

Linux For Embedded Systems

For Frabs

Course 102: Understanding Linux

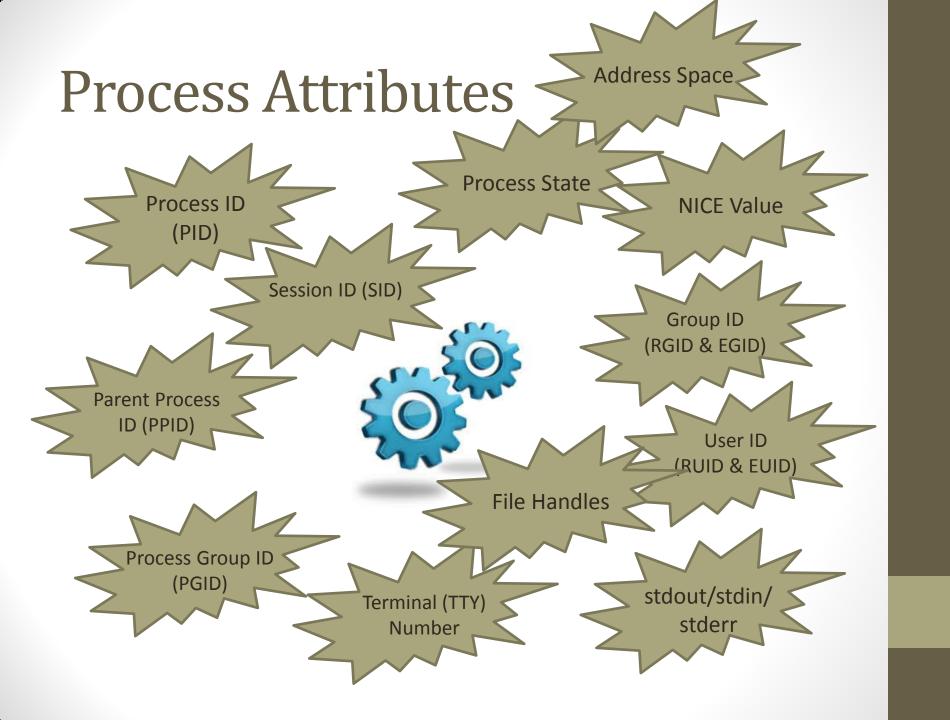
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Lecture 17: Process Monitoring

On a UNIX system, everything is a file; if something is not a file, it is a process



Process Attributes



- Process Id (PID)
 - A unique identification number used to refer to the process
- Parent Process ID (PPID)
 - The process ID of the parent process
- Process Group ID (*PGID*)
 - The ID for the process group that this process belong to
 - Will be equal to PID if the process is a Process Group Leader
- Session ID (SID)
 - The ID for the session that this process belong to
 - The same for the PID if this process is the <u>Session Leader</u>
- Terminal Number
 - The number of the terminal that is associated with the process
 - Only applicable for interactive processes
 - Batch processes and Daemons have the value of 0

Process Attributes



- Owner User ID
 - There are two user IDs for the process
 - Real User ID (*RUID*): the user who started the process
 - Effective User ID (*EUID*): the user whose privileges will be inherited by the process when accessing resources
 - By default RUID and EUID has the same value
- Owner Group ID
 - Similar to user ID, there are two Group IDs
 - Real Group ID (RGID): The primary group of the user who started the process
 - Effective Group ID (*EGID*): The Group ID whose privileges are inherited by the process when accessing system resources
 - By default RGID and EGID has the same value

Process Priority

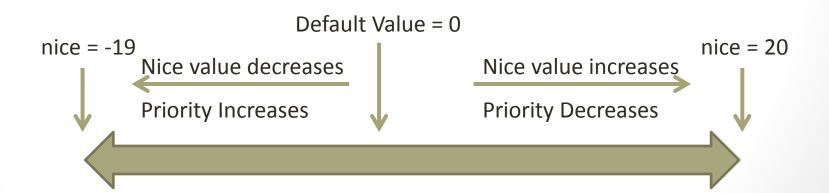


- Each process will have a priority value
- The process priority affects the scheduler behavior in the Linux Kernel
- A Process with higher priority may,
 - Receive more processor time by the kernel
 - Get scheduled more often
 - Preempt processes with lower processes
- Process priority is defined by,
 - User Controlled value (nice Value)
 - Kernel calculated value (based on the process behavior)
 - Processing bound
 - I/O bound

The "nice" Value



- This is a value between -19 to 20 assigned by the user
- The kernel uses this value as a factor in calculating the process priority
- The higher the "nice" value of the process, the more it is accommodating other processes (less aggressive), which means lower priority



Set Process Priority (nice Command)



```
$ nice -<value> command
$ nice -n <value> command
```

This command sets the nice value to manipulate the process priority

- To increase priority, nice should be decreased and vice versa
 - nice value vary between -20 to +19
 - Default nice value is "0"
- Example:
 - To set nice to value 5 for a new process,

```
$ nice -5 processCommand &
```

\$ nice -n 5 processCommand &

To set nice to value -10 for a new process

```
$ nice --10 processCommand &
```

\$ nice -n -10 processCommand &

Note: non-root users can only do 1-19 nice values

Modify Process Priority (renice Command)



\$ renice <value> <pid of process>

This command changes the "nice" value of a process

Example:

\$ renice 10 1002

- Note,
 - Non-root users can only <u>increase</u> the processes **nice** value (decrease its priority)
 - The passed value is the new nice value and not a increment/decrement value



DISPLAY PROCESS INFORMATION & SYSTEM RESOURCE USAGE



Displaying Process Info

Command	Function
\$ ps	Display Process Static Information
\$ pstree	Display Process Hierarchy
\$ top	Display Resource usage by processes
\$ vmsat	Display System Resource Usage
\$ xload \$ tload	System load average (in Graphical fashion)
\$ free	Display of Memory Usage (used/free)
\$ time	Measuring Running Time of a Command
\$ uptime	Measuring System Uptime

Display Process Info (ps Command)



\$ ps <options>

Display Information about the running processes

- The ps command is a very powerful and diverse command
- It has a lot of options to change the ways to display process info,
 - Some options are used to define the scope of which processes to show
 - Other options are used to define the format of the listing and which information to show
- we will go through the common forms for the command

The **ps** Command Defining Scope



\$ ps

Display info about processes under the current shell

```
$ ps -e
$ ps -A
```

Display all processes in the system

\$ ps a

 Display all processes in the system except those which are not attached with a terminal

\$ ps ax

 Display all processes in the system including those which are not attached with a terminal

Defining Format



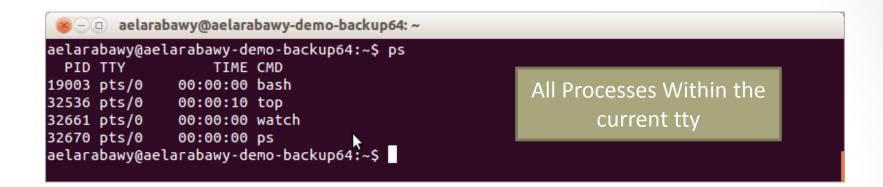
- You can use different options to define the format of the output (what columns to show)
- Some of the common usages

```
$ ps -f
$ ps -F
```

