

Assignment 4 - Process Management & Signal Handling

Part 1: Process Exploration

1. List all running processes using:

- `ps -ef`
- `ps aux`

```
ubuntu@ip-172-31-5-27: ~  
ubuntu@ip-172-31-5-27:~$ ps -ef  
UID          PID     PPID  C  STIME TTY          TIME CMD  
root           1         0  0  09:25 ?        00:00:02 /sbin/init  
root           2         0  0  09:25 ?        00:00:00 [kthreadd]  
root           3         2  0  09:25 ?        00:00:00 [pool_workqueue_release]  
root           4         2  0  09:25 ?        00:00:00 [kworker/R-rcu_gp]  
root           5         2  0  09:25 ?        00:00:00 [kworker/R-sync_wq]  
root           6         2  0  09:25 ?        00:00:00 [kworker/R-kvfree_rcu_rec  
root           7         2  0  09:25 ?        00:00:00 [kworker/R-slub_flushwq]  
root           8         2  0  09:25 ?        00:00:00 [kworker/R-netns]  
root          10         2  0  09:25 ?        00:00:00 [kworker/0:0H-events_high  
root          13         2  0  09:25 ?        00:00:00 [kworker/R-mm_percpu_wq]  
root          14         2  0  09:25 ?        00:00:00 [rcu_tasks_rude_kthread]  
root          15         2  0  09:25 ?        00:00:00 [rcu_tasks_trace_kthread]  
root          16         2  0  09:25 ?        00:00:00 [ksoftirqd/0]  
root          17         2  0  09:25 ?        00:00:00 [rcu_sched]  
root          18         2  0  09:25 ?        00:00:00 [rcu_exp_par_gp_kthread_w  
root          19         2  0  09:25 ?        00:00:00 [rcu_exp_gp_kthread_worke  
root          20         2  0  09:25 ?        00:00:00 [migration/0]  
root          21         2  0  09:25 ?        00:00:00 [idle_inject/0]  
root          22         2  0  09:25 ?        00:00:00 [cpuhp/0]  
root          23         2  0  09:25 ?        00:00:00 [cpuhp/1]  
root          24         2  0  09:25 ?        00:00:00 [idle_inject/1]  
root          25         2  0  09:25 ?        00:00:00 [migration/1]  
root          26         2  0  09:25 ?        00:00:00 [ksoftirqd/1]  
root          28         2  0  09:25 ?        00:00:00 [kworker/1:0H-events_high  
root          29         2  0  09:25 ?        00:00:00 [kdevtmpfs]  
root          30         2  0  09:25 ?        00:00:00 [kworker/R-inet_frag_wq]  
root          31         2  0  09:25 ?        00:00:00 [kauditd]  
root          32         2  0  09:25 ?        00:00:00 [khungtaskd]  
root          34         2  0  09:25 ?        00:00:00 [oom_reaper]  
root          36         2  0  09:25 ?        00:00:00 [kworker/R-writeback]  
root          37         2  0  09:25 ?        00:00:00 [kcompactd0]  
root          38         2  0  09:25 ?        00:00:00 [ksmd]  
root          39         2  0  09:25 ?        00:00:00 [khugepaged]  
root          40         2  0  09:25 ?        00:00:00 [kworker/R-kintegrityd]  
root          41         2  0  09:25 ?        00:00:00 [kworker/R-kblockd]  
root          42         2  0  09:25 ?        00:00:00 [kworker/R-blkcg_punt_bio  
root          44         2  0  09:25 ?        00:00:00 [irq/9-acpi]  
root          45         2  0  09:25 ?        00:00:00 [kworker/R-tpm_dev_wq]  
root          46         2  0  09:25 ?        00:00:00 [kworker/R-ata_sff]
```

```
ubuntu@ip-172-31-5-27: ~  
root          3465      3464  0 12:39 pts/0    00:00:00 sudo -i  
root          3466      3465  0 12:39 pts/0    00:00:00 -bash  
root          3551         2  0 13:00 ?        00:00:00 [kworker/1:1-cgroup_destr  
root          3621         2  0 13:40 ?        00:00:00 [kworker/0:1]  
root          3644         2  0 13:50 ?        00:00:00 [kworker/1:0]  
root          3645         2  0 13:50 ?        00:00:00 [kworker/1:3-cgroup_destr  
root          3647      1009  0 13:54 ?        00:00:00 sshd: ubuntu [priv]  
ubuntu        3745      3647  0 13:54 ?        00:00:00 sshd: ubuntu@pts/1  
ubuntu        3746      3745  0 13:54 pts/1    00:00:00 -bash  
root          3756         2  0 13:54 ?        00:00:00 [kworker/u8:1-events_unbo  
ubuntu        3757      3746  0 13:54 pts/1    00:00:00 ps -ef  
ubuntu@ip-172-31-5-27:~$ ps aux  
USER          PID  %CPU  %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND  
root           1   0.0   1.4 22724 13412 ?        Ss   09:25   0:02 /sbin/init  
root           2   0.0   0.0   0     0 ?        S    09:25   0:00 [kthreadd]  
root           3   0.0   0.0   0     0 ?        S    09:25   0:00 [pool_work  
root           4   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root           5   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root           6   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root           7   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root           8   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root          10   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/0  
root          13   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root          14   0.0   0.0   0     0 ?        I    09:25   0:00 [rcu_tasks  
root          15   0.0   0.0   0     0 ?        I    09:25   0:00 [rcu_tasks  
root          16   0.0   0.0   0     0 ?        S    09:25   0:00 [ksoftirqd  
root          17   0.0   0.0   0     0 ?        I    09:25   0:00 [rcu_sched  
root          18   0.0   0.0   0     0 ?        S    09:25   0:00 [rcu_exp_p  
root          19   0.0   0.0   0     0 ?        S    09:25   0:00 [rcu_exp_g  
root          20   0.0   0.0   0     0 ?        S    09:25   0:00 [migration  
root          21   0.0   0.0   0     0 ?        S    09:25   0:00 [idle_inje  
root          22   0.0   0.0   0     0 ?        S    09:25   0:00 [cpuhp/0]  
root          23   0.0   0.0   0     0 ?        S    09:25   0:00 [cpuhp/1]  
root          24   0.0   0.0   0     0 ?        S    09:25   0:00 [idle_inje  
root          25   0.0   0.0   0     0 ?        S    09:25   0:00 [migration  
root          26   0.0   0.0   0     0 ?        S    09:25   0:00 [ksoftirqd  
root          28   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/1  
root          29   0.0   0.0   0     0 ?        S    09:25   0:00 [kdevtmpfs  
root          30   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root          31   0.0   0.0   0     0 ?        S    09:25   0:00 [kauditd]  
root          32   0.0   0.0   0     0 ?        S    09:25   0:00 [khungtask  
root          34   0.0   0.0   0     0 ?        S    09:25   0:00 [oom_reape  
root          36   0.0   0.0   0     0 ?        I<   09:25   0:00 [kworker/R  
root          37   0.0   0.0   0     0 ?        S    09:25   0:00 [kcompactd
```

