Lab Number: 03 **Date: 2025/07/01**

Title: OS Installation & Practice on Basic Networking Commands

THEORY:

Linux:

Linux is a family of open-source operating systems, based on the Linux kernel, first released in 1991 by Linus Torvalds. It's known for its flexibility, security, and wide range of applications, from smartphones and servers to supercomputers and embedded systems. While often referred to as an OS, Linux is technically a kernel, which is the core of an operating system. Linux distributions, like Ubuntu or Fedora, bundle the kernel with other software to create a complete OS.

Fig.: Linux OS and its Evolution and Future

Virtual Box:

VirtualBox is free and open-source virtualization software that allows users to run multiple operating systems on a single physical machine. It enables the creation and management of virtual machines (VMs), each capable of hosting a different OS alongside the host system. This capability is useful for testing software, developing applications on various platforms, and creating isolated environments for experimentation. Essentially, it provides the functionality of multiple computers within a single computer.

Fig.: Virtual Box

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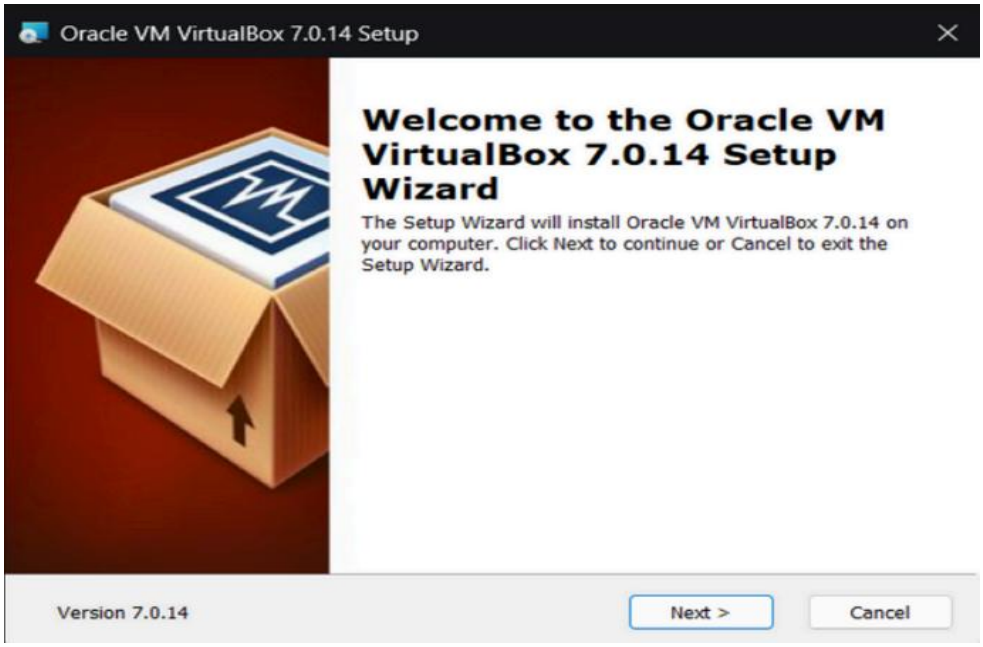
VMware:

VMware is a leading provider of virtualization and cloud computing software and services. It enables the creation of virtual machines, which are software-based versions of physical computers, allowing users to run multiple operating systems and applications on a single physical machine. This virtualization technology offers benefits like increased efficiency, improved resource utilization, and simplified data center management. VMware's core product, vSphere, is a suite of virtualization tools that includes the ESXi hypervisor, which manages the allocation of hardware resources to virtual machines.

Fig.: VMware

Installing Virtual Box:

Installing a virtual machine (VM) enables running multiple operating systems on one physical machine parallelly, useful for testing, development in isolated environments, and efficient resource use. VMs also support backups, disaster recovery, and enhanced security compared to traditional setups.



Here, click on **Next** and go to next phase.

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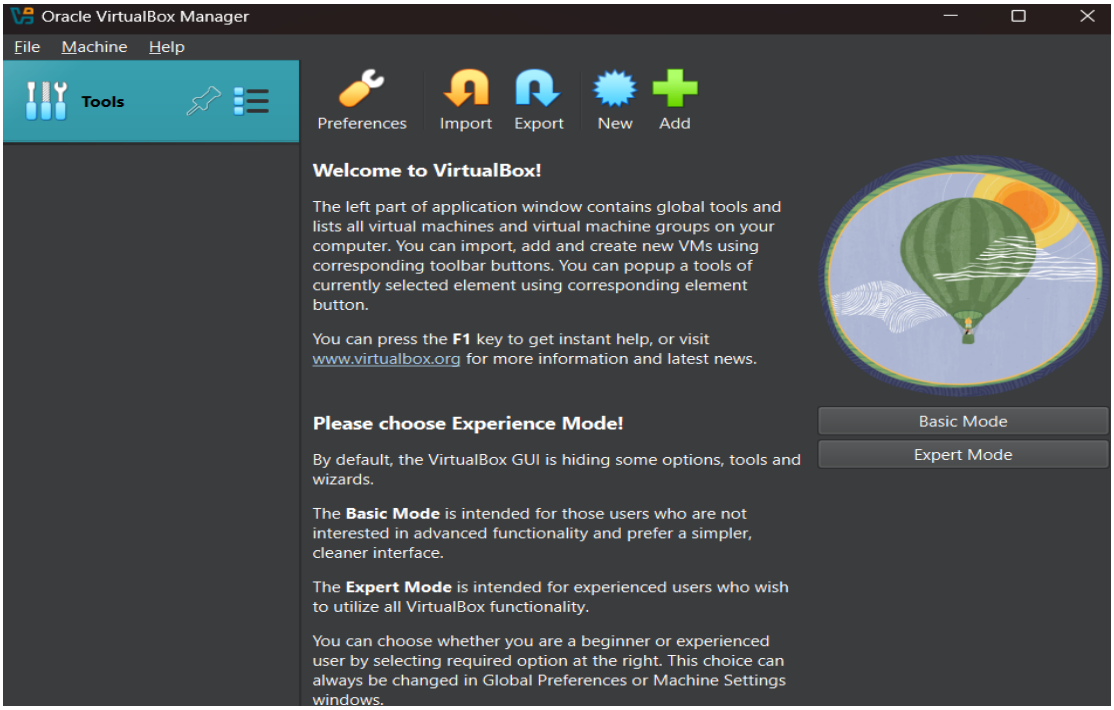
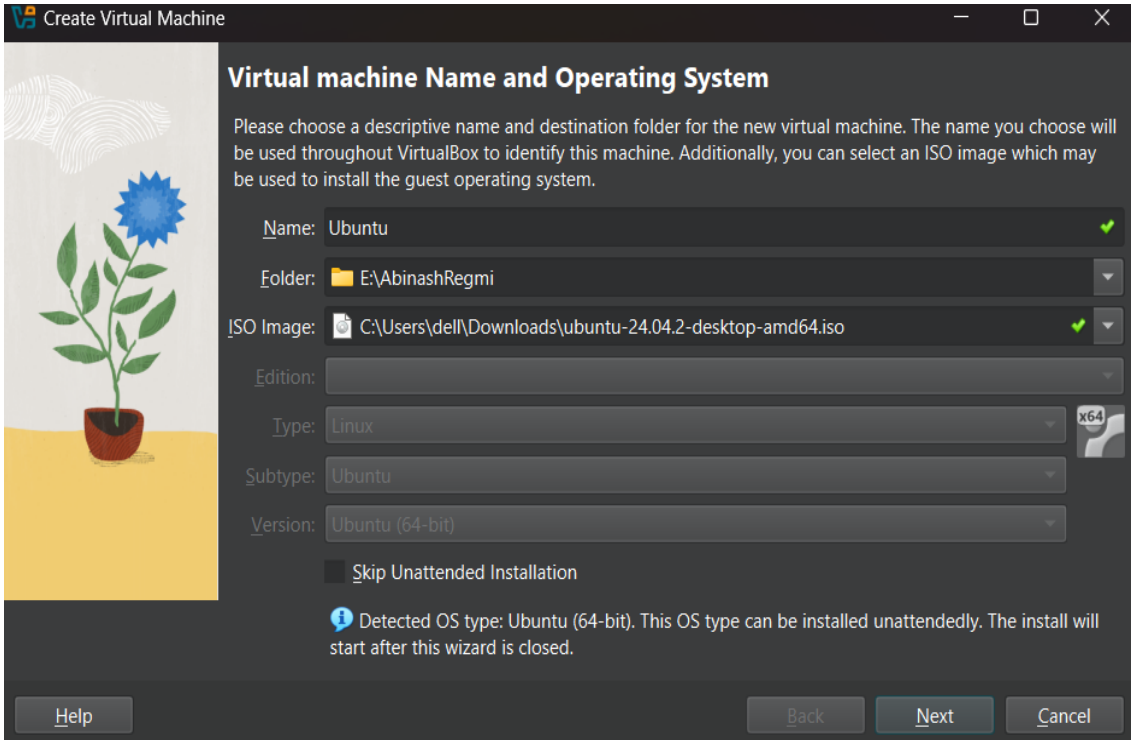
Once Virtual Box is installed then we can create, add or import new VMs using toolbar buttons



