Computer Science Fundamentals & Career Pathways

Course – BTech CSE Core

Section – A

Course Code - ETCCCP105

Assignment Number 02: Basics of Linux and Open-Source Tools

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Roll No. – 2501010119

Semester: 1

Linux is an open-source operating system (OS)—just like Windows or macOS—but it is free to use, modify, and distribute. Linux is based on Unix. It is open-source, meaning anyone can view or change its code. It is known for being secure, fast, and stable. Ubuntu is one of the popular Linux Distributions.

Steps to Install Ubuntu Using VirtualBox:

1. Download VirtualBox - Go to the official website → Download VirtualBox for Windows.

2. Download Ubuntu ISO - Go to Ubuntu official site → Download Ubuntu Desktop ISO (Ubuntu 22.04 LTS)

3. Open the downloaded VirtualBox .exe file . Click Next → Next → Install . Allow the network permissions if asked. After installation, open VirtualBox.

4. Click New. Create a new virtual machine and then move next.

5. Allocate the respective RAM (Memory). Create a virtual hard disk now. Select the VM → Click Settings. Go to Storage. Under Controller: IDE → click the Empty disk. On the right, click the small CD icon → Choose a disk file. Select your Ubuntu ISO file. Click OK.

6. Start the VM. Click Start. You will see Ubuntu booting from the ISO.

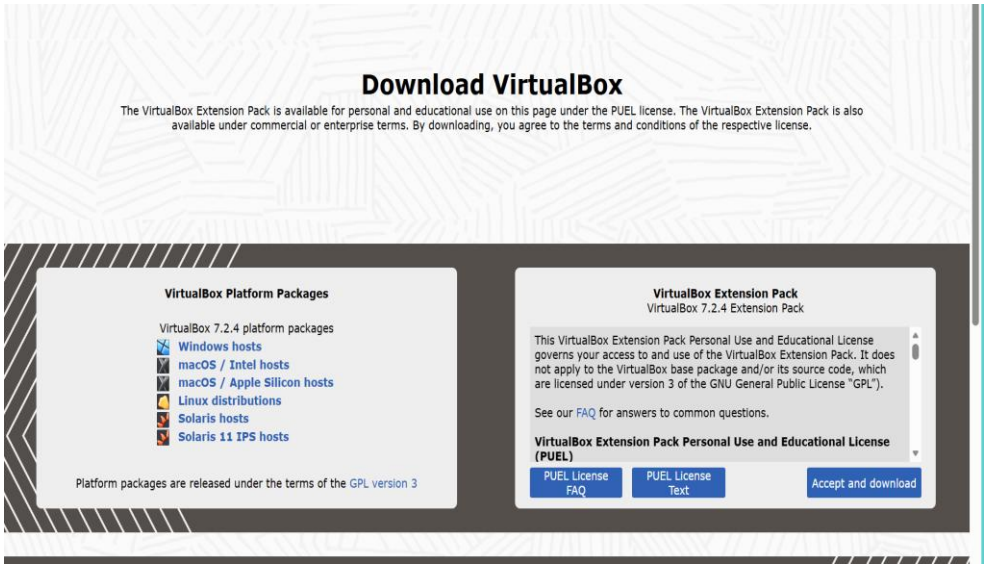
7. Click Install Ubuntu. Select your keyboard layout → Continue. Choose: Normal Installation. Tick Download updates while installing. Click Continue. For installation type: Select Erase disk and install Ubuntu. Click Install Now → Continue.

8. Create Your User Account. Enter: Your name, PC name, Username, Password. Click Continue.

Now the installation will take 5–15 minutes.

9. After installation, click Restart Now.
If it says Remove installation medium, just press Enter.

10. Ubuntu will boot into your desktop.


Download VirtualBox
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VirtualBox Platform Packages
VirtualBox 7.2.4 platform packages
Windows hosts
macOS / Intel hosts
macOS / Apple Silicon hosts
Linux distributions
Solaris hosts
Solaris 11 IPS hosts
Platform packages are released under the terms of the GPL version 3
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VirtualBox 7.2.4 Extension Pack
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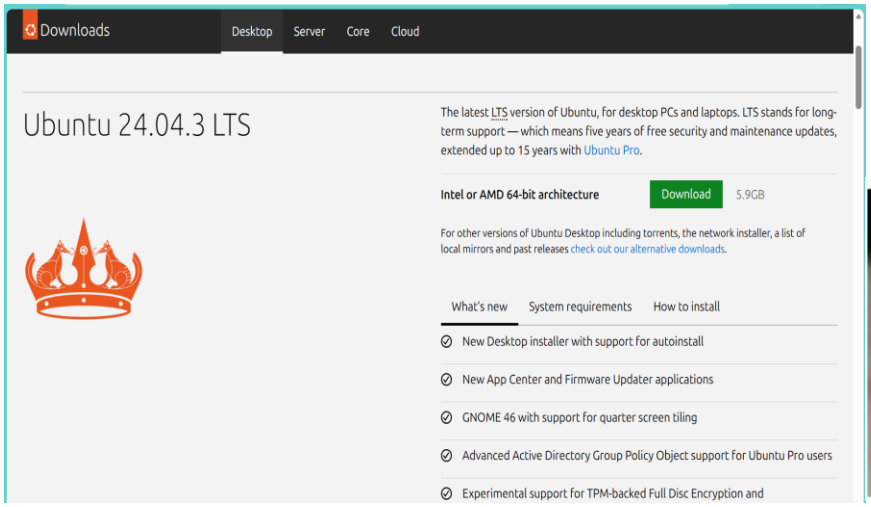
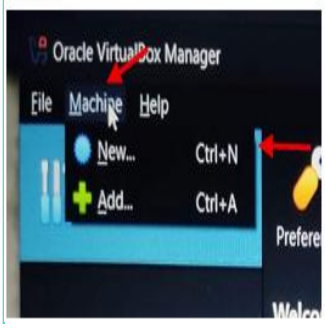
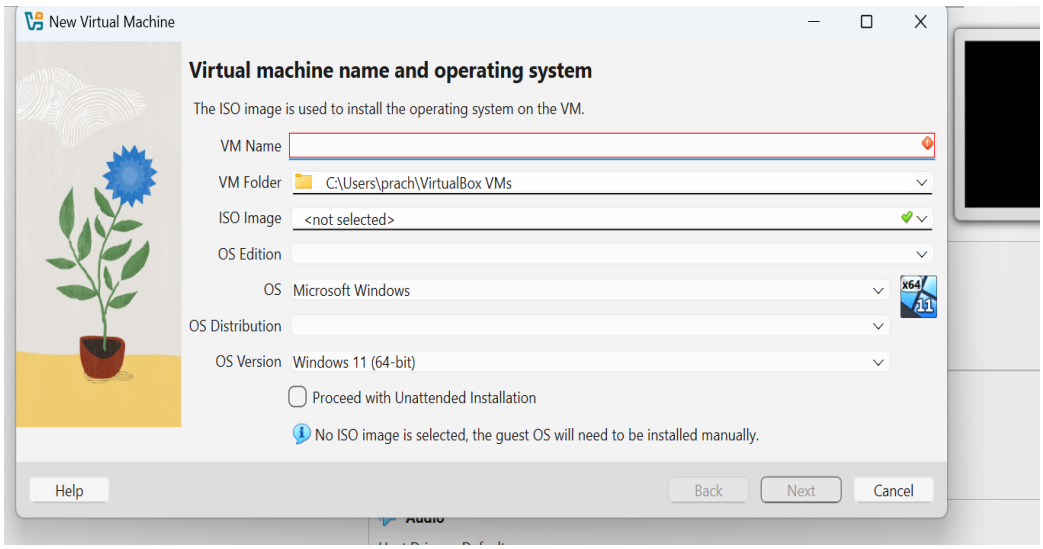
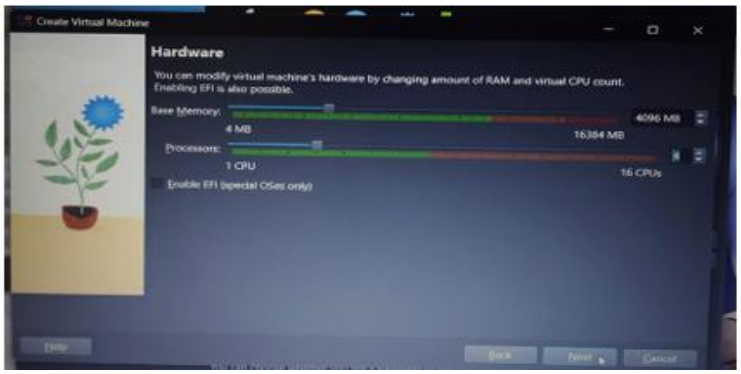
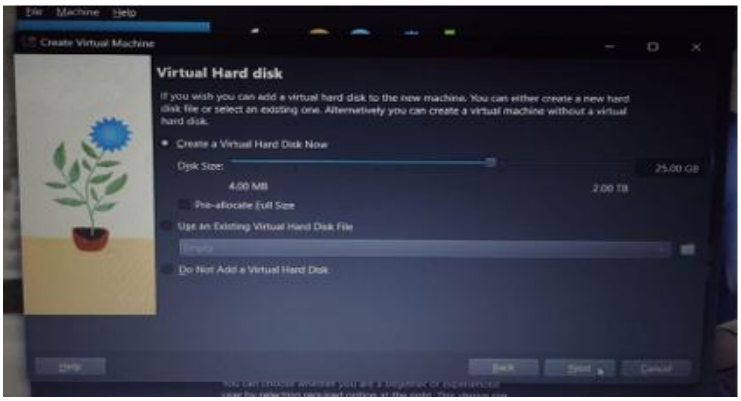
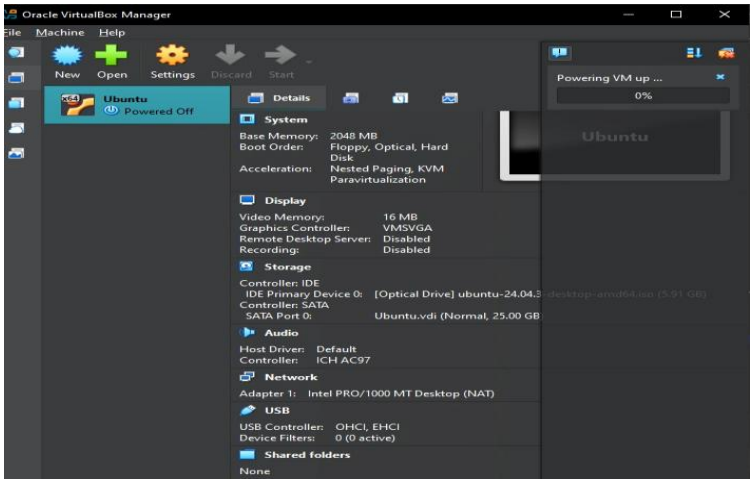

