

# Linux Process Management Commands\*\*

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## Linux Process Management Commands

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

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### 💡 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
vibhu	1234	1.2	1.5	274532	15632	?	S1	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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USER	PID	%CPU	%MEM	VSZ	RSS	TTY	STAT	START	TIME	COMMAND
root	1	0.1	0.4	24980	15348	?	Ss	04:14	0:02	/sbin/init sp
root	2	0.0	0.0	0	0	?	S	04:14	0:00	[kthreadd]
root	3	0.0	0.0	0	0	?	S	04:14	0:00	[pool_workque]
root	4	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/R-rc]
root	5	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/R-sy]
root	6	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/R-kv]
root	7	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/R-sl]
root	8	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/R-ne]
root	10	0.1	0.0	0	0	?	I	04:14	0:02	[kworker/0:1-]
root	11	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/0:0H]
root	12	0.0	0.0	0	0	?	I	04:14	0:00	[kworker/u16:]
root	13	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/R-mm]
root	14	0.0	0.0	0	0	?	I	04:14	0:00	[rcu_tasks_kt]
root	15	0.0	0.0	0	0	?	I	04:14	0:00	[rcu_tasks_ru]
root	16	0.0	0.0	0	0	?	I	04:14	0:00	[rcu_tasks_tr]
root	17	0.0	0.0	0	0	?	S	04:14	0:00	[ksoftirqd/0]
root	18	0.0	0.0	0	0	?	I	04:14	0:01	[rcu_preempt]
root	19	0.0	0.0	0	0	?	S	04:14	0:00	[rcu_exp_par_]
root	20	0.0	0.0	0	0	?	S	04:14	0:00	[rcu_exp_gp_k]
root	21	0.0	0.0	0	0	?	S	04:14	0:00	[migration/0]
root	22	0.0	0.0	0	0	?	S	04:14	0:00	[idle_inject/]
root	23	0.0	0.0	0	0	?	S	04:14	0:00	[cpuhp/0]
root	24	0.0	0.0	0	0	?	S	04:14	0:00	[cpuhp/1]
root	25	0.0	0.0	0	0	?	S	04:14	0:00	[idle_inject/]
root	26	0.0	0.0	0	0	?	S	04:14	0:00	[migration/1]
root	27	0.0	0.0	0	0	?	S	04:14	0:00	[ksoftirqd/1]
root	28	0.0	0.0	0	0	?	I	04:14	0:00	[kworker/1:0-]
root	29	0.0	0.0	0	0	?	I<	04:14	0:00	[kworker/1:0H]
root	30	0.0	0.0	0	0	?	S	04:14	0:00	[cpuhp/2]
root	31	0.0	0.0	0	0	?	S	04:14	0:00	[idle_inject/]
root	32	0.0	0.0	0	0	?	S	04:14	0:00	[migration/2]

## 2. Process Tree: `pstree -p`

Shows parent-child process relationships.

### Example Output:

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

```
vboxuser@ubuntu1:~/Desktop$ pstree -p
systemd(1)─ ModemManager(1222)─ {ModemManager}(1244)
                         ├ {ModemManager}(1245)
                         ├ {ModemManager}(1248)
                         └ NetworkManager(1179)─ {NetworkManager}(1232)
                               ├ {NetworkManager}(1234)
                               └ {NetworkManager}(1237)
                         └ accounts-daemon(1103)─ {accounts-daemon}(1161)
                               ├ {accounts-daemon}(1162)
                               └ {accounts-daemon}(1175)
                         └ avahi-daemon(1063)─ avahi-daemon(1150)
                         └ colord(1634)─ {colord}(1643)
                               ├ {colord}(1644)
                               └ {colord}(1646)
                         └ cron(1108)
                         └ cups-browsed(1347)─ {cups-browsed}(1364)
                               ├ {cups-browsed}(1365)
                               └ {cups-browsed}(1366)
                         └ cupsd(1323)─ dbus(1338)
                               ├ dbus(1339)
                               └ dbus(1340)
                         └ dbus-daemon(1064)
                         └ fwupd(4507)─ {fwupd}(4511)
                               ├ {fwupd}(4512)
                               └ {fwupd}(4513)
                         └ gdm3(1344)─ gdm-session-wor(2061)─ gdm-wayland-ses(2145)─ gnome-session-b(2161)─ {gnome-session-b}(224+)
                               ├ {gnome-session-b}(224+)
                               └ {gnome-session-b}(224+)
                         └ gdm-wayland-ses(2152)
                         └ gdm-wayland-ses(2153)
```

### 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+

10	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker+
11	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+

