

Lab 1: Ubuntu Deployment on VirtualBox with Networking Modes, Linux Commands, and Nginx Setup

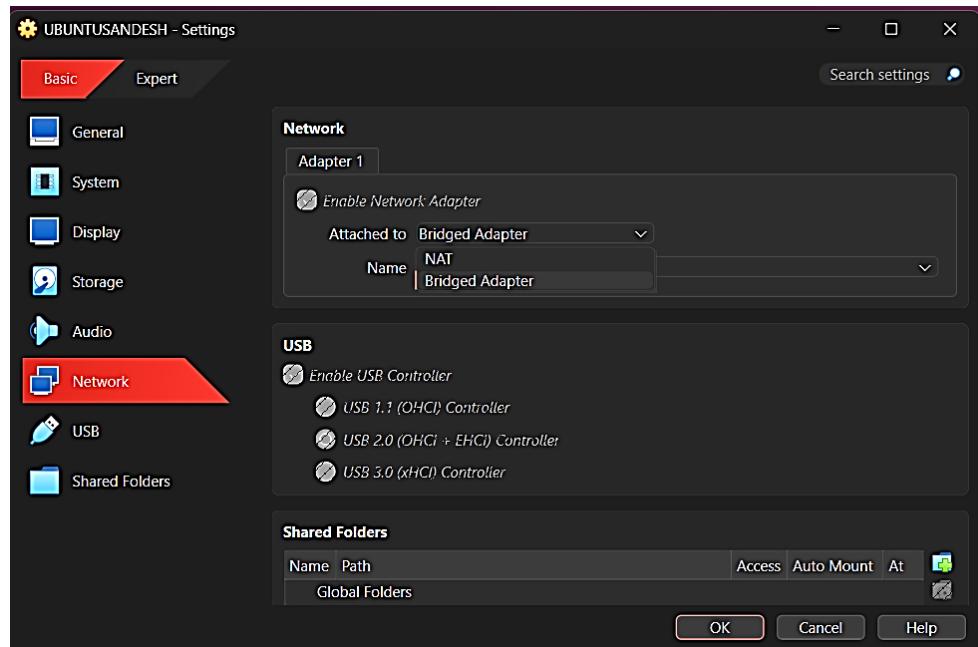
Objectives

1. Deploy Ubuntu OS using VirtualBox.
2. Understand and configure different networking modes (NAT vs Bridge).
3. Execute essential Linux commands for file and system management.
4. Understand the difference between absolute and relative paths.
5. Install and verify Nginx web server operation.
6. Check network ports and running services.

Tools and Technologies Used

1. Oracle VirtualBox
2. Ubuntu OS (ISO Image)
3. Terminal / Bash Shell
4. Nginx Web Server
5. net-tools package

1. NAT vs Bridge Networking



NAT (Network Address Translation)

- a. Default network mode in VirtualBox.
- b. VM gets a private IP assigned by VirtualBox.
- c. VM can access the internet, but external devices cannot access the VM directly.
- d. Useful for isolated setups where you do not want your VM exposed to the local network.

```
vboxuser@UBUNTUSANDESH:~/Desktop$ 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 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:e3:d3:44 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 86346sec preferred_lft 86346sec
    inet6 fd17:625c:f037:2:a00:27ff:fee3:d344/64 scope global dynamic noprefixroute
        valid_lft 86348sec preferred_lft 14348sec
    inet6 fe80::a00:27ff:fee3:d344/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
vboxuser@UBUNTUSANDESH:~/Desktop$
```

