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# LCF511 - Gestion des Paramètres du matériel et les Ressources

```
[root@centos8 ~]# sed -i 's/^mirrorlist/#mirrorlist/g' /etc/yum.repos.d/CentOS-*  
[root@centos8 ~]# sed -i 's|#baseurl=http://mirror.centos.org|baseurl=http://vault.centos.org|g'  
/etc/yum.repos.d/CentOS-*
```

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## Présentation des Fichiers Spéciaux

Dans l'ordinateur les périphériques sont reliés à un **contrôleur** qui communique avec le processeur à l'aide d'un **bus**. Le contrôleur ainsi que les périphériques nécessitent des pilotes. Sous Linux, les pilotes sont généralement fournis sous la forme d'un **module**. Chaque périphérique est représenté par un **fichier spécial** dans le répertoire **/dev** et c'est dans ce fichier que le système trouve les informations nécessaires pour s'adresser au pilote.



**Important** : Les périphériques qui nécessitent à ce que l'ordinateur soit éteint afin des les brancher/débrancher sont appelés communément **Cold Plug Devices**. Les périphériques qui peuvent être brancher/débrancher à chaud sont appelés des **Hot Plug Devices**.

Consultez le contenu du répertoire /dev :

```
[root@centos8 ~]# ls -l /dev | more
total 0
crw-r--r--. 1 root root      10, 235 Jun 28 02:04 autofs
drwxr-xr-x. 2 root root      180 Jun 28 02:04 block
drwxr-xr-x. 2 root root     100 Jun 28 02:04 bsg
drwxr-xr-x. 3 root root      60 Jun 28 02:04 bus
lrwxrwxrwx. 1 root root       3 Jun 28 02:04 cdrom -> sr0
drwxr-xr-x. 2 root root    2940 Jun 28 02:04 char
drwxr-xr-x. 2 root root      80 Jun 28 02:04 cl_centos8
crw----- 1 root root       5,   1 Jun 28 02:04 console
lrwxrwxrwx. 1 root root     11 Jun 28 02:04 core -> /proc/kcore
```

```

drwxr-xr-x. 10 root root      200 Jun 28 02:04 cpu
crw-----.  1 root root    10,  62 Jun 28 02:04 cpu_dma_latency
drwxr-xr-x.  6 root root    120 Jun 28 02:04 disk
brw-rw----.  1 root disk  253,   0 Jun 28 02:04 dm-0
brw-rw----.  1 root disk  253,   1 Jun 28 02:04 dm-1
drwxr-xr-x.  3 root root     80 Jun 28 02:04 dri
crw-rw----.  1 root video  29,   0 Jun 28 02:04 fb0
lrwxrwxrwx.  1 root root     13 Jun 28 02:04 fd -> /proc/self/fd
crw-rw-rw-.  1 root root     1,   7 Jun 28 02:04 full
crw-rw-rw-.  1 root root    10, 229 Jun 28 02:04 fuse
crw-----.  1 root root  245,   0 Jun 28 02:04 hidraw0
crw-----.  1 root root    10, 228 Jun 28 02:04 hpet
drwxr-xr-x.  3 root root      0 Jun 28 02:04 hugepages
crw-----.  1 root root    10, 183 Jun 28 02:04 hwrng
lrwxrwxrwx.  1 root root     12 Jun 28 02:04 initctl -> /run/initctl
drwxr-xr-x.  4 root root    280 Jun 28 02:04 input
crw-r--r--.  1 root root     1,  11 Jun 28 02:04 kmsg
lrwxrwxrwx.  1 root root     28 Jun 28 02:04 log -> /run/systemd/journal/dev-log
crw-rw----.  1 root disk    10, 237 Jun 28 02:04 loop-control
crw-rw----.  1 root lp       6,   0 Jun 28 02:04 lp0
crw-rw----.  1 root lp       6,   1 Jun 28 02:04 lp1
crw-rw----.  1 root lp       6,   2 Jun 28 02:04 lp2
crw-rw----.  1 root lp       6,   3 Jun 28 02:04 lp3
drwxr-xr-x.  2 root root    100 Jun 28 02:04 mapper
crw-----.  1 root root    10, 227 Jun 28 02:04 mcelog
crw-r-----. 1 root kmem     1,   1 Jun 28 02:04 mem
drwxrwxrwt.  2 root root     40 Jun 28 02:04 mqueue
drwxr-xr-x.  2 root root     60 Jun 28 02:04 net
crw-rw-rw-.  1 root root     1,   3 Jun 28 02:04 null
--More--

```

On peut noter dans la sortie de la commande que certains fichiers sont de type **bloc (b)**, tandis que d'autre sont de type **caractère (c)**.

...

```
brw-rw----. 1 root disk      8,   1 Jun 28 02:04 sda1
...
crw-rw-rw-. 1 root tty       5,   0 Jun 28 02:04 tty
...
```

La différence entre les deux repose sur le type de communication entre le système et le module. Dans le premier cas le système accède au périphérique par des coordonnées du bloc de données sur le support tandis que dans le deuxième cas la communication d'échange de données se fait octet par octet sans utiliser des tampons.

Les deux informations clefs du fichier spécial sont situées à la place de la taille d'un fichier normal et se nomment le **majeur** et le **mineur** :

- le **majeur** identifie le pilote du périphérique et donc son contrôleur,
- le **mineur** identifie le périphérique ou une particularité du périphérique telle une partition d'un disque.

## LAB #1 - Découvrir le Matériel

### 1.1 - La Commande lspci

Cette commande vous renseigne sur les adaptateurs reliés aux bus PCI, AGP et PCI express :

```
[root@centos8 ~]# lspci
00:00.0 Host bridge: Intel Corporation 440FX - 82441FX PMC [Natoma] (rev 02)
00:01.0 ISA bridge: Intel Corporation 82371SB PIIX3 ISA [Natoma/Triton II]
00:01.1 IDE interface: Intel Corporation 82371SB PIIX3 IDE [Natoma/Triton II]
00:01.2 USB controller: Intel Corporation 82371SB PIIX3 USB [Natoma/Triton II] (rev 01)
00:01.3 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 03)
00:02.0 VGA compatible controller: Device 1234:1111 (rev 02)
00:03.0 Unclassified device [00ff]: Red Hat, Inc. Virtio memory balloon
00:07.0 SATA controller: Intel Corporation 82801IR/IO/IH (ICH9R/D0/DH) 6 port SATA Controller [AHCI mode] (rev 02)
00:12.0 Ethernet controller: Red Hat, Inc. Virtio network device
00:1e.0 PCI bridge: Red Hat, Inc. QEMU PCI-PCI bridge
```

00:1f.0 PCI bridge: Red Hat, Inc. QEMU PCI-PCI bridge

Pour obtenir de l'information sur un adaptateur spécifique, il convient d'utiliser la même commande avec l'option **-v** en spécifiant l'identifiant concerné :

```
[root@centos8 ~]# lspci -v -s 00:03.0
00:03.0 Unclassified device [00ff]: Red Hat, Inc. Virtio memory balloon
  Subsystem: Red Hat, Inc. Device 0005
  Physical Slot: 3
  Flags: bus master, fast devsel, latency 0, IRQ 10
  I/O ports at e000 [size=64]
  Memory at fe400000 (64-bit, prefetchable) [size=16K]
  Capabilities: [84] Vendor Specific Information: VirtIO: <unknown>
  Capabilities: [70] Vendor Specific Information: VirtIO: Notify
  Capabilities: [60] Vendor Specific Information: VirtIO: DeviceCfg
  Capabilities: [50] Vendor Specific Information: VirtIO: ISR
  Capabilities: [40] Vendor Specific Information: VirtIO: CommonCfg
  Kernel driver in use: virtio-pci
```

ou :

```
[root@centos8 ~]# lspci -vv -s 00:03.0
00:03.0 Unclassified device [00ff]: Red Hat, Inc. Virtio memory balloon
  Subsystem: Red Hat, Inc. Device 0005
  Physical Slot: 3
  Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr- Stepping- SERR+ FastB2B- DisINTx-
  Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- >SERR- <PERR- INTx-
  Latency: 0
  Interrupt: pin A routed to IRQ 10
  Region 0: I/O ports at e000 [size=64]
  Region 4: Memory at fe400000 (64-bit, prefetchable) [size=16K]
  Capabilities: [84] Vendor Specific Information: VirtIO: <unknown>
    BAR=0 offset=00000000 size=00000000
  Capabilities: [70] Vendor Specific Information: VirtIO: Notify
```

```
BAR=4 offset=00003000 size=00001000 multiplier=00000004
Capabilities: [60] Vendor Specific Information: VirtIO: DeviceCfg
BAR=4 offset=00002000 size=00001000
Capabilities: [50] Vendor Specific Information: VirtIO: ISR
BAR=4 offset=00001000 size=00001000
Capabilities: [40] Vendor Specific Information: VirtIO: CommonCfg
BAR=4 offset=00000000 size=00001000
Kernel driver in use: virtio-pci
```

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# lspci --help
lspci: invalid option -- '-'
Usage: lspci [<switches>]
```

### Basic display modes:

```
-mm      Produce machine-readable output (single -m for an obsolete format)
-t       Show bus tree
```

### Display options:

```
-v       Be verbose (-vv or -vvv for higher verbosity)
-k       Show kernel drivers handling each device
-x       Show hex-dump of the standard part of the config space
-xxx     Show hex-dump of the whole config space (dangerous; root only)
-xxxx    Show hex-dump of the 4096-byte extended config space (root only)
-b       Bus-centric view (addresses and IRQ's as seen by the bus)
-D       Always show domain numbers
-P       Display bridge path in addition to bus and device number
-PP      Display bus path in addition to bus and device number
```

Resolving of device ID's to names:

```
-n          Show numeric ID's
-nn         Show both textual and numeric ID's (names & numbers)
-q          Query the PCI ID database for unknown ID's via DNS
-qq         As above, but re-query locally cached entries
-Q          Query the PCI ID database for all ID's via DNS
```

Selection of devices:

```
-s [[[[<domain>]:]<bus>:][<slot>][.<func>]] Show only devices in selected slots
-d [<vendor>]:<device>[:<class>]          Show only devices with specified ID's
```

Other options:

```
-i <file>      Use specified ID database instead of /usr/share/hwdata/pci.ids
-p <file>      Look up kernel modules in a given file instead of default modules.pcimap
-M            Enable `bus
```

## 1.2 - La Commande lsusb

Cette commande vous renseigne sur les adaptateurs reliés au bus usb :

```
[root@centos8 ~]# lsusb
Bus 001 Device 002: ID 0627:0001 Adomax Technology Co., Ltd
Bus 001 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub

[root@centos8 ~]# lsusb -vt
/:  Bus 01.Port 1: Dev 1, Class=root_hub, Driver=uhci_hcd/2p, 12M
    |__ Port 1: Dev 2, If 0, Class=Human Interface Device, Driver=usbhid, 12M
```

### Options de la commande

Les options de cette commande sont :



```
[root@centos8 ~]# lsusb --help
Usage: lsusb [options]...
List USB devices
-v, --verbose
    Increase verbosity (show descriptors)
-s [[bus]:][devnum]
    Show only devices with specified device and/or
    bus numbers (in decimal)
-d vendor:[product]
    Show only devices with the specified vendor and
    product ID numbers (in hexadecimal)
    .LAB#1
-D device
    Selects which device lsusb will examine
-t, --tree
    Dump the physical USB device hierarchy as a tree
-V, --version
    Show version of program
-h, --help
    Show usage and help
```

### 1.3 - La Commande lsblk

Cette commande vous renseigne sur les partitions des disques :

```
[root@centos8 ~]# lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda                                8:0    0   32G  0 disk
├─sda1                            8:1    0    1G  0 part /boot
└─sda2                            8:2    0   31G  0 part
   ├─cl_centos8-root              253:0    0  27.8G  0 lvm  /
   └─cl_centos8-swap              253:1    0   3.2G  0 lvm  [SWAP]
```

```
sdb          8:16  0    4G  0 disk
sdc          8:32  0   64G  0 disk
└─sdc1       8:33  0   64G  0 part /home
sdd          8:48  0   32G  0 disk
sr0         11:0   1 1024M  0 rom
```

```
[root@centos8 ~]# lsblk -l
```

| NAME            | MAJ:MIN | RM | SIZE  | RO | TYPE | MOUNTPPOINT |
|-----------------|---------|----|-------|----|------|-------------|
| sda             | 8:0     | 0  | 32G   | 0  | disk |             |
| sda1            | 8:1     | 0  | 1G    | 0  | part | /boot       |
| sda2            | 8:2     | 0  | 31G   | 0  | part |             |
| sdb             | 8:16    | 0  | 4G    | 0  | disk |             |
| sdc             | 8:32    | 0  | 64G   | 0  | disk |             |
| sdc1            | 8:33    | 0  | 64G   | 0  | part | /home       |
| sdd             | 8:48    | 0  | 32G   | 0  | disk |             |
| sr0             | 11:0    | 1  | 1024M | 0  | rom  |             |
| cl_centos8-root | 253:0   | 0  | 27.8G | 0  | lvm  | /           |
| cl_centos8-swap | 253:1   | 0  | 3.2G  | 0  | lvm  | [SWAP]      |

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# lsblk --help
```

Usage:

```
lsblk [options] [<device> ...]
```

List information about block devices.

Options:

|             |                                                          |
|-------------|----------------------------------------------------------|
| -a, --all   | print all devices                                        |
| -b, --bytes | print SIZE in bytes rather than in human readable format |

```
-d, --nodeps      don't print slaves or holders
-D, --discard     print discard capabilities
-z, --zoned       print zone model
-e, --exclude <list> exclude devices by major number (default: RAM disks)
-f, --fs          output info about filesystems
-i, --ascii       use ascii characters only
-I, --include <list> show only devices with specified major numbers
-J, --json        use JSON output format
-l, --list        use list format output
-T, --tree        use tree format output
-m, --perms       output info about permissions
-n, --noheadings  don't print headings
-o, --output <list> output columns
-O, --output-all output all columns
-p, --paths       print complete device path
-P, --pairs       use key="value" output format
-r, --raw         use raw output format
-s, --inverse     inverse dependencies
-S, --scsi        output info about SCSI devices
-t, --topology    output info about topology
-x, --sort <column> sort output by <column>

-h, --help        display this help
-V, --version     display version
```

Available output columns:

|             |                             |
|-------------|-----------------------------|
| NAME        | device name                 |
| KNAME       | internal kernel device name |
| MAJ:MIN     | major:minor device number   |
| FSTYPE      | filesystem type             |
| MOUNTPPOINT | where the device is mounted |
| LABEL       | filesystem LABEL            |
| UUID        | filesystem UUID             |
| PARTTYPE    | partition type UUID         |

|            |                                                |
|------------|------------------------------------------------|
| PARTLABEL  | partition LABEL                                |
| PARTUUID   | partition UUID                                 |
| PARTFLAGS  | partition flags                                |
| RA         | read-ahead of the device                       |
| RO         | read-only device                               |
| RM         | removable device                               |
| HOTPLUG    | removable or hotplug device (usb, pcmcia, ...) |
| MODEL      | device identifier                              |
| SERIAL     | disk serial number                             |
| SIZE       | size of the device                             |
| STATE      | state of the device                            |
| OWNER      | user name                                      |
| GROUP      | group name                                     |
| MODE       | device node permissions                        |
| ALIGNMENT  | alignment offset                               |
| MIN-IO     | minimum I/O size                               |
| OPT-IO     | optimal I/O size                               |
| PHY-SEC    | physical sector size                           |
| LOG-SEC    | logical sector size                            |
| ROTA       | rotational device                              |
| SCHED      | I/O scheduler name                             |
| RQ-SIZE    | request queue size                             |
| TYPE       | device type                                    |
| DISC-ALN   | discard alignment offset                       |
| DISC-GRAN  | discard granularity                            |
| DISC-MAX   | discard max bytes                              |
| DISC-ZERO  | discard zeroes data                            |
| WSAME      | write same max bytes                           |
| WWN        | unique storage identifier                      |
| RAND       | adds randomness                                |
| PKNAME     | internal parent kernel device name             |
| HCTL       | Host:Channel:Target:Lun for SCSI               |
| TRAN       | device transport type                          |
| SUBSYSTEMS | de-duplicated chain of subsystems              |

```
REV   device revision
VENDOR device vendor
ZONED zone model
```

For more details see `lsblk(8)`.

