

# Listing Processes\_ps\_and\_top

## The ps Command (System V Style):

1. **ps** provides information about currently running processes keyed by **PID**.
2. If you want a repetitive update of this status, you can use **top** or other commonly installed variants (such as **htop** or **atop**) from the command line.
3. **ps** has many options for specifying exactly which tasks to examine. Without options, **ps** will display all processes running under the current shell.
4. You can use the **-u** option to display information of processes for a specified username.
5. The command **ps -ef** displays all the processes in the system in full detail.
6. The command **ps -eLf** goes one step further and displays one line of information for every thread (remember, a process can contain multiple threads).

```
student@ubuntu: ~  
student@ubuntu:~$ ps -ef  
UID          PID     PPID  C  STIME TTY          TIME CMD  
root           1         0  2  16:07 ?        00:00:02 /sbin/init auto noprompt  
root           2         0  0  16:07 ?        00:00:00 [kthreadd]  
root           3         2  0  16:07 ?        00:00:00 [ksoftirqd/0]  
root           4         2  0  16:07 ?        00:00:00 [kworker/0:0]  
root           5         2  0  16:07 ?        00:00:00 [kworker/0:0H]  
root           6         2  0  16:07 ?        00:00:00 [kworker/u256:0]  
root           7         2  0  16:07 ?        00:00:00 [rcu_sched]  
root           8         2  0  16:07 ?        00:00:00 [rcu_bh]  
root           9         2  0  16:07 ?        00:00:00 [migration/0]  
root          10         2  0  16:07 ?        00:00:00 [watchdog/0]  
root          11         2  0  16:07 ?        00:00:00 [watchdog/1]  
root          12         2  0  16:07 ?        00:00:00 [migration/1]  
root          13         2  0  16:07 ?        00:00:00 [ksoftirqd/1]  
....  
student       3669       3084  0  16:08 ?        00:00:00 /usr/lib/gnome-terminal/gnome-terminal-server  
student       3675       3669  0  16:08 pts/18    00:00:00 bash  
student       3701       3324  0  16:08 ?        00:00:00 zeitgeist-datahub  
student       3712       3708  0  16:08 ?        00:00:00 /usr/bin/zeitgeist-daemon  
student       3719       3084  0  16:08 ?        00:00:00 /usr/lib/x86_64-linux-gnu/zeitgeist-fts  
student       3785       3324  0  16:09 ?        00:00:00 update-notifier  
root          3792         1  22  16:09 ?        00:00:02 /usr/bin/python3 /usr/sbin/aptd  
student       4074       3675  0  16:09 pts/18    00:00:00 ps -ef  
student@ubuntu:~$
```

## The ps Command (BSD Style):

1. The command **ps aux** displays all processes of all users.
2. The command **ps axo** allows you to specify which attributes you want to view.
3. The below screenshot shows a sample output of **ps** with the **aux** and **axo** qualifiers.

```

File Edit View Search Terminal Help
c7:/home/coop>ps aux | head -10
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.0 125680  5544 ?        Ss   07:34   0:01 /usr/lib/systemd/sys
root         2  0.0  0.0     0     0 ?        S    07:34   0:00 [kthreadd]
root         3  0.0  0.0     0     0 ?        S    07:34   0:00 [ksoftirqd/0]
root         5  0.0  0.0     0     0 ?        S<   07:34   0:00 [kworker/0:0H]
root         7  0.0  0.0     0     0 ?        S    07:34   0:02 [rcu_preempt]
root         8  0.0  0.0     0     0 ?        S    07:34   0:00 [rcu_sched]
root         9  0.0  0.0     0     0 ?        S    07:34   0:00 [rcu_bh]
root        10  0.0  0.0     0     0 ?        S    07:34   0:00 [rcuop/0]
root        11  0.0  0.0     0     0 ?        S    07:34   0:00 [rcuos/0]
c7:/home/coop>ps axo stat,priority,pid,pcpu,comm | head -10
STAT PRI  PID %CPU COMMAND
Ss   20    1  0.0 systemd
S    20    2  0.0 kthreadd
S    20    3  0.0 ksoftirqd/0
S<    0    5  0.0 kworker/0:0H
S    20    7  0.0 rcu_preempt
S    20    8  0.0 rcu_sched
S    20    9  0.0 rcu_bh
S    20   10  0.0 rcuop/0
S    20   11  0.0 rcuos/0
c7:/home/coop>

