

# 501 - Processos

Curs 2021 - 2022

ASIX M01-ISO UF1-A01-16 Administració de processos

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|--|----------|
| <b>Administració de processos</b>      | <b>1</b> |
| Descripció                             | 1        |
| Gestió de processos                    | 2        |
| Processes: ps, pstree, pgrep, watch    | 2        |
| Signals: kill killall pkill            | 5        |
| Background: & jobs bg fg               | 7        |
| nohup                                  | 9        |
| Priority (nice): nice renice           | 9        |
| General information: top, free, uptime | 10       |
| Exercicis d'exemple                    | 11       |

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## Administració de processos

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### Descripció

#### Ordres a treballar:

- ☐ ps, pstree, pgrep
- ☐ watch, time
- ☐ kill, killall, pkill
- ☐ SIGNALS 15, 9, 1, 2, 20, 18, 19
- ☐ &, jobs, bg, fg
- ☐ nohup
- ☐ nice, renice
- ☐ top, free, uptime

### Gestió de processos

Processes: ps, pstree, pgrep, watch

## ps

Two notations for options BSD and GNU:

- ps
- ps ax
- ps aux
- ps -ef
- ps -l

Common options:

- a Allows the ps command to show all processes.
- u Shows processes by all users and ignores restrictions to only list the current user's processes.
- x Lists all processes and removes the restriction to only display the processes that are running in the current terminal.
- -e every process
- -f full details

```
$ ps
      PID TTY          TIME CMD
  5230 pts/0    00:00:00 bash
  5236 pts/0    00:00:00 ps

$ ps -l
 F S      UID          PID    PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
 0 S 100366     5230     5223  0  80   0 -  4377 -   pts/0    00:00:00 bash
 4 R 100366     5244     5230  0  80   0 -  2405 -   pts/0    00:00:00 ps

$ ps a
      PID TTY          STAT TIME COMMAND
  2952 tty2    Ss+      0:00 /sbin/agetty -o -p -- \u --noclear tty2 linux
  3413 tty3    Ssl+     0:00 /usr/libexec/gdm-x-session --run-script /usr/bin/gnome-session
  3415 tty3    Sl+      0:40 /usr/lib/xorg/Xorg vt3 -displayfd 3 -auth
/run/user/100366/gdm/Xauthority -nolisten tcp -background
  3431 tty3    Sl+      0:00 /usr/libexec/gnome-session-binary --systemd
  5230 pts/0    Ss       0:00 bash
  5262 pts/1    Ss+      0:00 bash
  5270 pts/1    S        0:00 sleep 123456789
  5271 pts/1    S        0:00 sleep 22222222
  5278 pts/0    R+       0:00 ps a

$ ps -ef | head
UID          PID    PPID  C STIME TTY          TIME CMD
root           1        0  0  09:55 ?            00:00:02 /sbin/init
root           2        0  0  09:55 ?            00:00:00 [kthreadd]
root           3        2  0  09:55 ?            00:00:00 [rcu_gp]
root           4        2  0  09:55 ?            00:00:00 [rcu_par_gp]
root           6        2  0  09:55 ?            00:00:00 [kworker/0:0H-events_highpri]
root           8        2  0  09:55 ?            00:00:00 [mm_percpu_wq]
root           9        2  0  09:55 ?            00:00:00 [rcu_tasks_rude_]
root          10        2  0  09:55 ?            00:00:00 [rcu_tasks_trace]
root          11        2  0  09:55 ?            00:00:00 [ksoftirqd/0]
```

Stat:

- D Uninterruptible Sleep
- R Running
- S Interruptible Sleep
- T Stopped
- Z Zombie

## pgrep

- -l list name
- -i ignore case
- -u user

```
$ pgrep sleep
5270
5271

$ pgrep sleep -l
5270 sleep
5271 sleep

$ pgrep -li BASH
5230 bash
5262 bash

$ pgrep systemd -l
1 systemd
253 systemd-journal
291 systemd-udev
314 systemd-timesyn
571 systemd-logind
3294 systemd

$ pgrep systemd -l
1 systemd
253 systemd-journal
291 systemd-udev
314 systemd-timesyn
571 systemd-logind
3294 systemd
```