To specify which fields to show use "-o" option

```
$ ps -o pid,ppid,pgid,sid,command
```







```
prasad$ps
 PID TTY
                 TIME CMD
 659 pts/5 00:00:00 ksh
1188 pts/5 00:00:00 ksh
1543 pts/5 00:00:00 ksh
1671 pts/5 00:00:00 ksh
1676 pts/5 00:00:00 ksh
8232 pts/5 00:00:00 ksh
8380 pts/5 00:00:00 ksh
8720 pts/5 00:00:00 ksh
8904 pts/5 00:00:00 ksh
20882 pts/5 00:00:00 ksh
21116 pts/5 00:00:00 find
21903 pts/5 00:00:00 grep
22075 pts/5 00:00:00 ps
32726 pts/5 00:00:00 ksh
```

```
aelarabawy@aelarabawy-demo-backup64: ~
aelarabawy@aelarabawy-demo-backup64:~$ ps -e | more
  PID TTY
                   TIME CMD
    1?
               00:00:01 init
    2 ?
               00:00:00 kthreadd
    3 ?
               00:00:11 ksoftirgd/0
               00:00:00 migration/0
    6 ?
    7 ?
               00:00:05 watchdog/0
    8 ?
               00:00:00 migration/1
                                                            All Processes in the
    9 ?
               00:00:00 kworker/1:0
   10 ?
               00:00:06 ksoftirgd/1
                                                                   System
   11 ?
               00:00:04 watchdog/1
   12 ?
               00:00:00 migration/2
   13 ?
               00:00:00 kworker/2:0
               00:00:06 ksoftirgd/2
   14 ?
   15 ?
           € 00:00:04 watchdog/2
               00:00:00 migration/3
   16 ?
   17 ?
               00:00:20 kworker/3:0
                                                 Not attached to any TTY
   18 ?
               00:00:05 ksoftirgd/3
   19 ?
               00:00:05 watchdog/3
                                                  (Daemons or Automatic
   20 ?
               00:00:00 migration/4
               00:00:00 kworker/4:0
   21 ?
                                                         Processes)
   22 ?
               00:00:02 ksoftirgd/4
   23 ?
               00:00:03 watchdog/4
   24 ?
               00:00:00 migration/5
   25 ?
               00:00:00 kworker/5:0
   26 ?
               00:00:01 ksoftirgd/5
   27 ?
               00:00:04 watchdog/5
   28 ?
               00:00:00 migration/6
   29 ?
               00:00:23 kworker/6:0
   30 ?
               00:00:01 ksoftirgd/6
   31 ?
               00:00:04 watchdog/6
               00:00:00 migration/7
   32 ?
 -More--
```



```
🔞 🖃 🗆 aelarabawy@aelarabawy-demo-backup64: ~
aelarabawy@aelarabawy-demo-backup64:~$ ps -A | more
  PID TTY
                   TIME CMD
    1 ?
               00:00:01 init
    2 ?
               00:00:00 kthreadd
    3 ?
               00:00:11 ksoftirgd/0
    6 ?
               00:00:00 migration/0
    7 ?
               00:00:05 watchdog/0
    8 ?
               00:00:00 migration/1
                                                              All Processes in the System
    9 ?
               00:00:00 kworker/1:0
   10 ?
               00:00:06 ksoftirgd/1
                                                                           Same as
               00:00:04 watchdog/1
   11 ?
   12 ?
               00:00:00 migration/2
                                                                            $ ps -e
   13 ?
               00:00:00 kworker/2:0
   14 ?
               00:00:06 ksoftirqd/2
   15 ?
               00:00:04 watchdog/2
   16 ?
               00:00:00 migration/3
               00:00:20 kworker/3:0
   17 ?
               00:00:05 ksoftirqd/3
   18 ?
               00:00:05 watchdog/3
   19 ?
   20 ?
               00:00:00 migration/4
   21 ?
               00:00:00 kworker/4:0
   22 ?
               00:00:02 ksoftirqd/4
               00:00:03 watchdog/4
   23 ?
   24 ?
               00:00:00 migration/5
   25 ?
               00:00:00 kworker/5:0
   26 ?
               00:00:01 ksoftirqd/5
   27 ?
               00:00:04 watchdog/5
   28 ?
               00:00:00 migration/6
               00:00:23 kworker/6:0
   29 ?
   30 ?
               00:00:01 ksoftirqd/6
               00:00:04 watchdog/6
   31 ?
   32 ?
               00:00:00 migration/7
   34 ?
               00:00:01 ksoftirqd/7
 -More--
```



a : don't limit to same tty
but have to be attached to a tty
u : Long Format (more fields)

\$ ps au

```
aelarabawy@aelarabawy-demo-backup64: ~
                                                  u: Long Format (more fields)
aelarabawy@aelarabawy-demo-backup64:~$ ps au
USER
                                                           TIME COMMAND
          PID %CPU %MEM
                           VSZ
                                 RSS TTY
                                              STAT START
root
         1111 0.0 0.0
                        19988
                                 984 tty4
                                              Ss+
                                                   Jun03
                                                           0:00 /sbin/getty -8 38400 tty4
                                                           0:00 /sbin/getty -8 38400 tty5
                                 984 tty5
root
         1116 0.0 0.0
                         19988
                                              Ss+
                                                   Jun03
         1123 0.0 0.0
                        19988
                                 972 tty2
                                                           0:00 /sbin/getty -8 38400 tty2
root
                                              Ss+
                                                   Jun03
         1125 0.0 0.0 19988
                                 980 ttv3
                                                           0:00 /sbin/getty -8 38400 tty3
root
                                              Ss+
                                                   Jun03
                                 976 tty6
         1128 0.0 0.0 19988
                                                           0:00 /sbin/getty -8 38400 tty6
                                              Ss+
                                                   Jun03
root
                                                          64:02 /usr/bin/Xorg :0 -backgrou
         1262 0.1 3.0 171268 246044 tty7
                                                   Jun03
root
                                              Ss+
                                 984 tty1
                                                           0:00 /sbin/getty -8 38400 tty1
root
         1498 0.0 0.0 19988
                                              Ss+
                                                   Jun03
1001
               0.0 0.0 28788
                                5904 pts/0
                                                           0:00 bash
         19003
                                              Ss
                                                   Jun23
1001
        19063 0.0 0.0 28744
                                5864 pts/1
                                                   Jun23
                                              Ss+
                                                           0:00 bash
1001
                                5776 pts/2
                                                  Jul01
        30658 0.0 0.0 28724
                                              Ss+
                                                           0:00 bash
1001
                                1528 pts/0
                                                           0:10 top
        32536 0.1
                    0.0
                        17456
                                                   09:03
                                              Т
1001
               0.0 0.0
                        18016
                                1440 pts/0
                                              Т
                                                   11:18
                                                           0:00 watch -n 2 ls
         32661
        32727 0.0 0.0 22360 1280 pts/0
                                                   11:27
                                                           0:00 ps au
1001
                                              R+
aelarabawy@aelarabawy-demo-backup64:~$
```

Keep in mind that some options are preceded with "-" and others not For example:

\$ ps -a is not the same as \$ ps a



\$ ps aux

a : don't limit to same tty but have to be attached to a tty

x : Remove the tty restriction

u : Long Format (more fields)

