

St. Francis Institute of Technology, Mumbai-400 103
Department of Information Technology

A.Y. 2023-2024

Class: SE-ITA/B, Semester: IV

Subject: **UNIX LAB**

Experiment – 5: Study and Implementation of Basic system administrative tasks.

1. **Aim:** To Study and Implement Basic system administrative tasks.
2. **Objectives:**
 - To learn and implement system administrative commands.
 - To analyze the system performance using administrative commands.
3. **Outcomes:** After study of this experiment, the student will be able to
 - Configure the system using administrative commands.
 - Evaluate system performance using various administrative commands. (L402.4)
4. **Prerequisite:** Basic UNIX commands.
5. **Requirements:** Personal Computer, Ubuntu OS, LibreOffice.
6. **Pre-Experiment Exercise:**

Brief Theory:

System Administration

System administration involves management of the entire system. It includes activities ranging from maintaining user accounts, security and managing disk space to performing backups. System administrator is the ultimate authority in a UNIX environment.

Process Management

A process is a program in execution. Process management describes how the operating systems manage the multiple processes running at a particular instance of time. The process manager implements CPU sharing (called scheduling), process synchronization mechanisms, and a deadlock strategy. In addition, the process manager implements part of the operating system's protection and security.

Memory management

Memory management is the process of controlling and coordinating computer memory, assigning portions called blocks to various running programs and releasing it for reuse when no longer needed, to optimize overall system performance. UNIX memory management scheme includes swapping and demand paging.

File system management

On all UNIX systems user data is organised and stored in files. These files are subsequently organised into a management structure comprising directories and sub-directories. These directories and sub-directories are organised into a tree-like structure called the file system.

The file manager administers the file system by:

- Storing the information on a device
- Mapping the block storage to a logical view
- Allocating/deallocating storage
- Providing directories

User management

User management describes the ability for administrators to manage user access to various hardware and software resources of the computer system. UNIX is a multi- user operating system. User management activities in UNIX include

- Addition/ removal of users
- Creating or deleting user groups
- Maintaining user/group information
- Modifying user/group information
- Elevating user privileges

7. Laboratory Exercise

A. Procedure

Explain the following commands in UNIX with syntax and example:

1. Process management commands
ps, pstree, pidof, pgrep, nice, renice, kill
2. Memory management commands
free, meminfo, vmstat, top, htop, ipcs
3. File system management
commands fdisk, mount,
umount, df, du
4. User management commands
useradd, passwd, userdel, usermod, groupadd, groupdel, groupmod.

B. Result/Observation/Program code

8. Post-Experiments Exercise

A. Extended Theory:

None.

B. Questions:

1. What is the difference between kill, pkill and killall command in UNIX?
2. What is PPID? How do I obtain PPID of a process in UNIX?
3. What is the difference between 'adduser' and 'useradd' command?
4. Can we delete a nonempty user group in UNIX?

C. Conclusion:

1. Write what was performed in the experiment.
2. Mention few applications of what was studied.
3. Write the significance of the topic studied in the experiment.

D. References:

1. Yashwant Kanetkar, UNIX Shell Programming, BPB Publications.
2. Sumitabha Das, UNIX Concepts and Applications, 3rd Ed., Tata McGraw Hill.
3. <https://www.tutorialspoint.com/unix>

```

student@312-04: ~
student@312-04:~$ pstree
systemd--ModemManager--2*[{ModemManager}]
      |--NetworkManager--2*[{NetworkManager}]
      |--accounts-daemon--2*[{accounts-daemon}]
      |--acpid
      |--anacron
      |--avahi-daemon--avahi-daemon
      |--bluetoothd
      |--colord--2*[{colord}]
      |--cron
      |--cups-browsed--2*[{cups-browsed}]
      |--cupsd--dbus
      |--dbus-daemon
      |--fwupd--4*[{fwupd}]
      |--gdm3--gdm-session-wor--gdm-wayland-ses--gnome-session-+
              |               |               |
              |               |               2*[{gdm-waylan+
              |               |               |
              |               |               2*[{gdm-session-wor}]
              |               |
              |               2*[{gdm3}]
              |
      |--gnome-keyring-d--3*[{gnome-keyring-d}]
      |--irqbalance--{irqbalance}
      |--2*[kerneloops]
      |--networkd-dispat
      |--packagekitd--2*[{packagekitd}]
      |--polkitd--2*[{polkitd}]