Installing Linux (Ubuntu) Desktop OS:

Step 1: Click New on Virtual Machine toolbar and add details about the new VM and required OS.



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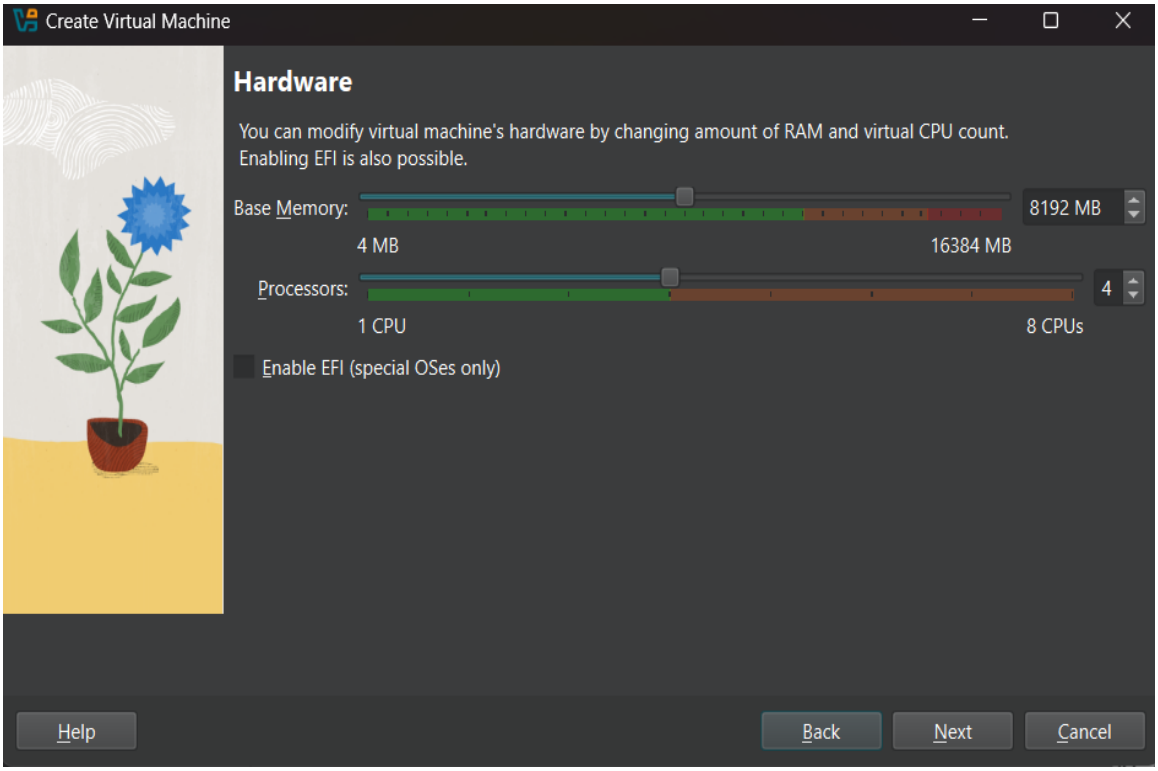
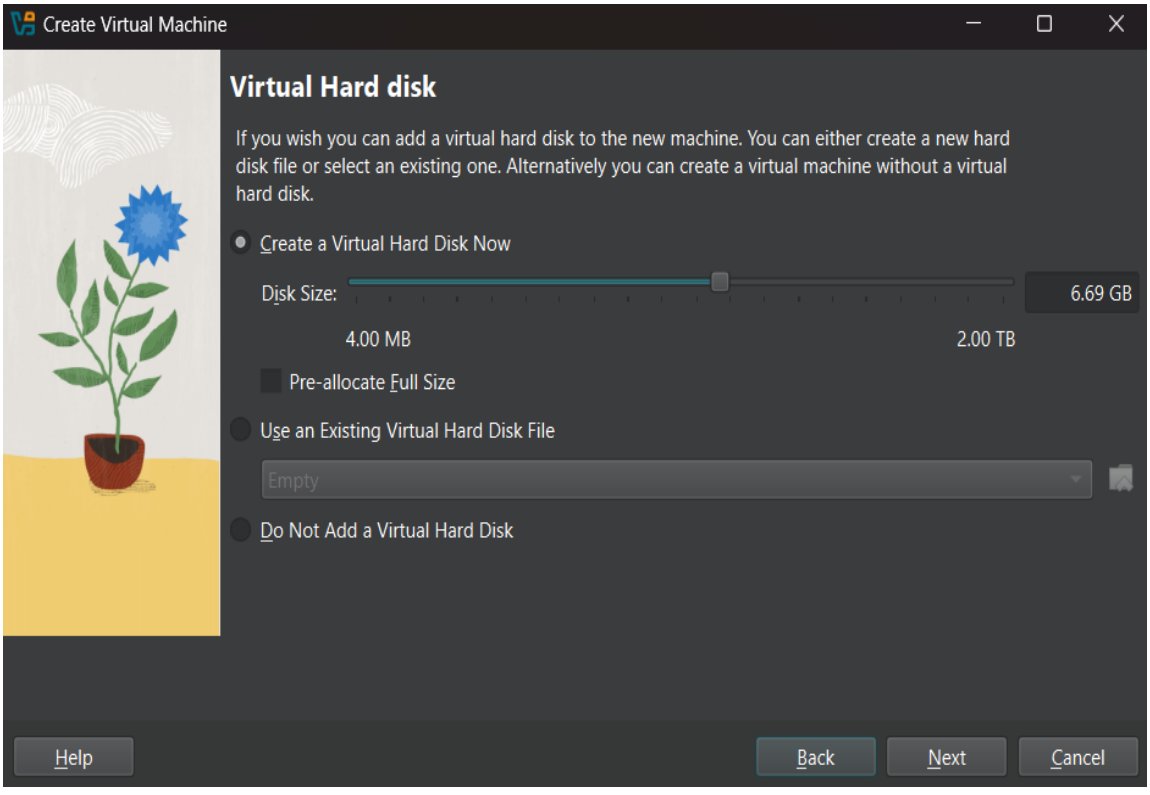
Step 2: Select the Base Memory and Processors to be allocated to the Virtual Machine as per your need.



Step 3: Select the size of memory you want for Virtual Hard Disk.