## 1.4 - La Commande lsscsi

Cette commande vous renseigne sur les périphériques SCSI et NVMe :

```
[root@centos8 ~]# lsscsi
[1:0:0:0]    cd/dvd  QEMU      QEMU DVD-ROM    2.5+  /dev/sr0
[2:0:0:0]    disk   ATA       QEMU HARDDISK   2.5+  /dev/sda
[3:0:0:0]    disk   ATA       QEMU HARDDISK   2.5+  /dev/sdb
[4:0:0:0]    disk   ATA       QEMU HARDDISK   2.5+  /dev/sdc
[5:0:0:0]    disk   ATA       QEMU HARDDISK   2.5+  /dev/sdd
```

### Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# man lsscsi
[root@centos8 ~]# lsscsi --help
Usage: lsscsi  [--brief] [--classic] [--controllers] [--device] [--generic]
              [--help] [--hosts] [--kname] [--list] [--long] [--long-unit]
              [--lunhex] [--no-nvme] [--pdt] [--protection] [--prot-mode]
              [--scsi_id] [--size] [--sz-lbs] [--sysfsroot=PATH] [--transport]
              [--unit] [--verbose] [--version] [--wwn]  [<h:c:t:l>]

where:
  --brief|-b          tuple and device name only
  --classic|-c        alternate output similar to 'cat /proc/scsi/scsi'
```

```
--controllers|-C    synonym for --hosts since NVMe controllers treated
                     like SCSI hosts
--device|-d         show device node's major + minor numbers
--generic|-g        show scsi generic device name
--help|-h           this usage information
--hosts|-H          lists scsi hosts rather than scsi devices
--kname|-k          show kernel name instead of device node name
--list|-L           additional information output one
                     attribute=value per line
--long|-l           additional information output
--long-unit|-U      print LU name in full, use twice to prefix with
                     '.naa', 'eui.', 'uuid.' or 't10.'
--lunhex|-x         show LUN part of tuple as hex number in T10 format;
                     use twice to get full 16 digit hexadecimal LUN
--no-nvme|-N        exclude NVMe devices from output
--pdt|-D            show the peripheral device type in hex
--protection|-p     show target and initiator protection information
--protmode|-P       show negotiated protection information mode
--scsi_id|-i        show udev derived /dev/disk/by-id/scsi* entry
--size|-s           show disk size, (once for decimal (e.g. 3 GB),
                     twice for power of two (e.g. 2.7 GiB),
                     thrice for number of blocks))
--sysfsroot=PATH|-y PATH    set sysfs mount point to PATH (def: /sys)
--sz-lbs|-S         show size as a number of logical blocks; if used twice
                     adds comma followed by logical block size in bytes
--transport|-t      transport information for target or, if '--hosts'
                     given, for initiator
--unit|-u           logical unit (LU) name (aka WWN for ATA/SATA)
--verbose|-v        output path names where data is found
--version|-V        output version string and exit
--wwn|-w            output WWN for disks (from /dev/disk/by-id/wwn*)
<h:c:t:l>          filter output list (def: '*:*:*:*' (all)). Meaning:
                     <host_num:controller:target:lun> or for NVMe:
                     <'N':ctl_num:cntlid:namespace_id>
```

List SCSI devices or hosts, followed by NVMe namespaces or controllers. Many storage devices (e.g. SATA disks and USB attached storage) use SCSI command sets and hence are also listed by this utility. Hyphenated long options can also take underscore (and vice versa).

## 1.5 - La Commande lscpu

Cett commande vous renseigne sur l'architecture des CPUs :

```
[root@centos8 ~]# lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                8
On-line CPU(s) list:  0-7
Thread(s) per core:    1
Core(s) per socket:    4
Socket(s):             2
NUMA node(s):          1
Vendor ID:             GenuineIntel
BIOS Vendor ID:        QEMU
CPU family:            6
Model:                 158
Model name:            Intel(R) Xeon(R) CPU E3-1270 v6 @ 3.80GHz
BIOS Model name:       pc-i440fx-7.0
Stepping:              9
CPU MHz:               3791.998
BogoMIPS:              7583.99
Virtualization:        VT-x
Hypervisor vendor:     KVM
Virtualization type:   full
L1d cache:             32K
L1i cache:             32K
```

```
L2 cache:          4096K
L3 cache:          16384K
NUMA node0 CPU(s): 0-7
Flags:             fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ss ht syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon rep_good nopl xtopology cpuid tsc_known_freq
pni pclmulqdq vmx ssse3 fma cx16 pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx
f16c rdrand hypervisor lahf_lm abm 3dnowprefetch cpuid_fault invpcid_single pti ssbd ibrs ibpb stibp tpr_shadow
vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm mpx rdseed adx
smap clflushopt xsaveopt xsavec xgetbv1 xsaves arat umip md_clear arch_capabilities
```

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# lscpu --help
```

### Usage:

```
lscpu [options]
```

Display information about the CPU architecture.

### Options:

|                         |                                                     |
|-------------------------|-----------------------------------------------------|
| -a, --all               | print both online and offline CPUs (default for -e) |
| -b, --online            | print online CPUs only (default for -p)             |
| -c, --offline           | print offline CPUs only                             |
| -J, --json              | use JSON for default or extended format             |
| -e, --extended[=<list>] | print out an extended readable format               |
| -p, --parse[=<list>]    | print out a parsable format                         |
| -s, --sysroot <dir>     | use specified directory as system root              |
| -x, --hex               | print hexadecimal masks rather than lists of CPUs   |
| -y, --physical          | print physical instead of logical IDs               |
| -h, --help              | display this help                                   |



-V, --version            display version

Available output columns:

|              |                                               |
|--------------|-----------------------------------------------|
| CPU          | logical CPU number                            |
| CORE         | logical core number                           |
| SOCKET       | logical socket number                         |
| CLUSTER      | logical cluster number                        |
| NODE         | logical NUMA node number                      |
| BOOK         | logical book number                           |
| DRAWER       | logical drawer number                         |
| CACHE        | shows how caches are shared between CPUs      |
| POLARIZATION | CPU dispatching mode on virtual hardware      |
| ADDRESS      | physical address of a CPU                     |
| CONFIGURED   | shows if the hypervisor has allocated the CPU |
| ONLINE       | shows if Linux currently makes use of the CPU |
| MAXMHZ       | shows the maximum MHz of the CPU              |
| MINMHZ       | shows the minimum MHz of the CPU              |

For more details see `lscpu(1)`.

## 1.6 - La Commande lshw

Cette commande vous renseigne sur le matériel selon la **classe** de celui-ci. Commencez par visualiser les périphériques et leurs classes répectives :

```
[root@centos8 ~]# lshw -businfo
```

| Bus info | Device | Class     | Description                               |
|----------|--------|-----------|-------------------------------------------|
| =====    |        |           |                                           |
|          |        | system    | Standard PC (i440FX + PIIX, 1996)         |
|          |        | bus       | Motherboard                               |
|          |        | memory    | 96KiB BIOS                                |
| cpu@0    |        | processor | Intel(R) Xeon(R) CPU E3-1270 v6 @ 3.80GHz |
| cpu@1    |        | processor | Intel(R) Xeon(R) CPU E3-1270 v6 @ 3.80GHz |
|          |        | memory    | 16GiB System Memory                       |

|                  |            |         |                                               |
|------------------|------------|---------|-----------------------------------------------|
|                  |            | memory  | DIMM RAM [empty]                              |
| pci@0000:00:00.0 |            | bridge  | 440FX - 82441FX PMC [Natoma]                  |
| pci@0000:00:01.0 |            | bridge  | 82371SB PIIX3 ISA [Natoma/Triton II]          |
|                  |            | input   | PnP device PNP0303                            |
|                  |            | input   | PnP device PNP0f13                            |
|                  |            | storage | PnP device PNP0700                            |
|                  |            | system  | PnP device PNP0b00                            |
| pci@0000:00:01.1 | scsi1      | storage | 82371SB PIIX3 IDE [Natoma/Triton II]          |
| scsi@1:0.0.0     | /dev/cdrom | disk    | QEMU DVD-ROM                                  |
| pci@0000:00:01.2 |            | bus     | 82371SB PIIX3 USB [Natoma/Triton II]          |
| usb@1            | usb1       | bus     | UHCI Host Controller                          |
| usb@1:1          | input5     | input   | QEMU QEMU USB Tablet                          |
| pci@0000:00:01.3 |            | bridge  | 82371AB/EB/MB PIIX4 ACPI                      |
| pci@0000:00:02.0 | /dev/fb0   | display | bochs-drmdrmfb                                |
| pci@0000:00:03.0 |            | generic | Virtio memory balloon                         |
| virtio@0         |            | generic | Virtual I/O device                            |
| pci@0000:00:07.0 | scsi2      | storage | 82801IR/IO/IH (ICH9R/D0/DH) 6 port SATA Contr |
| scsi@2:0.0.0     | /dev/sda   | disk    | 34GB QEMU HARDDISK                            |
| scsi@2:0.0.0,1   | /dev/sda1  | volume  | 1GiB EXT4 volume                              |
| scsi@2:0.0.0,2   | /dev/sda2  | volume  | 30GiB Linux LVM Physical Volume partition     |
| scsi@3:0.0.0     | /dev/sdb   | disk    | 4294MB QEMU HARDDISK                          |
| scsi@4:0.0.0     | /dev/sdc   | disk    | 68GB QEMU HARDDISK                            |
| scsi@4:0.0.0,1   | /dev/sdc1  | volume  | 63GiB EXT4 volume                             |
| scsi@5:0.0.0     | /dev/sdd   | disk    | 34GB QEMU HARDDISK                            |
| pci@0000:00:12.0 |            | network | Virtio network device                         |
| virtio@1         | ens18      | network | Ethernet interface                            |
| pci@0000:00:13.0 |            | network | Virtio network device                         |
| virtio@2         | ens19      | network | Ethernet interface                            |
| pci@0000:00:1e.0 |            | bridge  | QEMU PCI-PCI bridge                           |
| pci@0000:00:1f.0 |            | bridge  | QEMU PCI-PCI bridge                           |
|                  | input0     | input   | Power Button                                  |
|                  | input1     | input   | AT Translated Set 2 keyboard                  |
|                  | input3     | input   | VirtualPS/2 VMware VMMouse                    |
|                  | input4     | input   | VirtualPS/2 VMware VMMouse                    |

|        |       |            |
|--------|-------|------------|
| input6 | input | PC Speaker |
|--------|-------|------------|

Consultez maintenant le matériel de la classe **system** :

```
[root@centos8 ~]# lshw -c system
centos8.ittraining.loc
  description: Computer
  product: Standard PC (i440FX + PIIX, 1996)
  vendor: QEMU
  version: pc-i440fx-7.0
  width: 64 bits
  capabilities: smbios-2.8 dmi-2.8 smp vsyscall32
  configuration: boot=normal uuid=95bd69e3-4a74-44a7-b58c-b74fbfb86df2
*-pnp00:03
  product: PnP device PNP0b00
  physical id: 3
  capabilities: pnp
  configuration: driver=rtc_cmos
```

Consultez maintenant le matériel des autres classes principales :

```
[root@centos8 ~]# lshw -c memory
*-firmware
  description: BIOS
  vendor: SeaBIOS
  physical id: 0
  version: rel-1.16.0-0-gd239552ce722-prebuilt.qemu.org
  date: 04/01/2014
  size: 96KiB
*-memory
  description: System Memory
  physical id: 1000
  size: 16GiB
  capabilities: ecc
```

```
configuration: errordetection=multi-bit-ecc
*-bank
  description: DIMM RAM [empty]
  vendor: QEMU
  physical id: 0
  slot: DIMM 0
```

```
[root@centos8 ~]# lshw -c video
```

```
*-display
  description: VGA compatible controller
  product: bochs-drmdrmfb
  physical id: 2
  bus info: pci@0000:00:02.0
  logical name: /dev/fb0
  version: 02
  width: 32 bits
  clock: 33MHz
  capabilities: vga_controller rom fb
  configuration: depth=32 driver=bochs-drm latency=0 resolution=1280,800
  resources: irq:0 memory:fd000000-fdffffff memory:fea90000-fea90fff memory:c0000-dffff
```

```
[root@centos8 ~]# lshw -c storage
```

```
*-pnp00:02
  product: PnP device PNP0700
  physical id: 2
  capabilities: pnp
*-ide
  description: IDE interface
  product: 82371SB PIIX3 IDE [Natoma/Triton II]
  vendor: Intel Corporation
  physical id: 1.1
  bus info: pci@0000:00:01.1
  logical name: scsi1
```

```
version: 00
width: 32 bits
clock: 33MHz
capabilities: ide isa_compat_mode bus_master emulated
configuration: driver=ata_piix latency=0
resources: irq:0 ioport:1f0(size=8) ioport:3f6 ioport:170(size=8) ioport:376 ioport:e0c0(size=16)
```

\*-sata

```
description: SATA controller
product: 82801IR/IO/IH (ICH9R/D0/DH) 6 port SATA Controller [AHCI mode]
vendor: Intel Corporation
physical id: 7
bus info: pci@0000:00:07.0
logical name: scsi2
logical name: scsi3
logical name: scsi4
logical name: scsi5
version: 02
width: 32 bits
clock: 33MHz
capabilities: sata msi ahci_1.0 bus_master cap_list emulated
configuration: driver=ahci latency=0
resources: irq:30 ioport:e060(size=32) memory:fea91000-fea91fff
```