```

3) Pgrep: Searches for a specified process by its name and returns its process ID.

```
student@312-04: ~  
student@312-04:~$ pgrep -u root, daemon  
607  
student@312-04:~$
```

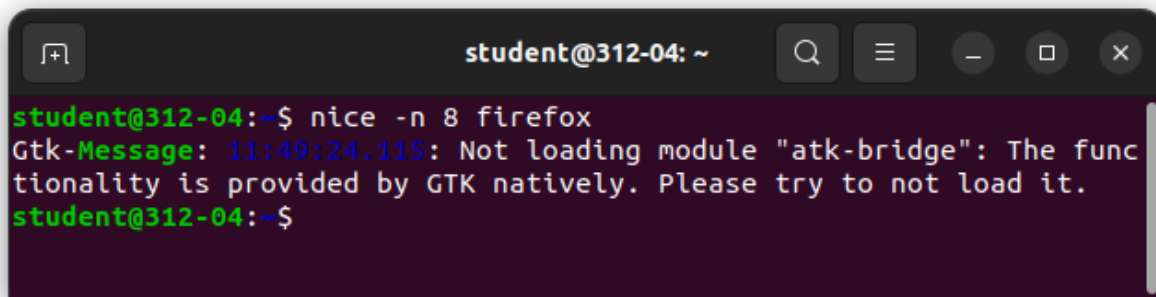
4) pstree -p :Similar to pstree, but includes process IDs in the tree display.

```
student@312-04: ~  
student@312-04:~$ pstree -p  
systemd(1)─ModemManager(730)─{ModemManager}(754)  
│          │          └─{ModemManager}(758)  
│          └─NetworkManager(616)─{NetworkManager}(709)  
│                                   └─{NetworkManager}(715)  
│          └─accounts-daemon(607)─{accounts-daemon}(661)  
│                                   └─{accounts-daemon}(713)  
│          └─acpid(608)  
│          └─anacron(609)  
│          └─avahi-daemon(611)─avahi-daemon(655)  
│          └─bluetoothd(612)  
│          └─colord(775)─{colord}(784)  
│                          └─{colord}(788)  
│          └─cron(613)  
│          └─cups-browsed(1438)─{cups-browsed}(1457)  
│                                   └─{cups-browsed}(1458)  
│          └─cupsd(723)─dbus(5910)  
│                          └─dbus(7484)  
│          └─dbus-daemon(615)  
│          └─fwupd(2246)─{fwupd}(2261)  
│                          └─{fwupd}(2264)
```

5) pidof : Returns the process ID of a specified application.

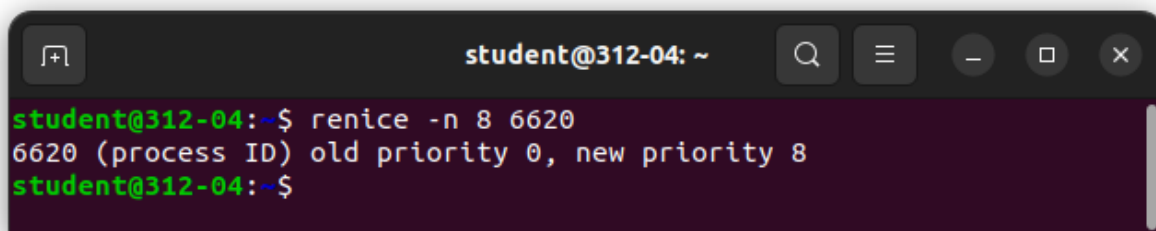
```
student@312-04: ~  
student@312-04:~$ pidof firefox  
7318 7300 7275 7144 7137 7130 6944 6836 6815 6620  
student@312-04:~$
```

- 6) Nice : Launches a command with an adjusted priority, affecting its CPU scheduling priority.