```

## The Process Tree:

1. **ps tree** displays the processes running on the system in the form of a tree diagram showing the relationship between a process and its parent process and any other processes that it created.
2. Repeated entries of a process are not displayed, and threads are displayed in curly braces.

```

student@ubuntu:~/Pictures$ pstree
systemd--ModemManager--{gdbus}
                        {gmain}
--NetworkManager--dhclient
                    dnsmasq
                    {gdbus}
                    {gmain}
--accounts-daemon--{gdbus}
                   {gmain}
--acpid
--agetty
--apache2--2*[apache2--26*[{apache2}]]
--avahi-daemon--avahi-daemon
--cgmanager
--collectd
--colord--{gdbus}
          {gmain}
--cron
--cups-browsed--{gdbus}
                {gmain}

```

## top:

1. While a static view of what the system is doing is useful, monitoring the system performance live over time is also valuable. One option would be to run **ps** at regular intervals, say, every few seconds.
2. A better alternative is to use **top** to get constant real-time updates (every two seconds by default), until you exit by typing **q**.
3. **top** clearly highlights which processes are consuming the most CPU cycles and memory (using appropriate commands from within **top**).

```
File Edit View Search Terminal Help
top - 10:52:22 up 3:17, 5 users, load average: 1.11, 0.43, 0.20
Tasks: 333 total, 3 running, 330 sleeping, 0 stopped, 0 zombie
%Cpu(s): 24.6 us, 5.5 sy, 0.0 ni, 65.8 id, 4.0 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem : 16283344 total, 9176888 free, 1713680 used, 5392776 buff/cache
KiB Swap: 8290300 total, 8290300 free, 0 used, 13387900 avail Mem

  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM    TIME+  COMMAND
 10831 root        20   0  113636   2512  2256  R   73.1   0.0   0:02.20  awk
 10830 root        20   0  141180   23968  3232  S   14.6   0.1   0:00.44  objdump
 2442  coop       20   0 2080636  280092  86628  S   12.6   1.7   2:29.41  gnome-shell
 10832 root        20   0    4196    676   596  R    5.0   0.0   0:00.15  test_get_len
 1449  root       20   0  467744  44588  29032  S    2.0   0.3   1:15.14  Xorg
 3819  coop       20   0  539608 160724  63500  S    2.0   1.0   3:06.89  skype-bin
 7492  coop       20   0 1184072 228944  84920  S    1.3   1.4   0:17.70  thunderbird
 4428  coop       20   0  644404  55776  49988  S    1.0   0.3   0:00.23  gnome-screensho
 4058  coop       20   0 1492732 327060 108116  S    0.7   2.0   2:04.10  chrome
 28  root       rt    0      0      0      0  S    0.3   0.0   0:00.03  migration/2
 68  root       20   0      0      0      0  S    0.3   0.0   0:00.49  rcuop/6
 2372  coop       20   0 1492444 63244  28244  S    0.3   0.4   0:02.38  gnome-settings-
 2758  coop       20   0  659456 65372  51556  S    0.3   0.4   0:03.99  gnome-terminal-
 1  root       20   0  125680   5544   3676  S    0.0   0.0   0:01.55  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  ksoftirqd/0
 5  root       0 -20      0      0      0  S    0.0   0.0   0:00.00  kworker/0:0H
 7  root       20   0      0      0      0  S    0.0   0.0   0:02.61  rcu_preempt
 8  root       20   0      0      0      0  S    0.0   0.0   0:00.00  rcu_sched
 9  root       20   0      0      0      0  S    0.0   0.0   0:00.00  rcu_bh
10  root       20   0      0      0      0  S    0.0   0.0   0:00.43  rcuop/0
11  root       20   0      0      0      0  S    0.0   0.0   0:00.00  rcuos/0
```

## top

### First Line of the top Output:

1. The first line of the top output displays a quick summary of what is happening in the system, including:
  - How long the system has been up
  - How many users are logged on
  - What is the load average
2. The load average determines how busy the system is.
3. A load average of 1.00 per CPU indicates a fully subscribed, but not overloaded, system.
4. If the load average goes above this value, it indicates that processes are competing for CPU time.
5. If the load average is very high, it might indicate that the system is having a problem, such as a runaway process (a process in a non-responding state).