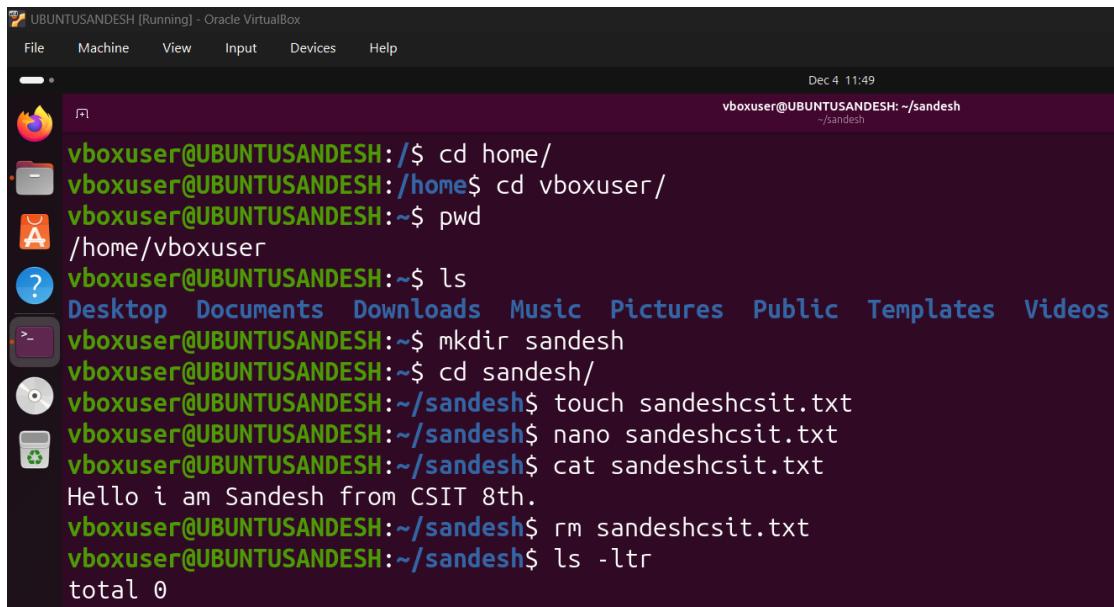
Bridge Mode

- a. VM acts as a full device on the local network.
- b. Gets an IP from the same router as the host machine.
- c. Other devices in the network can ping or access the VM.
- d. Useful for hosting services or testing server accessibility.

```
vboxuser@UBUNTUSANDESH:~/Desktop$ 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 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:e3:d3:44 brd ff:ff:ff:ff:ff:ff
    inet 192.168.80.158/21 brd 192.168.87.255 scope global dynamic noprefixroute enp0s3
        valid_lft 42945sec preferred_lft 42945sec
    inet6 fe80::a00:27ff:fee3:d344/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
vboxuser@UBUNTUSANDESH:~/Desktop$
```