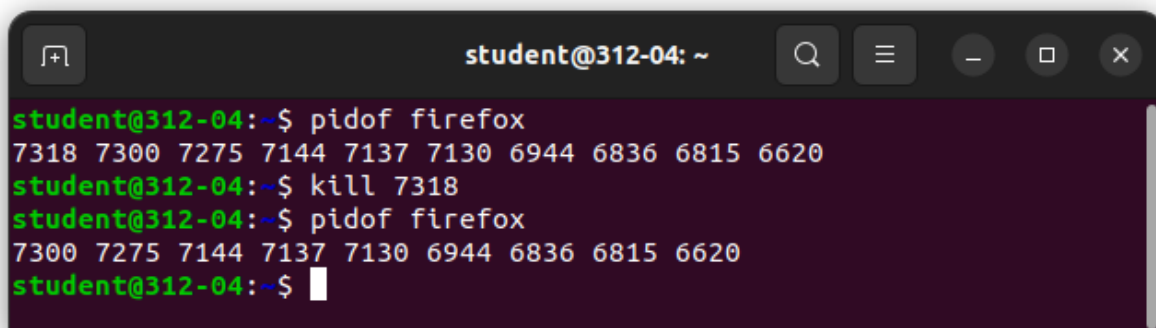
```
student@312-04: ~  
student@312-04:~$ nice -n 8 firefox  
Gtk-Message: 11:49:24.115: Not loading module "atk-bridge": The functionality is provided by GTK natively. Please try to not load it.  
student@312-04:~$
```

- 7) Renice : Changes the priority of an already running process.



```
student@312-04: ~  
student@312-04:~$ renice -n 8 6620  
6620 (process ID) old priority 0, new priority 8  
student@312-04:~$
```

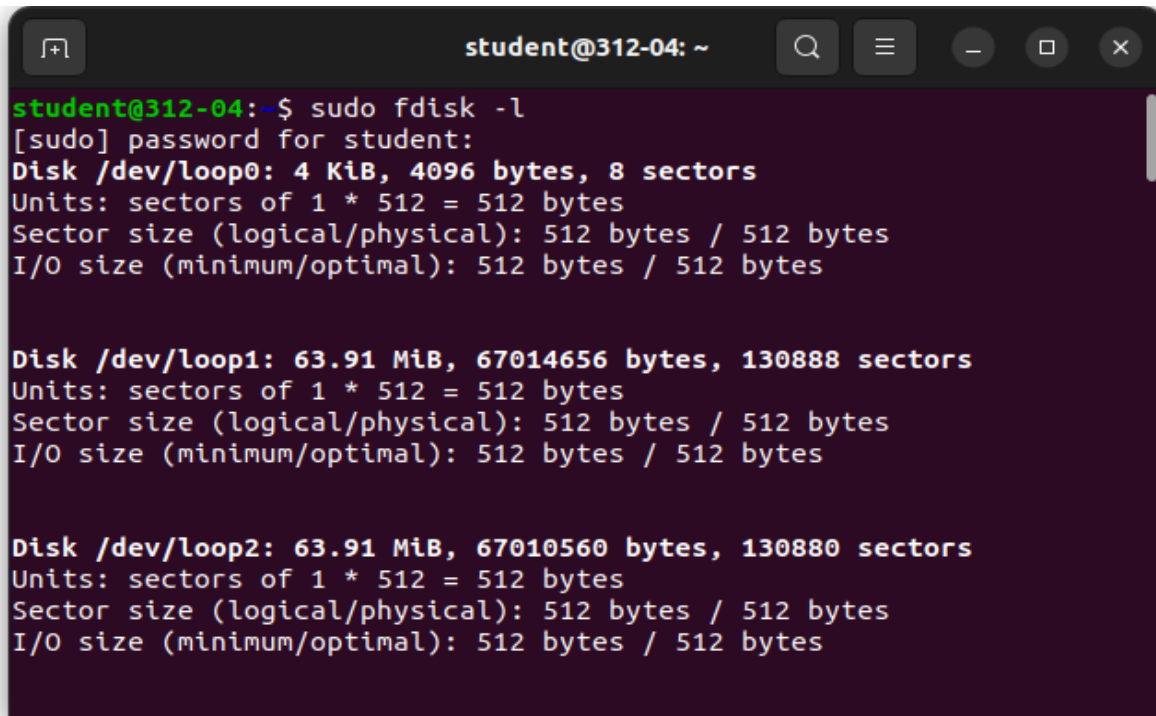
- 8) Kill : Sends a signal to terminate or control a process.



```
student@312-04: ~  
student@312-04:~$ pidof firefox  
7318 7300 7275 7144 7137 7130 6944 6836 6815 6620  
student@312-04:~$ kill 7318  
student@312-04:~$ pidof firefox  
7300 7275 7144 7137 7130 6944 6836 6815 6620  
student@312-04:~$
```

