

# Lab 8 – Process Management in Linux

## 1. Process Status

### Command:

```
ps aux
```

### Explanation:

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

```
(mukund@kali) [~]
$ ps aux
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START  TIME COMMAND
root      1  1.1  0.3 23724 14256 ?        Ss   12:54  0:02 /sbin/init splash
root      2  0.0  0.0     0   0 ?        S     12:54  0:00 [kthreadd]
root      3  0.0  0.0     0   0 ?        S     12:54  0:00 [pool_workqueue_release]
root      4  0.0  0.0     0   0 ?        S     12:54  0:00 [kworker/u8:0-kvfb-rcu_reclaim]
root      5  0.0  0.0     0   0 ?        I<   12:54  0:00 [kworker/k-rcu_gp]
root      6  0.0  0.0     0   0 ?        I<   12:54  0:00 [kworker/k-sync_wq]
root      7  0.0  0.0     0   0 ?        I<   12:54  0:00 [kworker/k-slab_flushwq]
root      8  0.0  0.0     0   0 ?        I<   12:54  0:00 [kworker/k-netns]
root      9  0.0  0.0     0   0 ?        I    12:54  0:00 [kworker/0-events]
root     10  0.0  0.0     0   0 ?        I    12:54  0:00 [kworker/0:1-events]
root     11  0.0  0.0     0   0 ?        I<   12:54  0:00 [kworker/0:0-highpri]
root     12  0.0  0.0     0   0 ?        I    12:54  0:00 [kworker/u2:0-ipv6_addrconf]
root     13  0.0  0.0     0   0 ?        I<   12:54  0:00 [kworker/k-mm_percpu_wq]
root     14  0.0  0.0     0   0 ?        I    12:54  0:00 [rcu_task_kthread]
root     15  0.0  0.0     0   0 ?        I<   12:54  0:00 [rcu_task_krude_kthread]
root     16  0.0  0.0     0   0 ?        I<   12:54  0:00 [rcu_task_kspace_kthread]
root     17  0.0  0.0     0   0 ?        S    12:54  0:00 [ksoftirqd/0]
root     18  0.3  0.0     0   0 ?        I    12:54  0:00 [rcu_prempt]
root     19  0.0  0.0     0   0 ?        S    12:54  0:00 [rcu_exp_gp_kthread_worker/0]
root     20  0.6  0.0     0   0 ?        S    12:54  0:01 [rcu_exp_gp_kthread_worker/1]
root     21  0.0  0.0     0   0 ?        S    12:54  0:00 [migration/0]
root     22  0.0  0.0     0   0 ?        S    12:54  0:00 [idle_inject/0]
root     23  0.0  0.0     0   0 ?        S    12:54  0:00 [cpuhp/0]
root     24  0.0  0.0     0   0 ?        S    12:54  0:00 [cpuhp/1]
root     25  0.0  0.0     0   0 ?        S    12:54  0:00 [idle_inject/1]
root     26  1.0  0.0     0   0 ?        S    12:54  0:02 [migration/1]
```

## 2. Process Tree

### Command:

```
pstree -p
```

### Shows parent-child process relationships.

```
(mukund@kali) [~]
$ pstree -p
systemd(1) —ModemManager(719)—{ModemManager}(729)
              |           {ModemManager}(730)
              |           {ModemManager}(733)
NetworkManager(701) —{NetworkManager}(742)
                     |           {NetworkManager}(744)
                     |           {NetworkManager}(745)
VBoxClient(1568) —VBoxClient(1569)—{VBoxClient}(1571)
                  |           {VBoxClient}(1572)
                  |           {VBoxClient}(1573)
VBoxClient(1583) —VBoxClient(1584)—{VBoxClient}(1586)
                  |           {VBoxClient}(1588)
                  |           {VBoxClient}(1589)
VBoxClient(1591) —VBoxClient(1592)—{VBoxClient}(1601)
                  |           {VBoxClient}(1602)
                  |           {VBoxClient}(1604)
                  |           {VBoxClient}(1608)
VBoxClient(1705) —VBoxClient(1706)—{VBoxClient}(1708)
                  |           {VBoxClient}(1709)
                  |           {VBoxClient}(1710)
VBoxService(790) —{VBoxService}(792)
                  |           {VBoxService}(793)
                  |           {VBoxService}(794)
                  |           {VBoxService}(795)
                  |           {VBoxService}(796)
                  |           {VBoxService}(797)
                  |           {VBoxService}(798)
                  |           {VBoxService}(801)
accounts-daemon(602) —{accounts-daemon}(603)
                     |           {accounts-daemon}(605)
                     |           {accounts-daemon}(702)
colord(979) —{colord}(999)
                 |           {colord}(1000)
                 |           {colord}(1002)
```