⊗ -□	aelarabawy@aelarabawy-demo-backup64: ~
-------------	--

aelarabawy	@aela	arabaw	vy-dem	o-backu	p64:~\$	ps	aux mo	ге			
USER	PID	%CPU	%MEM	VSZ	RSS	TTY	STA	T START	TIME COMMAND		
root	1	0.0	0.0	24732	2692	?	Ss	Jun03	0:01 /sbin/init		
root	2	0.0	0.0	0	0	?	S	Jun03	0:00 [kthreadd]		
root	3	0.0	0.0	0	0	?	S	Jun03	0:11 [ksoftirqd/0]		
root	6	0.0	0.0	0	0	?	S	Jun03	0:00 [migration/0]	k	
root	7	0.0	0.0	0	0	?	S	Jun03	0:05 [watchdog/0]		
root	8	0.0	0.0	0	0	?	S	Jun03	0:00 [migration/1]		
root	9	0.0	0.0	0	0	?	S	Jun03	0:00 [kworker/1:0]		
root	10	0.0	0.0	0	0	?	S	Jun03	0:06 [ksoftirqd/1]		
root	11	0.0	0.0	0	0	?	S	Jun03	0:04 [watchdog/1]		
root	12	0.0	0.0	0	0	?	S	Jun03	0:00 [migration/2]		
root	13	0.0	0.0	0	0	?	S	Jun03	0:00 [kworker/2:0]		
root	14	0.0	0.0	0	0	?	S	Jun03	0:06 [ksoftirqd/2]		
root	15	0.0	0.0	0	0	?	S	Jun03	0:04 [watchdog/2]		



\$ ps a -F

a : don't limit to same tty
but have to be attached to a tty

```
aelarabawy@aelarabawy-demo-backup64: ~
                                                   -F: Long Format (more fields)
aelarabawy@aelarabawy-demo-backup64:~$ ps a -F
UID
           PID PPID C
                           SZ
                                RSS PSR STIME TTY
                                                       STAT
                                                               TIME CMD
                         4997
root
                                      3 Jun03 tty4
                                                               0:00 /sbin/getty -8 38400 tty4
          1111
                      0
                                984
                                                        Ss+
                         4997
                                      3 Jun03 tty5
                                                               0:00 /sbin/getty -8 38400 tty5
root
          1116
                                984
                                                        Ss+
                                                               0:00 /sbin/getty -8 38400 tty2
                                      2 Jun03 tty2
          1123
                                972
root
                         4997
                                                        Ss+
          1125
                         4997
                                980
                                      3 Jun03 tty3
                                                               0:00 /sbin/getty -8 38400 tty3
root
                      0
                                                        Ss+
          1128
                         4997
                                976
                                                               0:00 /sbin/getty -8 38400 tty6
root
                                      2 Jun03 tty6
                                                       Ss+
                                                              64:06 /usr/bin/Xorg :0 -background
root
          1262 1184
                      0 42817 251924
                                      0 Jun03 tty7
                                                        Ss+
                                                               0:00 /sbin/getty -8 38400 tty1
          1498
                         4997
                                984
                                      3 Jun03 tty1
root
                                                        Ss+
                        7197
                                                               0:00 bash
1001
        19003 18996 0
                               5904
                                      1 Jun23 pts/0
                                                        Ss
1001
                        7186
                                      0 Jun23 pts/1
        19063 18996 0
                                                               0:00 bash
                               5864
                                                        Ss+
1001
        30658 18996
                        7181
                               5776
                                      0 Jul01 pts/2
                                                               0:00 bash
                                                        Ss+
1001
                               1528
                                      7 09:03 pts/0
        32536 19003 0 4364
                                                       Т
                                                              0:10 top
1001
        32661 19003 0
                         4504
                               1440
                                      6 11:18 pts/0
                                                       T
                                                              0:00 watch -n 2 ls
1001
                         5590
                                      0 11:31 pts/0
                                                               0:00 ps a -F
         32767 19003
                      0
                              1284
                                                       R+
aelarabawy@aelarabawy-demo-backup64:~$
```



\$ ps a -f

a : don't limit to same tty
but have to be attached to a tty

-f: Long Format (more fields)

```
aelarabawy@aelarabawy-demo-backup64: ~
aelarabawy@aelarabawy-demo-backup64:~$ ps a -f
                                              TIME CMD
UID
                                       STAT
           PID PPID C STIME TTY
1001
           308 19003 0 11:31 pts/0
                                              0:00 ps a -f
                                       R+
                                              0:00 /sbin/getty -8 38400 tty4
root
                   1 0 Jun03 tty4
          1111
                                       Ss+
                                              0:00 /sbin/getty -8 38400 tty5
                   1 0 Jun03 tty5
root
          1116
                                       Ss+
                     0 Jun03 tty2
                                              0:00 /sbin/getty -8 38400 tty2
          1123
root
                                       Ss+
                   1 0 Jun03 tty3
                                              0:00 /sbin/gotty -8 38400 tty3
root
          1125
                                       Ss+
          1128
                      0 Jun03 tty6
                                              0:00 /sbin/getty -8 38400 tty6
root
                                       Ss+
                                             64:06 /usr/bin/Xorg :0 -background none -verbose
root
          1262 1184
                     0 Jun03 tty7
                                       Ss+
                                              0:00 /sbin/getty -8 38400 tty1
root
          1498
                   1 0 Jun03 tty1
                                       Ss+
1001
         19003 18996 0 Jun23 pts/0
                                              0:00 bash
                                       Ss
         19063 18996 0 Jun23 pts/1
1001
                                              0:00 bash
                                       Ss+
1001
                                              0:00 bash
         30658 18996 0 Jul01 pts/2
                                       Ss+
1001
         32536 19003 0 09:03 pts/0
                                              0:10 top
                                       Т
                                              0:00 watch -n 2 ls
1001
         32661 19003 0 11:18 pts/0
aelarabawy@aelarabawy-demo-backup64:~$
```