Downloads
Desktop
Server
Core
Cloud
Ubuntu 24.04.3 LTS
The latest LTS version of Ubuntu, for desktop PCs and laptops. LTS stands for long-term support — which means five years of free security and maintenance updates, extended up to 15 years with Ubuntu Pro.
Intel or AMD 64-bit architecture
Download
5.9GB
For other versions of Ubuntu Desktop including torrents, the network installer, a list of local mirrors and past releases check out our alternative downloads.
What's new
System requirements
How to install
New Desktop installer with support for autoinstall
New App Center and Firmware Updater applications
GNOME 46 with support for quarter screen tiling
Advanced Active Directory Group Policy Object support for Ubuntu Pro users
Experimental support for TPM-backed Full Disc Encryption and

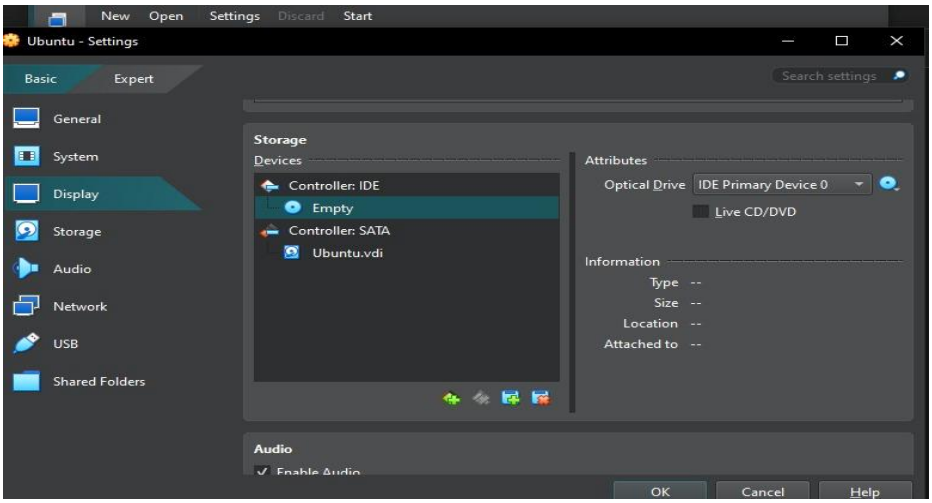

Oracle VirtualBox Manager
File
Machine
Help
New...
Ctrl+N
Add...
Ctrl+A

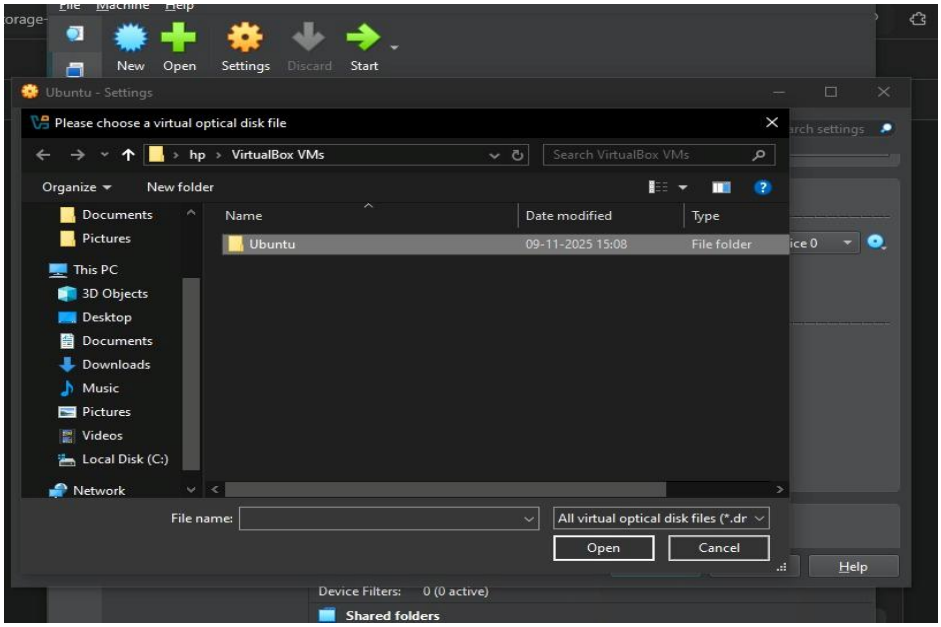

New Virtual Machine
Virtual machine name and operating system
The ISO image is used to install the operating system on the VM.
VM Name
VM Folder
C:\Users\prach\VirtualBox VMs
ISO Image
<not selected>
OS Edition
OS
Microsoft Windows
OS Distribution
OS Version
Windows 11 (64-bit)
Proceed with Unattended Installation
No ISO image is selected, the guest OS will need to be installed manually.
Help
Back
Next
Cancel

