47/100 VBW

ux Lab Practice Sheet – Shell Scripting (20 Questions)

ame: Sakshan Roll No: 590025061 Date: 4/Nov/25

Batch-1B.

1. Complete the script to check if a number is even or odd.

```
echo "Enter a number:"
read n
if [ $((n % 2)) -eq 0 ]; then
    echo "Even number"
else
    echo "Odd number"
fi
```

2. Complete the loop to print numbers from 1 to 10.

```
for i in 1 2 3 4 5 6 7 8 9 10
do
    echo $i
done
```

3. Fill the missing condition to check if a file exists.

```
echo "Enter filename:"
read f
if [ ___ $f ]; then
    echo "File exists"
else
    echo "File not found"
fi
```

4. Complete this script to compare two numbers.

```
echo "Enter two numbers:"
read a b
if [ $a -gt $b ]; then
    echo "$a is greater"
else
    echo "$b is greater"
fi
```

command to print your current directory

in directory:"

6. Debug the following code to fix numeric comparison.

```
a=10
b=5
if [ $a > $b ]; then
    echo "a is greater"
fi
```

7. Identify and fix the read error.

```
echo "Enter your name:"
readname
echo "Hello $name"
```

8. Correct the while loop increment.

```
i=1
while [ $i -le 5 ]
do
    echo $i
    i=$i+1
done
```

9. Fix this arithmetic expression.

```
x=5
y=2
z= x + y
echo $z
```

10. Correct the case statement syntax.

```
echo "Enter choice:"
read ch
case $ch in
1) echo "One"
2) echo "Two"
esac
```

11. Write a script to print numbers from 1 to 20 using a while loop.

12. Write a script that prints a multiplication table for a given number (1–20).

13. Write a script to find the factorial of a number using a for loop.

14. Write a script to find the sum of first 10 natural numbers.

15. Write a script to display all files in the current directory using a for loop.

16. Write a script to check whether a given year is a leap year or not.

17. Write a script to print all even numbers between 1 and 50 using while loop.

18. Write a script to count how many .sh files exist in the current directory.

19. Write a script that reads 5 numbers and prints their total sum.

20. Write a script to keep accepting numbers until 0 is entered, then display the sum.

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```
fact() {
  n=$1
  if [ "$n" -le 1 ]; then
  echo 1
  return
  
  m=1
  for ((i=2, i<=n ; i++));
  rem= $((rem$i))
  done
  echo "$rem"
```

(rem*$)

```
i=1
while [ $i -le 20 ]
do
  echo $((i++))
done.
```

```
echo " Enter a number 'n' from (1-10) "
read (1-10) "n"

for [n.. nx10E..n]
do
   echo " table of 'n' is:"
done.
```

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14//
```
i=0
while [$i -le 10]
do
    sum=$((sum+i))
    echo "sum"
done.
```

n(n+1)

```
files("Hello" "Bye")
echo "file: ${files[@]}"
```

16//.
```
echo "Enter a year"
read year.

if.
```

17//.
```
i=0
while [$i -le 50]
do.
    echo "$i"
    if [$i %2 = 0 ]; then
        echo "Even"
    else
        echo "Odd"!
```

15.

sic command.md
eck_file.sh
ear
mmand.md
st.png
nic.png
age.png
b3_Exp1.md
b4.md
b6.md
.png
anagment.md
etworks.md
alindromem.sh
aux.png
idset.png
stree.png
stree1.png
b.png
g.png
h.png
i.png

Intelligent Commands

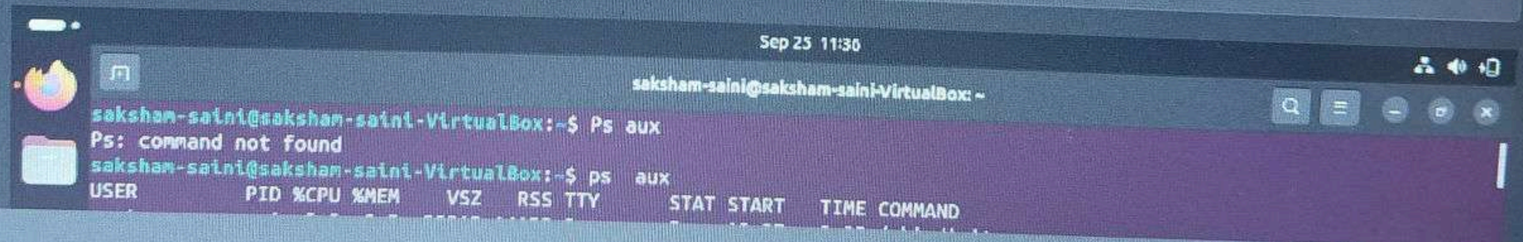
This document explains various Linux commands to manage and monitor processes.

🌲 1. List Processes: `ps aux`

- **a** → show processes for all users
- **u** → show user/owner of process
- **x** → show processes not attached to a terminal

Example Output:

```
USER         PID  %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root           1  0.0  0.1 167500  1100 ?        Ss   Sep25   0:05 /sbin/init
sameerbhardwaj     1234  1.2  1.5 274532 15632 ?        Sl   10:15   0:12
/usr/bin/python3 script.py
mysql     2001  0.5  2.0 450000 20988 ?        Ssl  Sep25   1:02 /usr/sbin/mysqld
```



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Linux Process Management Commands

This document explains various Linux commands to manage and monitor processes.

1. List Processes: `ps aux`

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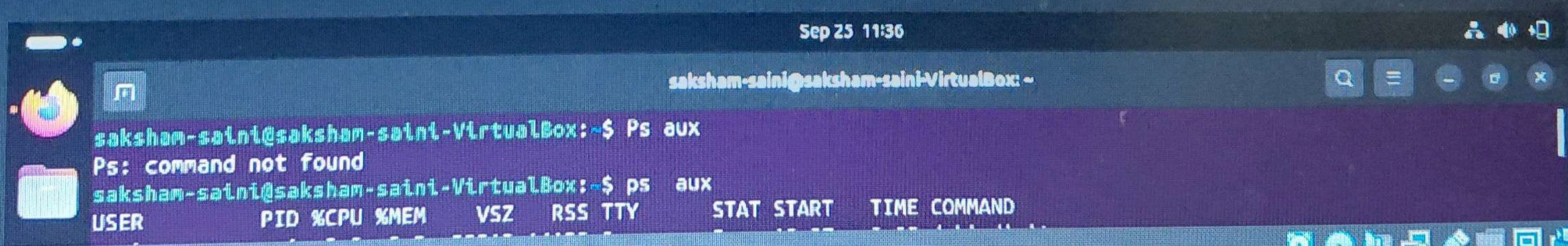
/usr/bin/python3 script.py
mysql       2001  0.5  2.0 450000 20988 ?        Ssl  Sep25   1:02 /usr/sbin/mysqld
```



```
root           2  0.0  0.0      0     0 ?        S    10:37   0:00 [kthreadd]
root           3  0.0  0.0      0     0 ?        S    10:37   0:00 [pool_workque
root           4  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-rc
root           5  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-sy
root           6  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-kv
root           7  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-sl
root           8  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-ne
root          13  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-mm
root          14  0.0  0.0      0     0 ?        I    10:37   0:00 [rcu_tasks_kt
root          15  0.0  0.0      0     0 ?        I    10:37   0:00 [rcu_tasks_ru
root          16  0.0  0.0      0     0 ?        I    10:37   0:00 [rcu_tasks_tr
root          17  0.0  0.0      0     0 ?        S    10:37   0:02 [ksoftirqd/0]
root          18  0.1  0.0      0     0 ?        I    10:37   0:06 [rcu_preempt]
root          19  0.0  0.0      0     0 ?        S    10:37   0:00 [rcu_exp_par_
root          20  0.0  0.0      0     0 ?        S    10:37   0:00 [rcu_exp_gp_k
root          21  0.0  0.0      0     0 ?        S    10:37   0:00 [migration/0]
root          22  0.0  0.0      0     0 ?        S    10:37   0:00 [idle_inject/
root          23  0.0  0.0      0     0 ?        S    10:37   0:00 [cpuhp/0]
root          24  0.0  0.0      0     0 ?        S    10:37   0:00 [cpuhp/1]
root          25  0.0  0.0      0     0 ?        S    10:37   0:00 [idle_inject/
root          26  0.0  0.0      0     0 ?        S    10:37   0:00 [migration/1]
root          27  0.0  0.0      0     0 ?        S    10:37   0:00 [ksoftirqd/1]
root          30  0.0  0.0      0     0 ?        S    10:37   0:00 [kdevtmpfs]
root          31  0.0  0.0      0     0 ?        I<   10:37   0:00 [kworker/R-in
root          32  0.0  0.0      0     0 ?        S    10:37   0:00 [kauditd]
root          33  0.0  0.0      0     0 ?        S    10:37   0:00 [khungtaskd]
root          34  0.0  0.0      0     0 ?        S    10:37   0:00 [oom_reaper]
root          35  0.1  0.0      0     0 ?        I    10:37   0:07 [kworker/uR:1
```

2. Process Tree: `pstree -p`

ws parent-child process relationships.

mple Output:

```
systemd(1)─┬─NetworkManager(778)
```

```
stemd(1)─┬─NetworkManager(778)
         ├─sshd(895)─┬─sshd(1023)───bash(1024)───pstree(1101)
         ├─mysqld(2001)
         └─python3(1234)
```

Sep 25 11:36

saksham-saini@saksham-saini-VirtualBox: ~

```
root        7880  0.0  0.0      0     0 ?        I    12:01   0:00 [kworker/1:0]
saksham+    7976  0.3  0.3  46352 20980 ?        S    12:03   0:00 /usr/bin/pyth
saksham+    7979  0.5  0.5 467640 29216 ?        Sl   12:03   0:00 /usr/bin/gnom
saksham+    7985  2.2  0.9 705584 54972 ?        Ssl  12:03   0:00 /usr/libexec/
saksham+    7993  0.0  0.0  19932  5488 pts/0    Ss   12:03   0:00 bash
saksham+    8027 33.3  0.0  22416  4740 pts/0    R+   12:04   0:00 ps aux
saksham-saini@saksham-saini-VirtualBox:~$ pstree -p
```

```
systemd(1)─┬─ModemManager(1132)─┬─{ModemManager}(1137)
           │                    ├─{ModemManager}(1138)
           │                    └─{ModemManager}(1140)
           ├─NetworkManager(943)─┬─{NetworkManager}(1096)
           │                     ├─{NetworkManager}(1097)
           │                     └─{NetworkManager}(1103)
           ├─accounts-daemon(828)─┬─{accounts-daemon}(897)
           │                      ├─{accounts-daemon}(898)
           │                      └─{accounts-daemon}(904)
           ├─avahi-daemon(756)───avahi-daemon(911)
           ├─colord(1471)─┬─{colord}(1478)
           │              ├─{colord}(1479)
           │              └─{colord}(1481)
           ├─cron(830)
           ├─cups-browsed(1234)─┬─{cups-browsed}(1253)
           │                    ├─{cups-browsed}(1254)
           │                    └─{cups-browsed}(1255)
           ├─cupsd(1214)
           ├─dbus-daemon(758)
           ├─fwupd(3341)─┬─{fwupd}(3342)
           │             ├─{fwupd}(3343)
           │             ├─{fwupd}(3344)
           │             ├─{fwupd}(3345)
```

nd ● Preview managment.md × managment.md

```
               ─{fwupd}(3347)
 ├─gdm3(1231)─┬─gdm-session-wor(1814)─┬─gdm-wayland-ses(1937)─┬─gnome+
                                                              └─{gdm-+
```