Part 2: Background Jobs

1. Start a long-running command: `sleep 1000 &`
2. View running background jobs.
3. Bring the job to foreground and send it back to background.

```
ubuntu@ip-172-31-5-27: ~  
ubuntu@ip-172-31-5-27:~$ sleep 1000 &  
[1] 3864  
ubuntu@ip-172-31-5-27:~$ jobs  
[1]+  Running                  sleep 1000 &  
ubuntu@ip-172-31-5-27:~$ fg %1  
sleep 1000  
^Z  
[1]+  Stopped                  sleep 1000  
ubuntu@ip-172-31-5-27:~$ bg %1  
[1]+ sleep 1000 &  
ubuntu@ip-172-31-5-27:~$ jobs  
[1]+  Running                  sleep 1000 &  
ubuntu@ip-172-31-5-27:~$
```

Part 3: Process Termination & Signals

1. Gracefully stop the sleep process using: `kill -15`
2. Verify if the process still exists.
3. Forcefully terminate it using: `kill -9`
4. Explain the difference between: `kill -15` `kill -9`

```
ubuntu@ip-172-31-5-27:~$ pgrep -a sleep  
3864 sleep 1000  
ubuntu@ip-172-31-5-27:~$ kill -15 3864  
ubuntu@ip-172-31-5-27:~$ ps -p 3864  
    PID TTY          TIME CMD  
ubuntu@ip-172-31-5-27:~$ kill -15 3864  
-bash: kill: (3864) - No such process
```

Kill - 15 SIGTERM (Graceful shutdown that allows clean up)

Kill- 9 SIGKILL (Force kill or immediate kill)

Part 4: Real-Time Monitoring

1. Use `top` to:
 - Identify top CPU-consuming processes
 - Sort by memory usage
2. Observe changes in real time.

To sort by CPU we use – p

To sort by memory usage we use - m

```
ubuntu@ip-172-31-5-27: ~  
top - 14:28:11 up 5:02, 6 users, load average: 0.05, 0.02, 0.00  
Tasks: 132 total, 1 running, 131 sleeping, 0 stopped, 0 zombie  
%Cpu(s): 0.0 us, 0.2 sy, 0.0 ni, 99.8 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st  
MiB Mem : 80.3/914.2 [|||||||||||||||||||||||||||||||||||||]  
MiB Swap: 0.0/0.0 [ ]  
  
  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM    TIME+  COMMAND  
  740 mysql     20   0 1786480 363048 6080 S   0.3   38.8   1:43.42 mysqld  
    1 root       20   0   22724   13412 9116 S   0.0    1.4   0:02.26 systemd  
    2 root       20   0        0        0    0 S   0.0    0.0   0:00.01 kthreadd  
    3 root       20   0        0        0    0 S   0.0    0.0   0:00.00 pool_wor+  
    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+  
    8 root        0 -20        0        0    0 I   0.0    0.0   0:00.00 kworker+  
   10 root        0 -20        0        0    0 I   0.0    0.0   0:00.00 kworker+  
   13 root        0 -20        0        0    0 I   0.0    0.0   0:00.00 kworker+  
   14 root       20   0        0        0    0 I   0.0    0.0   0:00.00 rcu_tas+  
   15 root       20   0        0        0    0 I   0.0    0.0   0:00.00 rcu_tas+  
   16 root       20   0        0        0    0 S   0.0    0.0   0:00.05 ksoftir+  
   17 root       20   0        0        0    0 I   0.0    0.0   0:00.37 rcu_sch+  
   18 root       20   0        0        0    0 S   0.0    0.0   0:00.00 rcu_exp+  
   19 root       20   0        0        0    0 S   0.0    0.0   0:00.00 rcu_exp+
```