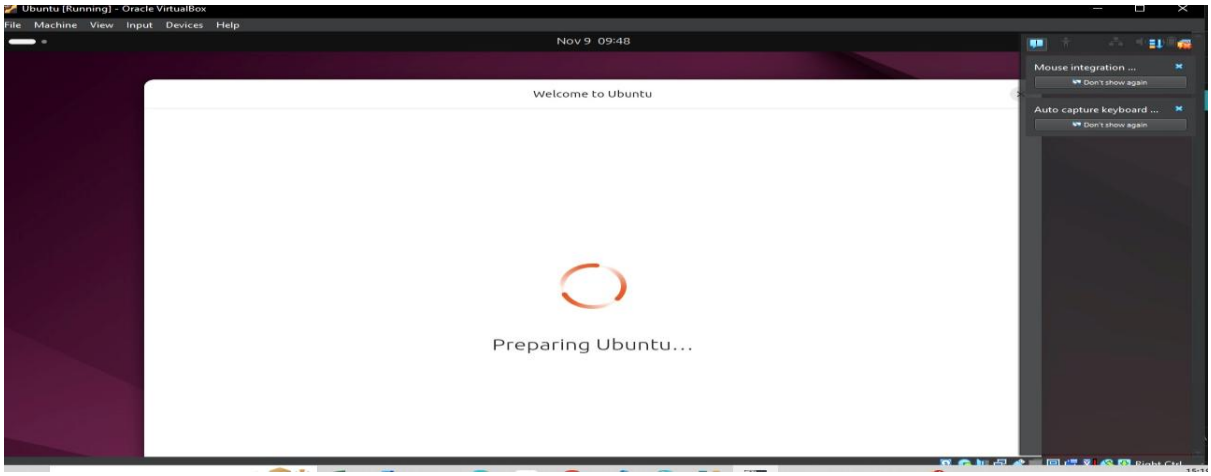

Create Virtual Machine
Hardware
You can modify virtual machine's hardware by changing amount of RAM and virtual CPU count.
Enabling EFI is also possible.
Base Memory:
4 MB
4096 MB
16384 MB
Processors:
1 CPU
16 CPUs
Enable EFI (special OSes only)
Help
Back
Next
Cancel

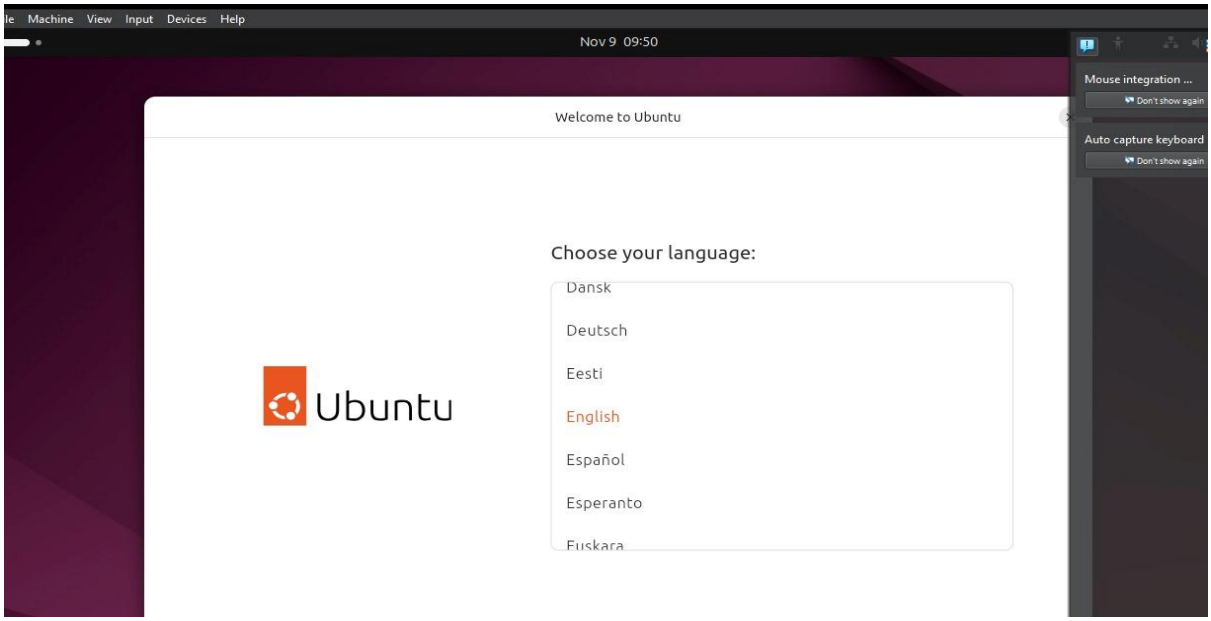

File Machine Help
Create Virtual Machine
Virtual Hard disk
If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select an existing one. Alternatively you can create a virtual machine without a virtual hard disk.
Create a Virtual Hard Disk Now
Disk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