Sep 25 11:36

saksham-saini@saksham-saini-VirtualBox: ~

```
 ├─colord(1471)─┬─{colord}(1478)
 │              ├─{colord}(1479)
 │              └─{colord}(1481)
 ├─cron(830)
 ├─cups-browsed(1234)─┬─{cups-browsed}(1253)
 │                    ├─{cups-browsed}(1254)
 │                    └─{cups-browsed}(1255)
 ├─cupsd(1214)
 ├─dbus-daemon(758)
 ├─fwupd(3341)─┬─{fwupd}(3342)
 │             ├─{fwupd}(3343)
 │             ├─{fwupd}(3344)
 │             ├─{fwupd}(3345)
 │             └─{fwupd}(3347)
 ├─gdm3(1231)─┬─gdm-session-wor(1814)─┬─gdm-wayland-ses(1937)─┬─gnome+
 │            │                       │                       ├─{gdm-+
 │            │                       │                       ├─{gdm-+
 │            │                       │                       └─{gdm-+
 │            │                       ├─{gdm-session-wor}(1815)
 │            │                       ├─{gdm-session-wor}(1816)
 │            │                       └─{gdm-session-wor}(1817)
 │            ├─{gdm3}(1236)
 │            ├─{gdm3}(1237)
 │            └─{gdm3}(1238)
 ├─gnome-remote-de(764)─┬─{gnome-remote-de}(1095)
 │                      ├─{gnome-remote-de}(1098)
 │                      └─{gnome-remote-de}(1102)
 ├─kerneloops(1240)
 ├─kerneloops(1244)
 ├─polkitd(795)─┬─{polkitd}(1099)
 │              ├─{polkitd}(1100)
 │              └─{polkitd}(1101)
 ├─power-profiles-(802)─┬─{power-profiles-}(848)
```

📊 3. Real-Time Monitoring: `top`

Displays real-time CPU/memory usage.

Example Output:

```
top - 10:40:46 up  22 min,  1 user,  load average: 0.22, 0.38, 0.27
Tasks: 211 total,   1 running, 210 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.1 us,  0.3 sy,  0.0 ni, 99.5 id,  0.0 wa,  0.0 hi,  0.1 si,  0.0 st
MiB Mem :   5776.9 total,   2161.6 free,   1138.6 used,   2799.3 buff/cache
MiB Swap:      0.0 total,      0.0 free,      0.0 used.   4638.2 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 1992 sameerb+  20   0 4967692 411396 141592 S   3.6  7.0   0:59.64 gnome-s+
12065 sameerb+  20   0  553448  52396  42096 S   0.5  0.9   0:00.63 gnome-t+
 1394 root      20   0  316824   8788   7380 S   0.3  0.1   0:00.39 upowerd
 2568 sameerb+  20   0 2947568  67764  51612 S   0.3  1.1   0:01.47 gjs
11299 root      20   0       0      0      0 I   0.3  0.0   0:01.92 kworker+
12078 sameerb+  20   0   14500   5924   3748 R   0.3  0.1   0:00.06 top
    1 root      20   0   23212  14144   9664 S   0.0  0.2   0:09.05 systemd
    2 root      20   0       0      0      0 S   0.0  0.0   0:00.02 kthreadd
    3 root      20   0       0      0      0 I   0.0  0.0   0:00.00 pool_wo+
    4 root      20   0       0      0      0 I   0.0  0.0   0:00.00 kworker+
    5 root       0 -20       0      0      0 I   0.0  0.0   0:00.00 kworker+
    6 root       0 -20       0      0      0 I   0.0  0.0   0:00.00 kworker+
    7 root       0 -20       0      0      0 I   0.0  0.0   0:00.00 kworker+
    8 root       0 -20       0      0      0 I   0.0  0.0   0:00.00 kworker+
```

```
        └─wpa_supplicant(946)
saksham-saini@saksham-saini-VirtualBox:~$ top

top - 12:06:26 up  1:28,  1 user,  load average: 0.58, 0.95, 0.96
Tasks: 206 total,   2 running, 204 sleeping,   0 stopped,   0 zombie
%Cpu(s):  1.4 us,  1.3 sy,  0.0 ni, 96.9 id,  0.0 wa,  0.0 hi,  0.4 si,  0.0 st
MiB Mem :   5433.6 total,    644.6 free,   2236.3 used,   2503.9 buff/cache
MiB Swap:   4096.0 total,   4096.0 free,      0.0 used.   3197.3 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   2095 saksham+  20   0 4054780 417344 166196 S   4.1   7.5   5:37.95 gnome-s+
   5168 saksham+  20   0 2979864 465844 100380 S   2.2   8.4   2:55.53 Isolate+
   8151 saksham+  20   0   23204   5884   3708 R   0.5   0.1   0:00.35 top
   2457 saksham+  20   0  398044   8000   6976 S   0.3   0.1   0:01.11 gvfs-af+
   3473 saksham+  20   0   11.5g 703448 243732 S   0.3  12.6   7:06.60 firefox
   4998 saksham+  20   0   70.9g 227280 129028 S   0.3   4.1   0:02.91 yelp
   6958 saksham+  20   0 2814976  61624  47296 S   0.3   1.1   0:00.85 gjs
   7305 saksham+  20   0 2701912 282596 102224 S   0.3   5.1   0:55.89 Isolate+
   7985 saksham+  20   0  706448  55612  44272 R   0.3   1.0   0:02.13 gnome-t+
   8122 root       0 -20       0      0      0 I   0.3   0.0   0:00.37 kworker+
      1 root      20   0   23312  14128   9392 S   0.0   0.3   0:05.16 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.08 kthreadd
      3 root      20   0       0      0      0 S   0.0   0.0   0:00.00 pool_wo+
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
      5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
      6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
      7 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
saksham-saini@saksham-saini-VirtualBox:~$ nice -n 10 sleep 300
q
^C
saksham-saini@saksham-saini-VirtualBox:~$ nice -n 10 sleep 300 &
[1] 8194
```