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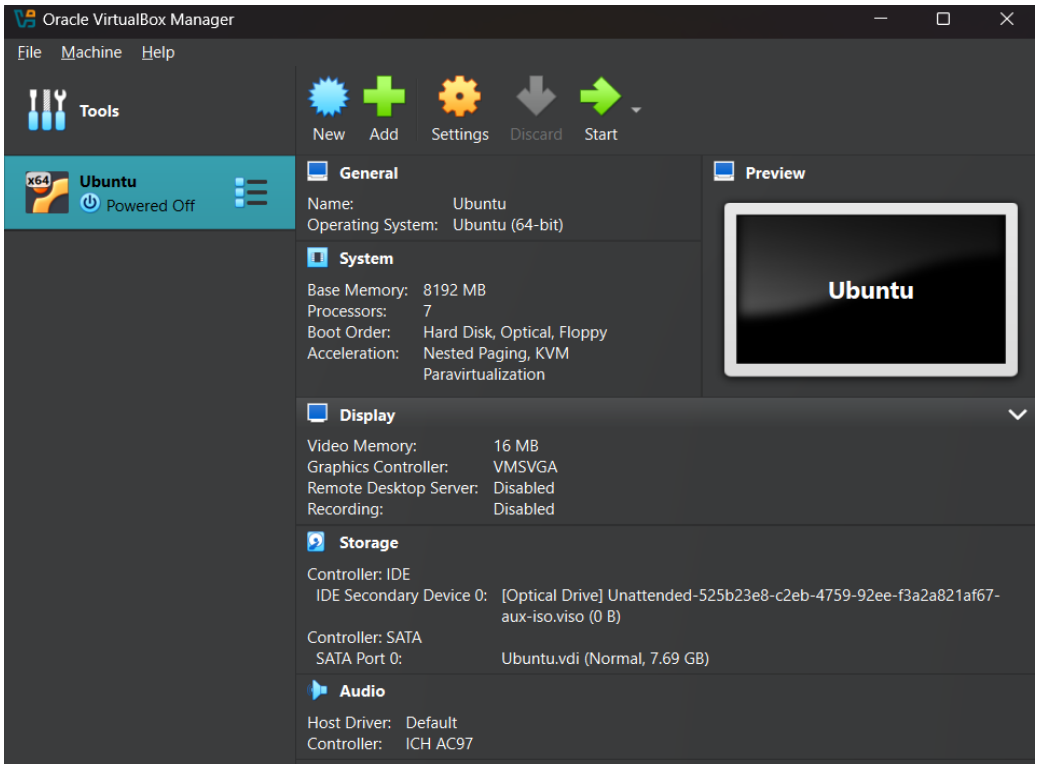
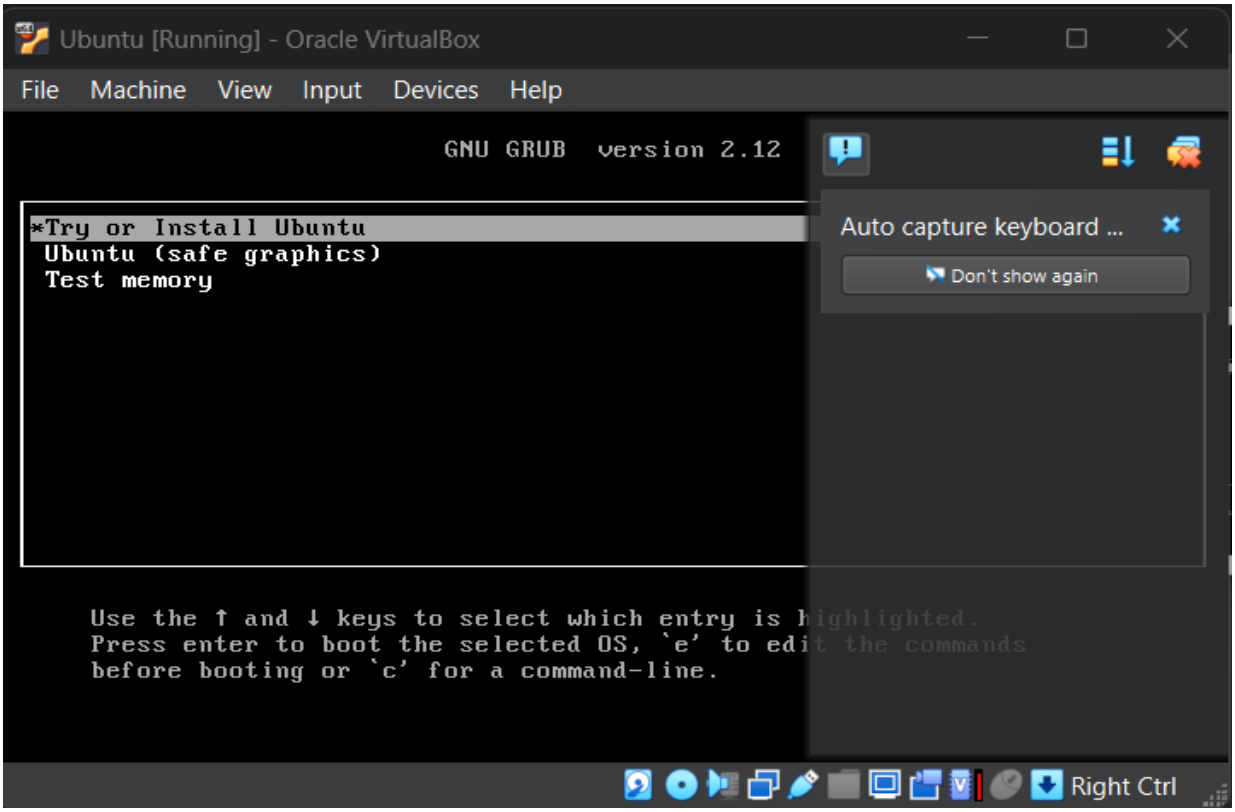
Step 4: This is the interface for the newly created Virtual Machine for Ubuntu Desktop OS. Select Server and click on Start to run the Virtual Machine



Step 5: Press Enter to install Ubuntu Server.