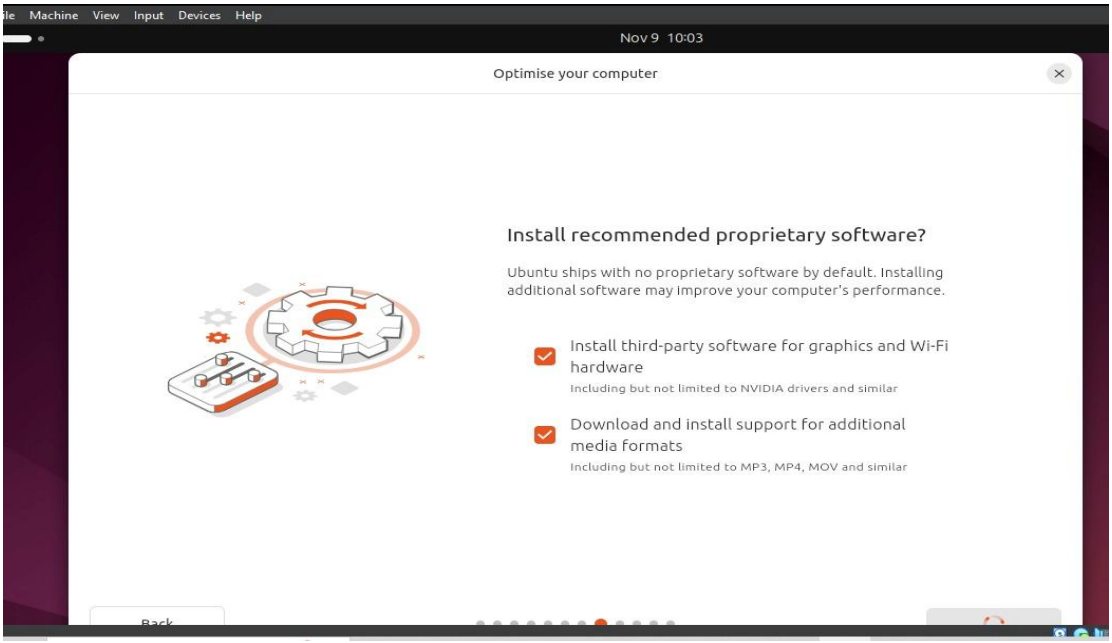

Oracle VirtualBox Manager
File Machine Help
New
Open
Settings
Discard
Start
Ubuntu
Powered Off
Details
System
Base Memory: 2048 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: Nested Paging, KVM Paravirtualization
Display
Video Memory: 16 MB
Graphics Controller: VMSVGA
Remote Desktop Server: Disabled
Recording: Disabled
Storage
Controller: IDE
IDE Primary Device 0: [Optical Drive] ubuntu-24.04.3
Controller: SATA
SATA Port 0: Ubuntu.vdi (Normal, 25.00 GB)
Audio
Host Driver: Default
Controller: ICH AC97
Network
Adapter 1: Intel PRO/1000 MT Desktop (NAT)
USB
USB Controller: OHCI, EHCI
Device Filters: 0 (0 active)
Shared folders
None
Powering VM up ...
0%
Ubuntu

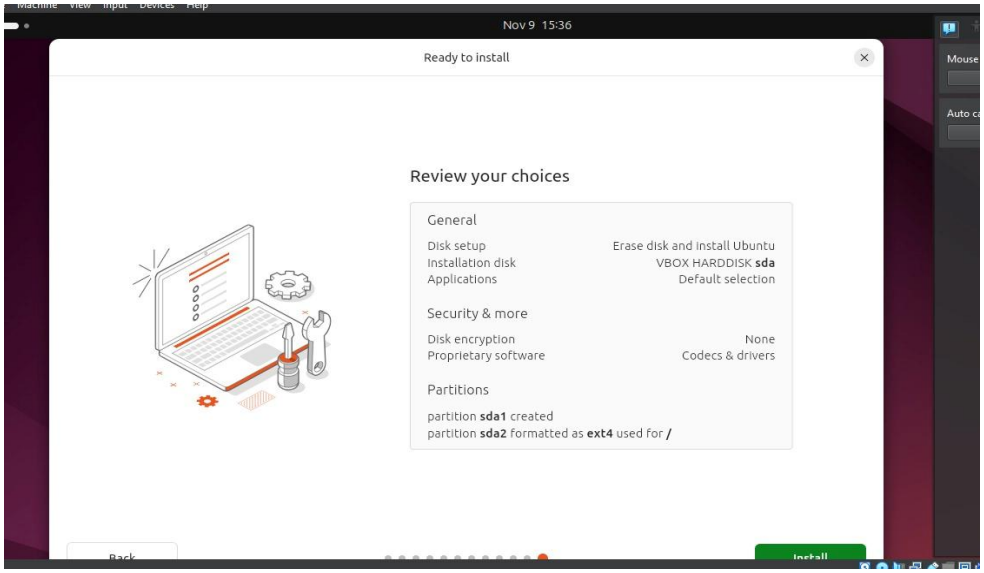

New
Open
Settings
Discard
Start
Ubuntu - Settings
Basic
Expert
Search settings
General
System
Display
Storage
Audio
Network
USB
Shared Folders
Storage
Devices
Controller: IDE
Empty
Controller: SATA
Ubuntu.vdi
Attributes
Optical Drive
IDE Primary Device 0
Live CD/DVD
Information
Type --
Size --
Location --
Attached to --
Audio
Enable Audio
OK
Cancel
Help

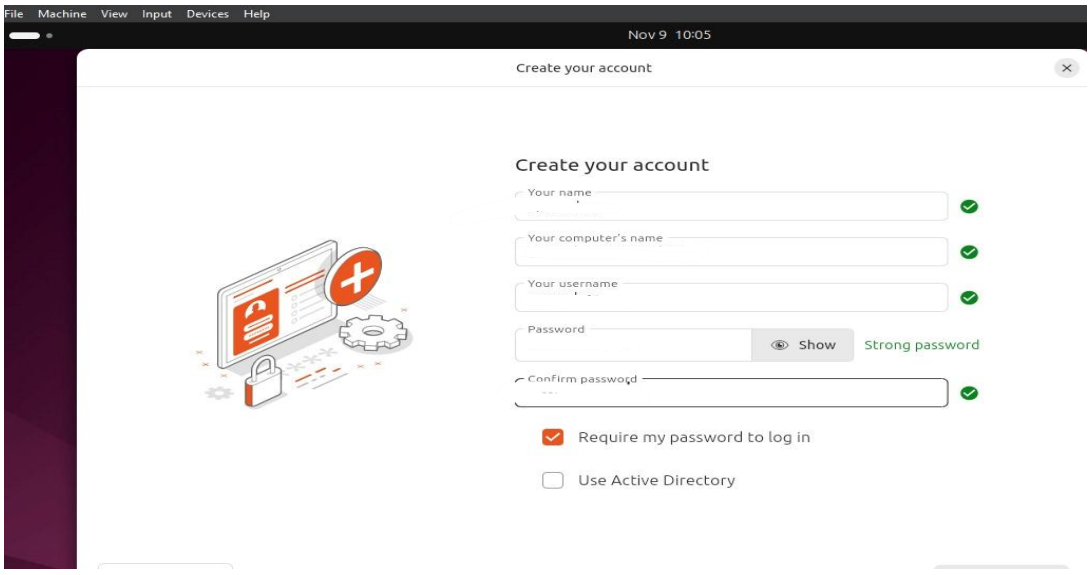

New
Open
Settings
Discard
Start
Ubuntu - Settings
Please choose a virtual optical disk file
hp
VirtualBox VMs
Search VirtualBox VMs
Organize
New folder
Documents
Pictures
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Network
Name
Date modified
Type
Ubuntu
09-11-2025 15:08
File folder
File name:
All virtual optical disk files (*.dr
Open
Cancel
Help
Device Filters:
0 (0 active)
Shared folders