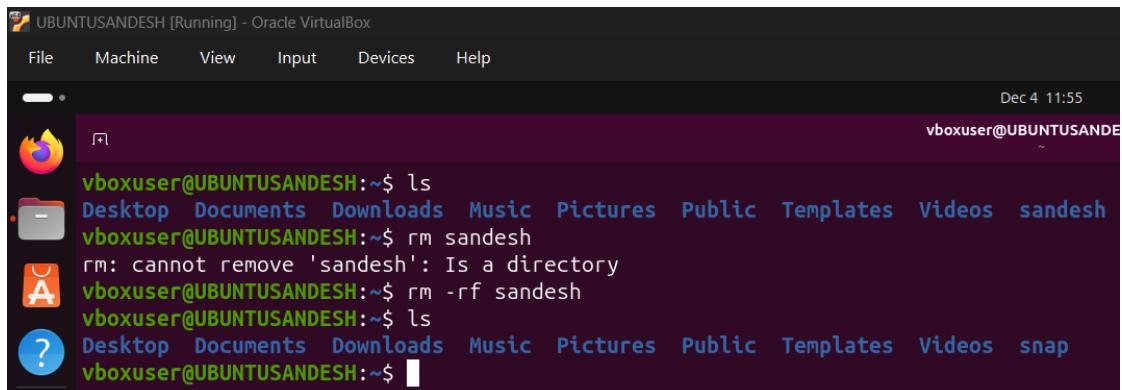
2. Basic Linux Commands Used

- a. cd: change directory
- b. pwd: Show current working directory
- c. ls: List files and directories
- d. mkdir <directory>: Create a new directory
- e. touch <file>: Create an empty file
- f. nano <file>: Open file in nano editor (exit: Ctrl X)
- g. cat <file>: Display file contents
- h. rm <file>: Delete a file
- i. ls -litr: List with details sorted by time



```
vboxuser@UBUNTUSANDESH [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Dec 4 11:49
vboxuser@UBUNTUSANDESH: ~/sandesh
vboxuser@UBUNTUSANDESH:/$ cd home/
vboxuser@UBUNTUSANDESH:/home$ cd vboxuser/
vboxuser@UBUNTUSANDESH:~/vboxuser$ pwd
/home/vboxuser
vboxuser@UBUNTUSANDESH:~/vboxuser$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos
vboxuser@UBUNTUSANDESH:~/vboxuser$ mkdir sandesh
vboxuser@UBUNTUSANDESH:~/vboxuser$ cd sandesh/
vboxuser@UBUNTUSANDESH:~/sandesh$ touch sandeshcsit.txt
vboxuser@UBUNTUSANDESH:~/sandesh$ nano sandeshcsit.txt
vboxuser@UBUNTUSANDESH:~/sandesh$ cat sandeshcsit.txt
Hello i am Sandesh from CSIT 8th.
vboxuser@UBUNTUSANDESH:~/sandesh$ rm sandeshcsit.txt
vboxuser@UBUNTUSANDESH:~/sandesh$ ls -litr
total 0
```

- j. rm <directory>: Fails if directory not empty
- k. rm -rf <directory>: Force delete directory



```
vboxuser@UBUNTUSANDESH [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Dec 4 11:55
vboxuser@UBUNTUSANDESH:~/sandesh$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos sandesh
vboxuser@UBUNTUSANDESH:~/sandesh$ rm sandesh
rm: cannot remove 'sandesh': Is a directory
vboxuser@UBUNTUSANDESH:~/sandesh$ rm -rf sandesh
vboxuser@UBUNTUSANDESH:~/sandesh$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos snap
vboxuser@UBUNTUSANDESH:~/sandesh$
```

1. df -h: Show disk/storage usage

m. free -mh: Show RAM usage

UbuntuSandesh [Running] - Oracle VirtualBox

vboxuser@UBUNTUSANDESH:~\$ df -h

Filesystem	Size	Used	Avail	Use%	Mounted on
tmpfs	330M	1.6M	328M	1%	/run
/dev/sda2	25G	6.3G	17G	27%	/
tmpfs	823M	0	823M	0%	/dev/shm
tmpfs	5.0M	8.0K	5.0M	1%	/run/lock
tmpfs	823M	8.0K	823M	1%	/tmp
tmpfs	165M	84K	165M	1%	/run/user/1000
/dev/sr0	51M	51M	0	100%	/media/vboxuser/VBox_GAs_7.2.4
tmpfs	1.0M	0	1.0M	0%	/run/credentials/systemd-resolved.service
tmpfs	1.0M	0	1.0M	0%	/run/credentials/systemd-journald.service

vboxuser@UBUNTUSANDESH:~\$ free -mh

	total	used	free	shared	buff/cache	available
Mem:	1.6Gi	1.4Gi	77Mi	86Mi	388Mi	239Mi
Swap:	0B	0B	0B			