[root@centos8 ~]# lshw -c disk

\*-cdrom

```
description: DVD reader
product: QEMU DVD-ROM
vendor: QEMU
physical id: 0.0.0
bus info: scsi@1:0.0.0
logical name: /dev/cdrom
logical name: /dev/sr0
version: 2.5+
```

```
capabilities: removable audio dvd
configuration: ansiversion=5 status=nodisc
*-disk:0
  description: ATA Disk
  product: QEMU HARDDISK
  physical id: 0
  bus info: scsi@2:0.0.0
  logical name: /dev/sda
  version: 2.5+
  serial: QM00005
  size: 32GiB (34GB)
  capabilities: partitioned partitioned:dos
  configuration: ansiversion=5 logicalsectorsize=512 sectorsize=512 signature=b39ec5c8
*-disk:1
  description: ATA Disk
  product: QEMU HARDDISK
  physical id: 1
  bus info: scsi@3:0.0.0
  logical name: /dev/sdb
  version: 2.5+
  serial: QM00007
  size: 4GiB (4294MB)
  configuration: ansiversion=5 logicalsectorsize=512 sectorsize=512
*-disk:2
  description: ATA Disk
  product: QEMU HARDDISK
  physical id: 2
  bus info: scsi@4:0.0.0
  logical name: /dev/sdc
  version: 2.5+
  serial: QM00009
  size: 64GiB (68GB)
  capabilities: partitioned partitioned:dos
  configuration: ansiversion=5 logicalsectorsize=512 sectorsize=512 signature=45352f44
```

```
*-disk:3
  description: ATA Disk
  product: QEMU HARDDISK
  physical id: 3
  bus info: scsi@5:0.0.0
  logical name: /dev/sdd
  version: 2.5+
  serial: QM00011
  size: 32GiB (34GB)
  configuration: ansiversion=5 logicalsectorsize=512 sectorsize=512
```

```
[root@centos8 ~]# lshw -c volume
```

```
*-volume:0
  description: EXT4 volume
  vendor: Linux
  physical id: 1
  bus info: scsi@2:0.0.0,1
  logical name: /dev/sda1
  logical name: /boot
  version: 1.0
  serial: 1c04981e-5317-4b73-9695-3ce25246835d
  size: 1GiB
  capacity: 1GiB
  capabilities: primary bootable journaled extended_attributes large_files huge_files dir_nlink recover
64bit extents ext4 ext2 initialized
  configuration: created=2021-06-16 12:21:27 filesystem=ext4 lastmountpoint=/boot modified=2022-11-10
07:12:41 mount.fstype=ext4 mount.options=rw,seclabel,relatime mounted=2022-11-10 07:12:41 state=mounted
*-volume:1
  description: Linux LVM Physical Volume partition
  physical id: 2
  bus info: scsi@2:0.0.0,2
  logical name: /dev/sda2
  serial: k0JTuY-TbBA-JSvU-vhkb-rvpz-QoPt-bIKe2e
```

```
    size: 30GiB
    capacity: 30GiB
    capabilities: primary multi lvm2
*-volume
    description: EXT4 volume
    vendor: Linux
    physical id: 1
    bus info: scsi@4:0.0.0,1
    logical name: /dev/sdc1
    logical name: /home
    version: 1.0
    serial: f76d6b66-985b-4a91-af9c-4987e8c1443c
    size: 63GiB
    capacity: 63GiB
    capabilities: primary journaled extended_attributes large_files huge_files dir_nlink recover 64bit extents
ext4 ext2 initialized
    configuration: created=2021-07-19 18:02:13 filesystem=ext4 lastmountpoint=/home modified=2022-11-10
15:34:07 mount.fstype=ext4 mount.options=rw,seclabel,relatime mounted=2022-11-10 15:34:07 state=mounted

[root@centos8 ~]# lshw -c network
*-network:0
    description: Ethernet controller
    product: Virtio network device
    vendor: Red Hat, Inc.
    physical id: 12
    bus info: pci@0000:00:12.0
    version: 00
    width: 64 bits
    clock: 33MHz
    capabilities: msix bus_master cap_list rom
    configuration: driver=virtio-pci latency=0
    resources: irq:10 ioport:e080(size=32) memory:fea92000-fea92fff memory:fe404000-fe407fff memory:fea00000-
fea3ffff
*-virtio1
```



```
description: Ethernet interface
physical id: 0
bus info: virtio@1
logical name: ens18
serial: 5e:3f:e8:43:d5:f9
capabilities: ethernet physical
configuration: autonegotiation=off broadcast=yes driver=virtio_net driverversion=1.0.0 ip=10.0.2.45
link=yes multicast=yes
*-network:1
description: Ethernet controller
product: Virtio network device
vendor: Red Hat, Inc.
physical id: 13
bus info: pci@0000:00:13.0
version: 00
width: 64 bits
clock: 33MHz
capabilities: msix bus_master cap_list rom
configuration: driver=virtio-pci latency=0
resources: irq:10 ioport:e0a0(size=32) memory:fea93000-fea93fff memory:fe408000-fe40bfff memory:fea40000-
fea7ffff
*-virtio2
description: Ethernet interface
physical id: 0
bus info: virtio@2
logical name: ens19
serial: ea:c8:86:9e:73:a6
capabilities: ethernet physical
configuration: autonegotiation=off broadcast=yes driver=virtio_net driverversion=1.0.0 link=yes
multicast=yes
```

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# lshw -h
Hardware Lister (lshw) - B.02.19.2
usage: lshw [-format] [-options ...]
        lshw -version

        -version          print program version (B.02.19.2)

format can be
    -html                output hardware tree as HTML
    -xml                 output hardware tree as XML
    -json                output hardware tree as a JSON object
    -short               output hardware paths
    -businfo             output bus information

options can be
    -dump filename       displays output and dump collected information into a file (SQLite database)
    -class CLASS          only show a certain class of hardware
    -C CLASS              same as '-class CLASS'
    -c CLASS              same as '-class CLASS'
    -disable TEST         disable a test (like pci, isapnp, cpuid, etc. )
    -enable TEST          enable a test (like pci, isapnp, cpuid, etc. )
    -quiet                don't display status
    -sanitize             sanitize output (remove sensitive information like serial numbers, etc.)
    -numeric              output numeric IDs (for PCI, USB, etc.)
    -notime               exclude volatile attributes (timestamps) from output
```

## 1.7 - La Commande dmidecode

La commande **dmidecode** lit la table **DMI** (*Desktop Management Interface*) aussi appelée **SMBIOS** (*System Management BIOS*) et fourni les informations sur :

- l'état du matériel actuel,
- les extensions possibles.

```
[root@centos8 ~]# dmidecode
# dmidecode 3.2
Getting SMBIOS data from sysfs.
SMBIOS 2.8 present.
11 structures occupying 511 bytes.
Table at 0x000F5870.

Handle 0x0000, DMI type 0, 24 bytes
BIOS Information
    Vendor: SeaBIOS
    Version: rel-1.14.0-0-g155821a1990b-prebuilt.qemu.org
    Release Date: 04/01/2014
    Address: 0xE8000
    Runtime Size: 96 kB
    ROM Size: 64 kB
    Characteristics:
        BIOS characteristics not supported
        Targeted content distribution is supported
    BIOS Revision: 0.0

Handle 0x0100, DMI type 1, 27 bytes
System Information
    Manufacturer: QEMU
    Product Name: Standard PC (i440FX + PIIX, 1996)
    Version: pc-i440fx-5.2
    Serial Number: Not Specified
    UUID: 95bd69e3-4a74-44a7-b58c-b74fbfb86df2
    Wake-up Type: Power Switch
    SKU Number: Not Specified
    Family: Not Specified
```

Handle 0x0300, DMI type 3, 22 bytes

Chassis Information

Manufacturer: QEMU  
Type: Other  
Lock: Not Present  
Version: pc-i440fx-5.2  
Serial Number: Not Specified  
Asset Tag: Not Specified  
Boot-up State: Safe  
Power Supply State: Safe  
Thermal State: Safe  
Security Status: Unknown  
OEM Information: 0x00000000  
Height: Unspecified  
Number Of Power Cords: Unspecified  
Contained Elements: 0  
SKU Number: Not Specified

Handle 0x0400, DMI type 4, 42 bytes

Processor Information

Socket Designation: CPU 0  
Type: Central Processor  
Family: Other  
Manufacturer: QEMU  
ID: 61 0F 00 00 FF FB 8B 07  
Version: pc-i440fx-5.2  
Voltage: Unknown  
External Clock: Unknown  
Max Speed: 2000 MHz  
Current Speed: 2000 MHz  
Status: Populated, Enabled  
Upgrade: Other  
L1 Cache Handle: Not Provided  
L2 Cache Handle: Not Provided

L3 Cache Handle: Not Provided  
Serial Number: Not Specified  
Asset Tag: Not Specified  
Part Number: Not Specified  
Core Count: 4  
Core Enabled: 4  
Thread Count: 1  
Characteristics: None

Handle 0x0401, DMI type 4, 42 bytes  
Processor Information

Socket Designation: CPU 1  
Type: Central Processor  
Family: Other  
Manufacturer: QEMU  
ID: 61 0F 00 00 FF FB 8B 07  
Version: pc-i440fx-5.2  
Voltage: Unknown  
External Clock: Unknown  
Max Speed: 2000 MHz  
Current Speed: 2000 MHz  
Status: Populated, Enabled  
Upgrade: Other  
L1 Cache Handle: Not Provided  
L2 Cache Handle: Not Provided  
L3 Cache Handle: Not Provided  
Serial Number: Not Specified  
Asset Tag: Not Specified  
Part Number: Not Specified  
Core Count: 4  
Core Enabled: 4  
Thread Count: 1  
Characteristics: None

Handle 0x1000, DMI type 16, 23 bytes

Physical Memory Array

Location: Other

Use: System Memory

Error Correction Type: Multi-bit ECC

Maximum Capacity: 4 GB

Error Information Handle: Not Provided

Number Of Devices: 1

Handle 0x1100, DMI type 17, 40 bytes

Memory Device

Array Handle: 0x1000

Error Information Handle: Not Provided

Total Width: Unknown

Data Width: Unknown

Size: 4 GB

Form Factor: DIMM

Set: None

Locator: DIMM 0

Bank Locator: Not Specified

Type: RAM

Type Detail: Other

Speed: Unknown

Manufacturer: QEMU

Serial Number: Not Specified

Asset Tag: Not Specified

Part Number: Not Specified

Rank: Unknown

Configured Memory Speed: Unknown

Minimum Voltage: Unknown

Maximum Voltage: Unknown

Configured Voltage: Unknown

Handle 0x1300, DMI type 19, 31 bytes

```
Memory Array Mapped Address
  Starting Address: 0x000000000000
  Ending Address: 0x000BFFFFFFF
  Range Size: 3 GB
  Physical Array Handle: 0x1000
  Partition Width: 1
```

```
Handle 0x1301, DMI type 19, 31 bytes
Memory Array Mapped Address
  Starting Address: 0x001000000000
  Ending Address: 0x0013FFFFFFF
  Range Size: 1 GB
  Physical Array Handle: 0x1000
  Partition Width: 1
```

```
Handle 0x2000, DMI type 32, 11 bytes
System Boot Information
  Status: No errors detected
```

```
Handle 0x7F00, DMI type 127, 4 bytes
End Of Table
```

## Options de la commande

Les options de cette commande sont :

```
[root@centos7 ~]# dmidecode --help
Usage: dmidecode [OPTIONS]
Options are:
  -d, --dev-mem FILE      Read memory from device FILE (default: /dev/mem)
  -h, --help              Display this help text and exit
  -q, --quiet             Less verbose output
  -s, --string KEYWORD    Only display the value of the given DMI string
```

|                  |                                        |
|------------------|----------------------------------------|
| -t, --type TYPE  | Only display the entries of given type |
| -u, --dump       | Do not decode the entries              |
| --dump-bin FILE  | Dump the DMI data to a binary file     |
| --from-dump FILE | Read the DMI data from a binary file   |
| -V, --version    | Display the version and exit           |

## 1.8 - La Commande smartctl

**smartctl** contrôle le système SMART (Self-Monitoring, Analysis and Reporting Technology) intégré à la plupart des disques durs et disques SSD ATA/SATA et SCSI/SAS :

```
[root@centos8 ~]# smartctl --smart=on --saveauto=on --offlineauto=on /dev/sdb

[root@centos8 ~]# smartctl -a /dev/sdb
smartctl 7.1 2020-04-05 r5049 [x86_64-linux-4.18.0-305.7.1.el8_4.x86_64] (local build)
Copyright (C) 2002-19, Bruce Allen, Christian Franke, www.smartmontools.org

=== START OF INFORMATION SECTION ===
Device Model:          QEMU HARDDISK
Serial Number:         QM00007
Firmware Version:      2.5+
User Capacity:         4,294,967,296 bytes [4.29 GB]
Sector Size:           512 bytes logical/physical
Device is:              Not in smartctl database [for details use: -P showall]
ATA Version is:         ATA/ATAPI-7, ATA/ATAPI-5 published, ANSI NCITS 340-2000
Local Time is:          Sun Nov 13 09:12:18 2022 CET
SMART support is:       Available - device has SMART capability.
SMART support is:       Enabled

=== START OF READ SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED

General SMART Values:
```



Offline data collection status: (0x02) Offline data collection activity was completed without error.  
Auto Offline Data Collection: Disabled.

Self-test execution status: ( 0) The previous self-test routine completed without error or no self-test has ever been run.

Total time to complete Offline data collection: ( 288) seconds.

Offline data collection capabilities: (0x19) SMART execute Offline immediate.  
No Auto Offline data collection support.  
Suspend Offline collection upon new command.  
Offline surface scan supported.  
Self-test supported.  
No Conveyance Self-test supported.  
No Selective Self-test supported.

SMART capabilities: (0x0003) Saves SMART data before entering power-saving mode.  
Supports SMART auto save timer.

Error logging capability: (0x01) Error logging supported.  
No General Purpose Logging support.

Short self-test routine recommended polling time: ( 2) minutes.

Extended self-test routine recommended polling time: ( 54) minutes.

SMART Attributes Data Structure revision number: 1

Vendor Specific SMART Attributes with Thresholds:

| ID# | ATTRIBUTE_NAME        | FLAG   | VALUE | WORST | THRESH | TYPE     | UPDATED | WHEN_FAILED | RAW_VALUE |
|-----|-----------------------|--------|-------|-------|--------|----------|---------|-------------|-----------|
| 1   | Raw_Read_Error_Rate   | 0x0003 | 100   | 100   | 006    | Pre-fail | Always  | -           | 0         |
| 3   | Spin_Up_Time          | 0x0003 | 100   | 100   | 000    | Pre-fail | Always  | -           | 16        |
| 4   | Start_Stop_Count      | 0x0002 | 100   | 100   | 020    | Old_age  | Always  | -           | 100       |
| 5   | Reallocated_Sector_Ct | 0x0003 | 100   | 100   | 036    | Pre-fail | Always  | -           | 0         |

|     |                         |        |     |     |     |          |        |   |                    |
|-----|-------------------------|--------|-----|-----|-----|----------|--------|---|--------------------|
| 9   | Power_On_Hours          | 0x0003 | 100 | 100 | 000 | Pre-fail | Always | - | 1                  |
| 12  | Power_Cycle_Count       | 0x0003 | 100 | 100 | 000 | Pre-fail | Always | - | 0                  |
| 190 | Airflow_Temperature_Cel | 0x0003 | 069 | 069 | 050 | Pre-fail | Always | - | 31 (Min/Max 31/31) |

SMART Error Log Version: 1

No Errors Logged

SMART Self-test log structure revision number 1

No self-tests have been logged. [To run self-tests, use: smartctl -t]

Selective Self-tests/Logging not supported

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# smartctl --help
smartctl 7.1 2020-04-05 r5049 [x86_64-linux-4.18.0-305.7.1.el8_4.x86_64] (local build)
Copyright (C) 2002-19, Bruce Allen, Christian Franke, www.smartmontools.org
```

Usage: smartctl [options] device

===== SHOW INFORMATION OPTIONS =====

- h, --help, --usage  
Display this help and exit
- V, --version, --copyright, --license  
Print license, copyright, and version information and exit
- i, --info  
Show identity information for device

```
--identify[=[w][nvb]]  
    Show words and bits from IDENTIFY DEVICE data                (ATA)
```

```
-g NAME, --get=NAME  
    Get device setting: all, aam, apm, dsn, lookahead, security,  
    wcache, rcache, wcreorder, wcache-sct
```

```
-a, --all  
    Show all SMART information for device
```

```
-x, --xall  
    Show all information for device
```

```
--scan  
    Scan for devices
```

```
--scan-open  
    Scan for devices and try to open each device
```