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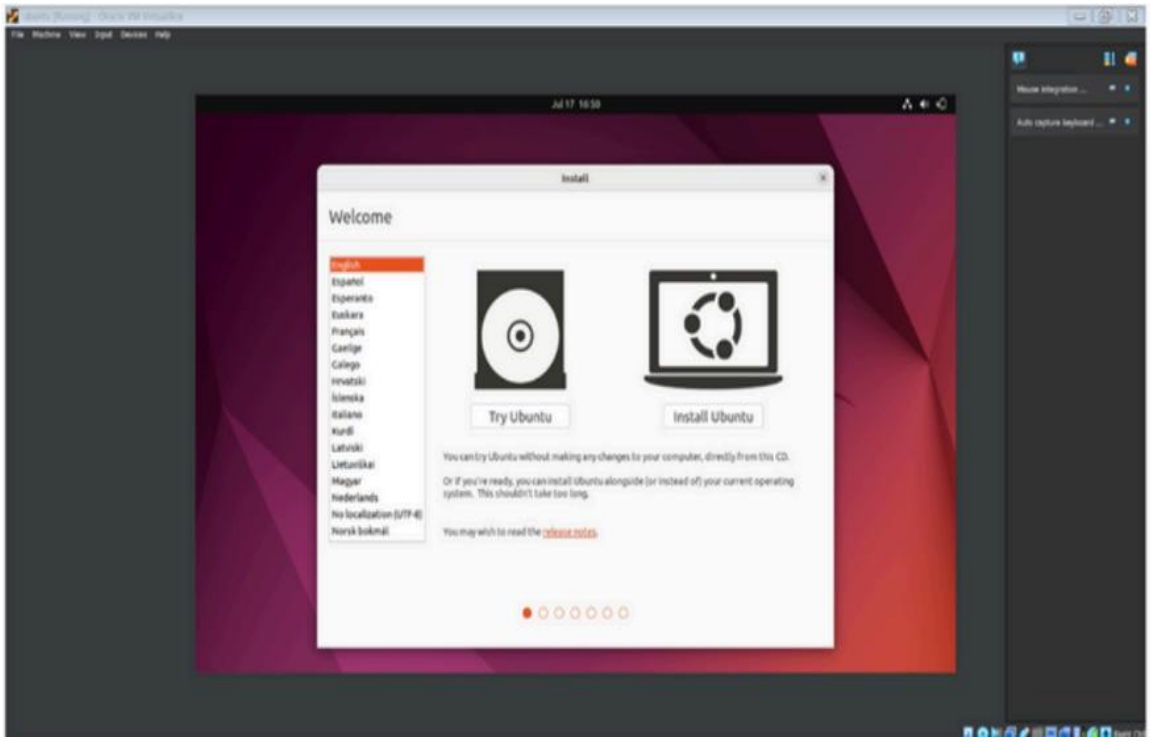
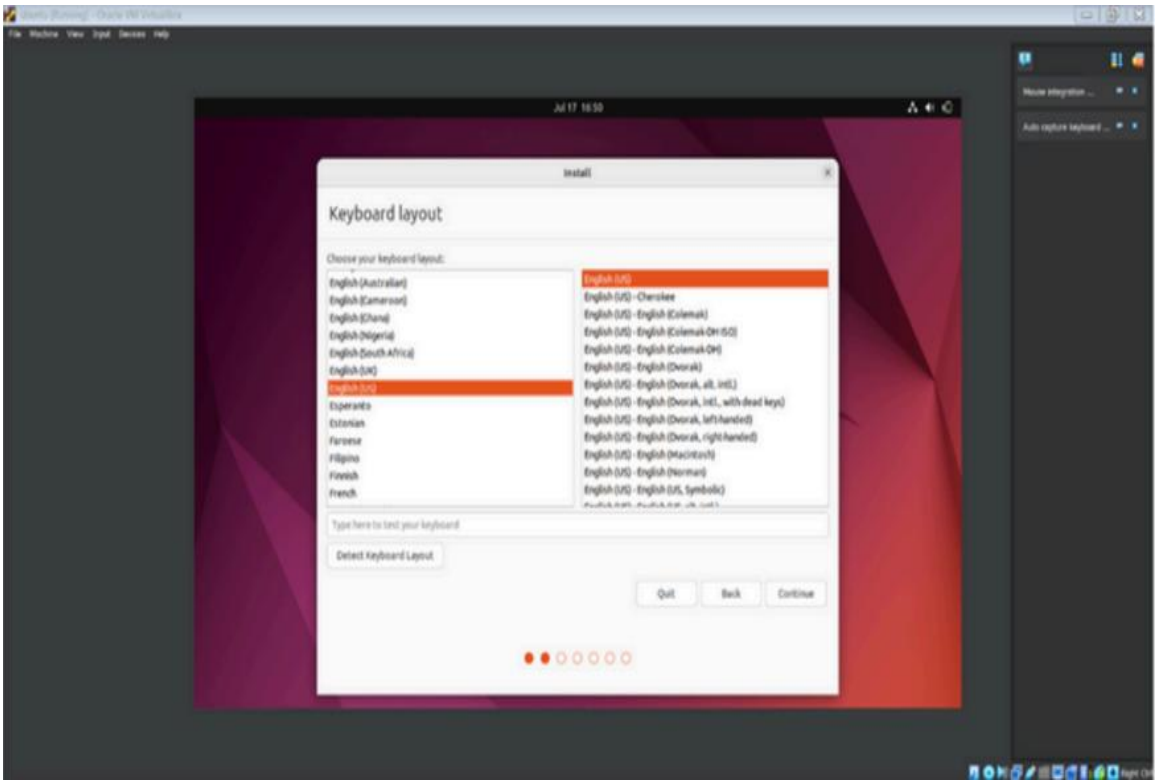
Step 6: Select the preferred language and click on Install Ubuntu.



Step 7: Select the preferred keyboard layout and its variant, click on Continue once finished.



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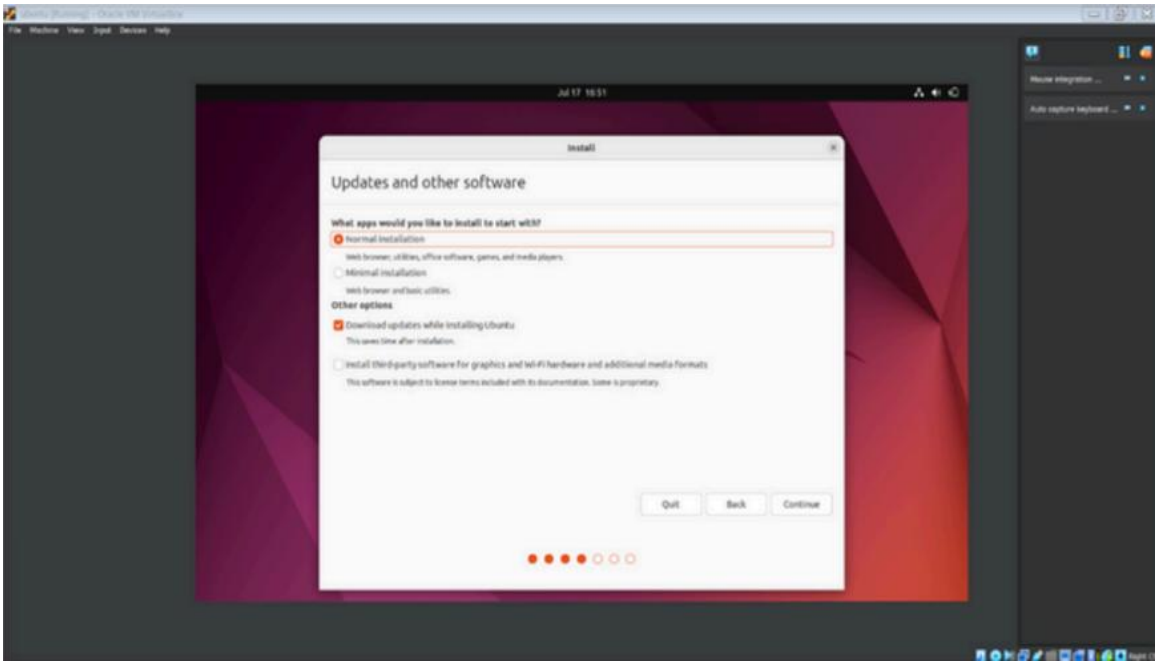
Step 8: It will prompt us to choose updates and other software to install alongside Ubuntu. We choose the options and click on Continue.



Step 9: We will be asked to choose the Installation type. Once selected we can press Enter. We will be informed about the partitions being formatted. If it's preferred, we press on Continue and proceed.

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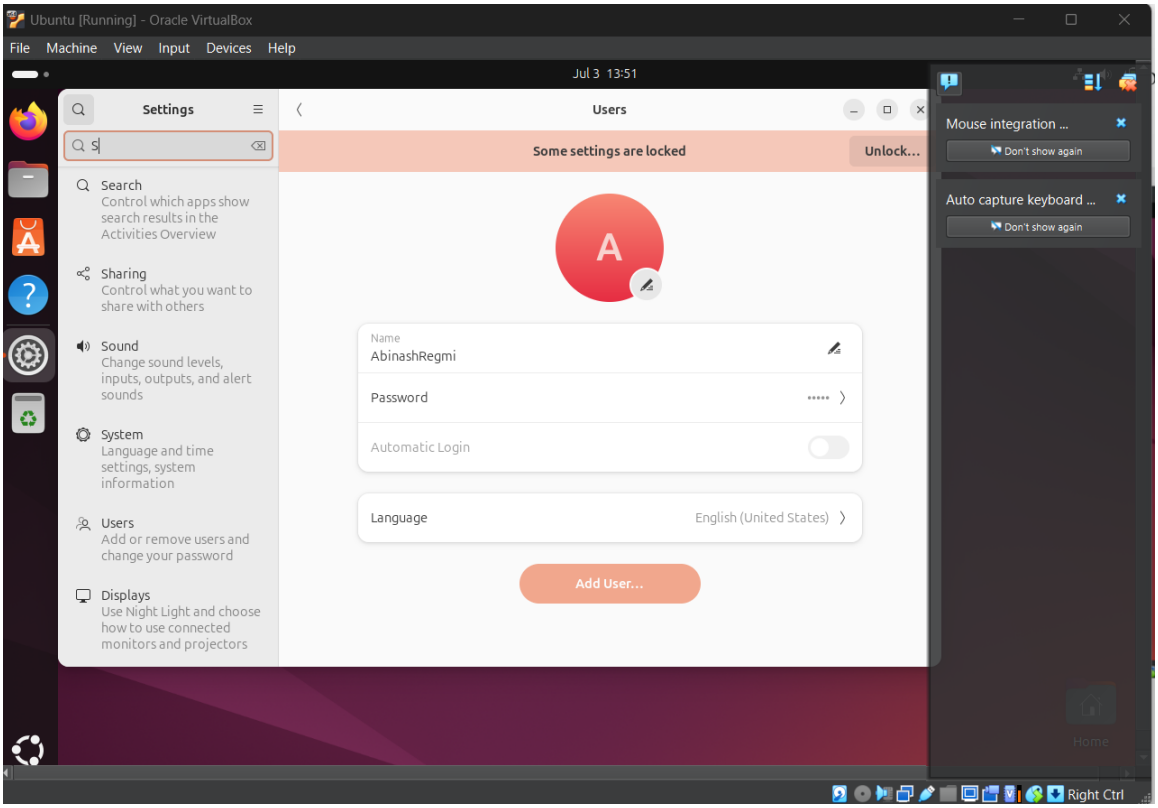
Step 10: Select the location and press Continue.