n. top: Show running processes

UbuntuSandesh [Running] - Oracle VirtualBox

Dec 4 12:04

vboxuser@UBUNTUSANDESH:~— top

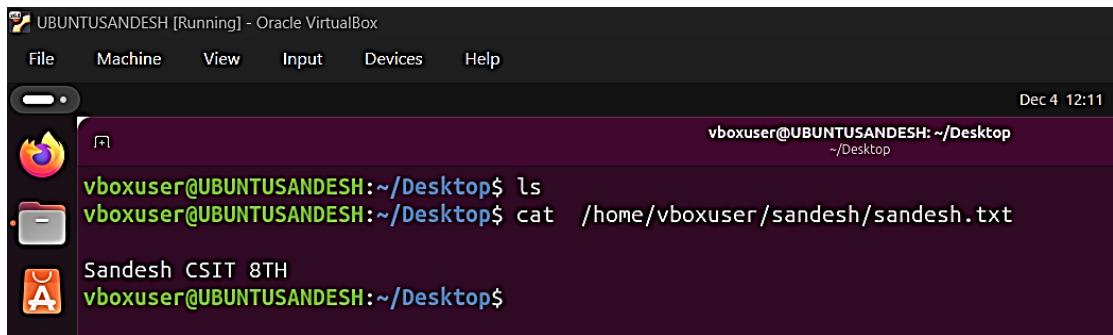
top - 12:04:23 up 1:40, 1 user, load average: 0.10, 0.57, 1.52
Tasks: 216 total, 1 running, 211 sleeping, 0 stopped, 4 zombie
%Cpu(s): 0.9 us, 1.4 sy, 0.0 ni, 97.8 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 1645.9 total, 86.1 free, 1408.4 used, 378.2 buff/cache
MiB Swap: 0.0 total, 0.0 free, 0.0 used. 237.5 avail Mem

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
5973	vboxuser	20	0	4080428	364628	97568	S	4.0	21.6	0:32.31	gnome-shell
6865	vboxuser	20	0	1725988	211824	70164	S	3.0	12.6	0:22.28	ptyxvis
7006	vboxuser	20	0	22216	6188	3992	R	0.7	0.4	0:00.92	top
1	root	20	0	24964	9984	5188	S	0.3	0.6	20:58.97	systemd
28	root	20	0	0	0	0	I	0.3	0.0	0:02.14	kworker/u10:0-flush-8:0
1660	root	20	0	232980	552	284	S	0.3	0.0	0:06.65	VBoxDRMClient
6163	vboxuser	20	0	586168	12188	4844	S	0.3	0.7	0:02.20	update-notifier
2	root	20	0	0	0	0	S	0.0	0.0	0:00.11	kthreadd
3	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pool_workqueue_release
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-rcu_gp
5	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-sync_wq
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-kvfree_rcu_reclaim
7	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-slub_flushwq
8	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-netns
11	root	0	-20	0	0	0	I	0.0	0.0	0:01.27	kworker/0:0-kblockd
12	root	20	0	0	0	0	I	0.0	0.0	0:00.00	kworker/u8:0-ipv6_addrconf
13	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-mm_percpu_wq
14	root	20	0	0	0	0	S	0.0	0.0	0:01.59	ksoftirqd/0
15	root	20	0	0	0	0	I	0.0	0.0	0:03.26	rcu_preempt
16	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcu_exp_par_gp_kthread_worker/0
17	root	20	0	0	0	0	S	0.0	0.0	0:00.17	rcu_exp_gp_kthread_worker
18	root	rt	0	0	0	0	S	0.0	0.0	0:00.14	migration/0
19	root	-51	0	0	0	0	S	0.0	0.0	0:00.00	idle_inject/0
20	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0
21	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/1
22	root	-51	0	0	0	0	S	0.0	0.0	0:00.00	idle_inject/1
23	root	rt	0	0	0	0	S	0.0	0.0	0:00.50	migration/1
24	root	20	0	0	0	0	S	0.0	0.0	0:01.26	ksoftirqd/1
27	root	20	0	0	0	0	I	0.0	0.0	0:01.64	kworker/u9:0-events_power_efficient
29	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kdevtmpfs
30	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-inet_frag_wq
31	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks_kthread