## pstree

```
$ pstree | head
systemd+-ModemManager---2*[{ModemManager}]
    |-NetworkManager---2*[{NetworkManager}]
    |-accounts-daemon---2*[{accounts-daemon}]
    |-agetty
    |-automount---2*[{automount}]
    |-avahi-daemon---avahi-daemon
    |-colord---2*[{colord}]
    |-containerd---8*[{containerd}]
    |-cron
    |-dbus-daemon

$ pstree -lap | head
systemd,1
  |-ModemManager,500
  |   |-{ModemManager},520
  |   `-{ModemManager},522
  |-NetworkManager,454 --no-daemon
  |   |-{NetworkManager},501
  |   `-{NetworkManager},503
  |-accounts-daemon,569
  |   |-{accounts-daemon},582
  |   `-{accounts-daemon},584
```

```
$ ps
```

| PID  | TTY   | TIME     | CMD   |
|------|-------|----------|-------|
| 5230 | pts/0 | 00:00:00 | bash  |
| 5784 | pts/0 | 00:00:00 | sleep |
| 5785 | pts/0 | 00:00:00 | sleep |
| 5844 | pts/0 | 00:00:00 | sleep |
| 6237 | pts/0 | 00:00:00 | sleep |
| 6426 | pts/0 | 00:00:00 | ps    |

\$ pstree -spl 5230

```
systemd(1)──systemd(3294)──gnome-terminal-(5223)──bash(5230)─┬─pstree(6429)
                                                                │─sleep(5784)
                                                                │─sleep(5785)
                                                                │─sleep(5844)
                                                                └─sleep(6237)
```

| CODE | NORMAL | HEADER  |
|------|--------|---------|
| %C   | pcpu   | %CPU    |
| %G   | group  | GROUP   |
| %P   | ppid   | PPID    |
| %U   | user   | USER    |
| %a   | args   | COMMAND |
| %c   | comm   | COMMAND |
| %g   | rgroup | RGROUP  |
| %n   | nice   | NI      |
| %p   | pid    | PID     |
| %r   | pgid   | PGID    |
| %t   | etime  | ELAPSED |
| %u   | ruser  | RUSER   |
| %x   | time   | TIME    |
| %y   | tty    | TTY     |
| %z   | vsz    | VSZ     |

\$ ps -o pid,ppid,user,%cpu,cmd

| PID  | PPID | USER   | %CPU | CMD                          |
|------|------|--------|------|------------------------------|
| 4283 | 4184 | ecanet | 0.0  | bash                         |
| 4385 | 4283 | ecanet | 0.0  | sleep 666666                 |
| 5177 | 4283 | ecanet | 0.0  | vim /tmp/carta               |
| 6268 | 4283 | ecanet | 0.0  | sleep 12345                  |
| 6680 | 4283 | ecanet | 0.0  | sleep 22332233               |
| 7167 | 4283 | ecanet | 0.0  | sleep 22332233               |
| 7187 | 4283 | ecanet | 0.0  | sleep 22332233               |
| 8318 | 4283 | ecanet | 0.0  | ps -o pid,ppid,user,%cpu,cmd |

## Watch

- 2s default
- -n n° seconds
- ^C
- -d difference

# watch date

```
Every 2.0s: date
          d02: Thu Oct 21 10:29:44 2021
```

```
Thu 21 Oct 2021 10:29:44 AM CEST
```

# watch ps a

```
# des d'una altra consola llançar processos, per exemple sleep
```

# watch free

```
# watch du -sh /var/tmp/img
# des d'una altra consola generar un disc imatge
# dd if=/dev/zero of=disc.img bs=1k count=2M
```

## time

```
$ cp /usr/bin/ls /tmp/

$ time gzip /usr/bin/ls
gzip: /usr/bin/ls.gz: Permission denied
real    0m0.002s
user    0m0.000s
sys     0m0.002s

$ time tree &> /dev/null
real    0m0.013s
user    0m0.001s
sys     0m0.004s

$ time tree &> /tmp/tree.txt
real    0m0.005s
user    0m0.002s
sys     0m0.003s
```