===== SMARTCTL RUN-TIME BEHAVIOR OPTIONS =====

```
-j, --json=[cgiosuv]  
    Print output in JSON format
```

```
-q TYPE, --quietmode=TYPE                (ATA)  
    Set smartctl quiet mode to one of: erroronly, silent, noserial
```

```
-d TYPE, --device=TYPE  
    Specify device type to one of:  
    ata, scsi[+TYPE], nvme[,NSID], sat[,auto][,N][+TYPE], usbcypress[,X], usbjmicron[,p][,x][,N],  
    usbprolific, usbsunplus, sntjmicron[,NSID], intelliprop,N[+TYPE], jmb39x,N[,sLBA][,force][+TYPE], marvell,  
    areca,N/E, 3ware,N, hpt,L/M/N, megaraid,N, aacraid,H,L,ID, cciss,N, auto, test
```

```
-T TYPE, --tolerance=TYPE                (ATA)
```

Tolerance: normal, conservative, permissive, verypermissive

-b TYPE, --badsum=TYPE (ATA)

Set action on bad checksum to one of: warn, exit, ignore

-r TYPE, --report=TYPE

Report transactions (see man page)

-n MODE[,STATUS], --nocheck=MODE[,STATUS] (ATA)

No check if: never, sleep, standby, idle (see man page)

===== DEVICE FEATURE ENABLE/DISABLE COMMANDS =====

-s VALUE, --smart=VALUE

Enable/disable SMART on device (on/off)

-o VALUE, --offlineauto=VALUE (ATA)

Enable/disable automatic offline testing on device (on/off)

-S VALUE, --saveauto=VALUE (ATA)

Enable/disable Attribute autosave on device (on/off)

-s NAME[,VALUE], --set=NAME[,VALUE]

Enable/disable/change device setting: aam,[N|off], apm,[N|off],  
dsn,[on|off], lookahead,[on|off], security-freeze,  
standby,[N|off|now], wcache,[on|off], rcache,[on|off],  
wcreorder,[on|off[,p]], wcache-sct,[ata|on|off[,p]]

===== READ AND DISPLAY DATA OPTIONS =====

-H, --health

Show device SMART health status

-c, --capabilities (ATA, NVMe)

## Show device SMART capabilities

```
-A, --attributes
    Show device SMART vendor-specific Attributes and values

-f FORMAT, --format=FORMAT                                     (ATA)
    Set output format for attributes: old, brief, hex[,id|val]

-l TYPE, --log=TYPE
    Show device log. TYPE: error, selftest, selective, directory[,g|s],
    xerror[,N][,error], xselftest[,N][,selftest], background,
    sasphy[,reset], sataphy[,reset], scttemp[sts,hist],
    scttempint,N[,p], scterc[,N,M], devstat[,N], defects[,N], ssd,
    gplog,N[,RANGE], smartlog,N[,RANGE], nvme-log,N,SIZE

-v N,OPTION , --vendorattribute=N,OPTION                       (ATA)
    Set display OPTION for vendor Attribute N (see man page)

-F TYPE, --firmwarebug=TYPE                                    (ATA)
    Use firmware bug workaround:
    none, nologdir, samsung, samsung2, samsung3, xerrorlba, swapid

-P TYPE, --presets=TYPE                                        (ATA)
    Drive-specific presets: use, ignore, show, showall

-B [+]FILE, --drivedb=[+]FILE                                   (ATA)
    Read and replace [add] drive database from FILE
    [default is +/etc/smartmontools/smart_drivedb.h
    and then    /usr/share/smartmontools/drivedb.h]

===== DEVICE SELF-TEST OPTIONS =====

-t TEST, --test=TEST
    Run test. TEST: offline, short, long, conveyance, force, vendor,N,
```

```
select,M-N, pending,N, afterselect,[on|off]
```

```
-C, --captive
```

```
    Do test in captive mode (along with -t)
```

```
-X, --abort
```

```
    Abort any non-captive test on device
```

```
===== SMARTCTL EXAMPLES =====
```

```
smartctl --all /dev/sda                (Prints all SMART information)
```

```
smartctl --smart=on --offlineauto=on --saveauto=on /dev/sda  
                                         (Enables SMART on first disk)
```

```
smartctl --test=long /dev/sda          (Executes extended disk self-test)
```

```
smartctl --attributes --log=selftest --quietmode=errorsonly /dev/sda  
                                         (Prints Self-Test & Attribute errors)
```

```
smartctl --all --device=3ware,2 /dev/sda
```

```
smartctl --all --device=3ware,2 /dev/twe0
```

```
smartctl --all --device=3ware,2 /dev/twa0
```

```
smartctl --all --device=3ware,2 /dev/twl0
```

```
    (Prints all SMART info for 3rd ATA disk on 3ware RAID controller)
```

```
smartctl --all --device=hpt,1/1/3 /dev/sda
```

```
    (Prints all SMART info for the SATA disk attached to the 3rd PMPort  
    of the 1st channel on the 1st HighPoint RAID controller)
```

```
smartctl --all --device=areca,3/1 /dev/sg2
```

```
    (Prints all SMART info for 3rd ATA disk of the 1st enclosure  
    on Areca RAID controller)
```

## 1.9 - Les Commandes accton et dump-acct

Cette commande permet d'activer ou désactiver la comptabilisation des processus :

```
[root@centos8 ~]# accton on
Turning on process accounting, file set to the default '/var/account/pacct'.
[root@centos8 ~]# systemctl status psacct
● psacct.service - Kernel process accounting
   Loaded: loaded (/usr/lib/systemd/system/psacct.service; disabled; vendor preset: d>
   Active: inactive (dead)
...skipping...
● psacct.service - Kernel process accounting
   Loaded: loaded (/usr/lib/systemd/system/psacct.service; disabled; vendor preset: d>
   Active: inactive (dead)

[root@centos8 ~]# systemctl enable psacct
Created symlink /etc/systemd/system/multi-user.target.wants/psacct.service →
/usr/lib/systemd/system/psacct.service.

[root@centos8 ~]# systemctl start psacct

[root@centos8 ~]# systemctl status psacct
● psacct.service - Kernel process accounting
   Loaded: loaded (/usr/lib/systemd/system/psacct.service; enabled; vendor preset: di>
   Active: active (exited) since Sun 2022-11-13 09:35:16 CET; 4s ago
   Process: 39765 ExecStart=/usr/sbin/accton /var/account/pacct (code=exited, status=0>
   Process: 39763 ExecStartPre=/usr/libexec/psacct/accton-create (code=exited, status=>
   Main PID: 39765 (code=exited, status=0/SUCCESS)

Nov 13 09:35:16 centos8.ittraining.loc systemd[1]: Starting Kernel process accounting>
Nov 13 09:35:16 centos8.ittraining.loc accton[39765]: Turning on process accounting, >
Nov 13 09:35:16 centos8.ittraining.loc systemd[1]: Started Kernel process accounting.
```

Par contre le fichier **/var/account/pacct** ne peut pas être lu avec les utilitaires de consultation de fichiers texte :

```
[root@centos8 ~]# cat /var/account/pacct
#pcKaccton pcEusleep%$pcu,awk$pc-iksmtuned('pc6pgrep'&pc-`ksmtuned)&pc,Eksmtuned*&pcd,awk&pc-
ksmtuned/. 'pc`D$less.'pcDEsystemctl+pcEssleep107pcu,awk07pc-jksmtuned437pc6pgrep327pc-
bksmtuned527pc,Gksmtuned627pcd,awk27pc-ksmtuned?9;pc2rpc-pipefs-gene=9;pc2nfs-server-geneA9;pcEsystemd-
cryptseI9;pcEsystemd-system-G9;pcEsystemd-hibernaC9;pcEsystemd-fstab-
gE;;pc(^readlinkM;;pc$dgrepJ<;pc?lvmconfigN@;pc&`selinuxenabled;9;pc?s+Hkdump-dep-gener<9;pc?k0lvm2-
activation:9;pc?B+anaconda-generaH9;pc?Esystemd-rc-locas>9;pc?SIostree-system-g0@;pc$agrep@9;pc?B+selinux-
autorelB9;pc?Esystemd-debug-gK9;pc?Esystemd-sysv-geL9;pc?Esystemd-veritysD9;pc?Esystemd-getty-gF9;pc?Esystemd-
gpt-aut9;pc@0C(sd-executor)8;pc`AEsystemctlSDpc?,accton-createUDpcacctonUDpacctonRQDpc@Esystemd-tty-
askQDpc@@EsystemctlTDpcEsystemd-cgroupsVDpcEsystemd-
cgroupsZYIpc`C$lessYIpcACE%systemctlúpcGkworker/dying77pcEssleepdcspcu,awkcspc-iksmtunedgfspc6pgrepfesp-
_ksmtunedhespc,Fksmtunediespcd,awkespc?-ksmtuned[root@centos8 ~]#
```

La commande **dump-acct** permet de voir son contenu mais pas de l'exploiter :

```
[root@centos8 ~]# dump-acct /var/account/pacct
accton          |v3|      0.00|      0.00|      1.00|      0|      0|  4360.00|      0.00|  39715|  37763|S   |
0|pts/0         |Sun Nov 13 09:33:52 2022
sleep          |v3|      0.00|      0.00|  6000.00|      0|      0|  7308.00|      0.00|  39712|   1022|   |
0|__            |Sun Nov 13 09:33:03 2022
awk            |v3|      0.00|      0.00|      0.00|      0|      0| 25512.00|      0.00|  39717|  39716|   |
0|__            |Sun Nov 13 09:34:03 2022
ksmtuned       |v3|      0.00|      0.00|      0.00|      0|      0| 26632.00|      0.00|  39716|   1022| F   |
0|__            |Sun Nov 13 09:34:03 2022
pgrep          |v3|      0.00|      0.00|      0.00|      0|      0| 45104.00|      0.00|  39720|  39719|   |
1|__            |Sun Nov 13 09:34:03 2022
ksmtuned       |v3|      0.00|      0.00|      0.00|      0|      0| 26632.00|      0.00|  39719|  39718| F   |
1|__            |Sun Nov 13 09:34:03 2022
ksmtuned       |v3|      0.00|      0.00|      0.00|      0|      0| 26112.00|      0.00|  39721|  39718| F   |
0|__            |Sun Nov 13 09:34:03 2022
awk            |v3|      0.00|      0.00|      0.00|      0|      0| 25376.00|      0.00|  39722|  39718|   |
0|__            |Sun Nov 13 09:34:03 2022
```



[illegible]

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# dump-acct --help
Usage: dump-acct [-hrR] [-n <recs>] <files>
      [--num <recs>] [--raw] [--reverse] [--help]
      [--format <version>] [--byteswap]
      [--ahz <freq>]
```

The system's default process accounting file is /var/account/pacct.

## 1.10 - La Commande lastcomm

Cette commande vous renseigne sur l'historique et les statistiques des commandes par utilisateur :

```
[root@centos8 ~]# lastcomm
bash          F    root    pts/0      0.00 secs Sun Nov 13 09:41
gdbus         X    root    pts/0      0.00 secs Sun Nov 13 09:41
ksmtuned      F    root    —          0.00 secs Sun Nov 13 09:41
awk           root    —          0.00 secs Sun Nov 13 09:41
kworker/dying F    root    —          0.00 secs Sun Nov 13 09:30
ksmtuned      F    root    —          0.00 secs Sun Nov 13 09:41
ksmtuned      F    root    —          0.00 secs Sun Nov 13 09:41
pgrep         root    —          0.00 secs Sun Nov 13 09:41
ksmtuned      F    root    —          0.00 secs Sun Nov 13 09:41
awk           root    —          0.00 secs Sun Nov 13 09:41
sleep         root    —          0.00 secs Sun Nov 13 09:40
kworker/dying F    root    —          0.00 secs Sun Nov 13 09:07
kworker/dying F    root    —          0.00 secs Sun Nov 13 09:35
kworker/dying F    root    —          0.00 secs Sun Nov 13 09:07
dump-acct     root    pts/0      0.00 secs Sun Nov 13 09:40
```

[illegible]

|                 |   |      |       |      |      |     |     |    |       |
|-----------------|---|------|-------|------|------|-----|-----|----|-------|
| man             | F | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| man             | F | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| awk             |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| pgrep           |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| awk             |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:38 |
| sleep           |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| dump-acct       |   | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| kworker/dying   | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:05 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| awk             |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| pgrep           |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| awk             |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:37 |
| sleep           |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| cat             |   | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| awk             |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| pgrep           |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| ksmtuned        | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| awk             |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:36 |
| sleep           |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| kworker/dying   | F | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:19 |
| systemctl       | S | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| less            | S | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-cgroups |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-cgroups |   | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |

|                 |    |      |       |      |      |     |     |    |       |
|-----------------|----|------|-------|------|------|-----|-----|----|-------|
| systemctl       | S  | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-tty-ask | S  | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| accton          | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| accton          |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| accton-create   | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemctl       | S  | root | pts/0 | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| (sd-executor)   | SF | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-gpt-aut | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-getty-g | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-veritys | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-sysv-ge | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-debug-g | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| selinux-autorel | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| grep            |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| ostree-system-g | S  | root | —     | 0.01 | secs | Sun | Nov | 13 | 09:35 |
| systemd-rc-loca | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| anaconda-genera | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| lvm2-activation | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| kdump-dep-gener | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| selinuxenabled  |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| lvmconfig       |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| grep            |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| readlink        |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-fstab-g | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-hiberna | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-system- | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| systemd-cryptse | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| nfs-server-gene | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| rpc-pipefs-gene | S  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| ksmtuned        | F  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| awk             |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| ksmtuned        | F  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| ksmtuned        | F  | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |
| pgrep           |    | root | —     | 0.00 | secs | Sun | Nov | 13 | 09:35 |

```

ksmtuned      F    root    —      0.00 secs Sun Nov 13 09:35
awk           root    —      0.00 secs Sun Nov 13 09:35
sleep         root    —      0.00 secs Sun Nov 13 09:34
systemctl     S    root    pts/0  0.00 secs Sun Nov 13 09:34
less          S    root    pts/0  0.00 secs Sun Nov 13 09:34
ksmtuned      F    root    —      0.00 secs Sun Nov 13 09:34
awk           root    —      0.00 secs Sun Nov 13 09:34
ksmtuned      F    root    —      0.00 secs Sun Nov 13 09:34
ksmtuned      F    root    —      0.00 secs Sun Nov 13 09:34
pgrep         root    —      0.00 secs Sun Nov 13 09:34
ksmtuned      F    root    —      0.00 secs Sun Nov 13 09:34
awk           root    —      0.00 secs Sun Nov 13 09:34
sleep         root    —      0.00 secs Sun Nov 13 09:33
accton        S    root    pts/0  0.00 secs Sun Nov 13 09:33

[root@centos8 ~]# lastcomm grep
grep          root    pts/0  0.00 secs Sun Nov 13 09:46
grep          root    pts/0  0.00 secs Sun Nov 13 09:45
grep          root    —      0.00 secs Sun Nov 13 09:35
grep          root    —      0.00 secs Sun Nov 13 09:35

```

## Options de la commande

Les options de cette commande sont :

```

[root@centos8 ~]# lastcomm --help
Usage: lastcomm [-hpV] [-f file] [command] ... [user] ... [terminal] ...
      [--forwards] [--file <file>] [--strict-match] [--print-controls]
      [--user <name>] [--tty <name>] [--command <name>] [--debug]
      [--show-paging] [--pid] [--ahz <freq>] [--version] [--help]

```

The system's default process accounting file is /var/account/pacct.

## 1.11 - La Commande sa

Cette commande vous renseigne sur les statistiques sur les processus lancés et leurs ressources systèmes:

```
[root@centos8 ~]# sa -u | egrep "root"
root      0.00 cpu      1090k mem      0 io accton
root      0.00 cpu      1827k mem      0 io sleep
root      0.00 cpu      6378k mem      0 io awk
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu     11276k mem      0 io pgrep
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu      6528k mem      0 io ksmtuned      *
root      0.00 cpu      6344k mem      0 io awk
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu      2426k mem      0 io less
root      0.00 cpu     23376k mem      0 io systemctl
root      0.00 cpu      1827k mem      0 io sleep
root      0.00 cpu      6378k mem      0 io awk
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu     11276k mem      0 io pgrep
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu      6528k mem      0 io ksmtuned      *
root      0.00 cpu      6344k mem      0 io awk
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu      9688k mem      0 io rpc-pipefs-gene
root      0.00 cpu      9720k mem      0 io nfs-server-gene
root      0.00 cpu     22592k mem      0 io systemd-cryptse
root      0.00 cpu     22592k mem      0 io systemd-system-
root      0.00 cpu     22592k mem      0 io systemd-hiberna
root      0.00 cpu     22592k mem      0 io systemd-fstab-g
root      0.00 cpu      1098k mem      0 io readlink
root      0.00 cpu      2302k mem      0 io grep
root      0.00 cpu     16260k mem      0 io lvmconfig
```

|      |      |     |        |     |   |    |                 |   |
|------|------|-----|--------|-----|---|----|-----------------|---|
| root | 0.00 | cpu | 3350k  | mem | 0 | io | selinuxenabled  |   |
| root | 0.00 | cpu | 5862k  | mem | 0 | io | kdump-dep-gener |   |
| root | 0.00 | cpu | 8406k  | mem | 0 | io | lvm2-activation |   |
| root | 0.00 | cpu | 5764k  | mem | 0 | io | anaconda-genera |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-rc-loca |   |
| root | 0.01 | cpu | 38192k | mem | 0 | io | ostree-system-g |   |
| root | 0.00 | cpu | 2302k  | mem | 0 | io | grep            |   |
| root | 0.00 | cpu | 5764k  | mem | 0 | io | selinux-autorel |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-debug-g |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-sysv-ge |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-veritys |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-getty-g |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-gpt-aut |   |
| root | 0.00 | cpu | 63728k | mem | 0 | io | (sd-executor)   | * |
| root | 0.00 | cpu | 23632k | mem | 0 | io | systemctl       |   |
| root | 0.00 | cpu | 6496k  | mem | 0 | io | accton-create   |   |
| root | 0.00 | cpu | 0k     | mem | 0 | io | accton          |   |
| root | 0.00 | cpu | 1090k  | mem | 0 | io | accton          |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-tty-ask |   |
| root | 0.00 | cpu | 23376k | mem | 0 | io | systemctl       |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-cgroups |   |
| root | 0.00 | cpu | 22592k | mem | 0 | io | systemd-cgroups |   |
| root | 0.00 | cpu | 2426k  | mem | 0 | io | less            |   |
| root | 0.00 | cpu | 23376k | mem | 0 | io | systemctl       |   |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying   | * |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep           |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk             |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned        | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned        | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned        | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk             |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned        | * |
| root | 0.00 | cpu | 1828k  | mem | 0 | io | cat             |   |



|      |      |     |        |     |   |    |               |   |
|------|------|-----|--------|-----|---|----|---------------|---|
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep         |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep         |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying | * |
| root | 0.00 | cpu | 1994k  | mem | 0 | io | dump-acct     |   |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep         |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep         |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 4582k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4844k  | mem | 0 | io | man           | * |
| root | 0.00 | cpu | 4186k  | mem | 0 | io | preconv       |   |
| root | 0.00 | cpu | 3476k  | mem | 0 | io | tbl           |   |
| root | 0.00 | cpu | 1831k  | mem | 0 | io | locale        |   |
| root | 0.00 | cpu | 3182k  | mem | 0 | io | nroff         | * |
| root | 0.00 | cpu | 4186k  | mem | 0 | io | troff         |   |
| root | 0.00 | cpu | 3674k  | mem | 0 | io | grotty        |   |
| root | 0.00 | cpu | 3496k  | mem | 0 | io | groff         |   |
| root | 0.00 | cpu | 3182k  | mem | 0 | io | nroff         |   |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man           | * |

|      |      |     |        |     |   |    |               |   |
|------|------|-----|--------|-----|---|----|---------------|---|
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep         |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep         |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying | * |
| root | 0.00 | cpu | 2426k  | mem | 0 | io | less          |   |
| root | 0.01 | cpu | 4770k  | mem | 0 | io | man           |   |
| root | 0.00 | cpu | 1994k  | mem | 0 | io | dump-acct     |   |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep         |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep         |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 2094k  | mem | 0 | io | dump-acct     |   |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying | * |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying | * |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying | * |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep         |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep         |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 0k     | mem | 0 | io | kworker/dying | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk           |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned      | * |
| root | 0.00 | cpu | 93648k | mem | 0 | io | gdbus         |   |

|      |      |     |        |     |   |    |          |   |
|------|------|-----|--------|-----|---|----|----------|---|
| root | 0.00 | cpu | 6888k  | mem | 0 | io | bash     | * |
| root | 0.00 | cpu | 5410k  | mem | 0 | io | lastcomm |   |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep    |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep    |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 4570k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4844k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4186k  | mem | 0 | io | preconv  |   |
| root | 0.00 | cpu | 3476k  | mem | 0 | io | tbl      |   |
| root | 0.00 | cpu | 1831k  | mem | 0 | io | locale   |   |
| root | 0.00 | cpu | 3182k  | mem | 0 | io | nroff    | * |
| root | 0.00 | cpu | 4186k  | mem | 0 | io | troff    |   |
| root | 0.00 | cpu | 3706k  | mem | 0 | io | grotty   |   |
| root | 0.00 | cpu | 3496k  | mem | 0 | io | groff    |   |
| root | 0.00 | cpu | 3182k  | mem | 0 | io | nroff    |   |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep    |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep    |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |

|      |      |     |        |     |   |    |          |   |
|------|------|-----|--------|-----|---|----|----------|---|
| root | 0.00 | cpu | 2426k  | mem | 0 | io | less     |   |
| root | 0.00 | cpu | 4770k  | mem | 0 | io | man      |   |
| root | 0.00 | cpu | 4604k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4760k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4844k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 4186k  | mem | 0 | io | preconv  |   |
| root | 0.00 | cpu | 3476k  | mem | 0 | io | tbl      |   |
| root | 0.00 | cpu | 1831k  | mem | 0 | io | locale   |   |
| root | 0.00 | cpu | 3182k  | mem | 0 | io | nroff    | * |
| root | 0.00 | cpu | 4186k  | mem | 0 | io | troff    |   |
| root | 0.00 | cpu | 3700k  | mem | 0 | io | grotty   |   |
| root | 0.00 | cpu | 3496k  | mem | 0 | io | groff    |   |
| root | 0.00 | cpu | 3182k  | mem | 0 | io | nroff    |   |
| root | 0.00 | cpu | 4804k  | mem | 0 | io | man      | * |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep    |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep    |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 1827k  | mem | 0 | io | sleep    |   |
| root | 0.00 | cpu | 6378k  | mem | 0 | io | awk      |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 11276k | mem | 0 | io | pgrep    |   |
| root | 0.00 | cpu | 6658k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6528k  | mem | 0 | io | ksmtuned | * |
| root | 0.00 | cpu | 6344k  | mem | 0 | io | awk      |   |

```

root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu           0k mem      0 io kworker/dying  *
root      0.00 cpu      2426k mem      0 io less
root      0.00 cpu      4770k mem      0 io man
root      0.00 cpu      5312k mem      0 io sa
root      0.00 cpu      3034k mem      0 io grep
root      0.00 cpu      5312k mem      0 io sa
root      0.00 cpu      1827k mem      0 io sleep
root      0.00 cpu      6378k mem      0 io awk
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu     11276k mem      0 io pgrep
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu      6528k mem      0 io ksmtuned      *
root      0.00 cpu      6344k mem      0 io awk
root      0.00 cpu      6658k mem      0 io ksmtuned      *
root      0.00 cpu           0k mem      0 io kworker/dying  *

```

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# sa --help
```

```

Usage: sa [ options ] [ file ]
options: [-abcdfiljkmnprstuDKP] [-v <num>] [--version] [--help]
[--other-acct-file <name>] [--other-usracct-file <name>]
[--print-seconds] [--dont-read-summary-files] [--debug]
[--separate-times] [--other-savacct-file <name>] [--percentages]
[--print-ratio] [--print-users] [--merge] [--user-summary] [--group-summary]
[--list-all-names] [--not-interactive] [--threshold <num>]
[--sort-ksec] [--sort-tio] [--sort-sys-user-div-calls] [--sort-avio]
[--sort-cpu-avmem] [--sort-num-calls] [--sort-real-time] [--ahz hz]
[--show-paging] [--show-paging-avg]

```

The system's default process accounting files are:

```
raw process accounting data: /var/account/pacct
summary by command name: /var/account/savacct
summary by username: /var/account/usracct
```

## 1.12 - La Commande ac

Cette commande vous renseigne sur les statistiques des temps de connexion des utilisateurs :

```
[root@centos8 ~]# ac -p
      trainee                247.51
      total      247.51
```

```
[root@centos8 ~]# ac -d
Jun 16 total      6.41
Jun 17 total     12.09
Jul 19 total      6.94
Jul 20 total     38.95
Sep  2 total      0.03
Sep  3 total      0.01
Sep  5 total     11.01
Oct  9 total      0.92
Oct 11 total      4.17
Oct 12 total      5.45
Nov  7 total     19.40
Nov  8 total     54.12
Nov  9 total     67.32
Nov 10 total      8.48
Nov 11 total      3.01
Today  total      9.23
```

## Options de la commande

Les options de cette commande sont :

```
[root@centos8 ~]# ac --help
```

```
Usage: ac [OPTION] ...
```

### OPTIONS:

|                         |                                                 |
|-------------------------|-------------------------------------------------|
| -d, --daily-totals      | Print totals for each day                       |
| -p, --individual-totals | Print time totals for each user                 |
| -f, --file <file>       | Read from <file>                                |
| --complain              | Print errors for whatever problem               |
| --reboots               | Count the time between login and reboot         |
| --supplants             | Count the time between logins on the terminal   |
| --timewarps             | Count the time between login and time warp      |
| --compatibility         | Shortcut for --reboots --supplants --timewarps  |
| -a, --all-days          | Do not skip days without login activity         |
| --tw-lenieny <value>    | Set the time warp lenieny <value> in seconds    |
| --tw-suspicious <value> | Set the time warp suspicious <value> in seconds |
| --print-year            | Print year when displaying dates                |
| --print-zeros           | Don't suppress zeros in category totals         |
| --debug                 | Print verbose internal information              |
| -V, --version           | Show version and exit                           |
| -h, --help              | Show help and exit                              |

The system's default login accounting file is /var/log/wtmp.

## LAB #2 - La commande sysctl

## 2.1 - Répertoire /proc

Le répertoire /proc contient des fichiers et des répertoires virtuels. Le contenu de ces fichiers est créé dynamiquement lors de la consultation. Seul root peut consulter la totalité des informations dans le répertoire /proc.

```
[root@centos8 ~]# ls /proc
```

|       |       |      |      |      |      |      |      |      |             |               |
|-------|-------|------|------|------|------|------|------|------|-------------|---------------|
| 1     | 16391 | 19   | 2212 | 2427 | 2622 | 431  | 59   | 84   | 999         | mdstat        |
| 10    | 16476 | 1931 | 2215 | 2428 | 2659 | 432  | 6    | 842  | acpi        | meminfo       |
| 1007  | 16534 | 1956 | 2222 | 2431 | 2667 | 433  | 60   | 8465 | buddyinfo   | misc          |
| 11    | 16576 | 1960 | 2226 | 2432 | 2686 | 434  | 61   | 866  | bus         | modules       |
| 11805 | 16593 | 2    | 2230 | 2435 | 27   | 435  | 63   | 867  | cgroups     | mounts        |
| 12    | 16598 | 20   | 2237 | 2439 | 28   | 436  | 64   | 868  | cmdline     | mtrr          |
| 1219  | 16600 | 2007 | 2238 | 244  | 29   | 437  | 65   | 869  | consoles    | net           |
| 1228  | 16613 | 2029 | 2241 | 2443 | 3    | 44   | 6568 | 87   | cpuinfo     | pagetypeinfo  |
| 1232  | 16646 | 203  | 2244 | 2445 | 31   | 446  | 66   | 870  | crypto      | partitions    |
| 1234  | 16673 | 2034 | 2247 | 2449 | 32   | 45   | 67   | 871  | devices     | sched_debug   |
| 1235  | 16677 | 2037 | 2260 | 2451 | 33   | 46   | 674  | 872  | diskstats   | schedstat     |
| 1247  | 16711 | 2054 | 2262 | 2465 | 34   | 47   | 68   | 874  | dma         | scsi          |
| 13    | 16712 | 2062 | 2267 | 2472 | 35   | 4790 | 69   | 875  | driver      | self          |
| 1307  | 16729 | 21   | 2268 | 2473 | 37   | 49   | 70   | 878  | execdomains | slabinfo      |
| 1339  | 16742 | 210  | 2274 | 2474 | 38   | 50   | 701  | 879  | fb          | softirqs      |
| 1356  | 17    | 2118 | 2275 | 2475 | 39   | 5076 | 71   | 880  | filesystems | stat          |
| 14    | 1764  | 2121 | 2280 | 2476 | 4    | 51   | 714  | 884  | fs          | swaps         |
| 1441  | 180   | 2124 | 2287 | 2478 | 40   | 52   | 72   | 887  | interrupts  | sys           |
| 1443  | 181   | 2126 | 2292 | 2481 | 402  | 53   | 73   | 9    | iomem       | sysrq-trigger |
| 1444  | 1817  | 2156 | 23   | 2484 | 41   | 532  | 74   | 901  | ioports     | sysvipc       |
| 1446  | 182   | 2160 | 2302 | 25   | 419  | 539  | 75   | 903  | irq         | thread-self   |
| 14977 | 1828  | 2164 | 2307 | 2536 | 420  | 55   | 76   | 9144 | kallsyms    | timer_list    |
| 15    | 1829  | 2165 | 2310 | 2539 | 421  | 568  | 8    | 916  | kcore       | tty           |
| 15067 | 183   | 2167 | 2330 | 2571 | 422  | 569  | 808  | 918  | keys        | uptime        |
| 1536  | 1845  | 2169 | 2332 | 2578 | 423  | 570  | 809  | 919  | key-users   | version       |
| 1553  | 185   | 2177 | 2349 | 2579 | 425  | 571  | 81   | 921  | kmsg        | vmallocinfo   |
| 15594 | 186   | 2187 | 2358 | 259  | 426  | 572  | 833  | 969  | kpagecgroup | vmstat        |



|       |      |      |      |      |     |     |     |     |            |          |
|-------|------|------|------|------|-----|-----|-----|-----|------------|----------|
| 15735 | 187  | 2190 | 2373 | 2593 | 427 | 573 | 835 | 986 | kpagecount | zoneinfo |
| 16    | 1880 | 2194 | 2384 | 26   | 428 | 574 | 837 | 989 | kpageflags |          |
| 16165 | 1883 | 22   | 239  | 2602 | 43  | 575 | 838 | 990 | loadavg    |          |
| 16167 | 1888 | 2204 | 241  | 2608 | 430 | 576 | 839 | 993 | locks      |          |