\$ ps auf

a : don't limit to same tty but have to be attached to a tty

u : Long Format

f : Show process in tree format

```
⊗ — □ aelarabawy@aelarabawy-demo-backup64: ~
```

```
aelarabawy@aelarabawy-demo-backup64:~$ ps auf
USER
          PID %CPU %MEM
                           VSZ
                                 RSS TTY
                                              STAT START
                                                           TIME COMMAND
1001
        30658 0.0 0.0
                         28724
                                5776 pts/2
                                              Ss+
                                                   Jul01
                                                           0:00 bash
        19063 0.0 0.0 28744
1001
                                5864 pts/1
                                              Ss+
                                                  Jun23
                                                           0:00 bash
1001
        19003 0.0 0.0 28788
                                                           0:00 bash
                                5904 pts/0
                                                   Jun23
1001
        32536 0.0 0.0 17456
                                1528 pts/0
                                                   09:03
                                                           0:10 \_ top
1001
        32661 0.0 0.0 18016
                                1440 pts/0
                                                  11:18
                                                           0:00 \_ watch -n 2 ls
                                1144 pts/0
                                                           0:00 \_ ps auf
1001
          378 0.0 0.0 22328
                                              R+
                                                  12:07
                                                         64:14 /usr/bin/Xorg :0 -background n
root
         1262 0.1 3.0 171268 245684 tty7
                                              Ss+ Jun03
                                                          0.00 /sbin/getty -8 38400 tty1
root
         1498
               0.0 0.0 19988
                                 984 tty1
                                              Ss+ Jun03
               0.0 0.0 19988
                                 976 ttv6
                                              Ss+ Jun03
                                                          0:00 /sbin/getty -8 38400 tty6
root
         1128
root
         1125 0.0 0.0
                         19988
                                 980 tty3
                                              Ss+ Jun03
                                                          0:00 /sbin/getty -8 38400 tty3
                                 972 tty2
                                                           0:00 /sbin/getty -8 38400 tty2
root
         1123 0.0 0.0
                        19988
                                              Ss+ Jun03
                                                          0:00 /sbin/getty -8 38400 tty5
         1116 0.0 0.0 19988
                                 984 ttv5
                                              Ss+ Jun03
root
                                                          0:00 /sbin/getty -8 38400 tty4
root
         1111 0.0 0.0 19988
                                 984 tty4
                                              Ss+
                                                  Jun03
aelarabawy@aelarabawy-demo-backup64:~$
```



• •	0			roc	ot@vz2	26b.liquidv	veb.co	m:/root — ssh — 108×28
root@hos	st [~]#	ps au	ıxf					
USER		%CPU		VSZ	RSS TT	Y STAT	START	TIME COMMAND
root	1	0.0	0.0	1412	480 ?	s	12:38	0:00 init [3]
root	13996	0.0	0.0	1480	500 ?	S	12:38	0:00 syslogd –m 0
named	14010	0.0	0.2	19100	2948 ?	S	12:38	0:00 /usr/sbin/named —u named
named	14011	0.0	0.2	19100	2948 ?	S	12:38	0:00 _ /usr/sbin/named -u named
named	14012	0.0	0.2	19100	2948 ?	S	12:38	0:00 _ /usr/sbin/named —u named
named	14013	0.0	0.2	19100	2948 ?	S	12:38	0:00 _ /usr/sbin/named —u named
named	14014	0.0			2948 ?	S	12:38	0:00 _ /usr/sbin/named —u named
named	14015	0.0			2948 ?	S	12:38	0:00 _ /usr/sbin/named =u named
named	14016	0.0	0.2	19100	2948 ?	S	12:38	0:00 _ /usr/sbin/named =u named
named	14017	0.0	0.2	19100	2948 ?	S	12:38	0:00 _ /usr/sbin/named =u named
root	14028	0.0	0.0		360 ?	S	12:38	0:00 /usr/sbin/courierlogger -pid=/var/spool/authd
root	14029	0.0	0.0	1736	548 ?	S	12:38	0:00 _ /usr/libexec/courier-authlib/authdaemond
root	14036	0.0	0.0	1736		S	12:38	0:00 _ /usr/libexec/courier-authlib/authdaem
root	14037	0.0	0.0			S	12:38	0:00 _ /usr/libexec/courier=authlib/authdaem
root	14038	0.0	0.0	1736		S	12:38	0:00 _ /usr/libexec/courier-authlib/authdaem
root	11691	0.0	0.3		3448 ?	S	12:45	0:00 _ /etc/authlib/authProg
root	14039	0.0	0.0	1736		S	12:38	0:00 _ /usr/libexec/courier-authlib/authdaem
root	14040	0.0	0.0	1736		S	12:38	0:00 _ /usr/libexec/courier-authlib/authdaem
root	7517	0.0	0.3		3448 ?	S	12:40	0:00 _ /etc/authlib/authProg
root	32256	0.0	0.0			S	12:39	0:00 /usr/sbin/sshd
root	32442	0.0	0.1		2008 ?	S	12:39	0:00 _ sshd: root@pts/0
root	32690	0.0	0.1		1200 pt		12:39	0:00 \bash
root	1458	0.0	0.1		2056 ?	S	12:39	0:00 _ sshd: root@pts/1
root	3300	0.0	0.1		1212 pt		12:40	0:00 \bash
root	13943	0.0	0.0				12:48	0:00 _ ps auxf
root	32265	0.0	0.0	2060	1016 ?	S	12:39	0:00 /bin/sh /usr/bin/mysqld_safedatadir=/var/l



```
🗕 🗆 aelarabawy@aelarabawy-demo-backup64: ~
aelarabawy@aelarabawy-demo-backup64:~$ ps a -o pid,ppid,pgid,sid,command
  PID PPID PGID
                   SID COMMAND
             334 19003 ps a -o pid,ppid,pgid,sid,command
 334 19003
         1 1111 1111 /sbin/getty -8 38400 tty4
 1111
 1116
         1 1116 1116 /sbin/getty -8 38400 tty5
 1123
         1 1123 1123 /sbin/getty -8 38400 tty2
         1 1125 1125 /sbin/getty -8 38400 tty3
 1125
 1128
         1 1128 1128 /sbin/getty -8 38400 tty6
1262 1184 1262 1262 /usr/bin/Xorg: 0 -background none -verbose -auth /var/run/gdm/auth-for-
         1 1498 1498 /sbin/getty -8 38400 tty1
 1498
19003 18996 19003 19003 bash
19063 18996 19063 19063 bash
30658 18996 30658 30658 bash
32536 19003 32536 19003 top
32661 19003 32661 19003 watch -n 2 ls
aelarabawy@aelarabawy-demo-backup64:~$
```





 To show threads for multithreaded applications, use one of the following options

```
$ ps -H
```

\$ ps -L

\$ ps -T

\$ ps -m

Linux 4 Embedded Systems

Common Practices

- There are hundreds of processes running in the system
- A common practice, is to do a full listing and pipe the output to a search filter to limit the list to what we are interested in \$ ps -ef | grep root
 - This shows all processes owned by the root user
 - \$ ps aux | grep "pts/2"
 - This shows all processes attached to the tty pts/2
- There are a lot of options for scope and format. For a special need, it is advised to refer to the man page for the command
 \$ man ps

\$ top

```
Current Time @aelarabawy-demo-backup64: ~
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
Tasks: 216 total, 1 running, 215 sleeping, 0 stopped,
Cpu(s): 2.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
     8160236k total, 3609032k used, 4551204k Tree, 590076k buffers
Swap: 9764860k total,
                         0k used, 9764860k free, 1115104k cached
 PID USER
             PR NI VIRT RES
                             SHR S %CPU %MEM
                                              TIME+ COMMAND
11560 aelaraba 20
                 0 1009m 142m 24m S
                                     15 1.8
                                             2603:23 chrome
2139 aelaraba 20
                 0 1436m 106m 49m S 2 1.3
                                            65:29.30 compiz
1262 root
             20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
                                    0 0.1 0:00.59 gnome-session
2060 aelaraba 20 0 385m 9760 7252 S
18996 aelaraba 20
                                   0 0.3 1:21.60 gnome-terminal
                  0 584m 22m 11m S
                                    0 1.7
31165 aelaraba 20
                                            1:24.75 chrome
                  0 1053m 138m
                              35m S
32526 root
             20
                                    0 0.0
                                            0:00.21 kworker/0:0
             20
                 0 24732 2692 1352 S
                                    0 0.0
                                             0:01.04 init
   1 root
                               0 S
                                    0 0.0 0:00.31 kthreadd
   2 root
             20
                               0 S
                                    0 0.0
                                             0:11.12 ksoftirgd/0
   3 root
                                    0 0.0
             RT
                               0 S
                                             0:00.36 migration/0
   6 root
                               0 S
   7 root
             RT
                                    0 0.0
                                             0:05.05 watchdog/0
                               0 S
                                    0 0.0
                                             0:00.14 migration/1
   8 root
             RT
                               0 S
                                    0 0.0
                                             0:00.00 kworker/1:0
   9 root
             20
                               0 S
                                     0.0
                                             0:06.43 ksoftirqd/1
             20
  10 root
                                             0:04.43 watchdog/1
                               0 S
  11 root
             RT
                                        0.0
```