## Signals: kill killall pkill

### Signals:

- 1 SIGHUP HUP Hang up, usually ends a process
- 2 SIGINT INT Interrupt, usually ends a process
- 3 SIGQUIT QUIT Quit, usually ends a process
- 9 SIGKILL KILL Kill, forcefully ends a process
- 15 SIGTERM TERM Terminate, usually ends a process
- 18 SIGCONT CONT Continue, resumes a stopped process
- 19 SIGSTOP STOP Stop, forcefully stops a process
- 20 SIGTSTP TSTP Terminal Stop, usually stops a process

```
$ kill -l
1) SIGHUP      2) SIGINT      3) SIGQUIT      4) SIGILL      5) SIGTRAP
6) SIGABRT     7) SIGBUS      8) SIGFPE       9) SIGKILL     10) SIGUSR1
11) SIGSEGV    12) SIGUSR2     13) SIGPIPE     14) SIGALRM     15) SIGTERM
16) SIGSTKFLT  17) SIGCHLD    18) SIGCONT     19) SIGSTOP     20) SIGTSTP
21) SIGTTIN    22) SIGTTOU     23) SIGURG      24) SIGXCPU     25) SIGXFSZ
26) SIGVTALRM  27) SIGPROF    28) SIGWINCH    29) SIGIO        30) SIGPWR
31) SIGSYS     34) SIGRTMIN    35) SIGRTMIN+1  36) SIGRTMIN+2  37) SIGRTMIN+3
38) SIGRTMIN+4 39) SIGRTMIN+5 40) SIGRTMIN+6 41) SIGRTMIN+7 42) SIGRTMIN+8
43) SIGRTMIN+9 44) SIGRTMIN+10 45) SIGRTMIN+11 46) SIGRTMIN+12 47)
SIGRTMIN+13
48) SIGRTMIN+14 49) SIGRTMIN+15 50) SIGRTMAX-14 51) SIGRTMAX-13 52)
SIGRTMAX-12
53) SIGRTMAX-11 54) SIGRTMAX-10 55) SIGRTMAX-9 56) SIGRTMAX-8 57) SIGRTMAX-7
58) SIGRTMAX-6 59) SIGRTMAX-5 60) SIGRTMAX-4 61) SIGRTMAX-3 62) SIGRTMAX-2
63) SIGRTMAX-1 64) SIGRTMAX
```

### Kill

- -1
- -HUP

- -SIGHUP

```
$ ps
  PID TTY          TIME CMD
 5230 pts/0    00:00:00 bash
 5784 pts/0    00:00:00 sleep
 5785 pts/0    00:00:00 sleep
 5844 pts/0    00:00:00 sleep
 6237 pts/0    00:00:00 sleep
 6484 pts/0    00:00:00 ps

$ jobs
[1]  Running                  sleep 111111111 &
[2]  Running                  sleep 222222222 &
[3]- Running                  sleep 333333333 &
[4]+ Running                  sleep 12345678 &

$ kill %4

$ kill 5844
[4]+  Terminated              sleep 12345678

$ jobs
[1]  Running                  sleep 111111111 &
[2]- Running                  sleep 222222222 &
[3]+  Terminated              sleep 333333333
```

```
$ ps
  PID TTY          TIME CMD
 5230 pts/0    00:00:00 bash
 5784 pts/0    00:00:00 sleep
 5785 pts/0    00:00:00 sleep
 6502 pts/0    00:00:00 ps

$ killall sleep
[1]-  Terminated              sleep 111111111
[2]+  Terminated              sleep 222222222
```

```
$ sleep 123456 &
[1] 6509
$ sleep 567890 &
[2] 6515

$ jobs
[1]- Running                  sleep 123456 &
[2]+ Running                  sleep 567890 &

$ pgrep -l lee
6509 sleep
6515 sleep

$ pkill lee
[1]-  Terminated              sleep 123456
[2]+  Terminated              sleep 567890
```

```
$ ps a
  PID TTY          STAT TIME COMMAND
 2952 tty2    Ss+      0:00 /sbin/agetty -o -p -- \u --noclear tty2 linux
 3413 tty3    Ssl+     0:00 /usr/libexec/gdm-x-session --run-script /usr/bin/gnome-session
 3415 tty3    Sl+      1:54 /usr/lib/xorg/Xorg vt3 -displayfd 3 -auth
/run/user/100366/gdm/Xauthority -nolisten tcp -backgroun
 3431 tty3    Sl+      0:00 /usr/libexec/gnome-session-binary --systemd
 5230 pts/0    Ss       0:00 bash
 5262 pts/1    Ss+      0:00 bash
 5349 pts/2    Ss+      0:00 bash
 6541 pts/0    R+       0:00 ps a

$ kill 5262
```

```
$ ps -l 5262
F S    UID        PID      PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S 100366     5262      5223  0  80   0  -  4608 -   pts/1    0:00 bash
```

```
$ kill -TERM 5262
```

```
$ ps -l 5262
F S    UID        PID      PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S 100366     5262      5223  0  80   0  -  4608 -   pts/1    0:00 bash
```

```
$ kill -9 5262
```

```
$ ps -l 5262
```

```
F S    UID        PID      PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
```