FILE SYSTEM MANAGEMENT COMMANDS:

1. Fdisk: Used for disk partitioning and management on Linux systems.

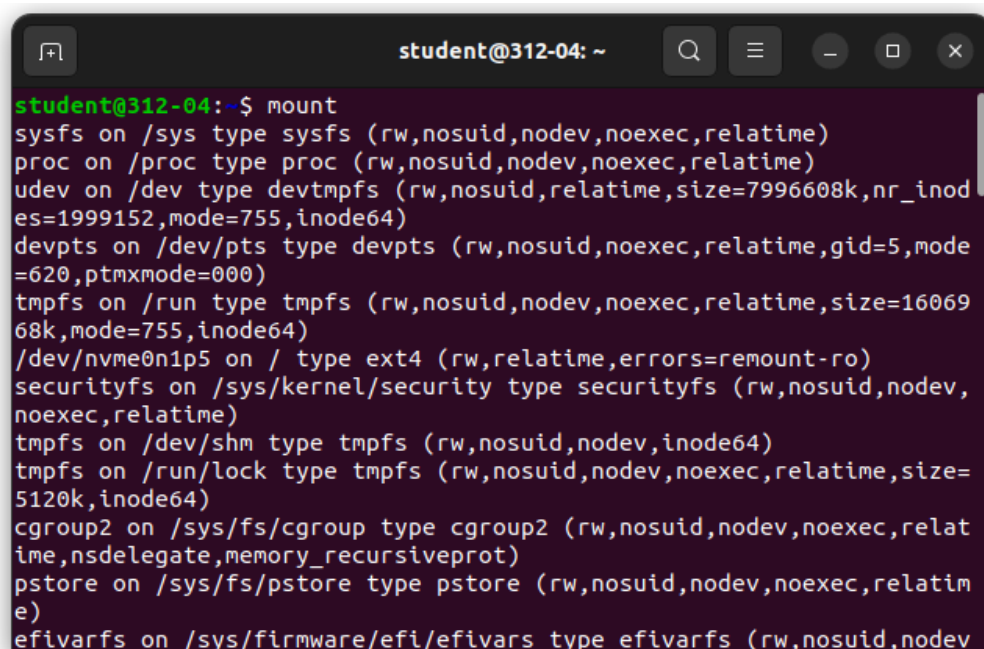


```
student@312-04:~$ sudo fdisk -l
[sudo] password for student:
Disk /dev/loop0: 4 KiB, 4096 bytes, 8 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/loop1: 63.91 MiB, 67014656 bytes, 130888 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

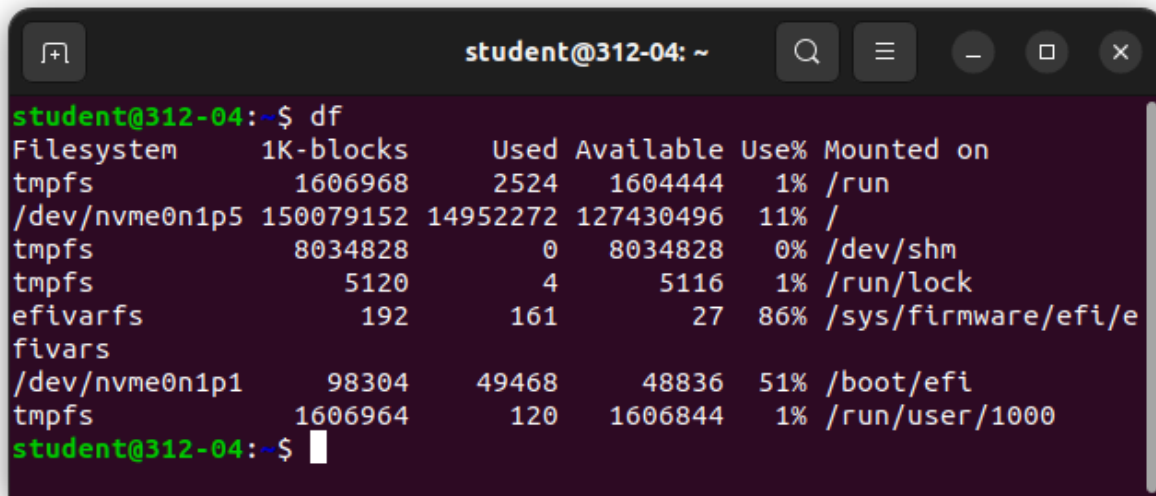
Disk /dev/loop2: 63.91 MiB, 67010560 bytes, 130880 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

2. Mount : Attaches a file system to a specified directory in the Linux file hierarchy



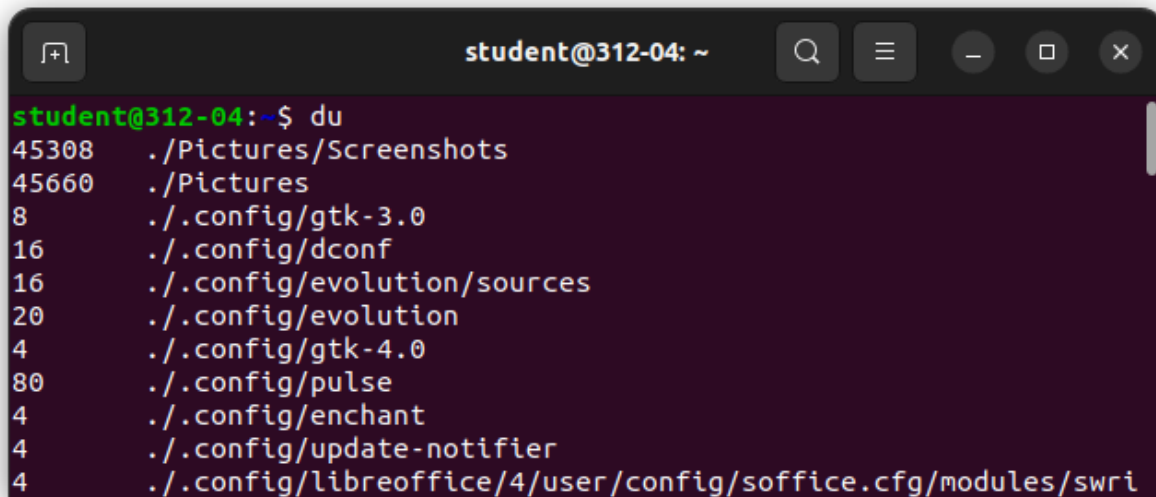
```
student@312-04:~$ mount
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
udev on /dev type devtmpfs (rw,nosuid,relatime,size=7996608k,nr_inodes=1999152,mode=755,inode64)
devpts on /dev/pts type devpts (rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000)
tmpfs on /run type tmpfs (rw,nosuid,nodev,noexec,relatime,size=1606968k,mode=755,inode64)
/dev/nvme0n1p5 on / type ext4 (rw,relatime,errors=remount-ro)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev,inode64)
tmpfs on /run/lock type tmpfs (rw,nosuid,nodev,noexec,relatime,size=5120k,inode64)
cgroup2 on /sys/fs/cgroup type cgroup2 (rw,nosuid,nodev,noexec,relatime,nsdelegate,memory_recursiveprot)
pstore on /sys/fs/pstore type pstore (rw,nosuid,nodev,noexec,relatime)
efivarfs on /sys/firmware/efi/efivars type efivarfs (rw,nosuid,nodev)
```


3. Df : Displays information about disk space usage on mounted file systems.