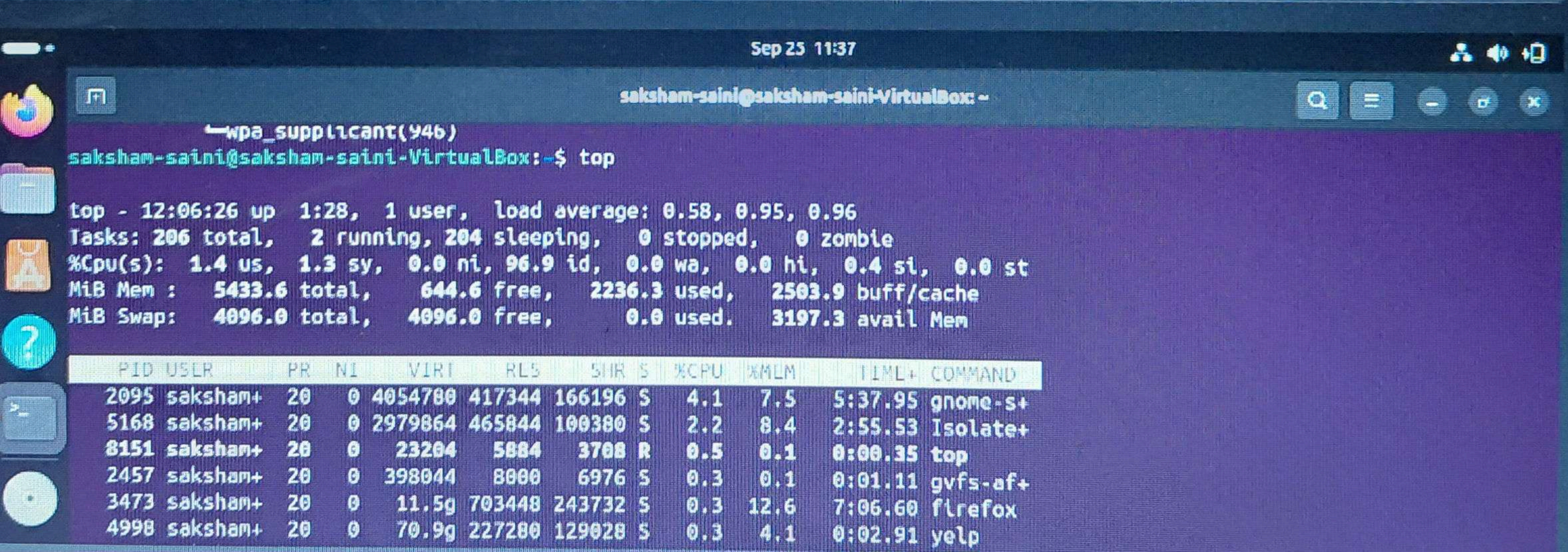
⚡ 4. Adjust Process Priority

- Start process with low priority:

```
nice -n 10 sleep 300 &
[1] 3050
```

- Change priority of running process:

```
renice -n -5 -p 3050
3050 (process ID) old priority 10, new priority -5
```



```
 7305 saksham+  20   0 2701912 282596 102224 S   0.3   5.1   0:55.89 Isolate+
 7985 saksham+  20   0  706448  55612  44272 R   0.3   1.0   0:02.13 gnome-t+
 8122 root       0 -20       0      0      0 I   0.3   0.0   0:00.37 kworker+
    1 root      20   0   23312  14128   9392 S   0.0   0.3   0:05.16 systemd
    2 root      20   0       0      0      0 S   0.0   0.0   0:00.08 kthreadd
    3 root      20   0       0      0      0 S   0.0   0.0   0:00.00 pool_wo+
    4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
    5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
    6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
    7 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker+
saksham-saini@saksham-saini-VirtualBox:~$ nice -n 10 sleep 300
q
^C
saksham-saini@saksham-saini-VirtualBox:~$ nice -n 10 sleep 300 &
[1] 8194
saksham-saini@saksham-saini-VirtualBox:~$ renice -n -5 -p 3050
```

🔧 5. CPU Affinity: `taskset`

- Show affinity:

```
taskset -cp 3050
pid 3050's current affinity list: 0-3
```

- Restrict to core 1 only:

```
taskset -cp 1 3050
pid 3050's current affinity list: 1
```

📂 6. I/O Scheduling Priority: `ionice`

```
ionice -c 3 -p 3050
successfully set pid 3050's IO scheduling class to idle
```

👉 Class 3 (idle) → Process only gets I/O when system is idle.

```
saksham-saini@saksham-saini-VirtualBox:~$ ionice -c 2 -p 8194
ionice: ioprio_set failed: No such process
[1]+  Done                    nice -n 10 sleep 300
saksham-saini@saksham-saini-VirtualBox:~$ ionice -c 1 -p 8194
```

📄 7. File Descriptors: `lsof`

```
COMMAND PID USER FD TYPE DEVICE SIZE/OFF NODE NAME
sleep 15082 sameerbhardwaj cwd DIR 8,2 4096 3407874 /home/sameerbhardwaj
sleep 15082 sameerbhardwaj rtd DIR 8,2 4096 2 /
sleep 15082 sameerbhardwaj txt REG 8,2 35336 275947 /usr/bin/sleep
sleep 15082 sameerbhardwaj mem REG 8,2 5719296 278970 /usr/lib/locale/locale-archive
```