Step 11: Setup the profile for the user that includes username and password, once finished press Enter



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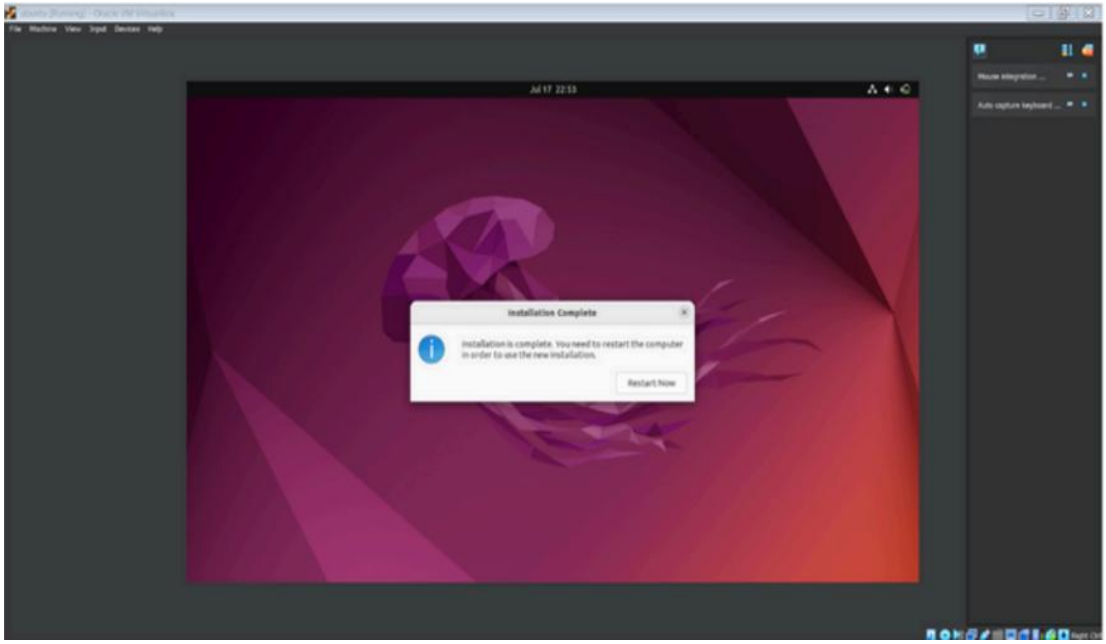
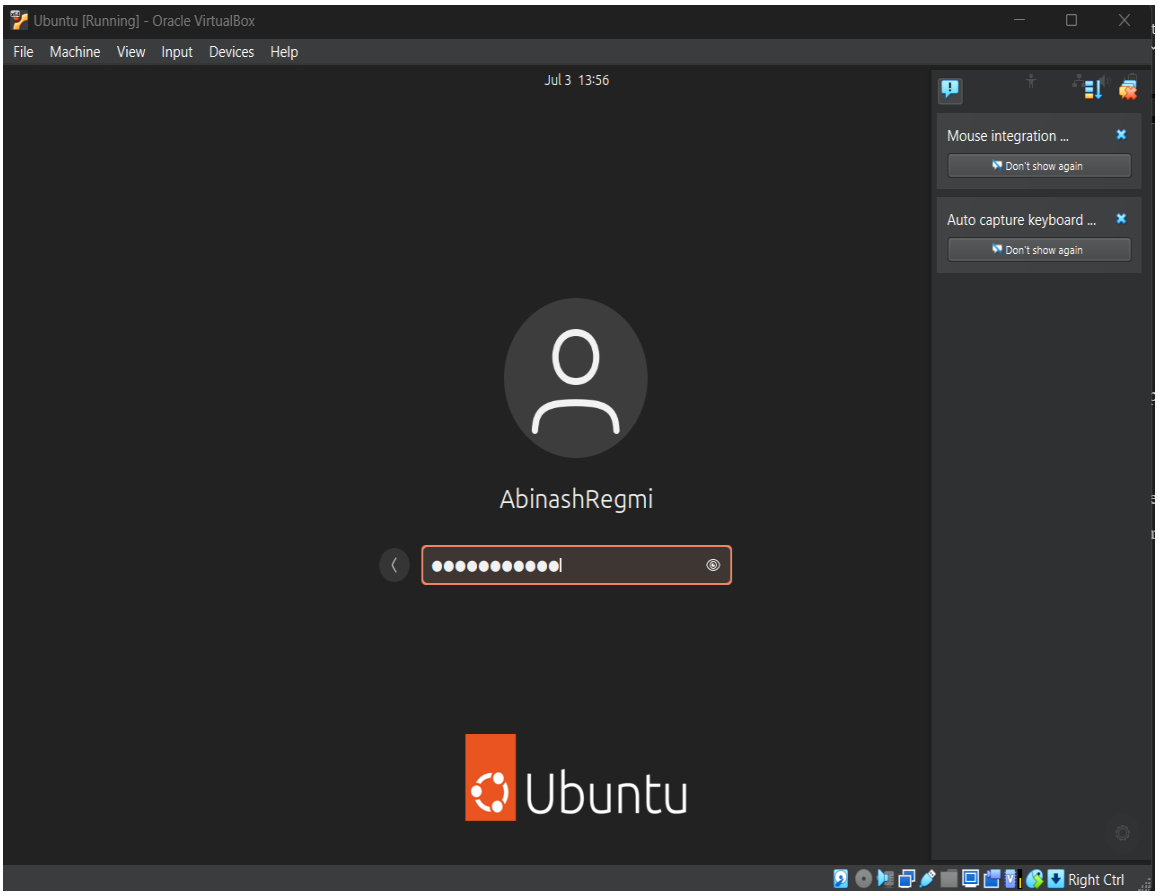
Step 12: Upon the completion of the installation process, the window on the right will prompt, Restart Now.



Step 13: Now enter the Login details on the screen and press Enter to login into the system.



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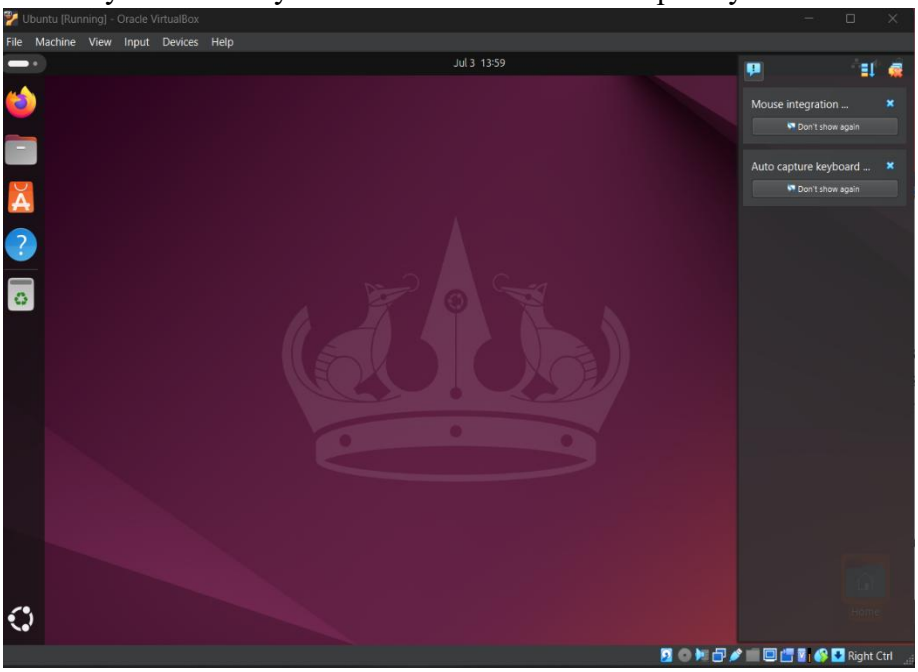
Step 14: Now our system is ready and Ubuntu is installed completely.