```
student@312-04: ~  
student@312-04:~$ df  
Filesystem      1K-blocks      Used Available Use% Mounted on  
tmpfs            1606968        2524    1604444   1% /run  
/dev/nvme0n1p5 150079152 14952272 127430496  11% /  
tmpfs            8034828         0    8034828   0% /dev/shm  
tmpfs             5120          4        5116   1% /run/lock  
efivarfs         192          161          27  86% /sys/firmware/efi/efivars  
/dev/nvme0n1p1   98304        49468     48836   51% /boot/efi  
tmpfs            1606964        120    1606844   1% /run/user/1000  
student@312-04:~$
```

4. Du: Estimates file space usage in a directory and its subdirectories.



```
student@312-04:~$ du  
45308  ./Pictures/Screenshots  
45660  ./Pictures  
8      ./config/gtk-3.0  
16     ./config/dconf  
16     ./config/evolution/sources  
20     ./config/evolution  
4      ./config/gtk-4.0  
80     ./config/pulse  
4      ./config/enchant  
4      ./config/update-notifier  
4      ./config/libreoffice/4/user/config/soffice.cfg/modules/swri
```

MEMORY MANAGEMENT COMMANDS:

1. Vmstat: Reports virtual memory statistics, including information about processes, memory, paging, block I/O, and CPU activity.

```
student@312-04: ~  
student@312-04:~$ vmstat  
procs -----memory----- ---swap-- -----io----- -system-- --  
----cpu-----  
r  b   swpd   free   buff   cache   si   so   bi   bo   in   cs us  
sy id wa st  
0  0       0 11570852 113896 2627728    0    0   44   14  127  275  
2  1 97  0  0  
student@312-04:~$
```

2. Free : Shows the amount of free and used memory in the system, including buffers and caches.

```
student@312-04: ~  
student@312-04:~$ free  
              total        used        free      shared  buff/cache  
available  
Mem:        16069656      1834532      11468432        633672       2766692  
           13259940  
Swap:        2097148           0         2097148  
student@312-04:~$
```

3. Meminfo : Provides detailed information about the system's memory usage.

```
student@312-04: ~  
student@312-04:~$ cat /proc/meminfo  
MemTotal:        16069656 kB  
MemFree:         11492488 kB  
MemAvailable:    13284280 kB  
Buffers:         114320 kB  
Cached:          2469404 kB  
SwapCached:        0 kB  
Active:          2514052 kB  
Inactive:        1041992 kB
```


4. `vmstat -f` : Displays the number of forks since boot.

```
student@312-04: ~  
student@312-04:~$ vmstat -f  
      8544 forks  
student@312-04:~$
```

5. `Top` : Dynamically updates and displays system resource usage, including CPU, memory, and processes.