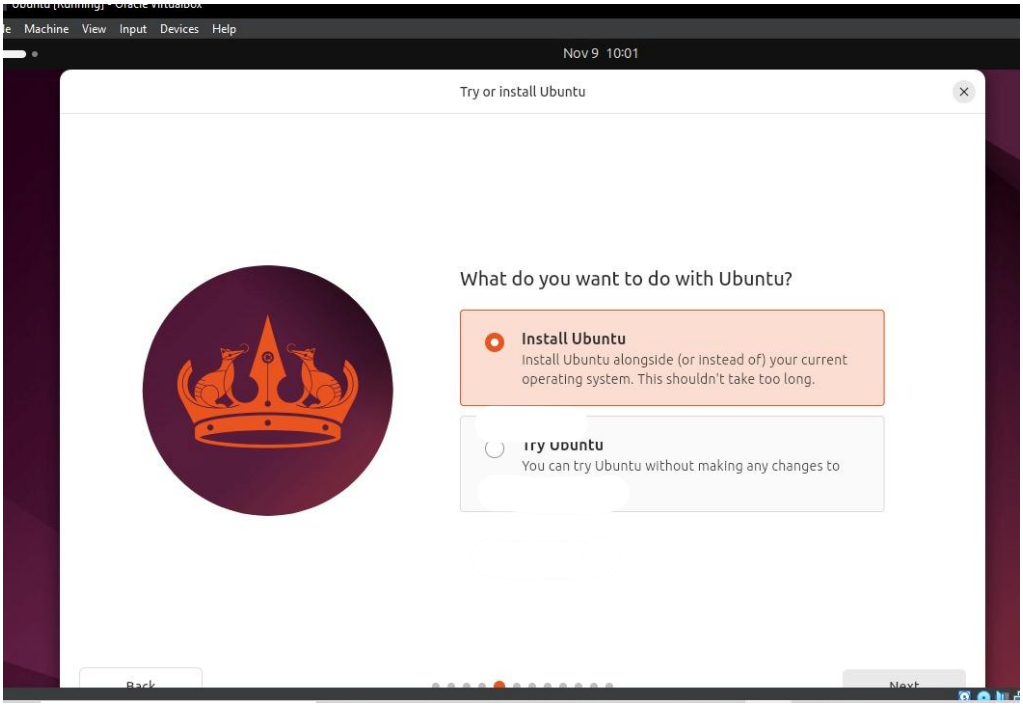

Ubuntu [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Nov 9 09:48
Welcome to Ubuntu
Mouse integration ...
Don't show again
Auto capture keyboard ...
Don't show again
Preparing Ubuntu...

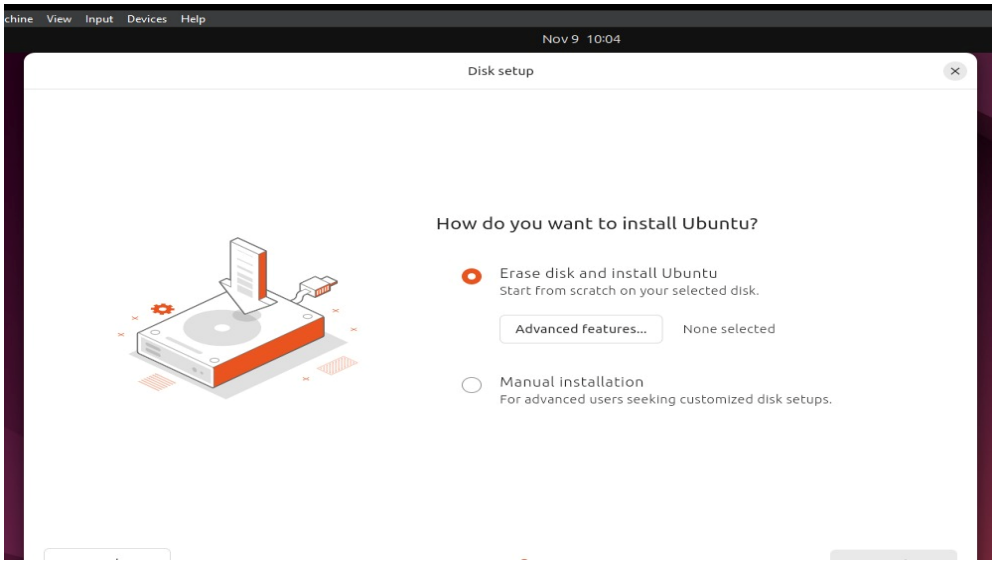

Machine View Input Devices Help
Nov 9 09:50
Welcome to Ubuntu
Mouse integration ...
Don't show again
Auto capture keyboard
Don't show again
Choose your language:
Dansk
Deutsch
Eesti
English
Español
Esperanto
Euskara
Ubuntu

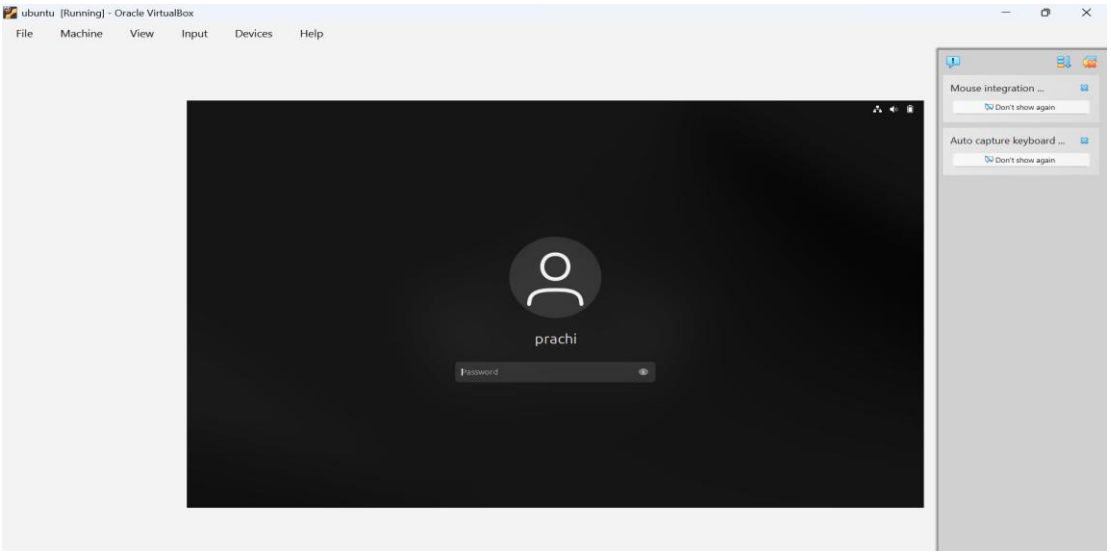

Machine View Input Devices Help
Nov 9 10:03
Optimise your computer
Install recommended proprietary software?
Ubuntu ships with no proprietary software by default. Installing additional software may improve your computer's performance.
Install third-party software for graphics and Wi-Fi hardware
Including but not limited to NVIDIA drivers and similar
Download and install support for additional media formats
Including but not limited to MP3, MP4, MOV and similar
Back

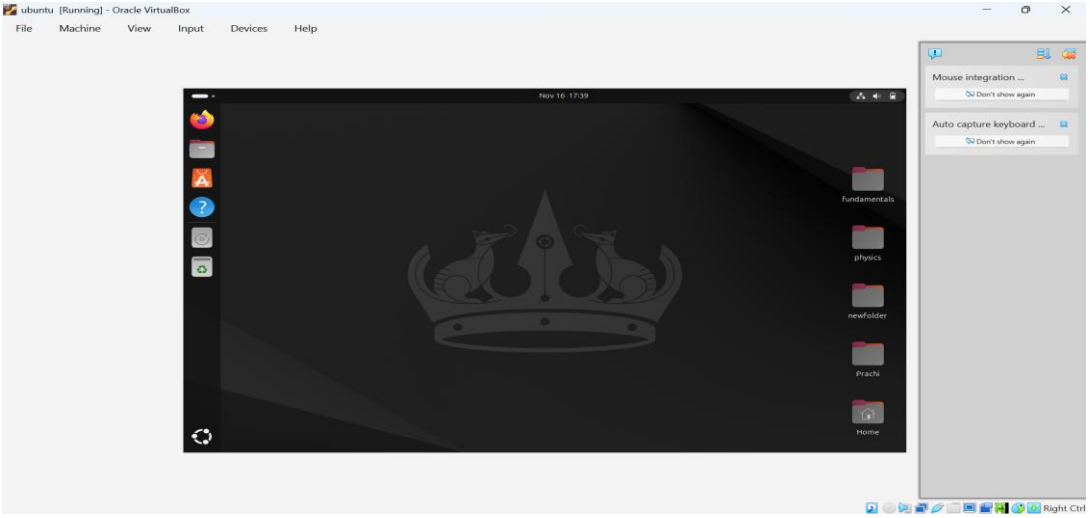

Nov 9 15:36
Ready to install
Review your choices
General
Disk setup
Erase disk and install Ubuntu
Installation disk
VBOX HARDDISK sda
Applications
Default selection
Security & more
Disk encryption
None
Proprietary software
Codecs & drivers
Partitions
partition sda1 created
partition sda2 formatted as ext4 used for /
Back
Install