\$ top

```
System Up Time o-backup64: ~
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
Tasks: 216 total, 1 running, 215 sleeping, 0 stopped,
Cpu(s): 2.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
      8160236k total, 3609032k used, 4551204k Tree, 590076k buffers
Swap: 9764860k total,
                          0k used, 9764860k free, 1115104k cached
 PID USER
              PR NI VIRT RES
                              SHR S %CPU %MEM
                                                TIME+ COMMAND
11560 aelaraba 20
                                      15 1.8
                  0 1009m 142m 24m S
                                               2603:23 chrome
2139 aelaraba 20
                  0 1436m 106m 49m S
                                      2 1.3
                                              65:29.30 compiz
1262 root
              20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
                                     0 0.1 0:00.59 gnome-session
2060 aelaraba 20 0 385m 9760 7252 S
11641 aelaraba 20 0 1025m 38m 10m S
                                     0 0.5 19:42.19 chrome
18996 aelaraba 20
                                     0 0.3 1:21.60 gnome-terminal
                  0 584m 22m 11m S
31165 aelaraba 20
                                     0 1.7
                                              1:24.75 chrome
                  0 1053m 138m
                               35m S
32526 root
              20
                                      0 0.0
                                              0:00.21 kworker/0:0
              20
                  0 24732 2692 1352 S
                                      0 0.0
                                               0:01.04 init
   1 root
                                 0 S
                                      0 0.0
                                               0:00.31 kthreadd
   2 root
              20
                                 0 S
                                      0 0.0
                                               0:11.12 ksoftirgd/0
   3 root
                                      0 0.0
              RT
                                 0 S
                                               0:00.36 migration/0
   6 root
                                 0 S
   7 root
              RT
                                      0 0.0
                                               0:05.05 watchdog/0
                                 0 S
                                      0 0.0
                                               0:00.14 migration/1
              RT
   8 root
                                 0 S
                                      0 0.0
                                               0:00.00 kworker/1:0
   9 root
              20
                                 0 S
                                       0.0
                                               0:06.43 ksoftirqd/1
              20
  10 root
                                               0:04.43 watchdog/1
                                 0 S
              RT
                                          0.0
  11 root
```

\$ top

```
aelarabawy@aelarabawy-de Number of Users
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
Tasks: 216 total, 1 running, 215 sleeping, 0 stopped,
Cpu(s): 2.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
      8160236k total, 3609032k used, 4551204k Tree, 590076k buffers
Swap: 9764860k total,
                          0k used, 9764860k free, 1115104k cached
 PID USER
              PR NI VIRT RES
                              SHR S %CPU %MEM
                                                TIME+ COMMAND
11560 aelaraba 20
                                      15 1.8
                  0 1009m 142m 24m S
                                               2603:23 chrome
2139 aelaraba 20
                  0 1436m 106m 49m S 2 1.3
                                              65:29.30 compiz
1262 root
              20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
                                     0 0.1 0:00.59 gnome-session
2060 aelaraba 20 0 385m 9760 7252 S
11641 aelaraba 20 0 1025m 38m 10m S
                                     0 0.5 19:42.19 chrome
18996 aelaraba 20
                                    0 0.3 1:21.60 gnome-terminal
                  0 584m 22m 11m S
31165 aelaraba 20
                                     0 1.7
                                             1:24.75 chrome
                  0 1053m 138m
                               35m S
32526 root
              20
                                      0 0.0
                                             0:00.21 kworker/0:0
              20
                  0 24732 2692 1352 S
                                      0 0.0
                                               0:01.04 init
   1 root
                                 0 S
                                      0 0.0
                                               0:00.31 kthreadd
   2 root
              20
                                 0 S
                                     0 0.0
                                               0:11.12 ksoftirgd/0
   3 root
                                      0 0.0
              RT
                                 0 S
                                               0:00.36 migration/0
   6 root
                                 0 S
   7 root
              RT
                                      0 0.0
                                               0:05.05 watchdog/0
                                 0 S
                                      0 0.0
                                               0:00.14 migration/1
              RT
   8 root
                                 0 S
                                      0 0.0
                                               0:00.00 kworker/1:0
   9 root
              20
                                 0 S
                                       0.0
                                               0:06.43 ksoftirqd/1
              20
  10 root
                                               0:04.43 watchdog/1
                                 0 S
              RT
                                          0.0
  11 root
```

\$ top

```
15m
                                                               5m
                                                          1m
 aelarabawy@aelarabawy-demo-backup64: ~
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
Tasks: 216 total, 1 running, 215 sleeping, 0 stopped,
Cpu(s): 2.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
      8160236k total, 3609032k used, 4551204k Free,
                                                       590076k buffers
Swap: 9764860k total,
                             0k used, 9764860k free, 1115104k cached
 PID USER
               PR NI VIRT RES
                                 SHR S %CPU %MEM
                                                    TIME+
                                                          COMMAND
11560 aelaraba 20
                    0 1009m 142m 24m S
                                         15 1.8
                                                   2603:23 chrome
2139 aelaraba 20
                    0 1436m 106m 49m S
                                          2 1.3 65:29.30 compiz
1262 root
               20 0 532m
                            Load Average
2060 aelaraba 20 0 385m
11641 aelaraba 20 0 1025m
18996 aelaraba 20
                    0 584m
                            1 = Load can make a CPU fully loaded
31165 aelaraba 20
                    0 1053m
                            If we are running with a single core .... Then it is 100% Loaded
32526 root
               20
                    0 24732 But in case of multiple core,
               20
   1 root
   2 root
               20
                            2 Cores: On average, each is 50% loaded
    3 root
                            4 Cores: On average, each is 25% loaded
    6 root
                          Note: we don't know how load is distributed among the cores
   7 root
               RT
   8 root
               RT
                                                   U:UU.14 PILQI atton/1
                                                   0:00.00 kworker/1:0
   9 root
                                    0 S
                                          0.0
                                          0 0.0
                                                   0:06.43 ksoftirqd/1
   10 root
               20
                                    0 S
                                                   0:04.43 watchdog/1
               RT
                                             0.0
   11 root
```