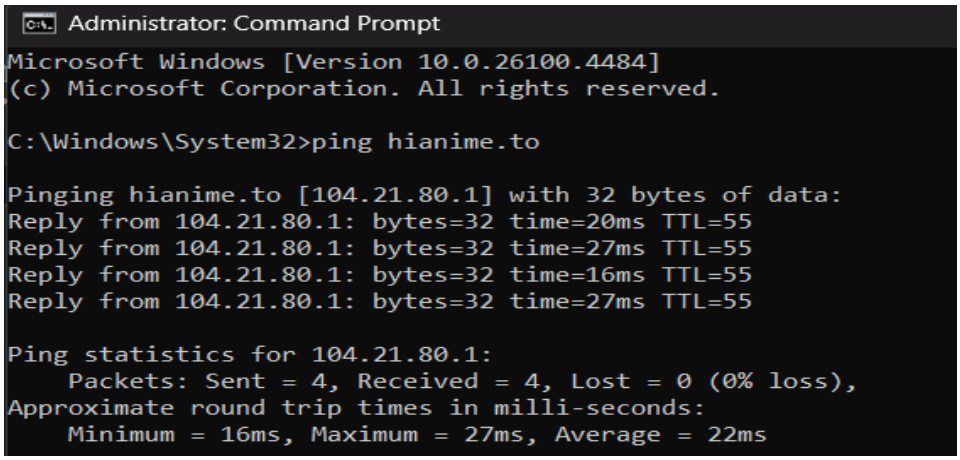
Networking Commands:

1. **PING**

   Definition: Ping (Packet Internet Groper) is a network utility used to test the reachability of a host and measure the round-trip time for messages sent from the originating host to a destination computer that are echoed back to the source.

   Syntax: *ping [options] hostname or IP address*

   Use: It is used to check the connectivity between my computer and the server to diagnose the network issue.



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2. IPCONFIG

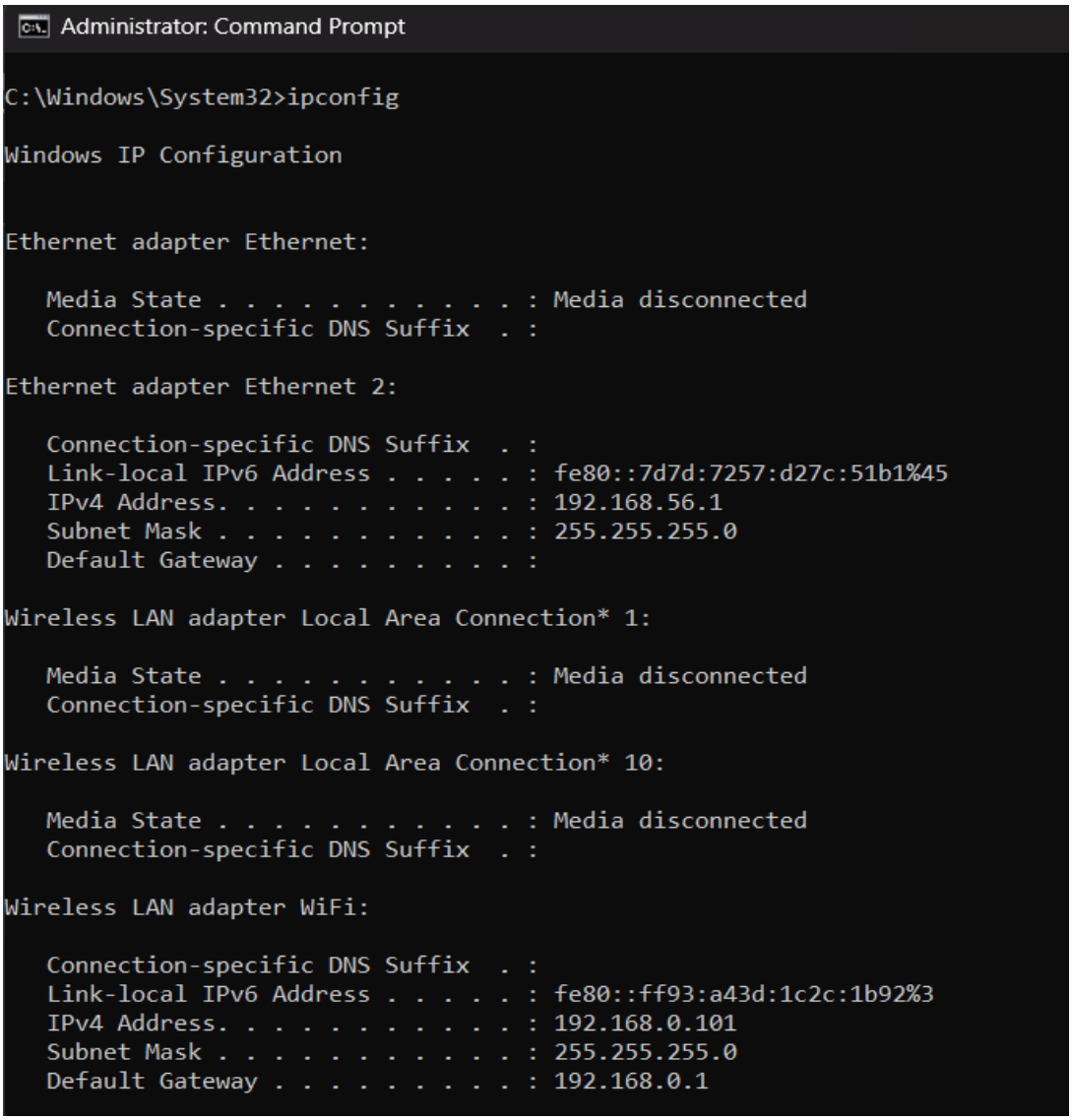
Definition: Ipconfig (Internet Protocol Configuration) is a command-line utility used to display and manage network configuration settings on Windows-based systems.

Purpose: To retrieve and display the current TCP/IP network configuration information on a Windows computer.

Syntax: Windows (ipconfig): *'ipconfig[/all]'*

Unix/Linux(ifconfig): '*ifconfig[interface]*'

Use: It is used to check the IP address assigned to my computer and verify the network settings before troubleshooting the connection issue.



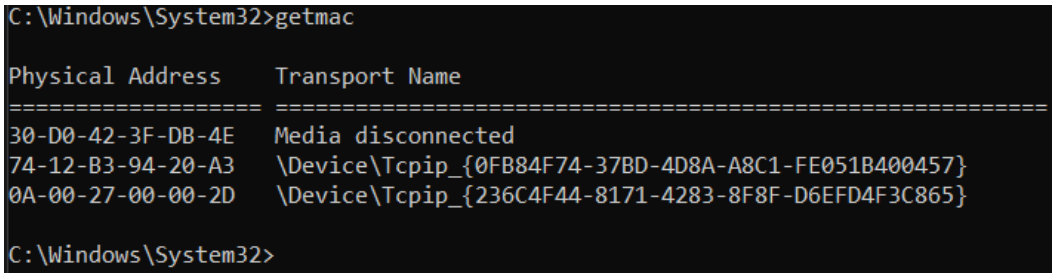
3. **GETMAC**

Definition: GETMAC is a Windows command-line utility used to retrieve the Media Access Control (MAC) address for network adapters installed on a computer. The MAC address uniquely identifies each network interface card (NIC) and is used for network communication.

