Operating systems

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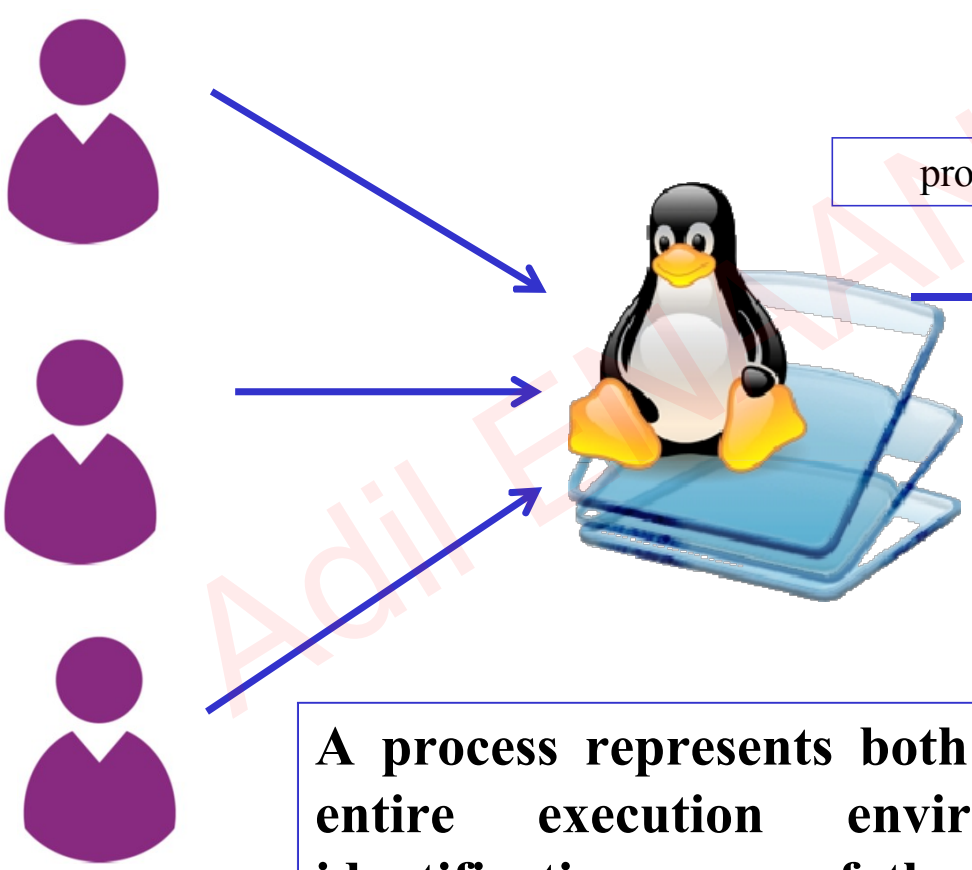
Chapter 5

Process management under Linux

Process concept



A process represents both a running program and its **entire execution environment (memory, state, identification, owner, father, etc.).**