```
student@312-04: ~  
top - 12:20:27 up 59 min,  1 user,  load average: 0.69, 0.54, 0.43  
Tasks: 307 total,  2 running, 304 sleeping,  0 stopped,  1 zombie  
%Cpu(s): 10.3 us,  1.5 sy,  0.0 ni, 86.8 id,  0.0 wa,  0.0 hi,  1.5  
MiB Mem : 15693.0 total, 11207.2 free, 1793.8 used, 2692.0 buf  
MiB Swap: 2048.0 total, 2048.0 free,  0.0 used. 12958.8 ava
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM
6620	student	28	8	11.7g	567380	264968	S	60.0	3.5
8758	student	20	0	13312	4224	3328	R	40.0	0.0
1710	student	20	0	5686360	258040	125136	R	20.0	1.6
7137	student	20	0	3144476	538632	156164	S	20.0	3.4
7393	student	20	0	556108	54128	38640	S	20.0	0.3
1	root	20	0	168020	12720	8112	S	0.0	0.1
2	root	20	0	0	0	0	S	0.0	0.0
3	root	0	-20	0	0	0	I	0.0	0.0
4	root	0	-20	0	0	0	I	0.0	0.0
5	root	0	-20	0	0	0	I	0.0	0.0
6	root	0	-20	0	0	0	I	0.0	0.0
7	root	20	0	0	0	0	I	0.0	0.0
8	root	0	-20	0	0	0	I	0.0	0.0
11	root	0	-20	0	0	0	I	0.0	0.0

6. Ipc : Displays information about interprocess communication (IPC) facilities

```
student@312-04: ~  
student@312-04:~$ ipcs  
  
----- Message Queues -----  
key          msqid      owner      perms      used-bytes   messages  
  
  
----- Shared Memory Segments -----  
key          shmid      owner      perms      bytes       nattch     st  
atus  
  
----- Semaphore Arrays -----  
key          semid      owner      perms      nsems  
  
student@312-04:~$
```

7. Htop : Interactive process viewer that provides a user-friendly representation of system resources.

```
student@312-04: ~
```

```
    0[ |      7.4%]   3[ |     0.7%]   6[ ||     2.7%]   9[ |      4.0%]  
    1[       0.0%]   4[||     5.4%]   7[|      4.1%]  10[|      3.4%]  
    2[ |     13.2%]   5[       0.0%]   8[ ||     2.7%]  11[|      3.4%]  
Mem [||||| ]        2.37G/15.3G Tasks: 127, 591 thr, 177 kthr; 0  
Swp [          ]         0K/2.00G Load average: 0.29 0.50 0.44  
                                     Uptime: 01:02:36
```

```
Main I/O
```

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+
9263	student	20	0	6520	5120	3456	R	2.0	0.0	0:00.12 /
1	root	20	0	164M	12720	8112	S	0.0	0.1	0:01.20 /
318	root	19	-1	64748	15372	14476	S	0.0	0.1	0:00.36 /
369	root	20	0	27340	7296	4608	S	0.0	0.0	0:00.18 /
560	systemd-oo	20	0	14836	6784	6016	S	0.0	0.0	0:04.18 /

```
F1Help F2Setup F3Search F4Filter F5Tree F6SortByF7Nice -F8Nice +F9Ki
```

8. Ipcs -a, ipcs -q, ipcs -s : Specific options for displaying information about message queues, semaphores, and shared memory, respectively.

```
student@312-04: ~  
student@312-04:~$ ipcs -a  
----- Message Queues -----  
key          msqid      owner      perms      used-bytes   messages  
  
----- Shared Memory Segments -----  
key          shmid      owner      perms      bytes       nattch     status  
  
----- Semaphore Arrays -----  
key          semid      owner      perms      nsems  
  
student@312-04:~$ ipcs -q  
----- Message Queues -----  
key          msqid      owner      perms      used-bytes   messages  
  
student@312-04:~$ ipcs -s  
----- Semaphore Arrays -----  
key          semid      owner      perms      nsems  
  
student@312-04:~$
```

USER MANAGEMENT COMMANDS:

1. Useradd and passwd : Create a new user and set or change their password.

```
student@312-04: ~  
student@312-04:~$ sudo useradd Vishal  
[sudo] password for student:  
student@312-04:~$ cat /etc/passwd  
root:x:0:0:root:/root:/bin/bash  
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin  
bin:x:2:2:bin:/bin:/usr/sbin/nologin  
sys:x:3:3:sys:/dev:/usr/sbin/nologin  
sync:x:4:65534:sync:/bin:/bin/sync
```

```
student@312-04: ~  
shreyesh2:x:1004:1005::/home/shreyesh2:/bin/sh  
Farheen:x:1005:1008::/home/Farheen:/bin/sh  
Aaditya:x:1006:1011::/home/Aaditya:/bin/sh  
TANMAY:x:1007:1013::/home/TANMAY:/bin/sh  
Jigar:x:1008:1015::/home/Jigar:/bin/sh  
kruti:x:1009:1017::/home/kruti:/bin/sh  
Vishal:x:1010:1019::/home/Vishal:/bin/sh  
student@312-04:~$
```

2. Userdel : Delete a user account.

```
student@312-04: ~  
student@312-04:~$ sudo userdel Vishal  
student@312-04:~$ cat /etc/passwd  
root:x:0:0:root:/root:/bin/bash  
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin  
bin:x:2:2:bin:/bin:/usr/sbin/nologin  
sys:x:3:3:sys:/dev:/usr/sbin/nologin  
sync:x:4:65534:sync:/bin:/bin/sync  
games:x:5:60:games:/usr/games:/usr/sbin/nologin
```

```
student@312-04: ~  
shreyesh1:x:1003:1004::/home/shreyesh1:/bin/sh  
shreyesh2:x:1004:1005::/home/shreyesh2:/bin/sh  
Farheen:x:1005:1008::/home/Farheen:/bin/sh  
Aaditya:x:1006:1011::/home/Aaditya:/bin/sh  
TANMAY:x:1007:1013::/home/TANMAY:/bin/sh  
Jigar:x:1008:1015::/home/Jigar:/bin/sh  
kruti:x:1009:1017::/home/kruti:/bin/sh  
student@312-04:~$
```

3. Groupadd : Create a new user group.

```
student@312-04:~$ sudo addgroup vishal  
Adding group `vishal' (GID 1020) ...  
Done.  
student@312-04:~$ cat /etc/group  
root:x:0:  
daemon:x:1:  
bin:x:2:  
sys:x:3:
```

```
student@312-04: ~  
kruti:x:1017:  
sheikh111:x:1000:  
SemiraMac:x:1002:  
wireshark:x:138:  
tanmay:x:1018:  
Vishal:x:1019:  
vishal:x:1020:  
student@312-04:~$
```

4. Groupdel : Delete a user group.

```
student@312-04: ~  
student@312-04:~$ sudo groupdel vishal  
student@312-04:~$ cat /etc/group  
root:x:0:  
daemon:x:1:  
bin:x:2:  
sys:x:3:  
adm:x:4:syslog,student  
tty:x:5:
```

```
student@312-04: ~  
shah:x:1016:  
kruti:x:1017:  
sheikh111:x:1000:  
SemiraMac:x:1002:  
wireshark:x:138:  
tanmay:x:1018:  
Vishal:x:1019:  
student@312-04:~$
```

5. Groupmod : Modify user group attributes.

```
student@312-04: ~  
student@312-04:~$ sudo groupmod -n vishal sheikh111  
student@312-04:~$ ls -l  
total 276  
-rw-r--r-- 1 student vishal 11 Mar 7 16:45 Aaron38  
-rw-rw-r-- 1 student vishal 19 Feb 15 15:54 abc.txt  
-rw-rw-r-- 1 student vishal 12 Feb 14 16:52 a.txt  
-rw-rw-r-- 1 student vishal 7 Feb 14 16:53 b.txt  
drwxr-xr-x 2 student vishal 4096 Apr 3 16:42 Desktop  
drwxrwxr-x 3 student vishal 4096 Feb 2 15:58 directory2  
drwxr-xr-x 2 student vishal 4096 Jan 12 20:55 Documents  
drwxr-xr-x 2 student vishal 4096 Apr 4 12:14 Downloads  
-rw-rw-r-- 1 student vishal 13 Feb 2 15:48 File1
```