3. Absolute Path vs Relative Path

Absolute Path

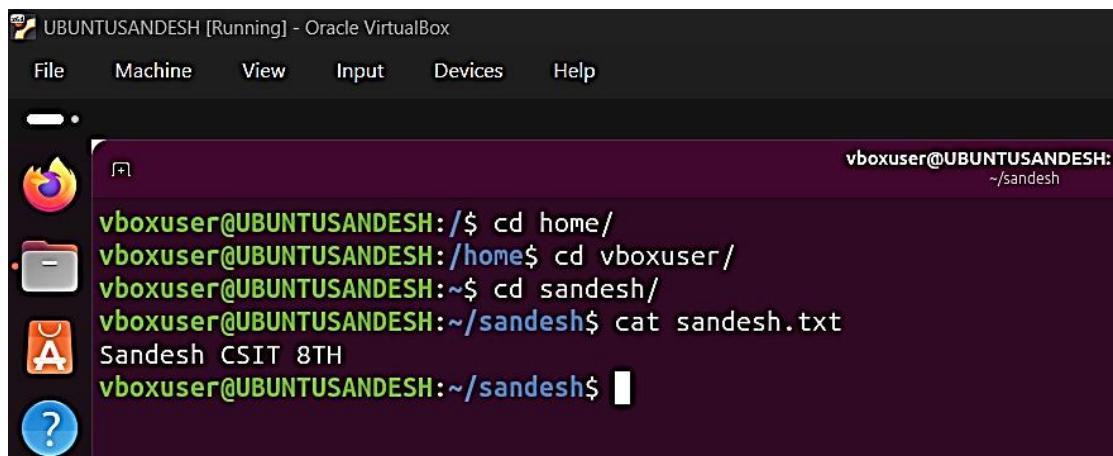
- a. Starts from root directory /.
- b. Complete path to a file or folder.
- c. Example: /home/user/documents/file.txt



```
vboxuser@UBUNTUSANDESH:~/Desktop$ ls
vboxuser@UBUNTUSANDESH:~/Desktop$ cat /home/vboxuser/sandesh/sandesh.txt
Sandesh CSIT 8TH
vboxuser@UBUNTUSANDESH:~/Desktop$
```

Relative Path

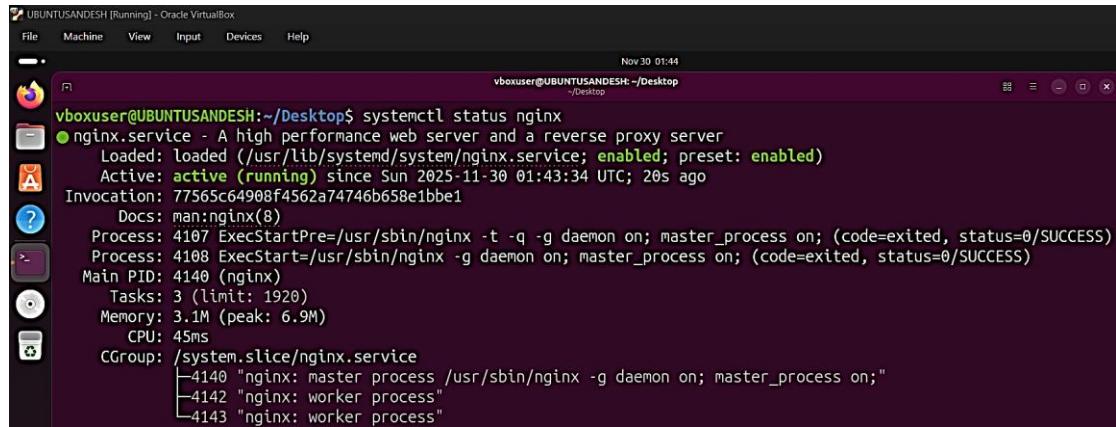
- a. Based on current working directory.
- b. Example: ../folder/file.txt or ./file.txt



```
vboxuser@UBUNTUSANDESH:/$ cd home/
vboxuser@UBUNTUSANDESH:/home$ cd vboxuser/
vboxuser@UBUNTUSANDESH:~/vboxuser$ cd sandesh/
vboxuser@UBUNTUSANDESH:~/vboxuser/sandesh$ cat sandesh.txt
Sandesh CSIT 8TH
vboxuser@UBUNTUSANDESH:~/vboxuser/sandesh$
```

