.10.23-1.amzn2.0.1.x86_64.rpm                                                              |  41 MB  00:00:00
(5/5): runc-1.1.7-1.amzn2.x86_64.rpm                                                                       | 2.9 MB  00:00:00
------------------------------------------------------------------------------------------------------------------------------------------------
Total                                                                                  74 MB/s |  72 MB  00:00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : runc-1.1.7-1.amzn2.x86_64                                                                                                   1/5
  Installing : containerd-1.6.19-1.amzn2.0.1.x86_64                                                                                        2/5
  Installing : libcgroup-0.41-21.amzn2.x86_64                                                                                              3/5
  Installing : pigz-2.3.4-1.amzn2.0.1.x86_64                                                                                               4/5
  Installing : docker-20.10.23-1.amzn2.0.1.x86_64                                                                                          5/5
  Verifying  : containerd-1.6.19-1.amzn2.0.1.x86_64                                                                                        1/5
  Verifying  : pigz-2.3.4-1.amzn2.0.1.x86_64                                                                                               2/5
  Verifying  : docker-20.10.23-1.amzn2.0.1.x86_64                                                                                          3/5
  Verifying  : runc-1.1.7-1.amzn2.x86_64                                                                                                   4/5
  Verifying  : libcgroup-0.41-21.amzn2.x86_64                                                                                              5/5
```

```
Installed:
  docker.x86_64 0:20.10.23-1.amzn2.0.1

Dependency Installed:
  containerd.x86_64 0:1.6.19-1.amzn2.0.1        libcgroup.x86_64 0:0.41-21.amzn2        pigz.x86_64 0:2.3.4-1.amzn2.0.1

Complete!
[root@ip-172-31-42-7 ec2-user]#
```

Docker – version

```
[root@ip-172-31-42-7 ec2-user]# docker -- version
Client:
 Version:           20.10.23
 API version:       1.41
 Go version:        go1.18.9
 Git commit:        7155243
 Built:             Tue Apr 11 22:56:36 2023
 OS/Arch:           linux/amd64
 Context:           default
 Experimental:      true
Cannot connect to the Docker daemon at unix:///var/run/docker.sock. Is the docker daemon running?
[root@ip-172-31-42-7 ec2-user]#
```

Docker info.

```
[root@ip-172-31-42-7 ec2-user]# docker info
Client:
 Context:    default
 Debug Mode: false
 Plugins:
  buildx: Docker Buildx (Docker Inc., 0.0.0+unknown)

Server:
ERROR: Cannot connect to the Docker daemon at unix:///var/run/docker.sock. Is the docker daemon running?
errors pretty printing info
```

Service docker start

```
[root@ip-172-31-42-7 ec2-user]# service docker  start
Redirecting to /bin/systemctl start docker.service
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# service docker  status
Redirecting to /bin/systemctl status docker.service
● docker.service - Docker Application Container Engine
   Loaded: loaded (/usr/lib/systemd/system/docker.service; disabled; vendor preset: disabled)
   Active: active (running) since Fri 2023-06-23 10:13:41 UTC; 2min 7s ago
     Docs: https://docs.docker.com
  Process: 3525 ExecStartPre=/usr/libexec/docker/docker-setup-runtimes.sh (code=exited, status=0/SUCCESS)
  Process: 3523 ExecStartPre=/bin/mkdir -p /run/docker (code=exited, status=0/SUCCESS)
 Main PID: 3528 (dockerd)
    Tasks: 7
   Memory: 20.6M
   CGroup: /system.slice/docker.service
           └─3528 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock --default-ulimit nofile=32768:65536

Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.627299351Z" level=info msg="ClientConn switching balancer ...le=grpc
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.659002099Z" level=warning msg="Your kernel does not suppor...weight"
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.659450134Z" level=warning msg="Your kernel does not suppor...device"
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.659919940Z" level=info msg="Loading containers: start."
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.812390380Z" level=info msg="Default bridge (docker0) is as...ddress"
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.860804771Z" level=info msg="Loading containers: done."
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.876213908Z" level=info msg="Docker daemon" commit=6051f14 ...0.10.23
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.876773054Z" level=info msg="Daemon has completed initialization"
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal systemd[1]: Started Docker Application Container Engine.
Jun 23 10:13:41 ip-172-31-42-7.ap-south-1.compute.internal dockerd[3528]: time="2023-06-23T10:13:41.899565742Z" level=info msg="API listen on /run/docker.sock"
Hint: Some lines were ellipsized, use -l to show in full.
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker images
REPOSITORY   TAG         IMAGE ID   CREATED   SIZE
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker  ps -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker pull ubuntu
Using default tag: latest
latest: Pulling from library/ubuntu
6b851dcae6ca: Pull complete
Digest: sha256:6120be6a2b7ce665d0cbddc3ce6eae60fe94637c6a66985312d1f02f63cc0bcd
Status: Downloaded newer image for ubuntu:latest
docker.io/library/ubuntu:latest
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker images
REPOSITORY   TAG       IMAGE ID       CREATED        SIZE
ubuntu       latest    99284ca6cea0   2 weeks ago    77.8MB
[root@ip-172-31-42-7 ec2-user]#
```

docker run -it ubuntu /bin/bash