Purpose: Retrieves the MAC address of a network adapter

Syntax: *getmac*

Use: It is used to obtain the MAC addresses of all network adapters on my Windows machine, which helped in troubleshooting network connectivity issues and configuring specific network settings based on MAC address filtering.



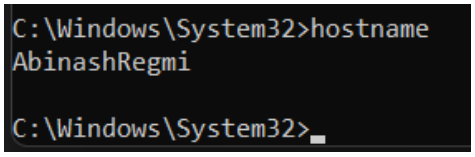
4. **HOSTNAME**

Definition: A hostname is a label assigned to a device connected to a computer network that uniquely identifies it within that network.

Purpose: To provide a human-readable label that uniquely identifies a device on a computer network.

Syntax: *hostname*

Use: To display the system name



5. **TRACERT**

Definition: Tracert is a diagnostic utility that traces the path of a network packet from source to destination.

Purpose: Trace packet route to destination

Syntax: *tracert <hostname>*

Use: It's a valuable tool for troubleshooting network issues like slow connections

```
C:\Windows\System32>tracert 9animetv.to

Tracing route to 9animetv.to [104.21.83.186]
over a maximum of 30 hops:

  1     2 ms     1 ms     7 ms  192.168.0.1
  2     3 ms     2 ms     2 ms  192.168.1.254
  3    12 ms     9 ms    14 ms  27.34.4.1
  4     5 ms     6 ms     9 ms  ae-21-233.45.gwmj-kltr-01.wlink.com.np [202.79.45.233]
  5     9 ms     8 ms     8 ms  ae-19-35.42.gwmj-ndc-01.wlink.com.np [202.79.42.34]
  6     9 ms    10 ms     5 ms  be-15-201.41.gwc-ndc-core-01.wlink.com.np [202.79.41.201]
  7     *        *        *     Request timed out.
  8    12 ms    11 ms    14 ms  103.211.151.11
  9     6 ms     7 ms     8 ms  104.21.83.186

Trace complete.
```

6. **NETSTAT**

Definition: Netstat (NETwork STATistics) is a command-line tool used to display network connections, routing tables, interface statistics, and more.

Purpose: To display network connections, routing tables, interface statistics, and multicast memberships on UNIX-like operating systems.

Syntax: *netstat*

Use: To diagnose network issues by examining active connections, routing tables, and interface statistics on my Unix-based system.

```
C:\Windows\System32>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    127.0.0.1:49670        AbinashRegmi:49671     ESTABLISHED
  TCP    127.0.0.1:49671        AbinashRegmi:49670     ESTABLISHED
  TCP    127.0.0.1:49672        AbinashRegmi:49673     ESTABLISHED
  TCP    127.0.0.1:49673        AbinashRegmi:49672     ESTABLISHED
  TCP    192.168.0.101:50056    a23-10-239-251:http    ESTABLISHED
  TCP    192.168.0.101:50057    a23-10-239-251:http    ESTABLISHED
  TCP    192.168.0.101:50192    4.213.25.240:https     ESTABLISHED
  TCP    192.168.0.101:50225    52.191.219.104:https   TIME_WAIT
  TCP    192.168.0.101:50227    52.191.219.104:https   TIME_WAIT
  TCP    192.168.0.101:50228    13.107.5.91:https      ESTABLISHED
  TCP    192.168.0.101:50229    a23-10-239-251:http    ESTABLISHED
  TCP    192.168.0.101:50232    a23-50-12-8:https      ESTABLISHED
  TCP    192.168.0.101:50233    a23-10-239-251:http    ESTABLISHED
  TCP    192.168.0.101:53473    4.213.25.240:https     ESTABLISHED
```

7. **NSLOOKUP**

Definition: NSLOOKUP (Name Server Lookup) is a command-line tool used for querying Domain Name System (DNS) servers to obtain DNS records and information about domain names, IP addresses, and related network services.

Purpose: View network connections and listening ports

Syntax: *nslookup <domain>*

Use: It is used for troubleshooting DNS issues, verifying DNS records, testing DNS configurations, and performing reverse DNS lookups

```
AbinashRegmi@Ubuntu:~$ nslookup localhost
Server:         127.0.0.53
Address:        127.0.0.53#53

Name:   localhost
Address: 127.0.0.1
Name:   localhost
Address: ::1
```

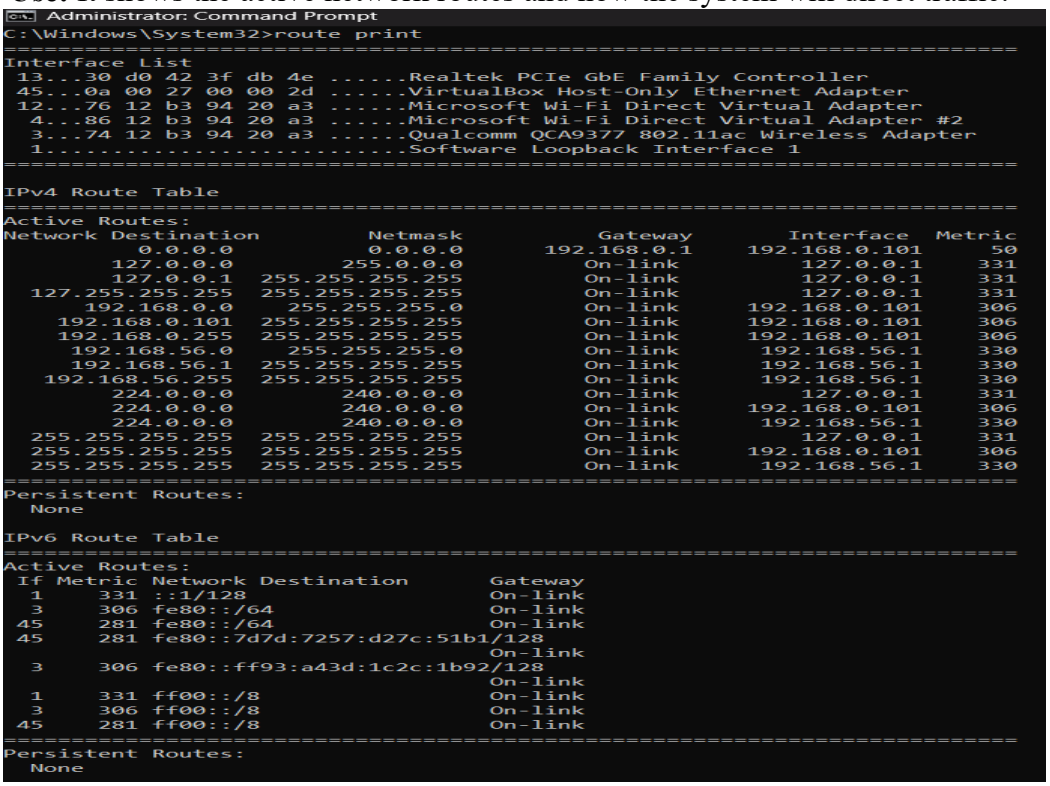
8. **ROUTE PRINT**

Definition: Route print refers to a command used to display the routing table of a device outlining the path that network traffic will take to reach various destinations.