File Machine View Input Devices Help
Nov 9 10:05
Create your account
Create your account
Your name
Your computer's name
Your username
Password
Show
Strong password
Confirm password
Require my password to log in
Use Active Directory

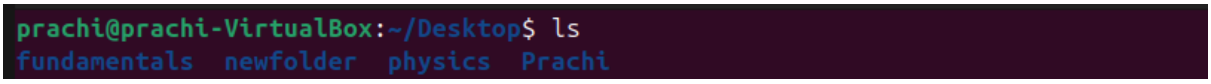

Machine View Input Devices Help
Nov 9 10:01
Try or install Ubuntu
What do you want to do with Ubuntu?
Install Ubuntu
Install Ubuntu alongside (or instead of) your current operating system. This shouldn't take too long.
You can try Ubuntu without making any changes to
Back
Next


View Input Devices Help
Nov 9 10:04
Disk setup
How do you want to install Ubuntu?
Erase disk and install Ubuntu
Start from scratch on your selected disk.
Advanced features...
None selected
Manual installation
For advanced users seeking customized disk setups.

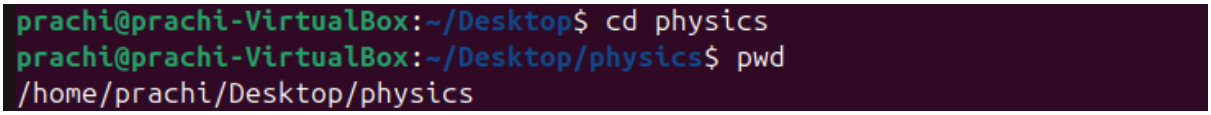

ubuntu [Running] - Oracle VirtualBox
File
Machine
View
Input
Devices
Help
Mouse integration ...
Don't show again
Auto capture keyboard ...
Don't show again
prachi
Password


ubuntu [Running] - Oracle VirtualBox
File
Machine
View
Input
Devices
Help
Nov 16 17:39
Mouse integration ...
Don't show again
Auto capture keyboard ...
Don't show again
fundamentals
physics
newfolder
Prachi
Home
Right Ctrl

COMMANDS

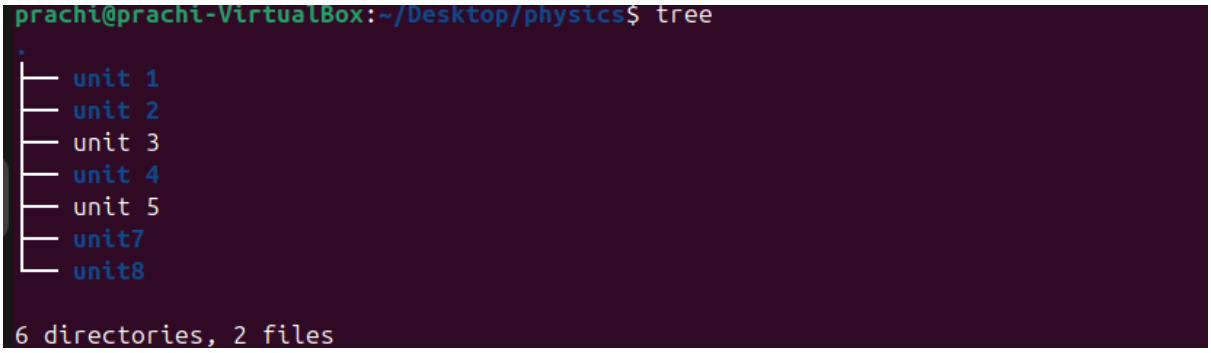
1. 

ls- View/Lists files/folders in current directory.

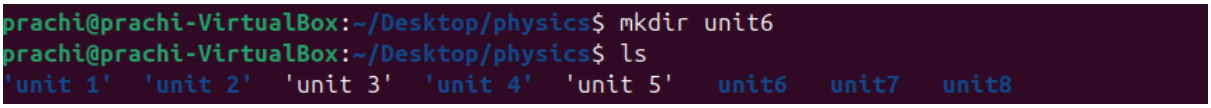
2. 

cd (Change Directory)- Move between directories.

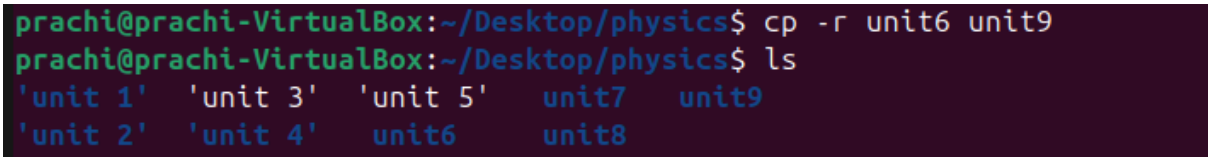
3. pwd -Shows current directory path.

4. 

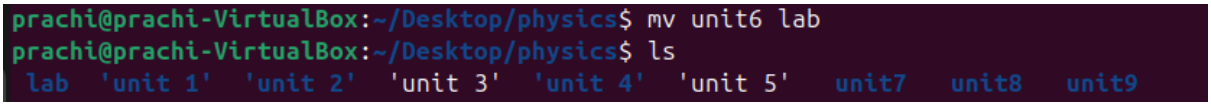
tree- Shows folder hierarchy.

5. 

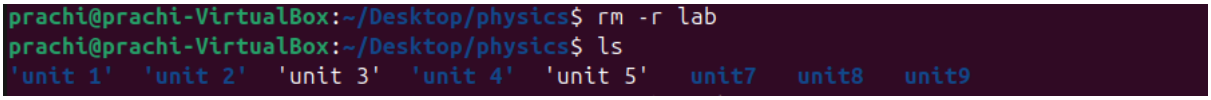
mkdir-Create a new folder.

6. 

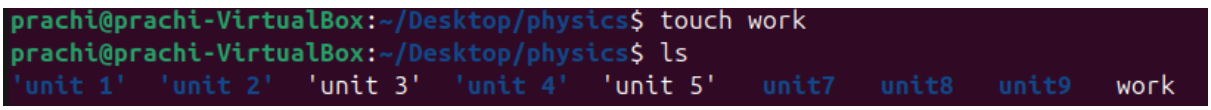
cp-Duplicate a file.

7. 

mv-Rename or move files.

8. 

rm- Delete file permanently.

9. 

Touch- Create new text file.

10.
```
prachi@prachi-VirtualBox:~/Desktop/physics$ chmod 755 unit7
prachi@prachi-VirtualBox:~/Desktop/physics$ ls -l
total 24
drwxrwxr-x 2 prachi prachi 4096 Nov 15 14:18 'unit 1'
drwxrwxr-x 2 prachi prachi 4096 Nov 15 15:51 'unit 2'
-rw-rw-r-- 1 prachi prachi    0 Nov 15 16:14 'unit 3'
drwxrwxr-x 2 prachi prachi 4096 Nov 15 16:09 'unit 4'
-rw-rw-r-- 1 prachi prachi    0 Nov 15 16:14 'unit 5'
drwxr-xr-x 2 prachi prachi 4096 Nov 16 07:16  unit7
drwxrwxr-x 2 prachi prachi 4096 Nov 16 07:15  unit8
drwxrwxr-x 2 prachi prachi 4096 Nov 16 07:21  unit9
-rw-rw-r-- 1 prachi prachi    0 Nov 16 07:26  work
```

chmod-Set read/write/execute permissions.