## Background: & jobs bg fg

- command; command
- command &
- +
- -
- %n job number
- ^Z
- foreground: appropriate console
- background: desirable no stdout and no stderr

```
$ sleep 11111111 &
```

```
[1] 5784
```

```
$ sleep 22222222 &
```

```
[2] 5785
```

```
$ sleep 33333333 &
```

```
[3] 5844
```

```
$ jobs
```

```
[1]   Running                  sleep 11111111 &
[2]-  Running                  sleep 22222222 &
[3]+  Running                  sleep 33333333 &
```

```
$ fg
```

```
sleep 33333333
```

```
^Z
```

```
[3]+  Stopped                  sleep 33333333
```

```
$ jobs
```

```
[1]   Running                  sleep 11111111 &
[2]-  Running                  sleep 22222222 &
[3]+  Stopped                  sleep 33333333
```

```
$ sleep 12345678
```

```
^Z
```

```
[4]+  Stopped                  sleep 12345678
```

```
$ jobs
```

```
[1]   Running                  sleep 11111111 &
```

```

[2]   Running                sleep 222222222 &
[3]-  Stopped                sleep 333333333
[4]+  Stopped                sleep 12345678

$ bg -
[3]-  sleep 333333333 &

$ jobs
[1]   Running                sleep 111111111 &
[2]   Running                sleep 222222222 &
[3]-  Running                sleep 333333333 &
[4]+  Stopped                sleep 12345678

$ fg +
sleep 12345678
^Z
[4]+  Stopped                sleep 12345678

$ bg %4
[4]+  sleep 12345678 &

$ jobs
[1]   Running                sleep 111111111 &
[2]   Running                sleep 222222222 &
[3]-  Running                sleep 333333333 &
[4]+  Running                sleep 12345678 &

```

```

$ tree / > /tmp/tree.txt 2> /dev/null &
[5] 6297

# this command should not generate errors at the console
$ find / -size +1M -print > /tmp/size.txt &
find: '/lost+found': Permission denied
find:
'/home/groups/inf/inf/repositori/Credits/zDAI/DAI-C2/DAI-C2_Curs-0708/c2-groups_0708/UD2
/A2/widal2236/exer1formulari': Permission denied

$ find / -size +1M -print > /tmp/size.txt 2> /dev/null &

```

- foreground is console appropriate

```

# edit carta and press ^z

$ vim /tmp/carta
[2]+  Stopped                vim /tmp/carta

$ jobs
[1]-  Running                nohup sleep 666666 &
[2]+  Stopped                vim /tmp/carta

# can not restart in background, vim is console appropriate
$ bg
[2]+  vim /tmp/carta &

[2]+  Stopped                vim /tmp/carta

```

nohup



- When a user logs off the system, all processes that are owned by that user are automatically sent the Hang Up SIGHUP signal. Typically, this signal causes those processes to end.
- In some cases, a user may want to execute a command that won't automatically exit when it is sent a HUP signal. To have a process ignore a Hang Up signal, start the process with the nohup command.

# in a text console / then close the console

```
$ nohup sleep 666666 &
[1] 4385
$ nohup: ignoring input and appending output to 'nohup.out'
```

```
$ ps ax
4385 ?        S          0:00 sleep 666666
```

## Priority (nice): nice renice

- default nice priority 0
- [-20 0 19] -20=max 19=min
- User only from 0 to 19. Root from -20 to 20. Only root negative (more) priority.

```
$ sleep 12345 &
[3] 6268

$ ps -l 6268
F S    UID      PID     PPID  C  PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1001      6268     4283  0   80   0 -  53824 -          pts/1        0:00 sleep 12345
```

```
$ renice -5 6268
renice: failed to set priority for 6268 (process ID): Permission denied

$ renice 5 6268
6268 (process ID) old priority 0, new priority 5

$ ps -l 6268
F S    UID      PID     PPID  C  PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1001      6268     4283  0   85   5 -  53824 -          pts/1        0:00 sleep 12345

$ renice 20 6268
6268 (process ID) old priority 5, new priority 19

$ ps -l 6268
F S    UID      PID     PPID  C  PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1001      6268     4283  0   99  19 -  53824 -          pts/1        0:00 sleep 12345
```

```
$ nice -15 sleep 22332233 &
[4] 6680

$ ps -l 6680
F S    UID      PID     PPID  C  PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
0 S    1001      6680     4283  0   95  15 -  53824 -          pts/1        0:00 sleep 22332233
```

```
$ nice -n 3 sleep 22332233 &
[6] 7187

$ renice 0 7187
renice: failed to set priority for 7187 (process ID): Permission denied

$ renice 5 7187
7187 (process ID) old priority 3, new priority 5
```