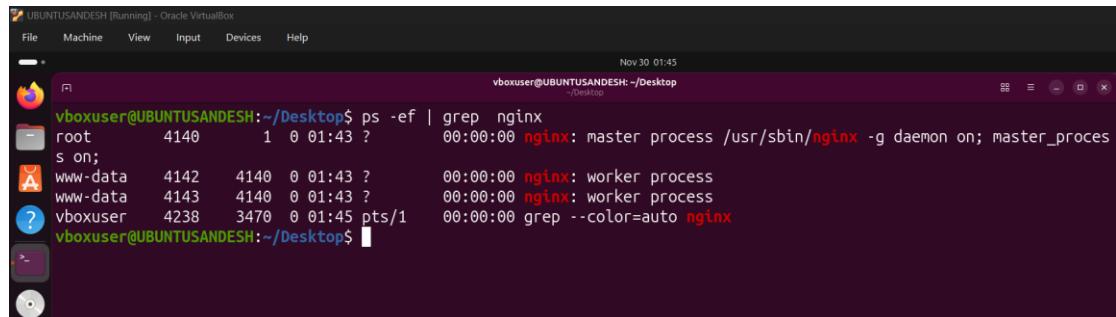
4. Use of Nginx on Ubuntu

Check if Nginx is running:



```
vboxuser@UBUNTUSANDESH:~/Desktop$ systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
    Loaded: loaded (/usr/lib/systemd/system/nginx.service; enabled; preset: enabled)
    Active: active (running) since Sun 2025-11-30 01:43:34 UTC; 20s ago
      Invocation: 77565c64908f4562a74746b658e1bbe1
        Docs: man:nginx(8)
   Process: 4107 ExecStartPre=/usr/sbin/nginx -t -q -g daemon on; master_process on; (code=exited, status=0/SUCCESS)
   Process: 4108 ExecStart=/usr/sbin/nginx -g daemon on; master_process on; (code=exited, status=0/SUCCESS)
     Main PID: 4140 (nginx)
        Tasks: 3 (limit: 1920)
       Memory: 3.1M (peak: 6.9M)
          CPU: 45ms
        CGroup: /system.slice/nginx.service
                ├─4140 "nginx: master process /usr/sbin/nginx -g daemon on; master_process on;"
                ├─4142 "nginx: worker process"
                └─4143 "nginx: worker process"
```

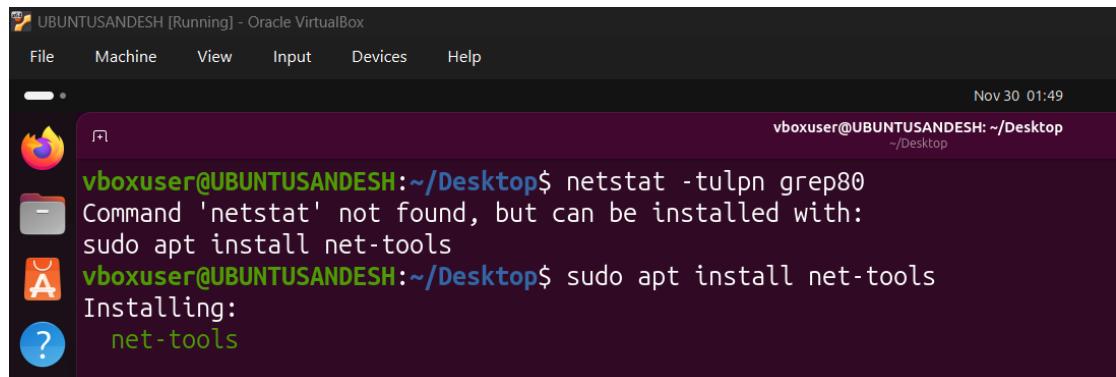
```
ps -ef | grep nginx
```



```
vboxuser@UBUNTUSANDESH:~/Desktop$ ps -ef | grep nginx
root      4140      1  0 01:43 ?        00:00:00 nginx: master process /usr/sbin/nginx -g daemon on; master_process
s on;
www-data  4142      4140  0 01:43 ?        00:00:00 nginx: worker process
www-data  4143      4140  0 01:43 ?        00:00:00 nginx: worker process
vboxuser  4238     3470  0 01:45 pts/1    00:00:00 grep --color=auto nginx
vboxuser@UBUNTUSANDESH:~/Desktop$
```