11.
```
prachi@prachi-VirtualBox:~/Desktop/physics$ sudo chown prachi physics
```

chown-Change file owner.

12.
```
prachi@prachi-VirtualBox:~/Desktop/physics$ kill
kill: usage: kill [-s sigspec | -n signum | -sigspec] pid | jobspec ... or kill -l [sigspec]
```

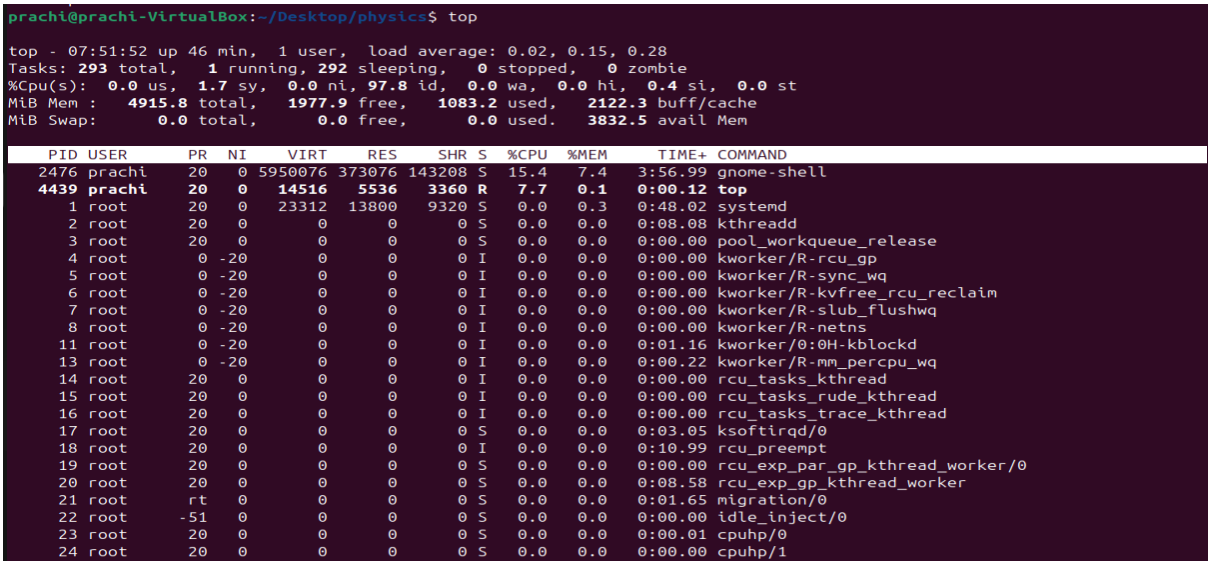
kill-Kill a process using PID.

13.
```
prachi@prachi-VirtualBox:~/Desktop/physics$ ping google.com
PING google.com (142.250.182.46) 56(84) bytes of data.
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=1 ttl=255 time=21.6 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=2 ttl=255 time=47.5 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=3 ttl=255 time=31.2 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=4 ttl=255 time=35.1 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=5 ttl=255 time=203 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=6 ttl=255 time=309 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=7 ttl=255 time=320 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=8 ttl=255 time=243 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=9 ttl=255 time=161 ms
64 bytes from maa05s19-in-f14.1e100.net (142.250.182.46): icmp_seq=10 ttl=255 time=48.6 ms
```

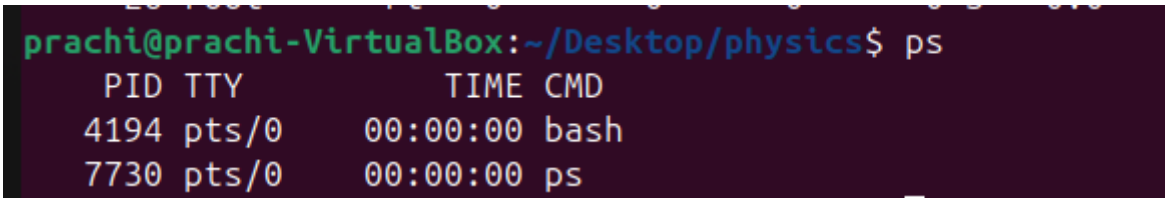
ping- Check network status.

14.
```
prachi@prachi-VirtualBox:~/Desktop/physics$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default 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 noprefixroute
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:64:56:fb brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
       valid_lft 84092sec preferred_lft 84092sec
    inet6 fd17:625c:f037:2:254e:c691:2125:cebf/64 scope global temporary dynamic
       valid_lft 86130sec preferred_lft 14130sec
    inet6 fd17:625c:f037:2:a00:27ff:fe64:56fb/64 scope global dynamic mngtmpaddr
       valid_lft 86130sec preferred_lft 14130sec
    inet6 fe80::a00:27ff:fe64:56fb/64 scope link
       valid_lft forever preferred_lft forever
```

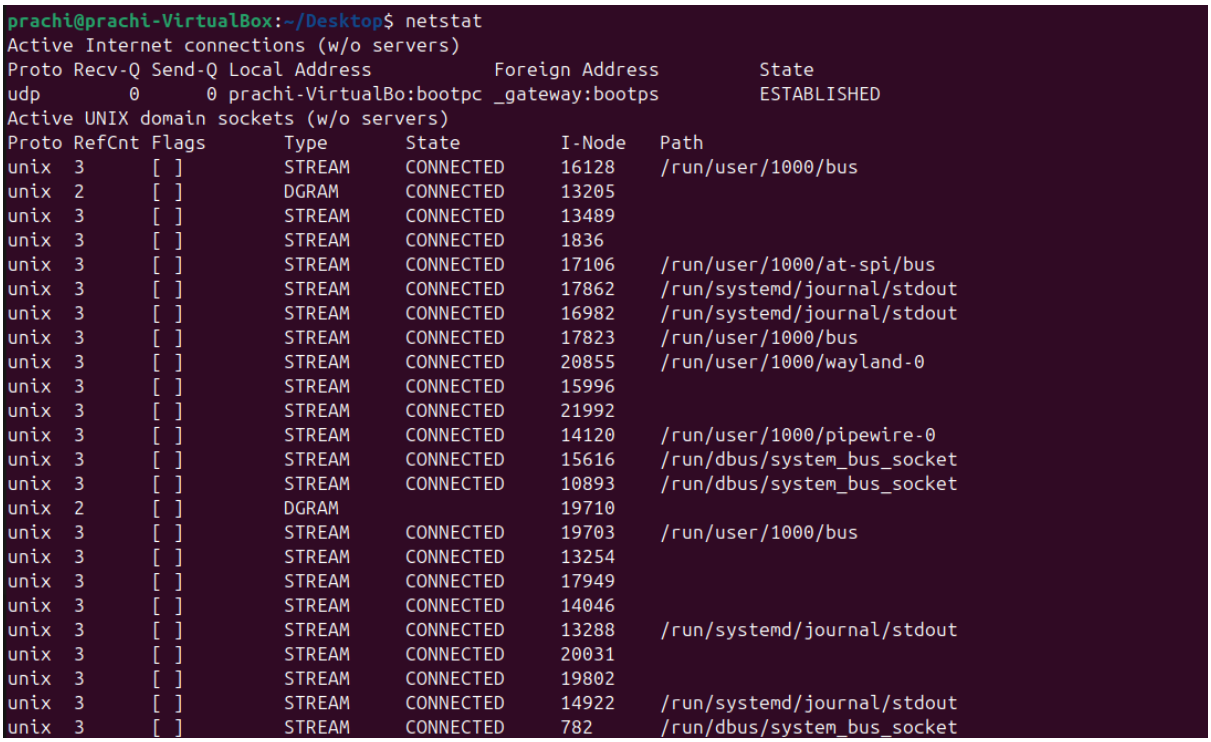
ip a- Display IP details.