🐛 8. Trace System Calls: `strace`

```
strace -p 3050
strace: Process 3050 attached
restart_syscall(<... resuming interrupted nanosleep ...>) = 0
nanosleep({tv_sec=300, tv_nsec=0}, 0x7ffd4a60d8b0) = ? ERESTART_RESTARTBLOCK
(Interrupted by signal)
```

📡 9. Find Process Using a Port: `fuser`

```
sudo fuser -n tcp 8080
8080/tcp:             4321
```

📊 10. Per-Process Stats: `pidstat`

```
pidstat -p 3050 2 3
```

```
30:24      1000      3050    0.00    0.00    0.00     1  sleep
30:26      1000      3050    0.00    0.00    0.00     1  sleep
```

Sep 25 11:39

saksham-saini@saksham-saini-VirtualBox: ~

```
saksham-saini@saksham-saini-VirtualBox:~$ pidstat -p 8194 2 3
linux 6.14.0-29-generic (saksham-saini-VirtualBox)      09/25/2025      _x86_64_(2 CPU)

11:10:57 AM   UID       PID    %usr %system  %guest   %wait    %CPU   CPU  Command
saksham-saini@saksham-saini-VirtualBox:~$ sudo cgcreate -g cpi,memory:/testgroup
sudo: cgcreate: command not found
saksham-saini@saksham-saini-VirtualBox:~$ sudo cgcreate -g cpu,memory:/testgroupsudo: cgcreate: command not found
saksham-saini@saksham-saini-VirtualBox:~$ sudo apt update
sudo apt install cgroup-tools
Hit:1 http://in.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://in.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1,164 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,443 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [197 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [282 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.6 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [8,744 B]
Get:12 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.3 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [1,855 kB]
Get:14 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [1,957 kB]
Get:15 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted Translation-en [441 kB]
Get:16 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:17 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 c-n-f Metadata [544 B]
Get:18 http://in.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,485 kB]
Get:19 http://in.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [299 kB]
Get:20 http://in.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [377 kB]
Get:21 http://in.archive.ubuntu.com/ubuntu noble-updates/universe Icons (48x48) [232 kB]
Get:22 http://in.archive.ubuntu.com/ubuntu noble-updates/universe Icons (64x64) [363 kB]
Get:23 http://in.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.1 kB]
Get:24 http://in.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [32.0 kB]
```

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11. Control Groups (cgroups)

- Create new cgroup:

```
sudo cgcreate -g cpu,memory:/testgroup
```

- Limit CPU and Memory:

```
echo 50000 | sudo tee /sys/fs/cgroup/cpu/testgroup/cpu.cfs_quota_us
echo 100M   | sudo tee /sys/fs/cgroup/memory/testgroup/memory.limit_in_bytes
```

- Add a process (PID 3050) to cgroup:

```
echo 3050 | sudo tee /sys/fs/cgroup/cpu/testgroup/cgroup.procs
```

Sep 25 11:39

saksham-saini@saksham-saini-VirtualBox: ~

```
saksham-saini@saksham-saini-VirtualBox:~$ pidstat -p 8194 2 3
Linux 6.14.0-29-generic (saksham-saini-VirtualBox)      09/25/2025      _x86_64_(2 CPU)

11:10:57 AM   UID       PID    %usr %system  %guest   %wait    %CPU   CPU  Command
saksham-saini@saksham-saini-VirtualBox:~$ sudo cgcreate -g cpi,memory:/testgroup
sudo: cgcreate: command not found
saksham-saini@saksham-saini-VirtualBox:~$ sudo cgcreate -g cpu,memory:/testgroupsudo: cgcreate: command not found
saksham-saini@saksham-saini-VirtualBox:~$ sudo apt update
sudo apt install cgroup-tools
Hit:1 http://in.archive.ubuntu.com/ubuntu noble InRelease
```

etworks.md ● Preview managment.md × pstree1.png

```
Get:9 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.6 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [8,744 B]
Get:12 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.3 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [1,855 kB]
Get:14 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [1,957 kB]
Get:15 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted Translation-en [441 kB]
Get:16 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:17 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 c-n-f Metadata [544 B]
Get:18 http://in.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,485 kB]
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Get:22 http://in.archive.ubuntu.com/ubuntu noble-updates/universe Icons (64x64) [363 kB]
Get:23 http://in.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.1 kB]
Get:24 http://in.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [32.0 kB]
```

✅ Summary Table

Tool	Focus	Alternative to
chrt	Real-time scheduling policies	nice
ionice	I/O priority control	(complementary)
taskset	CPU affinity control	(complementary)
cgroups	Fine-grained resource management	nice (more powerful)
systemd-run	systemd + cgroups resource management	nice
schedtool	Custom scheduling policies	nice

thank you

Experiment: Basic Linux Data Networking Commands

Aim

To study and execute basic data networking commands in Linux using the command line interface.

Objectives

- To understand Linux network configuration.
- To test network connectivity.
- To diagnose network-related issues.
- To access and transfer data between systems using networking tools.

Requirements

- Linux Operating System (Ubuntu/Debian/Fedora/Kali etc.)
- Terminal access
- Basic knowledge of Linux commands
- Internet connection (optional)

Theory

> Data networking in Linux is performed using built-in terminal commands. These commands help configure systems, test connections, and troubleshoot network problems.