## Fichiers

### Processeur

```
[root@centos8 ~]# cat /proc/cpuinfo
processor       : 0
vendor_id      : GenuineIntel
cpu family     : 15
model          : 6
model name     : Common KVM processor
stepping       : 1
microcode      : 0x1
cpu MHz        : 1999.987
cache size     : 16384 KB
physical id    : 0
siblings       : 4
core id        : 0
cpu cores      : 4
apicid         : 0
initial apicid : 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
```

```
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips      : 3999.97
clflush size  : 64
cache_alignment : 128
address sizes  : 40 bits physical, 48 bits virtual
power management:

processor      : 1
vendor_id     : GenuineIntel
cpu family    : 15
model         : 6
model name    : Common KVM processor
stepping      : 1
microcode     : 0x1
cpu MHz       : 1999.987
cache size    : 16384 KB
physical id   : 0
siblings      : 4
core id       : 1
cpu cores     : 4
apicid        : 1
initial apicid : 1
fpu           : yes
fpu_exception : yes
cpuid level   : 13
wp            : yes
flags         : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips      : 3999.97
clflush size  : 64
cache_alignment : 128
address sizes  : 40 bits physical, 48 bits virtual
```

## power management:

```
processor      : 2
vendor_id     : GenuineIntel
cpu family    : 15
model         : 6
model name    : Common KVM processor
stepping      : 1
microcode     : 0x1
cpu MHz       : 1999.987
cache size    : 16384 KB
physical id   : 0
siblings      : 4
core id       : 2
cpu cores     : 4
apicid        : 2
initial apicid : 2
fpu           : yes
fpu_exception : yes
cpuid level   : 13
wp            : yes
flags         : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips      : 3999.97
clflush size  : 64
cache_alignment : 128
address sizes : 40 bits physical, 48 bits virtual
power management:
```

```
processor      : 3
vendor_id     : GenuineIntel
cpu family    : 15
```

```
model          : 6
model name     : Common KVM processor
stepping       : 1
microcode      : 0x1
cpu MHz        : 1999.987
cache size     : 16384 KB
physical id    : 0
siblings       : 4
core id        : 3
cpu cores      : 4
apicid         : 3
initial apicid : 3
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault    : pt
bugs           : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips       : 3999.97
clflush size   : 64
cache_alignment : 128
address sizes   : 40 bits physical, 48 bits virtual
power management:

processor       : 4
vendor_id       : GenuineIntel
cpu family      : 15
model          : 6
model name     : Common KVM processor
stepping       : 1
microcode      : 0x1
cpu MHz        : 1999.987
```

```
cache size      : 16384 KB
physical id     : 1
siblings       : 4
core id        : 0
cpu cores      : 4
apicid         : 4
initial apicid : 4
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp            : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
bugs          : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips      : 3999.97
clflush size   : 64
cache_alignment : 128
address sizes  : 40 bits physical, 48 bits virtual
power management:

processor      : 5
vendor_id     : GenuineIntel
cpu family    : 15
model        : 6
model name    : Common KVM processor
stepping     : 1
microcode     : 0x1
cpu MHz      : 1999.987
cache size   : 16384 KB
physical id  : 1
siblings    : 4
core id     : 1
cpu cores   : 4
```

```
apicid      : 5
initial apicid : 5
fpu         : yes
fpu_exception : yes
cpuid level : 13
wp          : yes
flags       : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
bugs        : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips    : 3999.97
clflush size : 64
cache_alignment : 128
address sizes : 40 bits physical, 48 bits virtual
power management:

processor    : 6
vendor_id    : GenuineIntel
cpu family   : 15
model        : 6
model name   : Common KVM processor
stepping     : 1
microcode    : 0x1
cpu MHz      : 1999.987
cache size   : 16384 KB
physical id   : 1
siblings     : 4
core id      : 2
cpu cores    : 4
apicid       : 6
initial apicid : 6
fpu          : yes
fpu_exception : yes
cpuid level   : 13
```

```
wp                : yes
flags             : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
bugs              : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
bogomips          : 3999.97
clflush size      : 64
cache_alignment   : 128
address sizes     : 40 bits physical, 48 bits virtual
power management:

processor         : 7
vendor_id         : GenuineIntel
cpu family        : 15
model             : 6
model name        : Common KVM processor
stepping          : 1
microcode         : 0x1
cpu MHz           : 1999.987
cache size        : 16384 KB
physical id       : 1
siblings          : 4
core id           : 3
cpu cores         : 4
apicid            : 7
initial apicid    : 7
fpu               : yes
fpu_exception     : yes
cpuid level       : 13
wp               : yes
flags             : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse
sse2 ht syscall nx lm constant_tsc nopl xtopology cpuid tsc_known_freq pni cx16 x2apic hypervisor lahf_lm
cpuid_fault pti
bugs              : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs itlb_multihit
```

```

bogomips      : 3999.97
clflush size  : 64
cache_alignment : 128
address sizes  : 40 bits physical, 48 bits virtual
power management:

```

### Interruptions système

```

[root@centos8 ~]# cat /proc/interrupts

```

|                       | CPU0 | CPU1 | CPU2 | CPU3 | CPU4  | CPU5 | CPU6 | CPU7  |         |         |
|-----------------------|------|------|------|------|-------|------|------|-------|---------|---------|
| 0:                    | 109  | 0    | 0    | 0    | 0     | 0    | 0    | 0     | IO-APIC | 2-edge  |
| timer                 |      |      |      |      |       |      |      |       |         |         |
| 1:                    | 0    | 0    | 0    | 0    | 9     | 0    | 0    | 0     | IO-APIC | 1-edge  |
| i8042                 |      |      |      |      |       |      |      |       |         |         |
| 8:                    | 0    | 0    | 0    | 0    | 0     | 1    | 0    | 0     | IO-APIC | 8-edge  |
| rtc0                  |      |      |      |      |       |      |      |       |         |         |
| 9:                    | 0    | 0    | 0    | 0    | 0     | 0    | 0    | 0     | IO-APIC | 9-      |
| fasteoi acpi          |      |      |      |      |       |      |      |       |         |         |
| 10:                   | 0    | 0    | 0    | 0    | 47098 | 0    | 0    | 0     | IO-APIC | 10-     |
| fasteoi virtio0       |      |      |      |      |       |      |      |       |         |         |
| 11:                   | 0    | 0    | 31   | 0    | 0     | 0    | 0    | 0     | IO-APIC | 11-     |
| fasteoi uhci_hcd:usb1 |      |      |      |      |       |      |      |       |         |         |
| 12:                   | 0    | 0    | 0    | 15   | 0     | 0    | 0    | 0     | IO-APIC | 12-edge |
| i8042                 |      |      |      |      |       |      |      |       |         |         |
| 14:                   | 0    | 0    | 0    | 0    | 0     | 0    | 0    | 0     | IO-APIC | 14-edge |
| ata_piix              |      |      |      |      |       |      |      |       |         |         |
| 15:                   | 7376 | 0    | 144  | 0    | 0     | 0    | 0    | 84588 | IO-APIC | 15-edge |
| ata_piix              |      |      |      |      |       |      |      |       |         |         |
| 24:                   | 0    | 0    | 0    | 0    | 0     | 0    | 0    | 0     | PCI-MSI | 294912- |
| edge virtio1-config   |      |      |      |      |       |      |      |       |         |         |
| 25:                   | 0    | 0    | 0    | 0    | 0     | 5640 | 0    | 16    | PCI-MSI | 294913- |
| edge virtio1-input.0  |      |      |      |      |       |      |      |       |         |         |
| 26:                   | 36   | 0    | 0    | 5058 | 0     | 0    | 0    | 0     | PCI-MSI | 294914- |





|                    |   |   |   |   |   |   |   |   |                  |
|--------------------|---|---|---|---|---|---|---|---|------------------|
| HVS:               | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Hyper-V stimer0  |
| interrupts         |   |   |   |   |   |   |   |   |                  |
| ERR:               | 0 |   |   |   |   |   |   |   |                  |
| MIS:               | 0 |   |   |   |   |   |   |   |                  |
| PIN:               | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Posted-interrupt |
| notification event |   |   |   |   |   |   |   |   |                  |
| NPI:               | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Nested posted-   |
| interrupt event    |   |   |   |   |   |   |   |   |                  |
| PIW:               | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Posted-interrupt |
| wakeup event       |   |   |   |   |   |   |   |   |                  |



**Important :** Un pilote de périphérique demande au processeur de fournir un service en utilisant un IRQ. Quand la demande est faite, le processeur interrompt ses activités et passe le contrôle au pilote identifié par l'IRQ. Techniquement l'attribution d'un IRQ à un périphérique doit être exclusive. Dans le cas où deux périphériques demandent un service en même temps, c'est le périphérique ayant l'IRQ le plus bas qui est prioritaire.

### Canaux DMA

```
[root@centos8 ~]# cat /proc/dma
4: cascade
```

### Plages d'entrée/sortie

```
root@centos8 ~]# cat /proc/ioports | more
0000-0cf7 : PCI Bus 0000:00
 0000-001f : dma1
 0020-0021 : pic1
```

```
0040-0043 : timer0
0050-0053 : timer1
0060-0060 : keyboard
0064-0064 : keyboard
0070-0077 : rtc0
0080-008f : dma page reg
00a0-00a1 : pic2
00c0-00df : dma2
00f0-00ff : fpu
0170-0177 : 0000:00:01.1
    0170-0177 : ata_piix
01f0-01f7 : 0000:00:01.1
    01f0-01f7 : ata_piix
0376-0376 : 0000:00:01.1
    0376-0376 : ata_piix
03c0-03df : vga+
03f6-03f6 : 0000:00:01.1
    03f6-03f6 : ata_piix
--More--
```



**Important** - Si deux périphériques ont le même port, les **deux** périphériques seront inutilisables.

## Périphériques

```
[root@centos8 ~]# cat /proc/devices
Character devices:
1 mem
4 /dev/vc/0
4 tty
```

```
4 ttyS
5 /dev/tty
5 /dev/console
5 /dev/ptmx
7 vcs
10 misc
13 input
21 sg
29 fb
128 ptm
136 pts
162 raw
180 usb
188 ttyUSB
189 usb_device
202 cpu/msr
203 cpu/cpuid
226 drm
244 aux
245 hidraw
246 usbmon
247 bsg
248 watchdog
249 ptp
250 pps
251 rtc
252 dax
253 tpm
254 gpiochip
```

Block devices:

```
8 sd
9 md
11 sr
```

```
65 sd
66 sd
67 sd
68 sd
69 sd
70 sd
71 sd
128 sd
129 sd
130 sd
131 sd
132 sd
133 sd
134 sd
135 sd
253 device-mapper
254 mdp
259 blkext
```

## Modules

```
[root@centos8 ~]# cat /proc/modules | more
xt_CHECKSUM 16384 1 - Live 0xffffffffc09a8000
ipt_MASQUERADE 16384 3 - Live 0xffffffffc09a3000
xt_conntrack 16384 1 - Live 0xffffffffc099e000
ipt_REJECT 16384 2 - Live 0xffffffffc0999000
nft_compat 20480 16 - Live 0xffffffffc0993000
nf_nat_tftp 16384 0 - Live 0xffffffffc098b000
nft_objref 16384 1 - Live 0xffffffffc0986000
nf_conntrack_tftp 16384 3 nf_nat_tftp, Live 0xffffffffc0981000
nft_counter 16384 33 - Live 0xffffffffc097c000
tun 53248 1 - Live 0xffffffffc096e000
bridge 192512 0 - Live 0xffffffffc093e000
```

```
stp 16384 1 bridge, Live 0xfffffffffc0939000
llc 16384 2 bridge,stp, Live 0xfffffffffc0930000
nft_fib_inet 16384 1 - Live 0xfffffffffc08f5000
nft_fib_ipv4 16384 1 nft_fib_inet, Live 0xfffffffffc08ed000
nft_fib_ipv6 16384 1 nft_fib_inet, Live 0xfffffffffc08e8000
nft_fib 16384 3 nft_fib_inet,nft_fib_ipv4,nft_fib_ipv6, Live 0xfffffffffc08e3000
nft_reject_inet 16384 5 - Live 0xfffffffffc08de000
nf_reject_ipv4 16384 2 ipt_REJECT,nft_reject_inet, Live 0xfffffffffc08d9000
nf_reject_ipv6 16384 1 nft_reject_inet, Live 0xfffffffffc08d4000
nft_reject 16384 1 nft_reject_inet, Live 0xfffffffffc08cf000
--More--
```

### Statistiques de l'utilisation des disques

```
[root@centos8 ~]# cat /proc/diskstats
 8      0 sda 15481 112 1445637 154103 10272 2377 277530 890611 0 237219 1044714 0 0 0 0
 8      1 sda1 402 3 66754 13349 31 18 392 4632 0 2824 17981 0 0 0 0
 8      2 sda2 14915 109 1375516 140528 8450 2359 277138 869788 0 225416 1010316 0 0 0 0
 8     16 sdb 230 0 5991 36 0 0 0 0 0 110 36 0 0 0 0
11      0 sr0 10 0 4 2 0 0 0 0 0 9 2 0 0 0 0
253     0 dm-0 11651 0 1364532 72138 12121 0 288727 1208138 0 227630 1280276 0 0 0 0
253     1 dm-1 104 0 4440 79 0 0 0 0 0 71 79 0 0 0 0
```

### Partitions

```
[root@centos8 ~]# cat /proc/partitions
major minor  #blocks  name

 8          0   33554432 sda
 8          1    1048576 sda1
 8          2   32504832 sda2
```

|     |    |          |      |
|-----|----|----------|------|
| 8   | 16 | 4194304  | sdb  |
| 11  | 0  | 1048575  | sr0  |
| 253 | 0  | 29143040 | dm-0 |
| 253 | 1  | 3358720  | dm-1 |

### Espaces de pagination

```
[root@centos8 ~]# cat /proc/swaps
```

| Filename  | Type      | Size    | Used | Priority |
|-----------|-----------|---------|------|----------|
| /dev/dm-1 | partition | 3358716 | 0    | -2       |

### Statistiques d'utilisation du processeur

```
[root@centos8 ~]# cat /proc/loadavg
```

```
0.00 0.00 0.00 1/697 16936
```

### Statistiques d'utilisation de la mémoire

```
[root@centos8 ~]# cat /proc/meminfo
```

```
MemTotal:      3825032 kB
MemFree:       1862116 kB
MemAvailable:  2420560 kB
Buffers:       3300 kB
Cached:        750496 kB
SwapCached:    0 kB
Active:        315572 kB
Inactive:     1400260 kB
Active(anon):  1856 kB
Inactive(anon): 974728 kB
Active(file):  313716 kB
```

```
Inactive(file): 425532 kB
Unevictable: 0 kB
Mlocked: 0 kB
SwapTotal: 3358716 kB
SwapFree: 3358716 kB
Dirty: 0 kB
Writeback: 0 kB
AnonPages: 962004 kB
Mapped: 261084 kB
Shmem: 14552 kB
KReclaimable: 46980 kB
Slab: 118396 kB
SReclaimable: 46980 kB
SUnreclaim: 71416 kB
KernelStack: 11280 kB
PageTables: 46532 kB
NFS_Unstable: 0 kB
Bounce: 0 kB
WritebackTmp: 0 kB
CommitLimit: 5271232 kB
Committed_AS: 5072744 kB
VmallocTotal: 34359738367 kB
VmallocUsed: 0 kB
VmallocChunk: 0 kB
Percpu: 5920 kB
HardwareCorrupted: 0 kB
AnonHugePages: 546816 kB
ShmemHugePages: 0 kB
ShmemPmdMapped: 0 kB
FileHugePages: 0 kB
FilePmdMapped: 0 kB
HugePages_Total: 0
HugePages_Free: 0
HugePages_Rsvd: 0
```



```
HugePages_Surp:      0
Hugepagesize:        2048 kB
Hugetlb:             0 kB
DirectMap4k:         173944 kB
DirectMap2M:         4020224 kB
```

### Version du noyau

```
[root@centos8 ~]# cat /proc/version
Linux version 4.18.0-305.3.1.el8.x86_64 (mockbuild@kbuilder.bsys.centos.org) (gcc version 8.4.1 20200928 (Red Hat 8.4.1-1) (GCC)) #1 SMP Tue Jun 1 16:14:33 UTC 2021
```

## Répertoires

### ide/scsi

Ce répertoire contient des répertoires dans lesquels se trouvent des informations sur la capacité, le type et la géométrie des disques.