15. 

top- Monitor CPU/RAM usage.

16. 

ps- See running processes.

17. 

Netstat –is a command used to show **network connections**, **listening ports**, **routing tables**, and **network interface statistics**.

18.
```
prachi@prachi-VirtualBox:~/Desktop$ clear
```

Clear- The “clear” command in Linux is used to clear the terminal screen, removing all previous commands and output from the visible area.

19.
```
prachi@prachi-VirtualBox:~/Desktop$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
        inet6 fd17:625c:f037:2:a00:27ff:fe64:56fb  prefixlen 64  scopeid 0x0<global>
        inet6 fe80::a00:27ff:fe64:56fb  prefixlen 64  scopeid 0x20<link>
        inet6 fd17:625c:f037:2:700f:1c5c:3627:92bf  prefixlen 64  scopeid 0x0<global>
        ether 08:00:27:64:56:fb  txqueuelen 1000  (Ethernet)
        RX packets 2050  bytes 2452486 (2.4 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 731  bytes 82449 (82.4 KB)
        TX errors 0  dropped 24 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 271  bytes 22702 (22.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 271  bytes 22702 (22.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Ifconfig- The “ifconfig” command in Linux is used to configure and display network interfaces. It can show information about network interfaces, assign IP addresses, activate or deactivate interfaces, and set various parameters.

20.
```
prachi@prachi-VirtualBox:~/Desktop$ whoami
prachi
```

Whoami - The “whoami” command in Linux displays the username of the current effective user that is, the username under which the current process is running. This command can run without options also.

SHELL SCRIPT DEVELOPMENT

1. BACKUP A DIRECTORY

```
prachi@prachi-VirtualBox:~/Desktop$ ls
fundamentals  newfolder  physics  Prachi  script.sh
prachi@prachi-VirtualBox:~/Desktop$ nano script.sh
```

```
#!/bin/bash
# Purpose:Backup a specified directory to a backup folder with timestamp
#Author: Prachi
#Date :18/11/2025
#Usage: ./backup_directory.sh/path/to/source/path/to/backup
source_dir=$1
backup_dir=$2
timestamp=$(date  +%Y%m%dH%M%S)
if [ ! -d "$backup_dir"];
then
  mkdir -p "$backup_dir"
fi

cp-r "$source_dir" "$backup_dir/backup_$timestamp"
echo "Backup of $source_dir completed at $backup_dir/backup_$timestamp"
```

```
prachi@prachi-VirtualBox:~/Desktop$ cat script.sh
#!/bin/bash
# Purpose:Backup a specified directory to a backup folder with timestamp
#Author: Prachi
#Date :18/11/2025
#Usage: ./backup_directory.sh/path/to/source/path/to/backup
source_dir=$1
backup_dir=$2
timestamp=$(date  +%Y%m%d%H%M%S)
if [ ! -d "$backup_dir"];
then
  mkdir -p "$backup_dir"
fi

cp-r "$source_dir"
"$backup_dir/
backup_$timestamp"
echo "Backup of $source_dir
completed at $backup_dir/
backup_$timestamp"
```

2. CPU/Memory Monitoring Script

```
prachi@prachi-VirtualBox:~/Desktop$ ls
backup.sh  fundamentals  newfolder  physics  Prachi  script.sh
```

```
#!/bin/bash
#Purpose: Log CPU and memory usage to a file at regular intervals
#Author : Prachi
#Date :18/11/2025
#Usage: ./monitor_cpu_mem.sh interval_in_seconds output_file

interval=$1
output_file=$2

echo "Timestamp, CPU_Usage(%), Memory_Usage(%)">"$output_file"

while true; do
  timestamp =$(date +%Y-%m-%d\ %H:%M:%S)
  cpu_usage=$(top -bn | grep "Cpu(s)" | awk '{print 100-$8}')
  mem_usage =$(free | grep Mem | awk '{print $3/$2 * 100.0}')
  echo "$timestamp , $cpu_usage , $mem_usage">> "$output_file"
  sleep "$interval"
done
```

```
prachi@prachi-VirtualBox:~/Desktop$ cat backup.sh
#!/bin/bash
#Purpose: Log CPU and memory usage to a file at regular intervals
#Author : Prachi
#Date :18/11/2025
#Usage: ./monitor_cpu_mem.sh interval_in_seconds output_file

interval=$1
output_file=$2

echo "Timestamp, CPU_Usage(%), Memory_Usage(%)">"$output_file"

while true; do
  timestamp =$(date +%Y-%m-%d\ %H:%M:%S)
  cpu_usage=$(top -bn | grep "Cpu(s)" | awk '{print 100-$8}')
  mem_usage =$(free | grep Mem | awk '{print $3/$2 * 100.0}')
  echo "$timestamp , $cpu_usage , $mem_usage">> "$output_file"
  sleep "$interval"
done
```

3. AUTOMATED DOWNLOAD TASK

```
prachi@prachi-VirtualBox:~/Desktop$ ls
backup.sh  file.sh  fundamentals  newfolder  physics  Prachi  script.sh
```

```
#!/bin/bash
#Purpose:Download a file from the internet and save it to a specified location
#Author:Prachi
#Date:18/11/2025
#Usage: ./download_file.sh <url> <destination>

#Check if both arguments are provided
if [ $# -ne 2 ] ; then
  echo "Usage: $0 <url> <destination>"
  exit 1
fi

#Assign arguments to variables
url=$1
destination=$2

#download file using wget
wget -0 "$destination" "$url"

# Check if download was successful
if [ $? -eq 0 ]; then
  echo "File downloaded successfully to '$destination'"
else
  echo "Error:Failed to download file from '$url'"
fi
```

```
prachi@prachi-VirtualBox:~/Desktop$ cat file.sh
#!/bin/bash
#Purpose:Download a file from the internet and save it to a specified location
#Author:Prachi
#Date:18/11/2025
#Usage: ./download_file.sh <url> <destination>

#Check if both arguments are provided
if [ $# -ne 2 ] ; then
  echo "Usage: $0 <url> <destination>"
  exit 1
fi

#Assign arguments to variables
url=$1
destination=$2

#download file using wget
wget -0 "$destination" "$url"

# Check if download was successful
if [ $? -eq 0 ]; then
  echo "File downloaded successfully to '$destination'"
else
  echo "Error:Failed to download file from '$url'"
fi
```

GITHUB ASSIGNMENT LINK

Prachi551/linux-shell-assignment

REFLECTION

This assignment helped me understand how Linux commands and scripting automate real-world tasks efficiently.

I faced some challenges with terminal navigation and script debugging, but learned valuable troubleshooting skills.

Documenting scripts with sample outputs improved my clarity and technical presentation.

Overall, I can now use Linux confidently for system management, monitoring, and automation.

THANK YOU