\$ top

```
@aelarabawy-demo-backup64: ~
      Task Count
                 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
                   1 running, 215 sleeping, 0 stopped,
Tasks: 216 total,
Cpu(s): Z.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
      8160236k total, 3609032k used, 4551204k Tree, 590076k buffers
Swap: 9764860k total,
                            0k used, 9764860k free, 1115104k cached
 PID USER
               PR NI VIRT RES
                                 SHR S %CPU %MEM
                                                   TIME+ COMMAND
11560 aelaraba 20
                   0 1009m 142m 24m S
                                         15 1.8
                                                  2603:23 chrome
2139 aelaraba 20
                   0 1436m 106m 49m S 2 1.3
                                                 65:29.30 compiz
1262 root
               20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
2060 aelaraba 20 0 385m 9760 7252 S 0 0.1 0:00.59 gnome-session
11641 aelaraba 20 0 1025m 38m 10m S 0 0.5 19:42.19 chrome
                   0 584m 22m 11m S 0 0.3 1:21.60 gnome-terminal
18996 aelaraba 20
                                        0 1.7
31165 aelaraba 20
                                                1:24.75 chrome
                   0 1053m 138m
                                 35m S
                                        0 0.0
32526 root
               20
                                                0:00.21 kworker/0:0
               20
                   0 24732 2692 1352 S
                                        0 0.0
                                                  0:01.04 init
   1 root
                                   0 S
                                        0 0.0 0:00.31 kthreadd
   2 root
               20
                                   0 S
                                        0 0.0
                                                  0:11.12 ksoftirgd/0
   3 root
                                        0 0.0
               RT
                                   0 S
                                                  0:00.36 migration/0
   6 root
                                   0 S
   7 root
               RT
                                        0 0.0
                                                  0:05.05 watchdog/0
                                   0 S
                                        0 0.0
                                                  0:00.14 migration/1
               RT
   8 root
                                   0 S
                                        0 0.0
                                                  0:00.00 kworker/1:0
   9 root
               20
                                   0 S
                                         0.0
                                                  0:06.43 ksoftirqd/1
               20
   10 root
                                   0 S
                                                  0:04.43 watchdog/1
               RT
                                            0.0
   11 root
```

\$ top

```
Task States
top - 09:03:38 up 2
                                                               0.15
Tasks: 216 total, 1 running, 215 sleeping, 0 stopped,
Cpu(s): 2.2%us, 0.1%sy, ʊ.ʊ%ni, 97.3%id, ʊ.zxwa, ʊ.ʊ%ni, ʊ.1%si, 0.0%st
      8160236k total, 3609032k used, 4551204k Tree,
                                                  590076k buffers
Swap: 9764860k total,
                          0k used, 9764860k free, 1115104k cached
 PID USER
              PR NI VIRT RES
                              SHR S %CPU %MEM
                                               TIME+ COMMAND
11560 aelaraba
                  0 1009m 142m 24m S
                                      15 1.8
                                               2603:23 chrome
             20
2139 aelaraba 20
                  0 1436m 106m 49m S
                                      2 1.3
                                              65:29.30 compiz
1262 root
              20 0 532m 239m 205m S
                                     1 3.0 63:26.30 Xorg
                                     0 0.1 0:00.59 gnome-session
2060 aelaraba 20 0 385m 9760 7252 S
11641 aelaraba 20 0 1025m 38m 10m S
                                     0 0.5 19:42.19 chrome
18996 aelaraba 20
                                     0 0.3 1:21.60 gnome-terminal
                  0 584m 22m 11m S
31165 aelaraba 20
                                     0 1.7
                  0 1053m 138m
                               35m S
                                             1:24.75 chrome
32526 root
              20
                                      0.0
                                               0:00.21 kworker/0:0
              20
                  0 24732 2692 1352 S
                                      0 0.0
                                               0:01.04 init
   1 root
                                     0 0.0
                                0 S
                                              0:00.31 kthreadd
   2 root
              20
                                     0 0.0
                                               0:11.12 ksoftirgd/0
   3 root
                                0 S
                                     0 0.0
                                               0:00.36 migration/0
   6 root
                                0 S
   7 root
              RT
                                     0 0.0
                                              0:05.05 watchdog/0
                                0 S
                                     0 0.0
                                               0:00.14 migration/1
              RT
   8 root
                                0 S
                                     0 0.0
                                               0:00.00 kworker/1:0
   9 root
                                0 S
                                       0.0
                                               0:06.43 ksoftirqd/1
              20
  10 root
                                               0:04.43 watchdog/1
                                0 S
              RT
                                         0.0
  11 root
```

\$ top

```
aelarabawy@aelarabawy-demo-backup64: ~
top - 09
                                       CPU Usage
Tasks: 2
Cpu(s): 2.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
       8160236k total, 3609032k used, 4551204k Tree,
                                                          590076k buffers
Swap:
       9764860k total,
                              0k used, 9764860k free, 1115104k cached
  PID USER
                    ΝI
                        VIRT
                              RES
                                   SHR S %CPU %MEM
                                                       TIME+
                                                              COMMAND
11560 aelaraba
                                                      2603:23 chrome
                20
                     0 1009m 142m
                                   24m S
                                            15
                                                1.8
2139 aelaraba
                                             2 1.3
                                                     65:29.30 compiz
               20
                     0 1436m 106m
                                   49m S
 1262 root
                20 0 532m 239m 205m S
                                             1 3.0
                                                     63:2
                                                                     CPU Usage
 2060 aelaraba
               20 0 385m 9760 7252 S
                                            0 0.1
                                                      0:0
                                                                us = User Space Load
11641 aelaraba
               20
                                            0 0.5
                                                    19:4
                     0 1025m
                              38m
                                   10m S
                                                            sy = System load (Kernel load)
18996 aelaraba
                                                0.3
                                                      1:2
               20
                     0 584m
                              22m
                                   11m S
31165 aela<u>raba</u>
                20
                     0 1053m 138m
                                   35m S
                                             0 1.7
                                                                 ni = Nice Processes
32526 root
                20
                                             0 0.0
                                                      0:0
                                                                    id = Idle Time
                20
                     0 24732 2692 1352 S
                                             0 0.0
                                                      0:0
    1 root
                                                                 wa = Waiting for I/O
                                     0 S
                                               0.0
                                                      0:0
    2 root
                20
                                                0.0
                                                      0:1
    3 root
                                                               hi = Hardware Interrupt
                RT
                                     0 S
                                             0 0.0
                                                      0:0
    6 root
                                                               si = Software Interrupt
                                     0 S
    7 root
                RT
                                             0 0.0
                                                      0:0
                                                              st = Stolen to another VM
                                     0 S
                RT
                                             0 0.0
                                                      0:0
    8 root
                                     0 S
                                               0.0
    9 root
                20
                                                      0:00.00 kworker/1:0
                                                      0:06.43 ksoftirqd/1
                20
                                      0 S
                                                0.0
   10 root
                                     0 S
                                                      0:04.43 watchdog/1
                RT
   11 root
                                                0.0
```