### acpi

Ce répertoire contient des informations sur la gestion de l'énergie, les températures, les vitesses de ventilateurs, la charge des batteries.

### bus

Ce répertoire contient un sous-répertoire par bus.

---

## net

Ce répertoire contient des informations sur le réseau.

## sys

Ce répertoire contient des paramètres du noyau. Certains des fichiers dans ce répertoire sont accessibles en écriture par root en temps réel. Par exemple pour éviter des attaques réseau **DoS** utilisant la commande **ping**, saisissez la commande suivante :

```
# echo 1 > /proc/sys/net/ipv4/icmp_echo_ignore_all [Entrée]
```

Cette commande a pour résultat d'ignorer les requêtes ping.

## 2.2 - Utilisation de la Commande sysctl

Les fichiers dans le répertoire **/proc/sys** peuvent être administrés par la commande **sysctl** en temps réel.

La commande **sysctl** applique les règles consignés dans le fichier **/etc/sysctl.conf** au démarrage de la machine.

Saisissez la commande :

```
[root@centos8 ~]# cat /etc/sysctl.conf
# sysctl settings are defined through files in
# /usr/lib/sysctl.d/, /run/sysctl.d/, and /etc/sysctl.d/.
#
# Vendors settings live in /usr/lib/sysctl.d/.
# To override a whole file, create a new file with the same in
# /etc/sysctl.d/ and put new settings there. To override
# only specific settings, add a file with a lexically later
# name in /etc/sysctl.d/ and put new settings there.
#
```

```
# For more information, see sysctl.conf(5) and sysctl.d(5).

[root@centos8 ~]# ls -l /etc/sysctl.d/
total 0
lrwxrwxrwx. 1 root root 14 Mar 16 15:42 99-sysctl.conf -> ../sysctl.conf
[root@centos8 ~]# ls -l /usr/lib/sysctl.d/
total 24
-rw-r--r--. 1 root root 1810 Dec 22 2020 10-default-yama-scope.conf
-rw-r--r--. 1 root root 524 Mar 16 15:42 50-coredump.conf
-rw-r--r--. 1 root root 1270 Mar 16 15:42 50-default.conf
-rw-r--r--. 1 root root 246 Jun 15 2020 50-libkcap-optmem_max.conf
-rw-r--r--. 1 root root 636 Mar 16 15:42 50-pid-max.conf
-rw-r--r--. 1 root root 499 Nov 26 2019 60-libvirtd.conf

[root@centos8 ~]# cat /usr/lib/sysctl.d/50-default.conf
# This file is part of systemd.
#
# systemd is free software; you can redistribute it and/or modify it
# under the terms of the GNU Lesser General Public License as published by
# the Free Software Foundation; either version 2.1 of the License, or
# (at your option) any later version.

# See sysctl.d(5) and core(5) for documentation.

# To override settings in this file, create a local file in /etc
# (e.g. /etc/sysctl.d/90-override.conf), and put any assignments
# there.

# System Request functionality of the kernel (SYNC)
#
# Use kernel.sysrq = 1 to allow all keys.
# See https://www.kernel.org/doc/html/latest/admin-guide/sysrq.html for a list
# of values and keys.
kernel.sysrq = 16
```

```
# Append the PID to the core filename
kernel.core_uses_pid = 1

# https://bugzilla.redhat.com/show_bug.cgi?id=1689346
kernel.kptr_restrict = 1

# Source route verification
net.ipv4.conf.all.rp_filter = 1

# Do not accept source routing
net.ipv4.conf.all.accept_source_route = 0

# Promote secondary addresses when the primary address is removed
net.ipv4.conf.all.promote_secondaries = 1

# Fair Queue CoDel packet scheduler to fight bufferbloat
net.core.default_qdisc = fq_codel

# Enable hard and soft link protection
fs.protected_hardlinks = 1
fs.protected_symlinks = 1
```

Les options de la commande **sysctl** sont :

```
[root@centos8 ~]# sysctl --help
```

Usage:

```
sysctl [options] [variable[=value] ...]
```

Options:

|              |                                          |
|--------------|------------------------------------------|
| -a, --all    | display all variables                    |
| -A           | alias of -a                              |
| -X           | alias of -a                              |
| --deprecated | include deprecated parameters to listing |

```
-b, --binary      print value without new line
-e, --ignore      ignore unknown variables errors
-N, --names       print variable names without values
-n, --values      print only values of the given variable(s)
-p, --load[=<file>] read values from file
-f               alias of -p
    --system      read values from all system directories
-r, --pattern <expression>
                  select setting that match expression
-q, --quiet       do not echo variable set
-w, --write       enable writing a value to variable
-o               does nothing
-x               does nothing
-d               alias of -h

-h, --help       display this help and exit
-V, --version     output version information and exit
```

For more details see `sysctl(8)`.



**Important** : Consultez la page de la traduction du manuel de **sysctl** [ici](#) pour comprendre la commande.

## LAB#3 - Interprétation des informations dans /proc

Les informations brutes stockées dans /proc peuvent être interprétées grâce à l'utilisation des commandes dites de *gestion des performances* :

- free,
- uptime et w,

- iostat,
- hdparm,
- vmstat,
- mpstat,
- sar.

### 3.1 - La Commande free

La commande **free** permet de donner l'état de la mémoire totale, libre, partagée, swap et bufferisée. Saisissez donc la commande suivante :

```
[root@centos8 ~]# free -m
```

|       | total | used | free | shared | buff/cache | available |
|-------|-------|------|------|--------|------------|-----------|
| Mem:  | 3735  | 1135 | 1818 | 14     | 782        | 2363      |
| Swap: | 3279  | 0    | 3279 |        |            |           |

Dans le cas de cet exemple, nous pouvons constater que l'affichage montre :

- 3735 Mo de mémoire physique totale,
- 1135 Mo de mémoire physique utilisée et 1818 Mo de mémoire physique libre,
- 3279 Mo de mémoire swap totale et 0 Mo de swap utilisé

Les options de cette commande sont :

```
[root@centos8 ~]# free --help
```

Usage:

free [options]

Options:

|             |                          |
|-------------|--------------------------|
| -b, --bytes | show output in bytes     |
| --kilo      | show output in kilobytes |
| --mega      | show output in megabytes |
| --giga      | show output in gigabytes |

```
--tera      show output in terabytes
--peta      show output in petabytes
-k, --kibi   show output in kibibytes
-m, --mebi   show output in mebibytes
-g, --gibi   show output in gibibytes
--tebi      show output in tebibytes
--pebi      show output in pebibytes
-h, --human  show human-readable output
--si        use powers of 1000 not 1024
-l, --lohi   show detailed low and high memory statistics
-t, --total  show total for RAM + swap
-s N, --seconds N repeat printing every N seconds
-c N, --count N repeat printing N times, then exit
-w, --wide   wide output

--help      display this help and exit
-V, --version output version information and exit
```

For more details see `free(1)`.

### 3.2 - Les Commandes `uptime` et `w`

Chacune des ces commandes indique la charge moyenne du ou des processeurs depuis 1 minute, 5 minutes et 15 minutes :

```
[root@centos8 ~]# uptime
04:39:03 up 1 day,  2:34,  1 user,  load average: 0.00, 0.00, 0.00

[root@centos8 ~]# w
04:39:04 up 1 day,  2:34,  1 user,  load average: 0.00, 0.00, 0.00
USER      TTY      FROM            LOGIN@   IDLE   JCPU   PCPU WHAT
trainee   pts/0    10.0.2.1        03:58    0.00s  0.11s  0.02s sshd: trainee [priv]
```

Les valeurs **load average** ou *charge moyenne* indiquent le nombre moyen de processus en cours de traitement ou en attente pour la période

concernée.

Par exemple si les valeurs sur un système muni d'un seul processeur étaient **3,48 4,00 3,85** ceci indiquerait que le processeur a du mal à traiter les processus mettant en moyenne :

- 2,48 processus en attente dans la dernière minute,
- 3,00 processus en attente dans les dernières 5 minutes,
- 2,85 processus en attente dans les dernières 15 minutes.

Les options de ces commandes sont :

```
[root@centos8 ~]# uptime --help
```

Usage:

uptime [options]

Options:

-p, --pretty show uptime in pretty format  
-h, --help display this help and exit  
-s, --since system up since  
-V, --version output version information and exit

For more details see uptime(1).

```
[root@centos8 ~]# w --help
```

Usage:

w [options]

Options:

-h, --no-header do not print header  
-u, --no-current ignore current process username  
-s, --short short format  
-f, --from show remote hostname field



```
-o, --old-style      old style output
-i, --ip-addr        display IP address instead of hostname (if possible)

--help              display this help and exit
-V, --version        output version information and exit
```

For more details see w(1).

### 3.3 - La Commande iostat

La commande **iostat** affiche des statistiques sur l'utilisation des disques, des terminaux et des lecteurs de cartouche :

```
[root@centos8 ~]# iostat
bash: iostat: command not found...
Install package 'sysstat' to provide command 'iostat'? [N/y] y

* Waiting in queue...
The following packages have to be installed:
  lm_sensors-libs-3.4.0-22.20180522git70f7e08.el8.x86_64 Lm_sensors core libraries
  sysstat-11.7.3-5.el8.x86_64      Collection of performance monitoring tools for Linux
Proceed with changes? [N/y] y

* Waiting in queue...
* Waiting for authentication...
* Waiting in queue...
* Downloading packages...
* Requesting data...
* Testing changes...
* Installing packages...
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_(8 CPU)
```

```

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.03    0.00    0.03    0.01    0.00   99.93

Device            tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
sda                0.28         7.67         1.49     735338     142510
sdb                0.00         0.03         0.00        2995         0
scd0               0.00         0.00         0.00          2         0
dm-0               0.26         7.25         1.55     694786     148837
dm-1               0.00         0.02         0.00        2220         0

```

Au-dessous de la première ligne indiquant la version du noyau du système et son nom d'hôte ainsi que la date actuelle, **iostat** affiche une vue d'ensemble de l'utilisation CPU moyenne du système depuis le dernier démarrage. Le rapport d'utilisation du CPU inclut les pourcentages suivants :

- **%user** - Pourcentage de temps passé en mode utilisateur (exécutant des applications, etc.)
- **%nice** - Pourcentage de temps passé en mode utilisateur (pour les processus qui ont modifié leur priorité de programmation à l'aide de la commande **nice**)
- **%system** - Pourcentage de temps passé en mode noyau
- **%steal** - Pourcentage du temps passé par des CPU virtuels en attendant que l'hyperviseur s'occupe d'un autre CPU virtuel.
- **%iowait** - Pourcentage du temps passé à attendre les entrées et les sorties des disques.
- **%idle** - Pourcentage de temps passé en inactivité

Notez la valeur de **%iowait**. Dans le cas où ce pourcentage est trop élevé, ceci indique que le processeur passe son temps à attendre les entrées et les sorties de disque.

Au-dessous du rapport d'utilisation du CPU de la sortie de la commande **iostat** figure le rapport d'utilisation des périphériques. Ce dernier contient une ligne pour chaque périphérique disque du système et inclut les informations suivantes :

- La spécification du périphérique.
- Le nombre de transferts (ou opérations d'E/S) par seconde.
- Le nombre de blocs de KB lus par seconde.
- Le nombre de blocs de KB écrits par seconde.
- Le nombre total de KB lus.
- Le nombre total de KB écrits.

Dernièrement, pour voir les statistiques étendues des disques, utilisez la commande suivante :

```
[root@centos8 ~]# iostat -d -x
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      30/06/21      _x86_64_      (8 CPU)
```

| Device   | r/s   | w/s   | rkB/s | wkB/s | rrqm/s | wrqm/s | %rrqm | %wrqm | r_await | w_await | aqu-sz | rareq-sz |
|----------|-------|-------|-------|-------|--------|--------|-------|-------|---------|---------|--------|----------|
| wareq-sz | svctm | %util |       |       |        |        |       |       |         |         |        |          |
| sda      | 0.20  | 0.16  | 11.67 | 1.81  | 0.00   | 0.03   | 0.48  | 17.45 | 6.79    | 69.99   | 0.01   | 58.28    |
| 11.33    | 9.13  | 0.33  |       |       |        |        |       |       |         |         |        |          |
| sdb      | 0.00  | 0.00  | 0.02  | 0.00  | 0.00   | 0.00   | 0.00  | 0.00  | 0.13    | 0.00    | 0.00   | 8.81     |
| 0.00     | 0.51  | 0.00  |       |       |        |        |       |       |         |         |        |          |
| scd0     | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00  | 0.00  | 0.20    | 0.00    | 0.00   | 0.20     |
| 0.00     | 0.90  | 0.00  |       |       |        |        |       |       |         |         |        |          |
| dm-0     | 0.12  | 0.19  | 3.98  | 1.90  | 0.00   | 0.00   | 0.00  | 0.00  | 4.18    | 79.07   | 0.02   | 32.88    |
| 10.07    | 10.34 | 0.32  |       |       |        |        |       |       |         |         |        |          |
| dm-1     | 0.00  | 0.00  | 0.01  | 0.00  | 0.00   | 0.00   | 0.00  | 0.00  | 0.76    | 0.00    | 0.00   | 21.35    |
| 0.00     | 0.68  | 0.00  |       |       |        |        |       |       |         |         |        |          |

Les options de cette commande sont :

```
[root@centos8 ~]# iostat --help
Usage: iostat [ options ] [ <interval> [ <count> ] ]
Options are:
[ -c ] [ -d ] [ -h ] [ -k | -m ] [ -N ] [ -s ] [ -t ] [ -V ] [ -x ] [ -y ] [ -z ]
[ -j { ID | LABEL | PATH | UUID | ... } ] [ --human ] [ -o JSON ]
[ [ -H ] -g <group_name> ] [ -p [ <device> [,...] | ALL ] ]
[ <device> [...] | ALL ]
```

### 3.4 - La Commande hdparm

Pour surveiller la vitesse des entrées et des sorties du disque, vous pouvez utiliser la commande **hdparm** :

```
[root@centos8 ~]# hdparm -t /dev/sda
```

```
/dev/sda:
```

```
Timing buffered disk reads: 1410 MB in 3.00 seconds = 469.98 MB/sec
```

### 3.5 - La Commande vmstat

La commande **vmstat** affiche des statistiques sur la mémoire, la pagination et la charge ponctuelle du processeur :

```
[root@centos8 ~]# vmstat 1 10
```

```
procs -----memory----- ---swap-- -----io-----system-- -----cpu-----
 r  b    swpd    free    buff  cache    si    so    bi    bo    in    cs  us  sy  id  wa  st
 0  0        0 1765216    2256 866336    0    0     3     0     9    12  0  0 100  0  0
 0  0        0 1765136    2256 866336    0    0     0     0    57    80  0  0 100  0  0
 0  0        0 1765136    2256 866376    0    0     0     0    54    77  0  0 100  0  0
 0  0        0 1765136    2256 866376    0    0     0     0    66   100  0  0 100  0  0
 0  0        0 1765136    2256 866376    0    0     0     0   103   125  0  0 100  0  0
 0  0        0 1765108    2256 866376    0    0     0     0    64    86  0  0 100  0  0
 0  0        0 1765108    2256 866376    0    0     0     0    62    88  0  0 100  0  0
 0  0        0 1765108    2256 866376    0    0     0     0    68    97  0  0 100  0  0
 0  0        0 1765108    2256 866376    0    0     0     0    60    88  0  0 100  0  0
 0  0        0 1765108    2256 866376    0    0     0     0   177   251  0  0 100  0  0
```

La première ligne subdivise le champ en six catégories à savoir : processus, mémoire, swap, E/S, système et CPU sur lesquelles elle donne des statistiques. La seconde ligne identifie de manière encore plus détaillée chacun des champs, permettant ainsi de parcourir simplement et rapidement l'ensemble des données lors de la recherche de statistiques spécifiques.