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KiB Mem : 16283344 total, 9176888 free, 1713680 used, 5392776 buff/cache										
KiB Swap: 8290300 total, 8290300 free, 0 used. 13387900 avail Mem										
PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
10831	root	20	0	113636	2512	2256	R	73.1	0.0	0:02.20 awk
10830	root	20	0	141180	23968	3232	S	14.6	0.1	0:00.44 objdump
2442	coop	20	0	2080636	280092	86628	S	12.6	1.7	2:29.41 gnome-shell
10832	root	20	0	4196	676	596	R	5.0	0.0	0:00.15 test_get_len
1449	root	20	0	467744	44588	29032	S	2.0	0.3	1:15.14 Xorg
3819	coop	20	0	539608	160724	63500	S	2.0	1.0	3:06.89 skype-bin
7492	coop	20	0	1184072	228944	84920	S	1.3	1.4	0:17.70 thunderbird
4428	coop	20	0	644404	55776	49988	S	1.0	0.3	0:00.23 gnome-screensho
4058	coop	20	0	1492732	327060	108116	S	0.7	2.0	2:04.10 chrome
28	root	rt	0	0	0	0	S	0.3	0.0	0:00.03 migration/2
68	root	20	0	0	0	0	S	0.3	0.0	0:00.49 rcuop/6
2372	coop	20	0	1492444	63244	28244	S	0.3	0.4	0:02.38 gnome-settings-
2758	coop	20	0	659456	65372	51556	S	0.3	0.4	0:03.99 gnome-terminal-
1	root	20	0	125680	5544	3676	S	0.0	0.0	0:01.55 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 ksoftirqd/0
5	root	0	-20	0	0	0	S	0.0	0.0	0:00.00 kworker/0:0H
7	root	20	0	0	0	0	S	0.0	0.0	0:02.61 rcu_preempt
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcu_sched
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcu_bh
10	root	20	0	0	0	0	S	0.0	0.0	0:00.43 rcuop/0
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuos/0

## Second Line of the top Output:

1. The second line of the top output displays the total number of processes, the number of running, sleeping, stopped, and zombie processes.
2. Comparing the number of running processes with the load average helps determine if the system has reached its capacity or perhaps a particular user is running too many processes.
3. The stopped processes should be examined to see if everything is running correctly.

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Tasks: 333 total, 3 running, 330 sleeping, 0 stopped, 0 zombie										
%Cpu(s): 24.6 us, 5.5 sy, 0.0 ni, 65.8 id, 4.0 wa, 0.0 hi, 0.0 si, 0.0 st										
KiB Mem : 16283344 total, 9176888 free, 1713680 used, 5392776 buff/cache										
KiB Swap: 8290300 total, 8290300 free, 0 used. 13387900 avail Mem										
PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
10831	root	20	0	113636	2512	2256	R	73.1	0.0	0:02.20 awk
10830	root	20	0	141180	23968	3232	S	14.6	0.1	0:00.44 objdump
2442	coop	20	0	2080636	280092	86628	S	12.6	1.7	2:29.41 gnome-shell
10832	root	20	0	4196	676	596	R	5.0	0.0	0:00.15 test_get_len
1449	root	20	0	467744	44588	29032	S	2.0	0.3	1:15.14 Xorg
3819	coop	20	0	539608	160724	63500	S	2.0	1.0	3:06.89 skype-bin
7492	coop	20	0	1184072	228944	84920	S	1.3	1.4	0:17.70 thunderbird
4428	coop	20	0	644404	55776	49988	S	1.0	0.3	0:00.23 gnome-screensho
4058	coop	20	0	1492732	327060	108116	S	0.7	2.0	2:04.10 chrome
28	root	rt	0	0	0	0	S	0.3	0.0	0:00.03 migration/2
68	root	20	0	0	0	0	S	0.3	0.0	0:00.49 rcuop/6
2372	coop	20	0	1492444	63244	28244	S	0.3	0.4	0:02.38 gnome-settings-
2758	coop	20	0	659456	65372	51556	S	0.3	0.4	0:03.99 gnome-terminal-
1	root	20	0	125680	5544	3676	S	0.0	0.0	0:01.55 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 ksoftirqd/0
5	root	0	-20	0	0	0	S	0.0	0.0	0:00.00 kworker/0:0H
7	root	20	0	0	0	0	S	0.0	0.0	0:02.61 rcu_preempt
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcu_sched
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcu_bh
10	root	20	0	0	0	0	S	0.0	0.0	0:00.43 rcuop/0
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00 rcuos/0

## Third Line of the top Output:

1. The third line of the top output indicates how the CPU time is being divided between the users (**us**) and the kernel (**sy**) by displaying the percentage of CPU time used for each.
2. The percentage of user jobs running at a lower priority (**niceness - ni**) is then listed.
3. Idle mode (**id**) should be low if the load average is high, and vice versa.
4. The percentage of jobs waiting (**wa**) for I/O is listed.
5. Interrupts include the percentage of hardware (**hi**) vs. software interrupts (**si**). Steal time (**st**) is generally used with virtual machines, which has some of its idle CPU time taken for other uses.