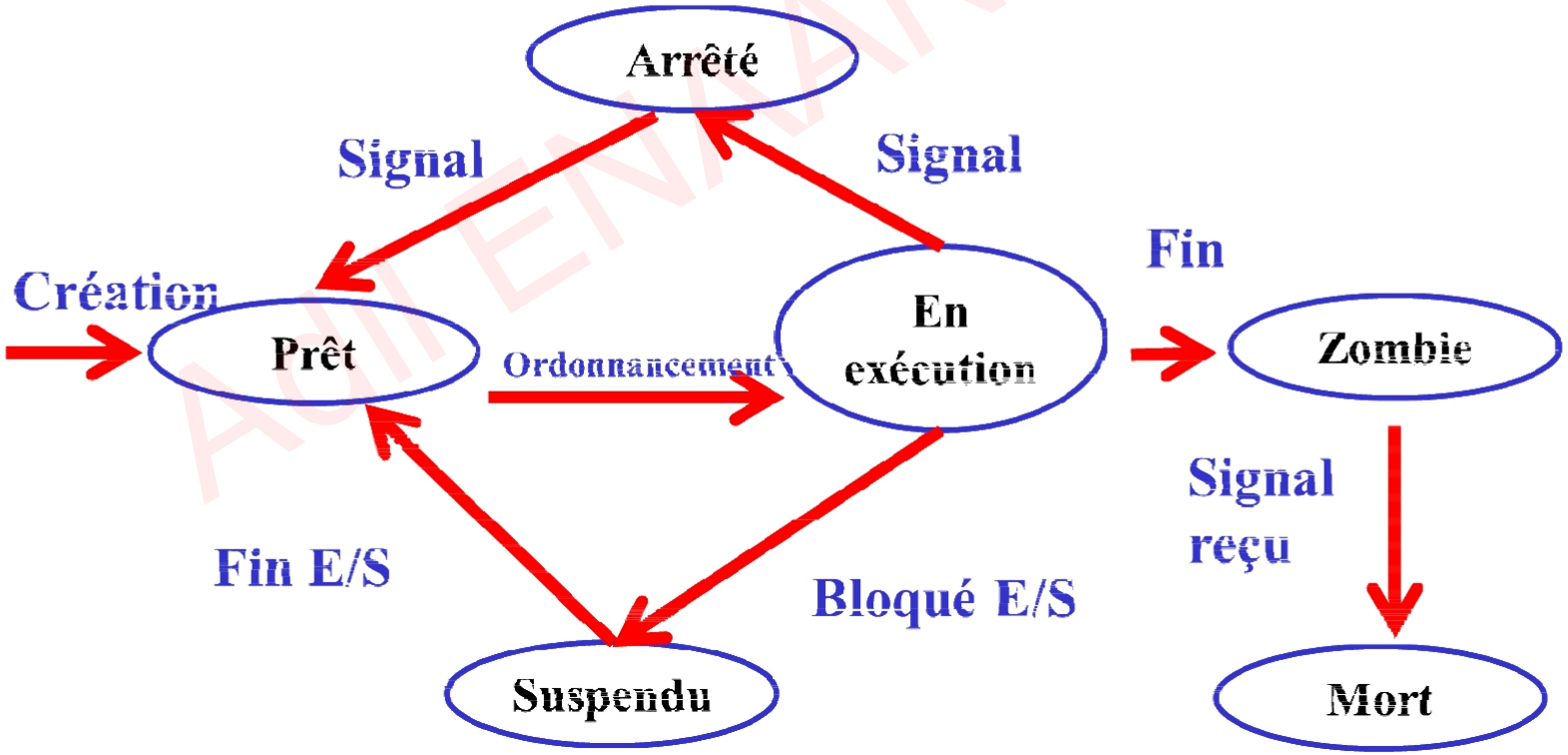
Process concept

A process is identified by:

- A unique PID process number;
- A PPID (Parent Process ID) number;
- A user number and a group number;
- Processing time and priority;
- Active work directory;
- Etc.

Process states

During its lifetime (time between launch and exit), a process can go through various states (process state):



List processes

The **ps** (process status) command provides information on current processes.

```
ubuntu@ubuntu-VirtualBox:~$ ps -ef
UID          PID  PPID  C STIME TTY          TIME CMD
root           1     0  0 11:55 ?        00:00:04 /sbin/init splash
root           2     0  0 11:55 ?        00:00:00 [kthreadd]
root           4     2  0 11:55 ?        00:00:00 [kworker/0:0H]
root           5     2  0 11:55 ?        00:00:00 [kworker/u2:0]
root           6     2  0 11:55 ?        00:00:00 [mm_percpu_wq]
root           7     2  0 11:55 ?        00:00:00 [ksoftirqd/0]
root           8     2  0 11:55 ?        00:00:00 [rcu_sched]
root           9     2  0 11:55 ?        00:00:00 [rcu_bh]
root          10     2  0 11:55 ?        00:00:00 [migration/0]
root          11     2  0 11:55 ?        00:00:00 [watchdog/0]
root          12     2  0 11:55 ?        00:00:00 [cpuhp/0]
root          13     2  0 11:55 ?        00:00:00 [kdevtmpfs]
root          14     2  0 11:55 ?        00:00:00 [netns]
root          15     2  0 11:55 ?        00:00:00 [rcu_tasks_kthre]
root          16     2  0 11:55 ?        00:00:00 [kauditd]
root          17     2  0 11:55 ?        00:00:00 [khungtaskd]
root          18     2  0 11:55 ?        00:00:00 [oom_reaper]
root          19     2  0 11:55 ?        00:00:00 [writeback]
root          20     2  0 11:55 ?        00:00:00 [kcompactd0]
root          21     2  0 11:55 ?        00:00:00 [ksmd]
```

List processes

Colonne	Définition
UID	User ID, nom de l'utilisateur.
PID	Process ID, numéro du processus.
PPID	Parent Process ID, numéro du processus père.
C	Facteur de priorité, plus la valeur est grande plus la priorité est élevée.
STIME	Heure de lancement du processus.
TTY	Nom du terminal depuis lequel le processus a été lancé.
TIME	Durée de traitement du processus.
CMD	Commande exécutée.
F	Drapeaux du processus (sort du cadre de l'ouvrage).
S	État du processus S (sleeping) R (running) Z (zombie).
PRI	Priorité du processus.
NI	Nice, incrément pour le scheduler.