## General information: top, free, uptime

```
$ uptime
16:27:18 up 34 min,  1 user,  load average: 0.70, 0.53, 0.46
```

```
$ free
              total          used          free   shared  buff/cache   available
Mem:      7648128       2360260       1577772       672780       3710096       4305240
Swap:      7811068           0       7811068

$ free -h
              total          used          free   shared  buff/cache   available
Mem:        7.3Gi       2.3Gi       1.5Gi       630Mi       3.5Gi       4.1Gi
Swap:       7.4Gi           0B       7.4Gi
```

```
top - 16:27:58 up 34 min,  1 user,  load average: 0.49, 0.49, 0.45
Tasks: 280 total,  1 running, 278 sleeping,  1 stopped,  0 zombie
%Cpu(s):  2.0 us,  0.8 sy,  0.0 ni, 96.5 id,  0.0 wa,  0.4 hi,  0.3 si,  0.0 st
MiB Mem :  7468.9 total,  1592.1 free,  2279.2 used,  3597.6 buff/cache
MiB Swap:  7628.0 total,  7628.0 free,   0.0 used.  4256.8 avail Mem
```

| PID  | USER   | PR | NI  | VIRT    | RES    | SHR    | S | %CPU | %MEM | TIME+   | COMMAND                |
|------|--------|----|-----|---------|--------|--------|---|------|------|---------|------------------------|
| 2071 | ecanet | 20 | 0   | 4656988 | 186508 | 103600 | S | 6.6  | 2.4  | 1:00.19 | gnome-shell            |
| 1893 | ecanet | 20 | 0   | 1379308 | 80008  | 45940  | S | 3.3  | 1.0  | 0:55.23 | Xorg                   |
| 3829 | ecanet | 20 | 0   | 36.6g   | 272548 | 107516 | S | 1.0  | 3.6  | 3:21.16 | chrome                 |
| 2838 | ecanet | 20 | 0   | 32.5g   | 112204 | 85140  | S | 0.7  | 1.5  | 0:24.45 | chrome                 |
| 14   | root   | 20 | 0   | 0       | 0      | 0      | I | 0.3  | 0.0  | 0:01.27 | rcu_sched              |
| 722  | root   | 0  | -20 | 0       | 0      | 0      | I | 0.3  | 0.0  | 0:02.38 | kworker/u9:2-i915_flip |
| 2776 | ecanet | 20 | 0   | 32.7g   | 255940 | 168972 | S | 0.3  | 3.3  | 1:10.81 | chrome                 |
| 5106 | root   | 20 | 0   | 0       | 0      | 0      | I | 0.3  | 0.0  | 0:01.37 | kworker/0:3-events     |
| 1    | root   | 20 | 0   | 173316  | 16228  | 10460  | S | 0.0  | 0.2  | 0:01.51 | systemd                |
| 2    | root   | 20 | 0   | 0       | 0      | 0      | S | 0.0  | 0.0  | 0:00.00 | kthreadd               |
| 3    | root   | 0  | -20 | 0       | 0      | 0      | I | 0.0  | 0.0  | 0:00.00 | rcu_gp                 |
| 4    | root   | 0  | -20 | 0       | 0      | 0      | I | 0.0  | 0.0  | 0:00.00 | rcu_par_gp             |

- Pressing the K key will allow a user to kill or send a signal to a process. After pressing the K key, the top command will prompt for a PID and then for a signal to send to that process.
- Pressing the R key will allow a user to renice a process by prompting for the PID and then the new niceness value.
- Press the Q key to quit the top command.
- M Sort by memory usage.
- N Sort by process ID number.
- T Sort by running time.
- P Sort by percentage of CPU usage.

## Exercicis d'exemple

1. Github LPIC-1 [103.5-Exercices.md](#)
2. Github LPIC-1 [103.6-Exercices.md](#)
3. LPI Exercices [103.5 Create, monitor and kill processes](#)