\$ top

```
aelarabawy@aelarabawy-demo-backup64: ~
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
Tasks: 2
                            Physical Memory Usage
Cpu(s):
                                                                     0%st
     8160236k total, 3609032k used, 4551204k \ree, 590076k buffers
Swap: 9764860k total,
                           0k used, 9764860k free, 1115104k cached
 PID USER
                                SHR S %CPU %MEM
                      VIRT
                           RES
                                                  TIME+ COMMAND
11560 aelaraba
                                24m S
                                                 2603:23 chrome
             20
                   0 1009m 142m
                                        15 1.8
2139 aelaraba 20
                   0 1436m 106m 49m S
                                         2 1.3
                                                65:29.30 compiz
1262 root
              20 0 532m 239m 205m S
                                       1 3.0 63:26.30 Xorg
                                       0 0.1
2060 aelaraba 20 0 385m 9760 7252 S
                                               0:00.59 gnome-session
11641 aelaraba 20 0 1025m 38m
                               10m S
                                       0 0.5 19:42.19 chrome
18996 aelaraba 20
                                       0 0.3 1:21.60 gnome-terminal
                   0 584m 22m
                                11m S
31165 aelaraba 20
                                       0 1.7
                   0 1053m 138m
                                35m S
                                                1:24.75 chrome
32526 root
              20
                                         0.0
                                                 0:00.21 kworker/0:0
              20
                   0 24732 2692 1352 S
                                        0.0
                                                 0:01.04 init
   1 root
                                  0 S
                                       0 0.0
                                                 0:00.31 kthreadd
   2 root
               20
                                       0 0.0
                                                 0:11.12 ksoftirgd/0
   3 root
              RT
                                  0 S
                                       0 0.0
                                                 0:00.36 migration/0
   6 root
                                  0 S
   7 root
               RT
                                       0 0.0
                                                 0:05.05 watchdog/0
                                  0 S
                                       0 0.0
                                                 0:00.14 migration/1
               RT
   8 root
                                                 0:00.00 kworker/1:0
                                  0 S
                                       0 0.0
   9 root
               20
                                  0 S
                                         0 0.0
                                                 0:06.43 ksoftirqd/1
               20
  10 root
                                  0 S
                                                 0:04.43 watchdog/1
               RT
                                           0.0
  11 root
```

\$ top

8 -	aelaraba	wy@a	aelai	rabawy-	demo-	backup	064	: ~			
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15 Tasks: 216 total, 1 running, 215 sleeping, 0 stopped, 0 zombie Cpu(s): Swap Memory Usage Mem:8											
Swap:	9764860k	tot	al,		0k u	ısed,	9	76486	0k fr	ee, 11151	104k cached
PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
11560	aelaraba	20	0	1009m	142m	24m	S	15	1.8	2603:23	chrome
2139	aelaraba	20	0	1436m	106m	49m	S	2	1.3	65:29.30	compiz
1262	root	20	0	532m	239m	205m	S	1	3.0	63:26.30	Xorg
2060	aelaraba	20	0	385m	9760	7252	S	0	0.1	0:00.59	gnome-session
11641	aelaraba	20	0	1025m	38m	10m	S	0	0.5	19:42.19	chrome
18996	aelaraba	20	0	584m	22m	11m	S	0	0.3	1:21.60	gnome-terminal
31165	aelaraba	20	0	1053m	138m	35m	S	0	1.7	1:24.75	chrome
32526	root	20	0	0	0	0	S	0	0.0	0:00.21	kworker/0:0
1	root	20	0	24732	2692	1352	s	0	0.0	0:01.04	init
2	root	20	0	0	0	0	s	0	0.0	0:00.31	kthreadd
3	root	20	0	0	0	0	s	0	0.0	0:11.12	ksoftirqd/0
6	root	RT	0	0	0	0	s	0	0.0		migration/0
7	root	RT	0	0	0	0	s	0	0.0		watchdog/0
8	root	RT	0	0	0	0	s	0	0.0		migration/1
9	root	20	0	0	0	0		0	0.0		kworker/1:0
10	root	20	0	0	0	0	S	0	0.0		ksoftirqd/1
	root	RT	0	0	0	0		0	0.0		watchdog/1

\$ top

```
top - 09:03:38 up 28 days, 19:15, 4 users, load average: 0.26, 0.25, 0.15
Tasks: 216 total, 1 running, 215 sleeping, 0 stopped,
Cpu(s): 2.2%us, 0.1%sy, 0.0%ni, 97.3%id, 0.2%wa, 0.0%hi, 0.1%si, 0.0%st
      8160236k total, 3609032k used, 4551204k Tree, 590076k buffers
Swap: 9764860k total,
                          0k used, 9764860k free, 1115104k cached
 PID USER
              PR NI VIRT RES SHR S %CPU %MEM
                                               TIME+ COMMAND
11560 aelaraba 20 0 1009m 142m 24m S
                                      15 1.8
                                               2603:23 chrome
2139 aelaraba 20 0 1436m 106m 49m S 2 1.3 65:29.30 compiz
1262 root
              20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
2060 aelaraba 20 0 385m 9760 7252 S 0 0.1 0:00.59 gnome-session
11641 aelaraba 20 0 1025m 38m 10m S 0 0.5 19:42.19 chrome
18996 aelaraba 20 0 584m 22m 11m S 0 0.3 1:21.60 gnome-terminal
31165 aelaraba 20
                              35m S 0 1.7
                                             1:24.75 chrome
                  0 1053m 138m
                                     0 0.0 0:00.21 kworker/0:0
32526 root
   1 root
              20
                  0 24732 2692 1352 S
                                      0 0.0 0:01.04 init
   2 root
                                 0 S
                                      0 0.0 0:00.31 kthreadd
              20
   3 root
                                 0 S
                                     0 0.0
                                               0:11.12 ksoftirgd/0
                                     0 0.0 0:00.36 migration/0
   6 root
                                 0 S
              RT 0 0 0
RT 0 0 0
                                 0 S
   7 root
                                      0 0.0 0:05.05 watchdog/0
                                 0 S
                                      0 0.0
                                               0:00.14 migration/1
   8 root
              20 0 0 0
                                 0 S
                                      0 0.0
                                               0:00.00 kworker/1:0
    root
                                 0 S
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                                               0:06.43 ksoftirqd/1
              20
    root
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              RT
                                       0.0
  11 root
```