List processes

For more information, use the -f parameter.

The -e parameter provides information on all running processes in the system.

The -u parameter is used to specify a comma-separated list of one or more users.

-g for process groups (usually the user's group)

-p for precise PIDs.

Stop a process

The **-o** parameter allows you to select the display format in the desired order according to a particular keyword list.

ps -o user, group, uid, gid, pid, ppid, command

```
ubuntu@ubuntu-VirtualBox:~/Bureau$ ps -o user,group,uid,pid,ppid,command
USER     GROUP      UID   PID  PPID COMMAND
ubuntu   ubuntu    1000  2291  1714 bash
ubuntu   ubuntu    1000  2689  2291 ps -o user,group,uid,pid,ppid,co
```

To stop a running process, we call the command

kill -Num_signal PID [PID2...]

Lesignal is one ofmeans of communication between l processes. When a signal is sent to a process, and react accordingly.

Stop a process

For example:

Killing a process by its pid

- **in a "nice" way**

  kill PID

- **in a "brutal" manner**

  kill -9 PID

Kill a process by name

killall ProcessName

Or :

pkill ProcessName

Start/stop a process

The following command displays the process PID

Pidof process_name

```
ubuntu@ubuntu-VirtualBox:~$ xclock
ubuntu@ubuntu-VirtualBox:~$ pidof xclock
4061
ubuntu@ubuntu-VirtualBox:~$ kill 4061
ubuntu@ubuntu-VirtualBox:~$
```

List process tree

pstree command: displays the process tree

```
ubuntu@ubuntu-VirtualBox:~$ pstree
systemd─┬─ModemManager───2*[{ModemManager}]
        ├─NetworkManager─┬─dhclient
        │                └─2*[{NetworkManager}]
        ├─accounts-daemon───2*[{accounts-daemon}]
        ├─acpid
        ├─avahi-daemon───avahi-daemon
        ├─boltd───2*[{boltd}]
        ├─colord───2*[{colord}]
        ├─cron
        ├─cups-browsed───2*[{cups-browsed}]
        ├─cupsd
        ├─dbus-daemon
        ├─fwupd───4*[{fwupd}]
        ├─gdm3─┬─gdm-session-wor─┬─gdm-x-session─┬─Xorg───{X+
```

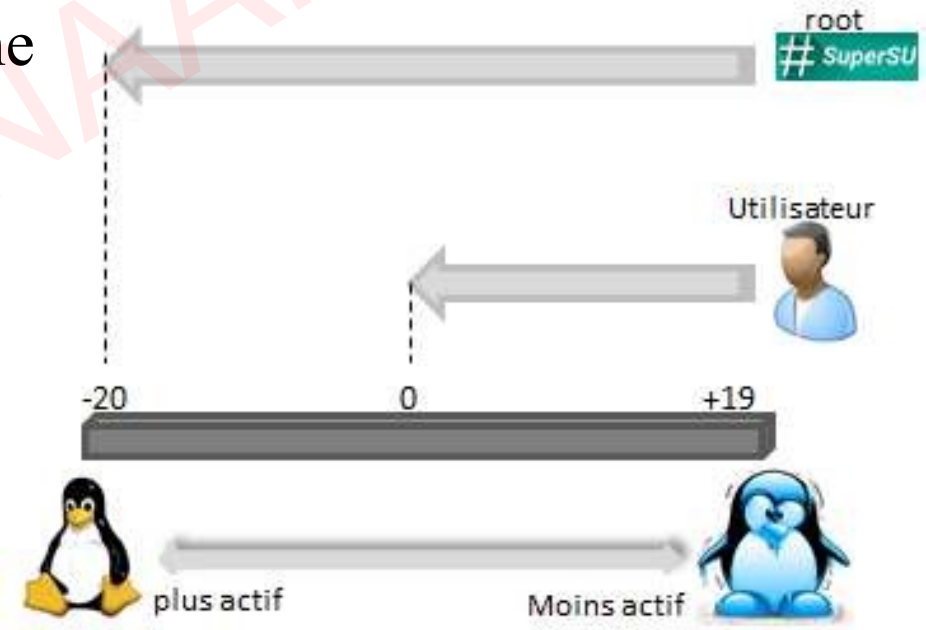
Process prioritization

nice command: Change process priority

nice order value

The higher the number, the lower the priority.
For example -2 is more priority than 0.