## Fourth and Fifth Lines of the top Output:

1. The fourth and fifth lines of the top output indicate memory usage, which is divided in two categories:
  - Physical memory (RAM) – displayed on line 4.
  - Swap space – displayed on line 5.
2. Both categories display total memory, used memory, and free space.
3. You need to monitor memory usage very carefully to ensure good system performance.
4. Once the physical memory is exhausted, the system starts using swap space (temporary storage space on the hard drive) as an extended memory pool, and since accessing disk is much slower than accessing memory, this will negatively affect system performance.

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KiB Mem : 16283344 total, 9176888 free, 1713680 used, 5392776 buff/cache  
KiB Swap: 8290300 total, 8290300 free, 0 used. 13387900 avail Mem

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
10831	root	20	0	113636	2512	2256	R	73.1	0.0	0:02.20	awk
10830	root	20	0	141180	23968	3232	S	14.6	0.1	0:00.44	objdump
2442	coop	20	0	2080636	280092	86628	S	12.6	1.7	2:29.41	gnome-shell
10832	root	20	0	4196	676	596	R	5.0	0.0	0:00.15	test_get_len
1449	root	20	0	467744	44588	29032	S	2.0	0.3	1:15.14	Xorg
3819	coop	20	0	539608	160724	63500	S	2.0	1.0	3:06.89	skype-bin
7492	coop	20	0	1184072	228944	84920	S	1.3	1.4	0:17.70	thunderbird
4428	coop	20	0	644404	55776	49988	S	1.0	0.3	0:00.23	gnome-screensho
4058	coop	20	0	1492732	327060	108116	S	0.7	2.0	2:04.10	chrome
28	root	rt	0	0	0	0	S	0.3	0.0	0:00.03	migration/2
68	root	20	0	0	0	0	S	0.3	0.0	0:00.49	rcuop/6
2372	coop	20	0	1492444	63244	28244	S	0.3	0.4	0:02.38	gnome-settings-
2758	coop	20	0	659456	65372	51556	S	0.3	0.4	0:03.99	gnome-terminal-
1	root	20	0	125680	5544	3676	S	0.0	0.0	0:01.55	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	ksoftirqd/0
5	root	0	-20	0	0	0	S	0.0	0.0	0:00.00	kworker/0:0H
7	root	20	0	0	0	0	S	0.0	0.0	0:02.61	rcu_preempt
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcu_sched
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcu_bh
10	root	20	0	0	0	0	S	0.0	0.0	0:00.43	rcuop/0
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/0



## Process List of the top Output:

1. Each line in the process list of the top output displays information about a process.
2. By default, processes are ordered by highest CPU usage. The following information about each process is displayed:
  - Process Identification Number (**PID**)
  - Process owner (**USER**)
  - Priority (**PR**) and nice values (**NI**)
  - Virtual (**VIRT**), physical (**RES**), and shared memory (**SHR**)
  - Status (**S**)
  - Percentage of CPU (**%CPU**) and memory (**%MEM**) used
  - Execution time (**TIME+**)
  - Command (**COMMAND**).

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1	root	20	0	125680	5544	3676	S	0.0	0.0	0:01.55	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	ksoftirqd/0
5	root	0	-20	0	0	0	S	0.0	0.0	0:00.00	kworker/0:0H
7	root	20	0	0	0	0	S	0.0	0.0	0:02.61	rcu_preempt
8	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcu_sched
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcu_bh
10	root	20	0	0	0	0	S	0.0	0.0	0:00.43	rcuop/0
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/0

## Process List of the top Output

## Interactive Keys with top:

1. The table lists what happens when pressing various keys when running top:

Command	Output
t	Display or hide summary information (rows 2 and 3)
m	Display or hide memory information (rows 4 and 5)
A	Sort the process list by top resource consumers
r	Renice (change the priority of) a specific processes
k	Kill a specific process
f	Enter the <code>top</code> configuration screen
o	Interactively select a new sort order in the process list