Command	Purpose
`ifconfig` / `ip addr`	Shows network interface configuration
`ping`	Tests connectivity to another host
`hostname`	Displays system hostname
`traceroute`	Shows the route packets take
`netstat`	Displays active connections
`nslookup`	Queries DNS information
`ssh`	Secure remote login
`scp`	Secure file transfer

Procedure

🏠 Case 1: Mac and Ubuntu on the same network

Nov 3 21:09

UPES

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🏠 Case 1: Mac and Ubuntu on the same network

✅Step 1: Enable SSH on Ubuntu

On Ubuntu, install and enable SSH:

```
sudo apt update
sudo apt install openssh-server
sudo systemctl enable ssh
sudo systemctl start ssh
```

ubuntu saksham [Running] - Oracle VirtualBox

File Machine View Input Devices Help

Oct 16 10:35

saksham-saini@saksham-saini-VirtualBox: ~

```
saksham-saini@saksham-saini-VirtualBox:~$ sudo apt install openssh-server openssh-client -y
[sudo] password for saksham-saini:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:9.6p1-3ubuntu13.14).
openssh-client is already the newest version (1:9.6p1-3ubuntu13.14).
The following package was automatically installed and is no longer required:
  libllvm19
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 10 not upgraded.
saksham-saini@saksham-saini-VirtualBox:~$ sudo apt list --installed | grep openssh

WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

openssh-client/noble-updates,now 1:9.6p1-3ubuntu13.14 amd64 [installed]
openssh-server/noble-updates,now 1:9.6p1-3ubuntu13.14 amd64 [installed]
```

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Check it's running:

```
sudo systemctl status ssh
```

✅ Step 2: Find Ubuntu's local IP address

Run:

```
hostname -I
```

```
saksham-saini@saksham-saini-VirtualBox:~$ hostname -I
10.0.2.15 fd17:625c:f037:2:20b1:35b:a8c1:f61e fd17:625c:f037:2:a00:27ff:fe4a:3fda
saksham-saini@saksham-saini-VirtualBox:~$ whoami
saksham-saini
saksham-saini@saksham-saini-VirtualBox:~$ ssh devsaini@10.53.227.53
^Z
[1]+  Stopped                 ssh devsaini@10.53.227.53
saksham-saini@saksham-saini-VirtualBox:~$ ssh devsaini@10.53.227.53
```

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Nov 3 21:09

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```
ED25519 key fingerprint is SHA256:DE7xQxj+7FMMH9YXyyXzSngbu3JHmBxoGxIlWoVHmqk.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.53.227.53' (ED25519) to the list of known hosts.
devsaini@10.53.227.53's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-29-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro
```

You'll get something like 192.168.1.42.

✅ Step 3: Connect from Mac

On your Mac, open Terminal and run:

```
ssh username@192.168.1.42
```

Replace username with your Ubuntu username.

Enter your password when prompted — you're in! ✅

```
saksham-saini@saksham-saini-VirtualBox:~$ ssh devsaini@10.53.227.53
The authenticity of host '10.53.227.53 (10.53.227.53)' can't be established.
```

ENG IN 21:09 03-11-2025

Nov 3 21:09

UPES

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```
ED25519 key fingerprint is SHA256:[illegible]
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.53.227.53' (ED25519) to the list of known hosts.
devsaini@10.53.227.53's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-29-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

125 updates can be applied immediately.
44 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

11 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm


The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
```

ENG IN 03-11-20

✅ Step 4: Create a File on Remote Computer

```
echo "This file was created remotely using SSH" > ~/ssh_test.txt
```

✅ Step 5: Verify the File**

```
cat ~/ssh_test.txt
```

✅ Step 6: Delete the File

```
rm ~/ssh_test.txt
```

✅ Step 7: Exit SSH

```
exit
```

/home/saksham-saini/Pictures/Screenshots/Screenshot from 2025-10-28 13-21-04.png /home/saksham-

```
# **🌐 Case 2: Mac and Ubuntu on different networks (e.g., home ↔ office or remote
server)**

##  **✅ • Option 1: Connect to a remote Ubuntu server (e.g., cloud VM)**

### **Step 1: View IP Address and Network Interfaces**
```bash
ip addr show
```

Step 2:Display hostname

```
hostname
```

step 3:Test Network connectivity(ping)

```
ping google.com -c 4
```

Step 4: Trace Route to Remote Host

```
traceroute google.com
```
```

Step 5: View Active Network Ports

```
netstat -tulnp
```

Step 6: DNS Lookup

```
nslookup google.com
```

Step 7: Remote Login using SSH

```
ssh user@192.168.1.10
```

Step 8: File Transfer using SCP

```
scp test.txt user@192.168.1.10:/home/user/
```

GUI

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Preview networks.md × pstree1.png

✅1) Prepare & secure the remote machine (run on friend's laptop)

Run these on the friend's laptop (they must have sudo):

install SSH and optional VNC

```
sudo apt update
sudo apt install -y openssh-server tigervnc-standalone-server
```

create non-root user if needed (won't fail if exists)

```
sudo useradd -m frienduser || true
```

enable and start SSH

```
sudo systemctl enable --now ssh
```

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add your public key (replace) and set safe permissions

```
sudo -u frienduser mkdir -p /home/frienduser/.ssh
echo "<your-pubkey>" | sudo tee -a /home/frienduser/.ssh/authorized_keys
sudo chmod 700 /home/frienduser/.ssh
sudo chmod 600 /home/frienduser/.ssh/authorized_keys
sudo chown -R frienduser:frienduser /home/frienduser/.ssh
```

Verify sshd is running:

```
sudo systemctl status ssh --no-pager
# or
ss -tlnp
/home/saksham-saini/Pictures/Screenshots/systum.png
```

✅2) Test X11 forwarding (single GUI app) — from your laptop

Preflight on your laptop:

Linux: usually ready.

macOS: install & run XQuartz and start it before SSH.

Windows: install an X server like VcXsrv or Xming and run it.