nice -5 xclock

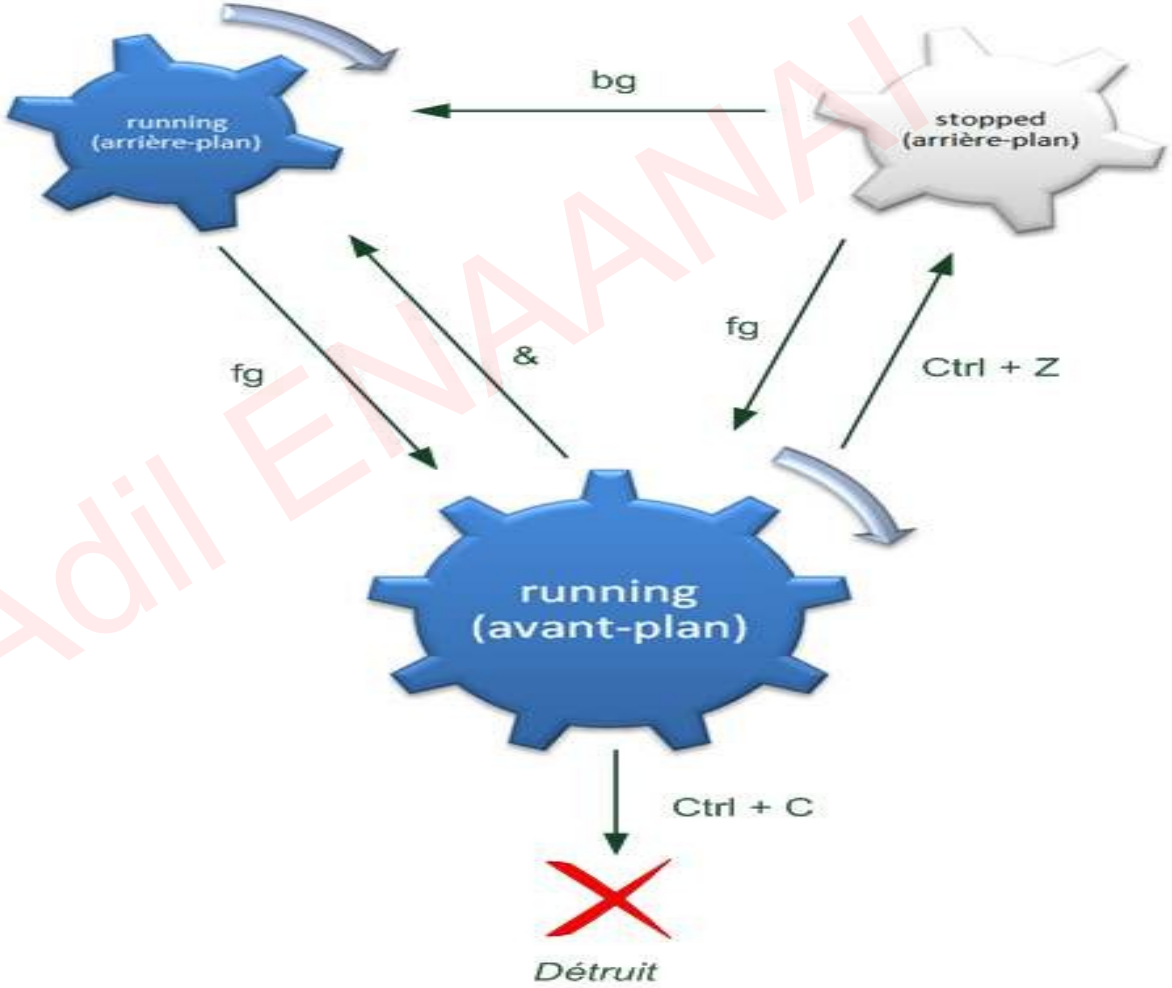


Process prioritization

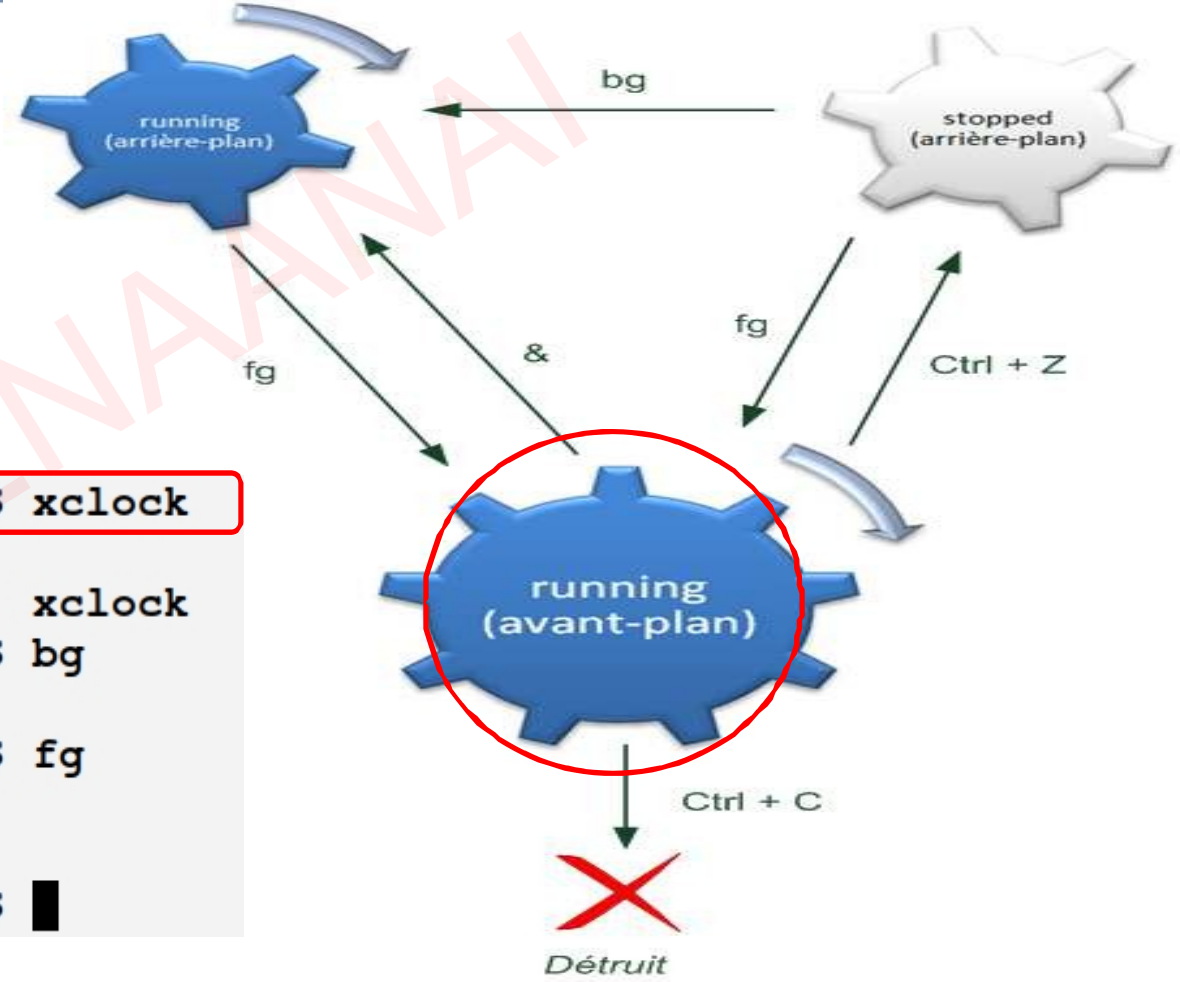
renice command: changes the priority of a program already running.

```
ubuntu@ubuntu-VirtualBox:~$ pidof xclock
4112
ubuntu@ubuntu-VirtualBox:~$ renice -8 4112
renice: échec de configuration de priorité pour 4112 (process
 ID): Permission non accordée
ubuntu@ubuntu-VirtualBox:~$ sudo renice -8 4112
[sudo] Mot de passe de ubuntu :
4112 (process ID) priorité précédente 5, nouvelle priorité -8
ubuntu@ubuntu-VirtualBox:~$
```

Process states



Process states Example




```
ubuntu@ubuntu-VirtualBox:~$ xclock
^Z
[1]+  Arrêté                 xclock
ubuntu@ubuntu-VirtualBox:~$ bg
[1]+ xclock &
ubuntu@ubuntu-VirtualBox:~$ fg
xclock
^C
ubuntu@ubuntu-VirtualBox:~$
```

Know the background processes

The **jobs** command

```
ubuntu@ubuntu-VirtualBox:~$ jobs
[1]   Arrêté                 xclock
[2]-  Arrêté                 xclock
[3]   En cours d'exécution    xclock &
[4]+  Arrêté                 xclock
ubuntu@ubuntu-VirtualBox:~$ bg 2
[2]- xclock &
ubuntu@ubuntu-VirtualBox:~$ jobs
[1]-  Arrêté                 xclock
[2]   En cours d'exécution    xclock &
[3]   En cours d'exécution    xclock &
[4]+  Arrêté                 xclock
```

End of chapter 5