Install net-tools:

```
sudo apt install net-tools
```

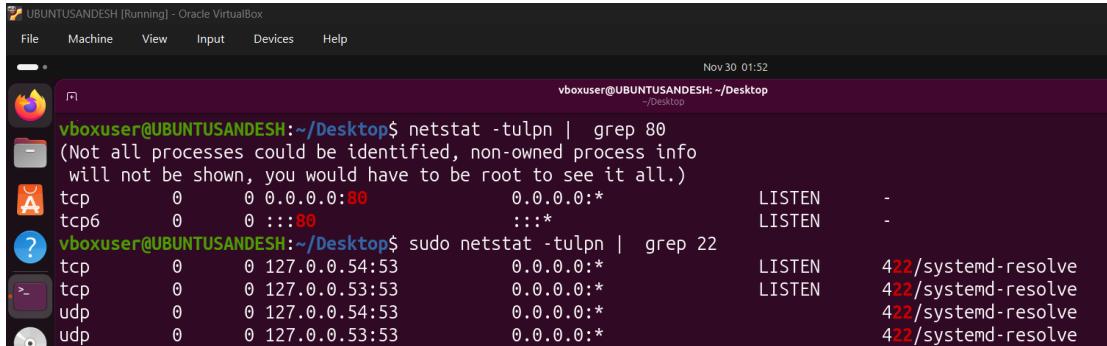


```
vboxuser@UBUNTUSANDESH:~/Desktop$ netstat -tulpn grep80
Command 'netstat' not found, but can be installed with:
sudo apt install net-tools
vboxuser@UBUNTUSANDESH:~/Desktop$ sudo apt install net-tools
Installing:
  net-tools
```

Check listening ports (for port 80 or 22):

```
netstat -tulpn | grep 80
```

```
sudo netstat -tulpn | grep 22
```



The screenshot shows a terminal window titled "UBUNTUSANDESH [Running] - Oracle VirtualBox". The terminal prompt is "vboxuser@UBUNTUSANDESH: ~/Desktop\$". The user runs two commands: "netstat -tulpn | grep 80" and "sudo netstat -tulpn | grep 22". The output for port 80 shows two entries: one for TCP (tcp) and one for TCP6 (tcp6), both listening on port 80. The output for port 22 shows four entries: two for TCP (tcp) listening on 127.0.0.54:53 and two for UDP (udp) listening on 127.0.0.53:53. All entries show the process as "422/systemd-resolve".

```
vboxuser@UBUNTUSANDESH:~/Desktop$ netstat -tulpn | grep 80
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
tcp      0      0 0.0.0.0:80          0.0.0.0:*
tcp6     0      0 ::1:80            ::*:*
vboxuser@UBUNTUSANDESH:~/Desktop$ sudo netstat -tulpn | grep 22
tcp      0      0 127.0.0.54:53    0.0.0.0:*
tcp      0      0 127.0.0.53:53    0.0.0.0:*
udp     127.0.0.53:53           0.0.0.0:*
udp     127.0.0.53:53           0.0.0.0:*
```

Conclusion

This lab focused on installing and working with Ubuntu inside VirtualBox. NAT and Bridge modes were compared, followed by hands-on use of basic Linux commands. Path concepts were clarified (absolute vs relative), and Nginx installation and network port checks were performed.