Then on your laptop run:

```
ssh -p 22 -X frienduser@FRIEND_IP
```

```
# once connected, run a simple GUI test:
```bash
xeyes &    # or gedit & or xclock &
```

Success criteria: the GUI app window appears on your laptop and is responsive.

Troubleshooting quick checks:

If you see Warning: No xauth data; using fake or X apps fail: try -Y (trusted) instead of -X: ssh -Y -p 22 frienduser@FRIEND_IP.

Ensure DISPLAY is set on the SSH session (run echo $DISPLAY — should show something like localhost:10.0).

Ensure client X server (XQuartz/VcXsrv) is running and allowing connections.

Security note: X11 forwards every GUI app over SSH, but X11 is older and can let remote apps access local X resources — use only with trusted machines. For stronger isolation, prefer the VNC-over-SSH approach below.
```

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✅ 3) Full desktop: VNC server on friend's laptop + SSH tunnel from your laptop

On friend's laptop (as frienduser):

start a VNC server on display :1 (creates :1 -> TCP 5901)

```
vncserver :1
# optionally stop with: vncserver -kill :1
```

(Configure desktop environment in ~/.vnc/xstartup if needed — many distros auto-configure.)

On your laptop: create a local SSH tunnel (keeps VNC server bound to localhost on remote; only SSH port open externally)

create an SSH tunnel mapping your localhost:5901 to friend's localhost:5901

```
ssh -L 5901:localhost:5901 -p 22 frienduser@FRIEND_IP -N &
# -N = no remote command; & runs in background (adjust as preferred)
```

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Then open your VNC viewer and connect to:

```
localhost:5901
```

Output / Observations

Command	Result
`ip addr`	Lists network interfaces and IP addresses
`ping`	Replies received indicate connectivity
`traceroute`	Displays the route path to the destination
`nslookup`	Shows DNS IP information
`ssh`	Connects to a remote machine securely
`scp`	Transfers files securely over SSH

Result

Basic Linux networking commands were successfully executed and network connectivity and configuration were verified.

Conclusion

Linux provides powerful built-in commands for networking tasks such as configuration, troubleshooting, monitoring, and secure communication between systems.

Viva Questions

❓ What is the purpose of the `ping` command?

✨The `ping` command is used to test network connectivity between the source and a destination host. It sends ICMP Echo Request packets and waits for Echo Reply packets to verify whether the destination is reachable and to measure round-trip time.

❓ What is the difference between SSH and Telnet?

✨| Feature | SSH (Secure Shell) | Telnet |

|---------|----------------|------| | Security | Encrypted communication | No encryption | | Default Port | 22 | 23 | | Usage | Secure remote login | Unsecure remote login | | Current Status | Widely used | Mostly outdated |

SSH is preferred over Telnet because it provides secure communication.

❓ How does `traceroute` help in network troubleshooting?

✨ **`traceroute`** displays the path taken by packets from the local system to a remote host. It shows each intermediate router (hop) along the path and the time taken. It helps identify:

- Network delays
- Connection failures
- Routing issues

❓ **Why is DNS used in networking?**

✨**DNS (Domain Name System) translates human-friendly domain names like `www.google.com` into machine-readable IP addresses like `142.250.182.14`. This is necessary because computers communicate using IP addresses, not domain names.**

❓ **How can you transfer a file securely in Linux?**

✨**Files can be transferred securely in Linux using the `scp` (Secure Copy) command, which uses SSH encryption.**

Example:

Nov 3 21:11

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pstree1.png

```
scp file.txt user@192.168.1.10:/home/user/
```