Purpose: View routing table

Syntax: *route print*

Use: It shows the active network routes and how the system will direct traffic.



```
Administrator: Command Prompt
C:\Windows\System32>route print
===========================================================================
Interface List
 13...30 d0 42 3f db 4e ......Realtek PCIe GbE Family Controller
 45...0a 00 27 00 00 2d ......VirtualBox Host-Only Ethernet Adapter
 12...76 12 b3 94 20 a3 ......Microsoft Wi-Fi Direct Virtual Adapter
  4...86 12 b3 94 20 a3 ......Microsoft Wi-Fi Direct Virtual Adapter #2
  3...74 12 b3 94 20 a3 ......Qualcomm QCA9377 802.11ac Wireless Adapter
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    192.168.0.1    192.168.0.101      50
        127.0.0.0        255.0.0.0         On-link         127.0.0.1     331
        127.0.0.1  255.255.255.255         On-link         127.0.0.1     331
  127.255.255.255  255.255.255.255         On-link         127.0.0.1     331
      192.168.0.0    255.255.255.0         On-link    192.168.0.101     306
    192.168.0.101  255.255.255.255         On-link    192.168.0.101     306
    192.168.0.255  255.255.255.255         On-link    192.168.0.101     306
     192.168.56.0    255.255.255.0         On-link     192.168.56.1     330
     192.168.56.1  255.255.255.255         On-link     192.168.56.1     330
   192.168.56.255  255.255.255.255         On-link     192.168.56.1     330
        224.0.0.0        240.0.0.0         On-link         127.0.0.1     331
        224.0.0.0        240.0.0.0         On-link    192.168.0.101     306
        224.0.0.0        240.0.0.0         On-link     192.168.56.1     330
  255.255.255.255  255.255.255.255         On-link         127.0.0.1     331
  255.255.255.255  255.255.255.255         On-link    192.168.0.101     306
  255.255.255.255  255.255.255.255         On-link     192.168.56.1     330
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  1    331 ::1/128                  On-link
  3    306 fe80::/64                On-link
 45    281 fe80::/64                On-link
 45    281 fe80::7d7d:7257:d27c:51b1/128
                                    On-link
  3    306 fe80::ff93:a43d:1c2c:1b92/128
                                    On-link
  1    331 ff00::/8                 On-link
  3    306 ff00::/8                 On-link
 45    281 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

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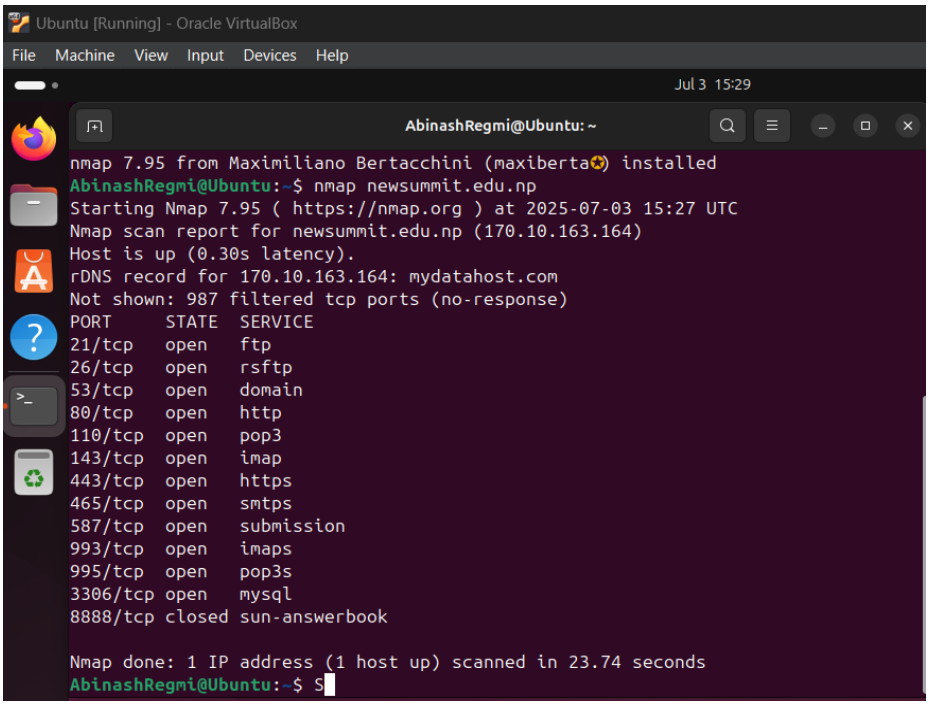
9. **NMAP**

Definition: Nmap (Network Mapper) is a powerful, free, and open-source tool used for network discovery and security auditing.

Purpose: Network scanner for hosts and ports

Syntax: *nmap <target>*

Use: It helps admins and security professionals identify potential weaknesses.



10. **NETCAT**

Definition: Netcat is a versatile command-line tool used in computer networking to read and write data across network connections, supporting both TCP and UDP protocols

Purpose: Raw TCP/UDP connections and port scanning

Syntax: *nc -z -v <target> <port>*

Use: It enables actions like establishing connections, transferring data, and even basic port scanning.

```
AbinashRegmi@Ubuntu:~$ nc -z -v newsummit.edu.np 20-25
nc: connect to newsummit.edu.np (170.10.163.164) port 20 (tcp) failed: Connectio
n refused
Connection to newsummit.edu.np (170.10.163.164) 21 port [tcp/ftp] succeeded!
nc: connect to newsummit.edu.np (170.10.163.164) port 22 (tcp) failed: Connectio
n refused
nc: connect to newsummit.edu.np (170.10.163.164) port 23 (tcp) failed: Connectio
n refused
nc: connect to newsummit.edu.np (170.10.163.164) port 24 (tcp) failed: Connectio
n refused
Connection to newsummit.edu.np (170.10.163.164) 25 port [tcp/smtp] succeeded!
```

11. CURL

Definition: Curl (Client URL) is a command line tool that developers use to transfer data to and from a server

Purpose: Transfer data to/from a server

Syntax: *curl <URL>*

Use: It is used to transfer data to and from Internet servers

```
AbinashRegmi@Ubuntu:~$ curl newsummit.edu.np
<!doctype html><html lang="en"><head><meta charset="utf-8"/><link rel="icon" hre
f="./images/logo.png"/><meta name="viewport" content="width=device-width,initial
-scale=1"/><meta name="theme-color" content="#000000"/><meta name="description"
content="Web site created using create-react-app"/><link rel="apple-touch-icon"
href="./images/logo.png"/><link rel="manifest" href="/manifest.json"/><link rel=
"stylesheet" href="https://cdn.jsdelivr.net/npm/yet-another-react-lightbox@3.17.
2/dist/styles.min.css"/><title>New Summit College</title><script defer="defer" s
rc="/static/js/main.2878cc4f.js"></script><link href="/static/css/main.68d21ec6.
css" rel="stylesheet"></head><body><noscript>You need to enable JavaScript to ru
n this app.</noscript><div id="root"></div><script src="https://cdn.jsdelivr.net
/npm/yet-another-react-lightbox@3.17.2/dist/plugins/fullscreen/index.min.js"></s
```

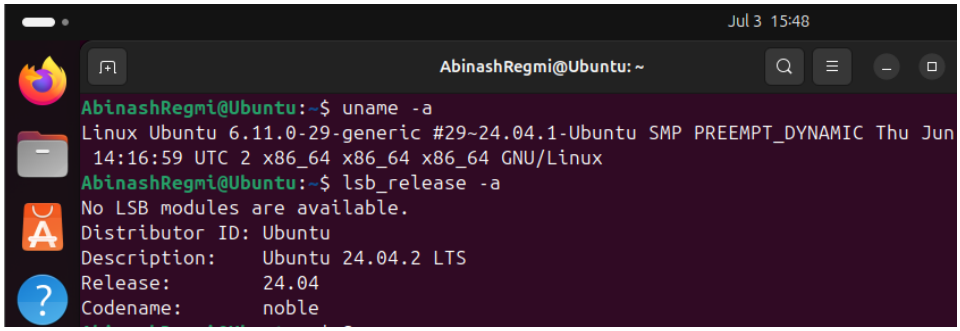
12. SYSTEMINFO

Definition: Displays detailed configuration information about a computer and its operating system, including operating system configurations, etc.

Purpose: System hardware and OS info

Syntax: *systeminfo*

Use: It helps us know hardware properties, product ID, security information, and so on.



Conclusion:

In this practical, the lab work involving the installation of VirtualBox or VMware and Ubuntu OS provided valuable insights into operating system fundamentals and virtualization concepts and technologies. Through practical exercises with basic networking commands such as PING, IPCONFIG, GETMAC, HOSTNAME, NSLOOKUP, TRACERT, NETSTAT, SYSTEMINFO, ROUTE PRINT, NMAP, NETCAT, and CURL, participants gained proficiency in network diagnostics, configuration, and system management. These activities contributed to a deeper understanding of essential tools for troubleshooting and optimizing network performances

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