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 PID USER
              PR NI VIRT RES SHR S %CPU %MEM
                                               TIME+ COMMAND
11560 aelaraba 20
                  0 1009m 142m 24m S
                                       15 1.8
                                                2603:23 chrome
<u>2139 aelaraba 2</u>0 0 1436m 106m 49m S 2 1.3 65:29.30 compiz
1262 root
              20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
2060 aelaraba 20 0 385m 9760 7252 S 0 0.1 0:00.59 gnome-session
11641 aelaraba 20 0 1025m 38m 10m S 0 0.5 19:42.19 chrome
                  0 584m 22m 11m S 0 0.3 1:21.60 gnome-terminal
18996 aelaraba 20
31165 aelaraba 20
                              35m S 0 1.7
                                              1:24.75 chrome
                   0 1053m 138m
                                      0 0.0 0:00.21 kworker/0:0
32526 root
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                  0 24732 2692 1352 S
                                      0 0.0 0:01.04 init
   1 root
   2 root
                                 0 S
                                      0 0.0 0:00.31 kthreadd
              20
   3 root
                                 0 S
                                      0 0.0
                                                0:11.12 ksoftirgd/0
                                      0 0.0 0:00.36 migration/0
   6 root
              RT
                                 0 S
              RT 0
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                                 0 S
                                      0 0.0 0:05.05 watchdog/0
   7 root
                                 0 S
                                      0 0.0
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                                               65:29.30 compiz
1262 root
              20 0 532m 239m 205m S 1 3.0 63:26.30 Xorg
2060 aelaraba 20 0 385m 9760 7252 S 0 0.1 0:00.59 gnome-session
11641 aelaraba 20 0 1025m 38m 10m S 0 0.5 19:42.19 chrome
                  0 584m 22m 11m S 0 0.3 1:21.60 gnome-terminal
18996 aelaraba 20
31165 aelaraba 20
                               35m S 0 1.7
                                              1:24.75 chrome
                   0 1053m 138m
                                      0 0.0
                                              0:00.21 kworker/0:0
32526 root
              20
              20
                  0 24732 2692 1352 S
                                      0 0.0
                                                0:01.04 init
   1 root
                                 0 S
                                      0 0.0
                                                0:00.31 kthreadd
   2 root
              20
                                 0 S
                                      0 0.0
                                                0:11.12 ksoftirgd/0
   3 root
                                      0 0.0 0:00.36 migration/0
                                 0 S
   6 root
                                 0 S
   7 root
              RT
                                      0 0.0 0:05.05 watchdog/0
                                 0 S
              RT
                                      0 0.0
                                                0:00.14 migration/1
   8 root
                                 0 S
                                      0 0.0
                                                0:00.00 kworker/1:0
   9 root
              20
                                 0 S
                                       0.0
                                                0:06.43 ksoftirqd/1
              20
  10 root
                                 0 S
                                                0:04.43 watchdog/1
              RT
                                          0.0
  11 root
```

Manipulating Output



- While the "top" tool is running,
 - Push 'M' to sort by memory usage
 - Push 'P' to sort by CPU processing usage
 - Push 'T' to sort by Time
 - Push 'k <pid>' to kill process by its pid
 - Push 'h' for getting a help page for all options
 - Push 'H' to enable/disable showing threads separately
 - Push 'q' to quit the tool

Display System Resource Usage (vmstat Command)

\$ vmstat

The 'vmstat' Command displays the system resource usage

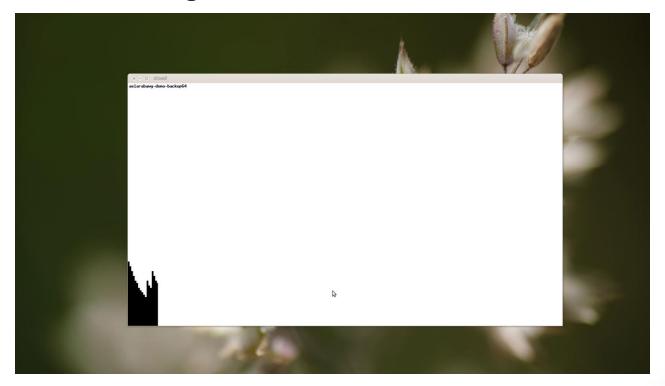
```
root@dm816x:/opt/dvr_rdk/ti816x# vmstat 2
        swpd
               free
                      buff cache
                                     si
                                          SO
               2016
                          0 123100
               2220
                          0 122656
               2172
                          0 122688
               2032
                          0 123160
                                                                839
               2564
                          0 122288
               3060
                          0 121836
                                                                647 1
               2984
                          0 122004
                                                          513
                                                                622
               2092
                          0 122724
                                                                680 1 5 35 58
               2484
                                                                673
                          0 122440
               2920
                                                                668 4 2 23 71
                          0 121996
               2208
                          0 122884
                                                                661
               3108
                                                                671 2
                          0 121808
           0
               2184
                          0 122708
                                                                652
               2084
                                                                683 3
                          0 122804
               2280
                          0 122828
                                                                641
               2204
                          0 122840
                                                                663 3
               3208
                                                                642
           0
                          0 121676
                                                        0 4501
               2984
                          0 122148
                                                        0 732
                                                                603 3 1 95
               2692
                                                                630
                          0 122164
               3044
                          0 121816
                                                                650
               1992
                          0 123052
                                                                651
```

Display (xload Command)



\$ xload

This command starts a graphical tool for measurement of system load average



Display (tload Command)



\$ tload

This command starts a graphical presentation (using characters) for measurement of system load average

Display Memory Usage (free Command)



\$ free < options >

This command displays amount of free and used memory in the system

```
aelarabawy@aelarabawy-demo-backup64: ~
aelarabawy@aelarabawy-demo-backup64:~$ free
             total
                         used
                                              shared
                                                        buffers
                                                                    cached
           8160236
                      3266896
                                  4803340
                                                         557576
                                                                    975520
Mem:
                                                   0
-/+ buffers/cache:
                      1733800
                                 6426436
Swap:
           9764860
                                 9704860
                            0
aelarabawy@aelarabawy-demo-backup64:~$
```



The free Command

	y@aelarabawy total	used	free	shared	buffers	cached
Mem:	7968	3190	4778	0	544	952
-/+ buffers/cache:		1693	6275			
Swap:	9535	0	9535			
aelarabaw	y@aelarabawy	-demo-backu	064:~\$	~		

	total	used	free	shared	buffers	cached
Mem:	8160236	3267548	4892688	0	557576	975596
-/+ buff	fers/cache:	1734376	6425860			
Swap:	9764860	0	9764860	k		
aelaraba	awy@aelarabaw	v-demo-back	up64:~\$	~		





	total	used	free	shared	buffers	cached
Mem:	8160236	3268944	4891292	0	557576	975788
-/+ buffe	rs/cache:	1735580	6424656			
Swap:	9764860	0	9764860			
	total	used	free	shared	buffers	cached
Mem:	8160236	3268944	4891292	0	557576	975788
-/+ buffers/cache:		1735580	6424656			
Swap:	9764860	0	9764860			
	total	used	free	shared	buffers	cached
Mem:	8160236	3269076	4891160	0	557576	975788
-/+ buffe	rs/cache:	1735712	6424524			
Swap:	9764860	0	9764860			
	total	used	free	shared	buffers	cached
Mem:	8160236	3268952	4891284	0	55 ⁷ 576	975788
-/+ buffe	rs/cache:	1735588	6424648			
Swap:	9764860	0	9764860			

Measuring Running Time (time Command)



\$ time <command>

Displays elapsed time running a command

```
aelarabawy@aelarabawy-demo-backup64: ~

aelarabawy@aelarabawy-demo-backup64: ~$ time tree > tree-file

real 0m0.559s
user 0m0.308s
sys 0m0.248s
aelarabawy@aelarabawy-demo-backup64: ~$
```

This will result in

- Output of the command
- Real time → total time = user + system + waiting
- User time → User space time
- System time → system time

Note that the waiting time stands for the time the command spent waiting due to :

- I/O blocking
- Scheduling and multi-tasking (context switching)

Measuring System Uptime (uptime Command)



\$ uptime

Displays system up-time and load average

```
aelarabawy@aelarabawy:~$ uptime
10:33:56 up 88 days, 17:39, 16 users, load average: 0.29, 0.27, 0.29
aelarabawy@aelarabawy:~$
```

Load average,

- Calculated for the last 1, 5, and 15 minutes
- Note that average load is not normalized to number of system cores,
 For example, a load average of 1 means,
 - Fully loaded CPU in case of a single core processor
 - 25% loaded CPU in case of a Quad-core processor