thank u

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Checkfile.sh

~~#!/bash/bin~~

```
#!/bin/bash
# check_file.sh
# Usage: ./check_file.sh filename.txt
if [ $# -ne 1 ]; then
  echo "Usage: $0 <filename>"
  exit 1
  fi

file = "$1"
if [ -e "$file" ]; then
  echo "File exists: $file"
  echo "---- contents ----"
  cat -- "file"
else
  echo "File '$file' does not exist."
  read -p "create it now? (y/n): "ans
  case "$ans" in
  [Yy]*) touch "$file"; echo "created $file"
"You can edit it using your favorite editor
  *) echo "Not creating file.";;
  esac
fi
```

```
#!/bin/bash
# check_file.sh
# Usage: ./check_file.sh <"filename.txt"
if
  [ $# -ne 1 ]; then
echo "Usage: $0 <filename>"
  exit 1
fi
file="$1"
if
  [ -e "$file" ]; then
echo "File exists: $file"
echo "——— —— ———"
cat --- "file"
else.
  echo "file doesnot exist."
read -p "create it now? (y/N); " ans.
case "$ans" in
[Yy]*) touch "$file"; echo "create $file"; echo
"You can create using for fit editor"; ;
  echo "Not creating file;;"
  esac
  fi
```

```
#!/bin/bash
# check_file.sh
# Usage: ./check_file.sh filename.txt

if [ $# -ne 1 ]; then
    echo "Usage: $0 <filename>"
    exit 1
fi

file="$1"
if [ -e "$file" ]; then
    echo "File exists: $file"
    echo "---contents---"
    cat -- "$file"
else
    echo "File '$file' does not exist."
    read -p "Create it now? (y/N): " ans
    case "$ans" in
        [yY]*) touch "$file" && echo "Created $file"; e
        "You can edit it using your fav. editor" ;;
        echo "Not creating file." ;;
    esac
fi
```

```
echo "file '$file' doesn't exists"
read -p "creat it now? (y/N)" ans
case "$ans" in
[y/Y]*) touch "$file"; echo "create $file"; echo "You ca
using your fav. editor" ;; *)
~~echo "Not creating file";~~
echo "Not creating file";
esac.
```

```
#!/bin/bash
#check_filesh
# Usage: ./check_file.sh "filename.txt"
if [ $# -ne 1 ]; then
   echo "Usage: $0 <filename>"
   exit 1
fi
file="$1"
if [ -e "$file" ]; then
echo "file exists $file"
echo "--- content ---"
cat "$file"
else
echo "file '$file' does not exist"
read -p "create it now? (y/N)" ans
case "$ans" in
[yY]*) touch "$file" ; echo "created $file" ; echo "You can edit
using your fav editor" ;;
*) echo "Not creating file" ;;
esac
fi
```

```
#!/bin/bash
#check_file.sh
# Usage: ./check_file.sh "filename.txt"
if [ $# -ne 1 ]; then
echo "Usage: $0 <filename>"
exit 1
fi
file="$1"
if [ -e "$file" ]; then
echo "File exist $file
echo "--- content ---"
cat "$file"
else
```

```
#!/bin/bash
# count_lwc.sh
# Usage: ./count_lwc.sh filename.txt

if [[ $# -ne 1 ]]; then
  echo "Usage: $0 <filename>"
  exit 1
fi
if [ ! -f "$1" ]; then
  echo "File not found"
  exit 1
fi
lines=$(wc -l < "$1")
words=$(wc -w < "$1")
chars=$(wc -m < "$1")
echo "Lines: $lines"
echo "words: $words"
echo "Chars: $chars"
```

```
#!/bin/bash
# count_lwc.sh
# Usage: ./count_lwc.sh filename.txt

if [[ $# -ne 1 ]]; then
  echo "Usage: $0 <filename>"
  exit 1
fi
if [ ! -f "$1" ]; then
  echo "File not found"
  exit 1
fi
lines=$(wc -l < "$1")
words=$(wc -w < "$1")
chars=$(wc -m < "$1")
```

```
echo "Lines: $lines"
echo "words: $words"
echo "Chars: $chars"
```

```
#!/bin/bas
# coount-lwosh
# Usage: ./coount-lwosh filename.txt

if [$# ne 1]; then
echo "Usage: $0 <filename>"
exit 1
fi
if [ ! -f "$i" ]; th.
echo " file not found"
exit 1
fi
lins = $(wc -l <"$i")
words = $(wc -w <"$1")
chars = $(wc -m <"$1")
echo "Lins: $lins"
echo "word: $words"
echo "Characters: $chars"
```

```
#!/bin/bash
#count_lws.sh
#Usage: ./count_lws.shfilena
if [$# ne 1] then
echo "Usage '$0 <filena>"
exit 1
fi
if [ ! -f "$1" ]; th
echo "file. not found."
exit 1
fi
lin = $(wc -l <"$1")
word = $(wc -w <"$1")
char = $(wc -m <"$1")
echo "lin: $lins"
echo "word: $echo"
echo "Characte: $chara.
```

```
#!/bin/bash
# Count_lws.sh
# Usage: ./count_lws.shfilename.txt
if [$# ne 1]: then
echo "Usage: $0 <filenam>"
exit 1
fi
if [ ! -f "$1" ]; th.
echo " file dot exist"
exist 1
fi
lin=$(wc -l <"$1"
word $(wc -w <"$1")
char: $(wc -m <"$1")
echo "lins: "$lins"
echo " word: $wordi
echo " character = $chor"
```

```
#!/bin/bash
# Usage : ./one_to_ten.sh
a=(1 2 3 4 5 6 7)
for i in "${a[@]}";do
  echo "$i"
done
```

```
#!/bin/bash
# Usage : ./one_to_ten.sh
  a=(1 2 3 4 5 6 7)
for i in "${a[@]}";do
  echo "$i"
done
```

```
#!/bin/bash
# Usage : ./one_to_ten.sh
  a=(1 2 3 4 5 6 7)
  for i in "${a[@]}";do
    echo "$i"
  done
```

```
#!/bin/bash
# Usage : ./one_to_ten.sh
  a=(1 2 3 4 5 6 7)
for i in "${a[@]}";do
  echo "$i"
done
```

```
#!/bin/bash
# Usage : ./one_to_ten.sh
  a=(1 2 3 4 5 6 7)
for i in "${a[@]}";do
  echo "$i"
done
```

```
#!/bin/bash
# Usage : ./one_to_ten.sh
  a(1 2 3 4 5 6 7)
for i in ${a[@]};do
  echo "$i"
done
```

```
res=1
for ((i=2; i<=n; i++)); do
    res=$((res * i))
done
echo "$res"
if [[ $# -lt 1 ]]; then
echo "Usage: $0 <non-negative-integer> [another...]"
exit 1
fi

for arg in "$@"; do
if ! [[ "$arg" =~ ^[0-9]+$ ]]; then
echo "$arg: not a non-negative integer, skipping."
continue
fi
echo "$arg! = $(fact "$arg")"
done.
```

#! /bin/bash
factorial.sh
Usage: ./factorial.sh 5

fact () {
n=$1
if [$n -le 1]; then
echo 1
return
fi
res=1
for ((i=2 ; i<=n ; i++)); do
res=$((res * i))
done
echo $res
if [$# -lt 1]; then
echo "Usage: $0 <non (-ve) integer>" >&2
exit 1
fi
for arg in "$@"; do
if ! [[$arg =~ ^[0-9]+$]]; then
echo "$arg: not a -ve integer" >&2
continue
fi
echo "$arg ! = $(fact $arg)"
done

```
#!/bin/bash
# factorial.sh
# Usage: ./factorial.sh

fact () {
n=$1
if [ "$n" -le 1 ]; then
  echo 1
  return
fi
res=1
for (( i=2; i<=n; i++ )); do
  res=$(( res * i ))
done
echo "$res"
if [ "$n" -lt 1 ]; then
  echo "Usage: $0 <non-negative-integer>" >&2
  exit 1
fi
for arg in "$@"; do
  if ! [[ "$arg" =~ ^[0-9]+$ ]]; then
    echo "$arg: not a non-neg. integer, skipping" >&2
    continue
  fi
  echo "$arg! = $(fact "$arg")"
done
```