👉 Press `q` to quit.

```
vboxuser@ubuntu1:~/Desktop$ top

top - 05:37:29 up 1:22, 2 users, load average: 0.18, 0.13, 0.07
Tasks: 230 total, 1 running, 229 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.9 us, 0.9 sy, 0.0 ni, 98.0 id, 0.0 wa, 0.0 hi, 0.2 si, 0.0 st
MiB Mem : 3306.7 total, 474.7 free, 1476.1 used, 1543.7 buff/cache
MiB Swap: 0.0 total, 0.0 free, 0.0 used. 1830.6 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
2314 vboxuser 20 0 4866684 452576 162904 S 10.6 13.4 2:18.87 gnome-shell
3026 vboxuser 20 0 566780 63892 49484 S 3.3 1.9 0:18.27 gnome-terminal-
4668 root 20 0 0 0 I 0.6 0.0 0:00.29 kworker/u19:0-events_power_efficient
1693 root 20 0 321644 10204 8412 S 0.3 0.3 0:01.79 upowerd
3302 vboxuser 20 0 3089240 409036 167608 S 0.3 12.1 0:35.85 firefox
4078 vboxuser 20 0 2433008 69436 54884 S 0.3 2.1 0:03.75 Web Content
4526 root 20 0 0 0 I 0.3 0.0 0:02.12 kworker/0:1-events
4840 root 20 0 0 0 I 0.3 0.0 0:00.07 kworker/u17:0-events_power_efficient
1 root 20 0 24980 15348 10740 S 0.0 0.5 0:02.94 systemd
2 root 20 0 0 0 S 0.0 0.0 0:00.05 kthreadd
3 root 20 0 0 0 S 0.0 0.0 0:00.00 pool_workqueue_release
4 root 0 -20 0 0 I 0.0 0.0 0:00.00 kworker/R-rcu_gp
5 root 0 -20 0 0 I 0.0 0.0 0:00.00 kworker/R-sync_wq
6 root 0 -20 0 0 I 0.0 0.0 0:00.00 kworker/R-kvfree_rcu_reclaim
7 root 0 -20 0 0 I 0.0 0.0 0:00.00 kworker/R-slub_flushwq
8 root 0 -20 0 0 I 0.0 0.0 0:00.00 kworker/R-netns
11 root 0 -20 0 0 I 0.0 0.0 0:00.83 kworker/0:0H-kblockd
12 root 20 0 0 0 I 0.0 0.0 0:00.00 kworker/u16:0-ipv6_addrconf
13 root 0 -20 0 0 I 0.0 0.0 0:00.00 kworker/R-mm_percpu_wq
14 root 20 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks_kthread
15 root 20 0 0 0 I 0.0 0.0 0:00.00 rcu_tasks_rude_kthread

```

## ⚡ 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
```

## 🔧 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.

## 📄 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
Linux 5.15.0 (ubuntu)  09/25/25          x86_64          (4 CPU)
12:30:20      UID      PID    %usr %system  %CPU   CPU  Command
12:30:22      1000    3050    0.00   0.00   0.00     1 sleep
12:30:24      1000    3050    0.00   0.00   0.00     1 sleep
12:30:26      1000    3050    0.00   0.00   0.00     1 sleep
```

## 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
```

```
--  
vboxuser@ubuntu1:~/Desktop$ nice -n 10 sleep 300 &  
[2] 3122  
vboxuser@ubuntu1:~/Desktop$ sudo renice -n -5 -p 3122  
3122 (process ID) old priority 10, new priority -5  
vboxuser@ubuntu1:~/Desktop$ taskset -cp 3122  
pid 3122's current affinity list: 0-3  
vboxuser@ubuntu1:~/Desktop$ taskset -cp 1 3122  
pid 3122's current affinity list: 0-3  
pid 3122's new affinity list: 1  
vboxuser@ubuntu1:~/Desktop$ ionice -c 3 -p 3122  
vboxuser@ubuntu1:~/Desktop$ ionice -c 1 -p 3122  
ionice: ioprio_set failed: Operation not permitted  
vboxuser@ubuntu1:~/Desktop$ lsof -p 3122 | head -5  
COMMAND  PID    USER   FD   TYPE DEVICE SIZE/OFF NODE NAME  
sleep  3122  vboxuser cwd     DIR      8,2      4096 1053301 /home/vboxuser/Desktop  
sleep  3122  vboxuser rtd     DIR      8,2      4096      2 /  
sleep  3122  vboxuser txt     REG      8,2     35416 1049712 /usr/bin/sleep  
sleep  3122  vboxuser mem     REG      8,2   5726160 1052643 /usr/lib/locale/locale-  
archive  
vboxuser@ubuntu1:~/Desktop$ █
```