### 3. Real-Time Monitoring

#### 💻 Command:

```
top
```

```
(mukund@mukund)-[~]
$ top
top - 13:01:18 up 7 min, 1 user, load average: 0.01, 0.31, 0.23
Tasks: 226 total, 1 running, 225 sleeping, 0 stopped, 0 zombie
CPU(s): 2.9 us, 2.2 sy, 0.0 ni, 94.5 id, 0.1 wa, 0.0 hi, 0.3 si, 0.0 st
Mem: 3921.1 total, 2256.0 free, 1218.0 used, 667.8 buff/cache
Swap: 3376.0 total, 0.0 used, 2703.1 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
1768 mukund 20 0 4937176 445188 164640 S 22.3 11.1 0:43.70 gnome-shell
1491 mukund 20 0 343176 124536 73948 S 9.6 3.1 0:01:21 Xorg
2529 mukund 20 0 710180 59844 47392 S 2.0 1.5 0:02:22 kdeinit5-terminal-
1791 mukund 20 0 168876 7492 6832 S 1.7 1.2 0:00:49 at-spi2-registr
1944 mukund 20 0 509532 81872 64244 S 1.3 2.0 0:00:93 kdeconnectd
18 root 20 0 0 0 0 I 0.3 0.0 0:01:15 rcu_prempt
41 root 20 >20 0 0 0 I 0.3 0.0 0:00:58 kworker/3:0-h-kblockd
45 root 20 0 0 0 0 S 0.3 0.0 0:00:31 ksftingd/4
1584 mukund 20 0 215416 3268 2884 S 0.3 0.1 0:00:78 VBoxclient
1592 mukund 20 0 215932 3028 2772 S 0.3 0.1 0:02:41 VBoxclient
1873 mukund 20 0 385672 10980 7108 S 0.3 0.3 0:00:13 ibus-daemon
2322 mukund 20 0 415792 29628 23156 S 0.3 0.7 0:00:13 xdg-desktop-por
3051 root 0 >20 0 0 0 I 0.3 0.0 0:00:02 kworker/4:2H-kblockd
4999 mukund 20 0 10480 5916 3740 R 0.3 0.0 0:00:01 top
1 root 20 0 23724 14256 10532 S 0.3 0.4 0:02:78 systemd
2 root 20 0 0 0 0 S 0.0 0.0 0:00:07 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/8-kvfree_rcu_reclaim
5 root 0 >20 0 0 0 I 0.0 0.0 0:00:00 kworker/R-rcu_gp
6 root 0 >20 0 0 0 I 0.0 0.0 0:00:00 kworker/R-sync_wq
7 root 0 >20 0 0 0 I 0.0 0.0 0:00:00 kworker/R-slub_flushhwq
8 root 0 >20 0 0 0 I 0.0 0.0 0:00:00 kworker/R-netsns
9 root 20 0 0 0 0 I 0.0 0.0 0:00:06 kworker/0:0-events
10 root 20 0 0 0 0 I 0.0 0.0 0:00:13 kworker/0:1-mm_percpu_wq
11 root 0 >20 0 0 0 I 0.0 0.0 0:00:00 kworker/0:0-events_highpri
12 root 20 0 0 0 0 I 0.0 0.0 0:00:00 kworker/u20:0-ipv6_addrconf
13 root 0 >20 0 0 0 I 0.0 0.0 0:00:00 kworker/0:0-mm_percpu_wq
14 root 20 0 0 0 0 I 0.0 0.0 0:00:00 rcu_tasks_kthread
15 root 20 0 0 0 0 I 0.0 0.0 0:00:00 rcu_tasks_rude_kthread
```

### 4. Adjust Process Priority

#### 💻 Start a process with low priority:

```
nice -n 10 sleep 300 &
```

**💡 OUTPUT:** Note the **PID** (e.g., **x**) for subsequent steps.

```
(mukund@mukund)-[~]
$ nice -n 10 sleep 300 &
[1] 5477
```

### 5. Change Priority of a Running Process

#### 💻 Command:

```
renice 5 -p x
```

(Replace **x** with the actual PID)

```
(mukund@mukund)-[~]
$ sudo renice -n -5 -p 5477
[sudo] password for mukund:
krsSorry, try again.
[sudo] password for mukund:
Sorry, try again.
[sudo] password for mukund:
5477 (process ID) old priority 15, new priority -5
```

### 6. I/O Scheduling Priority

**💻 Command:**

```
ionice -c 3 -p x
```

(Replace **x** with the actual PID)

**💻 OUTPUT:**

```
successfully set pid x's IO scheduling class to idle
```

```
[(mukund㉿kali)-[~]]$ ionice -c 3 -p 5477
```

## 7. File Descriptors Used by a Process

**💻 Command:**

```
lsof -p x | head -5
```

(Replace **x** with the actual PID)

```
[(mukund㉿kali)-[~]]$ lsof -p 5477 | head -5
```

## 8. Monitor Open Files Globally

**💻 Command:**

```
lsof | less
```

```
[(mukund㉿kali)-[~]]$ lsof | less
```

## 9. Find Process Using a Port

**💻 Command:**

```
sudo fuser -n tcp 8080
```

**💻 OUTPUT:**

```
8080/tcp: 4321
```

(The number is the PID using the port)

```
[(mukund㉿kali)-~] $ sudo fuser -n tcp 8080
```

## 10. Per-Process Statistics

 **Command:**

```
pidstat -p x 2 3
```

(Replace **x** with the actual PID)

```
[(mukund㉿kali)-~] $ pidstat -p 5477 2 3
Linux 6.12.25-amd64 (Kali)        25/09/25      _x86_64_        (5 CPU)
01:11:22 PM IST      PID      %usr %system  %guest   %CPU    CPU  Command

```

## 11. Control Groups (cgroups) for Resource Limits

 **Create a 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
```

(Note: **50000** is 50% of one CPU core, and **100M** is 100 Megabytes.)

```
[(mukund㉿kali)-~] $ sudo cgcreate -g cpu,memory:testgroup
```