```
[root@ip-172-31-42-7 ec2-user]# docker run -it ubuntu /bin/bash
root@66e5a86be6a8:/# exit
exit
[root@ip-172-31-42-7 ec2-user]# docker ds
docker: 'ds' is not a docker command.
See 'docker --help'
[root@ip-172-31-42-7 ec2-user]# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
[root@ip-172-31-42-7 ec2-user]# docker ps -a
CONTAINER ID   IMAGE     COMMAND       CREATED             STATUS                     PORTS     NAMES
66e5a86be6a8   ubuntu    "/bin/bash"   About a minute ago   Exited (0) 50 seconds ago            serene_leakey
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker run -it --name sobin ubuntu /bin/bash
root@25e5ba69b542:/# exit
exit
[root@ip-172-31-42-7 ec2-user]# docker ps -a
CONTAINER ID   IMAGE     COMMAND       CREATED          STATUS                     PORTS     NAMES
25e5ba69b542   ubuntu    "/bin/bash"   23 seconds ago   Exited (0) 4 seconds ago             sobin
66e5a86be6a8   ubuntu    "/bin/bash"   4 minutes ago    Exited (0) 3 minutes ago             serene_leakey
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker run -it --name solo nginx /bin/bash
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
5b5fe70539cd: Pull complete
441a1b465367: Pull complete
3b9543f2b500: Pull complete
ca89ed5461a9: Pull complete
b0e1283145af: Pull complete
4b98867cde79: Pull complete
4a85ce26214d: Pull complete
Digest: sha256:593dac25b7733ffb7afe1a72649a43e574778bf025ad60514ef40f6b5d606247
Status: Downloaded newer image for nginx:latest
```

```
Status: Downloaded newer image for nginx:latest
root@113a7cce74a6:/# exit
exit
[root@ip-172-31-42-7 ec2-user]# docker ps -a
CONTAINER ID   IMAGE     COMMAND                  CREATED         STATUS                     PORTS     NAMES
113a7cce74a6   nginx     "/docker-entrypoint.…"   56 seconds ago   Exited (0) 4 seconds ago             solo
25e5ba69b542   ubuntu    "/bin/bash"              2 minutes ago    Exited (0) 2 minutes ago             sobin
66e5a86be6a8   ubuntu    "/bin/bash"              6 minutes ago    Exited (0) 6 minutes ago             serene_leakey
[root@ip-172-31-42-7 ec2-user]#
```

```
[root@ip-172-31-42-7 ec2-user]# docker start solo
solo
[root@ip-172-31-42-7 ec2-user]# docker attach solo
root@113a7cce74a6:/# cat > file
hello welcome^Z
[1]+  Stopped                 cat > file
root@113a7cce74a6:/# cat file
root@113a7cce74a6:/# cat >file1.txt
hello welcome
^Z
[2]+  Stopped                 cat > file1.txt
root@113a7cce74a6:/# cat file.txt
cat: file.txt: No such file or directory
root@113a7cce74a6:/# cat file1.txt
hello welcome
root@113a7cce74a6:/# ls
bin   dev                  docker-entrypoint.sh  file       home  lib32  libx32  mnt  proc  run   srv  tmp  var
boot  docker-entrypoint.d  etc                   file1.txt  lib   lib64  media   opt  root  sbin  sys  usr
root@113a7cce74a6:/#
```

```
root@113a7cce74a6:/# apt install apache2
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3 libaprutil1-ldap libgdbm-compat4 libgdbm6 libgpm2 libjansson4 liblua5.3-0
  libncursesw6 libperl5.36 libproc2-0 libsqlite3-0 media-types netbase perl perl-modules-5.36 procps psmisc ssl-cert
```

```
Setting up procps (2:4.0.2-3) ...
Setting up netbase (6.4) ...
Setting up apache2-data (2.4.57-2) ...
Setting up libgdbm6:amd64 (1.23-3) ...
Setting up libaprutil1:amd64 (1.6.3-1) ...
Setting up libaprutil1-ldap:amd64 (1.6.3-1) ...
Setting up libaprutil1-dbd-sqlite3:amd64 (1.6.3-1) ...
Setting up libgdbm-compat4:amd64 (1.23-3) ...
Setting up libperl5.36:amd64 (5.36.0-7) ...
Setting up apache2-utils (2.4.57-2) ...
Setting up perl (5.36.0-7) ...
```

```
root@113a7cce74a6:/# which apache2
/usr/sbin/apache2
root@113a7cce74a6:/#
```

Result:

The program was executed and the result was successfully obtained. Thus CO3 was obtained.