Les champs relatifs aux processus sont les suivants :

- r — Le nombre de processus exécutables attendant d'avoir accès au CPU
- b — Le nombre de processus exécutables dans un état de veille qui ne peut être interrompu

Les champs relatifs à la mémoire sont les suivants :

- swpd — La quantité de mémoire virtuelle utilisée

- free — La quantité de mémoire libre
- buff — La quantité de mémoire utilisée par les tampons (ou buffers)
- cache — La quantité de mémoire utilisée comme cache de pages

Les champs relatifs au swap sont les suivants :

- si — La quantité de mémoire chargée depuis le disque
- so — La quantité de mémoire déchargée sur le disque

Les champs relatifs aux Entrées/Sorties (E/S) sont les suivants :

- bi — Blocs envoyés vers un périphérique blocs
- bo — Blocs reçus d'un périphérique blocs

Les champs relatifs au système sont les suivants :

- in — Nombre d'interruptions par seconde
- cs — Nombre de changements de contexte par seconde

Les champs relatifs au CPU sont les suivants :

- us — Le pourcentage de temps pendant lequel le CPU exécute un code de niveau utilisateur
- sy — Le pourcentage de temps pendant lequel le CPU exécute un code de niveau système
- id — Le pourcentage de temps pendant lequel le CPU était inoccupé
- wa — Attente d'E/S

Les options de cette commande sont :

```
[root@centos8 ~]# vmstat --help
```

Usage:

```
vmstat [options] [delay [count]]
```

Options:

```
-a, --active          active/inactive memory
```

```

-f, --forks          number of forks since boot
-m, --slabs          slabinfo
-n, --one-header     do not redisplay header
-s, --stats          event counter statistics
-d, --disk           disk statistics
-D, --disk-sum       summarize disk statistics
-p, --partition <dev> partition specific statistics
-S, --unit <char>    define display unit
-w, --wide           wide output
-t, --timestamp      show timestamp

-h, --help          display this help and exit
-V, --version       output version information and exit

```

For more details see `vmstat(8)`.



**Important** : Par défaut la commande `vmstat` affiche des informations depuis le démarrage du système.

### 3.6 - La Commande `mpstat`

La commande **`mpstat`** affiche des statistiques détaillées sur le CPU :

```

[root@centos8 ~]# mpstat
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_(8 CPU)

04:53:22   CPU   %usr   %nice    %sys %iowait    %irq   %soft  %steal  %guest  %gnice   %idle
04:53:22   all    0.03    0.00    0.01    0.02    0.01    0.01    0.00    0.00    0.00   99.92

```

Dans le cas où vous avez plusieurs processeurs ou coeurs, vous pouvez visualiser ces mêmes informations par unité de traitement :



[illegible]



|          |     |      |       |      |         |      |       |        |        |        |        |
|----------|-----|------|-------|------|---------|------|-------|--------|--------|--------|--------|
| 04:55:21 | 3   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| 04:55:21 | 4   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| 04:55:21 | 5   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| 04:55:21 | 6   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| 04:55:21 | 7   | 0.50 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 99.50  |
| Average: | CPU | %usr | %nice | %sys | %iowait | %irq | %soft | %steal | %guest | %gnice | %idle  |
| Average: | all | 0.01 | 0.00  | 0.00 | 0.00    | 0.02 | 0.00  | 0.01   | 0.00   | 0.00   | 99.95  |
| Average: | 0   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| Average: | 1   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| Average: | 2   | 0.00 | 0.00  | 0.00 | 0.00    | 0.10 | 0.00  | 0.00   | 0.00   | 0.00   | 99.90  |
| Average: | 3   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| Average: | 4   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.10   | 0.00   | 0.00   | 99.90  |
| Average: | 5   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| Average: | 6   | 0.00 | 0.00  | 0.00 | 0.00    | 0.00 | 0.00  | 0.00   | 0.00   | 0.00   | 100.00 |
| Average: | 7   | 0.10 | 0.00  | 0.00 | 0.00    | 0.10 | 0.00  | 0.00   | 0.00   | 0.00   | 99.80  |

Les options de cette commande sont :

```
[root@centos8 ~]# mpstat --help
Usage: mpstat [ options ] [ <interval> [ <count> ] ]
Options are:
[ -A ] [ -n ] [ -u ] [ -V ] [ -I { SUM | CPU | SCPU | ALL } ]
[ -N { <node_list> | ALL } ] [ -o JSON ] [ -P { <cpu_list> | ALL } ]
```

### 3.7 - La Commande sar

La commande **sar** (**S**ystem **A**ctivity **R**eporter) permet de surveiller toutes les ressources du système selon l'option qui est passée en argument à la commande.

Sous RHEL/CentOS 8 la commande **/usr/lib64/sa/sadc** permet de collecter les informations :

```
[root@centos8 ~]# ls /usr/lib64/sa
```

```
sa1 sa2 sadc
```

Le script **/usr/lib64/sa/sa1** exécute la commande **sadc**. Ce script prend deux options :

| Option | Description                      |
|--------|----------------------------------|
| -t     | L'intervalle entre les collectes |
| -n     | Nombre de collectes              |

Le script **/usr/lib64/sa/sa2** exécute la commande **sar** et consigne les informations dans un fichier au format **/var/log/sa/sar<jj>** :

```
[root@centos8 ~]# ls /var/log/sa/
sa29  s

ar29
```

Sous CentOS / RHEL 8, l'intervalle entre les collectes des informations est configuré par les **timers** de systemd au lieu des cron jobs :

```
[root@centos8 ~]# cat /usr/lib/systemd/system/sysstat-collect.timer
# /usr/lib/systemd/system/sysstat-collect.timer
# (C) 2014 Tomasz Torcz <tomek@pipebreaker.pl>
#
# sysstat-11.7.3 systemd unit file:
#     Activates activity collector every 10 minutes

[Unit]
Description=Run system activity accounting tool every 10 minutes

[Timer]
OnCalendar=*:00/10

[Install]
WantedBy=sysstat.service
```

La valeur de **OnCalendar** indique un collecte toutes les dix minutes.

Pour modifier l'intervalle entre les collectes, il faut créer un fichier **override** dans le répertoire **/etc/systemd/system/** en utilisant la commande **systemctl edit**. En effet, il ne faut jamais éditer les fichiers dans le répertoire **/usr/lib/systemd/system** :

```
[root@centos8 ~]# systemctl edit sysstat-collect.timer
[root@centos8 ~]# cat /etc/systemd/system/sysstat-collect.timer.d/override.conf
[Unit]
Description=Run system activity accounting tool every 2 minutes

[Timer]
OnCalendar=
OnCalendar=*:00/2
AccuracySec=0
```



**Important** : Notez la ligne **OnCalendar=** qui est nécessaire afin de surcharger la valeur par défaut.

Vérifiez ensuite la prise en compte de la configuration :

```
[root@centos8 ~]# systemctl status sysstat-collect.timer
● sysstat-collect.timer - Run system activity accounting tool every 2 minutes
  Loaded: loaded (/usr/lib/systemd/system/sysstat-collect.timer; enabled; vendor preset: disabled)
  Drop-In: /etc/systemd/system/sysstat-collect.timer.d
           └─override.conf
  Active: active (waiting) since Tue 2021-06-29 06:16:04 EDT; 3h 2min ago
  Trigger: Tue 2021-06-29 09:20:00 EDT; 1min 19s left

Jun 29 06:16:04 centos8.ittraining.loc systemd[1]: Started Run system activity accounting tool every 10 minutes.
```

```
[root@centos8 ~]# journalctl -g sysstat-collect.service
```

```
-- Logs begin at Mon 2021-06-28 02:04:10 EDT, end at Tue 2021-06-29 09:18:00 EDT. --
Jun 29 06:20:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 06:26:29 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 06:30:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 06:40:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 06:50:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:00:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:10:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:20:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:30:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:40:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:50:33 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:53:56 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:54:00 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:56:00 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 07:58:00 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
Jun 29 08:00:00 centos8.ittraining.loc systemd[1]: sysstat-collect.service: Succeeded.
...
```

Saisissez la commande suivante :

```
[root@centos8 ~]# sar
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_      (8 CPU)

06:16:04      LINUX RESTART      (8 CPU)

06:20:33      CPU      %user      %nice      %system      %iowait      %steal      %idle
06:26:29      all       0.03       0.00       0.03       0.00       0.00       99.94
06:30:33      all       0.02       0.00       0.03       0.00       0.00       99.95
06:40:33      all       0.02       0.00       0.03       0.00       0.00       99.94
06:50:33      all       0.02       0.00       0.02       0.00       0.00       99.95
07:00:33      all       0.02       0.00       0.02       0.00       0.00       99.95
07:10:33      all       0.02       0.00       0.02       0.00       0.00       99.95
07:20:33      all       0.02       0.00       0.03       0.00       0.00       99.95
```

|          |     |      |      |      |      |      |       |
|----------|-----|------|------|------|------|------|-------|
| 07:30:33 | all | 0.02 | 0.01 | 0.03 | 0.00 | 0.00 | 99.94 |
| 07:40:33 | all | 0.03 | 0.00 | 0.04 | 0.00 | 0.00 | 99.93 |
| 07:50:33 | all | 0.03 | 0.00 | 0.03 | 0.00 | 0.00 | 99.94 |
| 07:53:56 | all | 0.08 | 0.00 | 0.06 | 0.00 | 0.00 | 99.86 |
| 07:54:00 | all | 0.09 | 0.00 | 0.06 | 0.00 | 0.00 | 99.85 |
| Average: | all | 0.03 | 0.00 | 0.03 | 0.00 | 0.00 | 99.94 |

07:55:44 LINUX RESTART (8 CPU)

|          |     |       |       |         |         |        |       |
|----------|-----|-------|-------|---------|---------|--------|-------|
| 07:56:00 | CPU | %user | %nice | %system | %iowait | %steal | %idle |
| 07:58:00 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |
| 08:00:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:02:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |
| 08:04:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:06:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:08:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:10:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:12:00 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:14:00 | all | 0.02  | 0.00  | 0.03    | 0.01    | 0.00   | 99.94 |
| 08:16:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:18:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:20:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:22:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:24:00 | all | 0.02  | 0.00  | 0.02    | 0.00    | 0.00   | 99.95 |
| 08:26:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:28:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:30:00 | all | 0.02  | 0.05  | 0.05    | 0.00    | 0.00   | 99.87 |
| 08:32:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:34:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:36:00 | all | 0.03  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:38:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:40:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:42:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |
| 08:44:00 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |

|          |     |       |       |         |         |        |       |
|----------|-----|-------|-------|---------|---------|--------|-------|
| 08:46:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |
| 08:48:00 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:50:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:52:00 | all | 0.02  | 0.00  | 0.06    | 0.00    | 0.00   | 99.92 |
| 08:54:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 08:56:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 08:58:00 | all | 0.02  | 0.00  | 0.02    | 0.00    | 0.00   | 99.96 |
| 09:00:00 | all | 0.07  | 0.00  | 0.05    | 0.00    | 0.00   | 99.88 |
| 09:02:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 09:04:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 09:06:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 09:08:00 | all | 0.02  | 0.00  | 0.04    | 0.00    | 0.00   | 99.94 |
| 09:10:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 09:12:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |
| 09:12:00 | CPU | %user | %nice | %system | %iowait | %steal | %idle |
| 09:14:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 09:16:00 | all | 0.02  | 0.00  | 0.06    | 0.00    | 0.00   | 99.92 |
| 09:18:00 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 09:20:00 | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |
| Average: | all | 0.02  | 0.00  | 0.03    | 0.00    | 0.00   | 99.94 |

## Statistiques d'Utilisation du CPU

Visualisez maintenant les statistiques d'utilisation du CPU:

```
[root@centos8 ~]# sar -u 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_      (8 CPU)
```

|          |     |       |       |         |         |        |       |
|----------|-----|-------|-------|---------|---------|--------|-------|
| 09:22:52 | CPU | %user | %nice | %system | %iowait | %steal | %idle |
| 09:22:57 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 09:23:02 | all | 0.03  | 0.00  | 0.03    | 0.00    | 0.00   | 99.95 |
| 09:23:07 | all | 0.00  | 0.00  | 0.03    | 0.00    | 0.00   | 99.97 |

|          |     |      |      |      |      |      |       |
|----------|-----|------|------|------|------|------|-------|
| Average: | all | 0.02 | 0.00 | 0.03 | 0.00 | 0.00 | 99.96 |
|----------|-----|------|------|------|------|------|-------|

D'avantage de statistiques peuvent être obtenues en utilisant l'option **ALL** :

```
[root@centos8 ~]# sar -u ALL 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_(8 CPU)

01:49:14      CPU      %usr      %nice      %sys      %iowait      %steal      %irq      %soft      %guest      %gnice
%idle
01:49:19      all      0.03      0.00      0.00      0.00      0.00      0.03      0.00      0.00      0.00
99.95
01:49:24      all      0.03      0.00      0.03      0.00      0.00      0.10      0.05      0.00      0.00
99.80
01:49:29      all      0.00      0.00      0.00      0.25      0.00      0.10      0.05      0.00      0.00
99.60
Average:      all      0.02      0.00      0.01      0.08      0.00      0.08      0.03      0.00      0.00
99.78
```

Pour consulter les statistiques d'un coeur spécifique, utilisez l'option **-P** :

```
[root@centos8 ~]# sar -u -P 1 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_      (8 CPU)

01:51:52      CPU      %user      %nice      %system      %iowait      %steal      %idle
01:51:57      1      0.00      0.00      0.00      0.00      0.00      100.00
01:52:02      1      0.20      0.00      0.00      0.00      0.00      99.80
01:52:07      1      0.00      0.00      0.00      0.00      0.00      100.00
Average:      1      0.07      0.00      0.00      0.00      0.00      99.93
[root@centos8 ~]# sar -u -P 5 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_      (8 CPU)

01:52:16      CPU      %user      %nice      %system      %iowait      %steal      %idle
01:52:21      5      0.00      0.00      0.00      0.00      0.00      100.00
01:52:26      5      0.00      0.00      0.00      0.00      0.00      100.00
```

|          |   |      |      |      |      |      |        |
|----------|---|------|------|------|------|------|--------|
| 01:52:31 | 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |
| Average: | 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 |

## Statistiques d'Utilisation de la Mémoire et du Swap

Utilisez l'option **-r** pour visualiser les statistiques concernant la mémoire :

```
[root@centos8 ~]# sar -r 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      30/06/21      _x86_64_(8 CPU)

07:33:32      kbmemfree   kbavail  kbmemused  %memused  kbbuffers  kbcached  kbcommit   %commit  kbactive  kbinact
kbdirty
07:33:37      1647240    2297232   2177792    56.94     3356      827396    5096432    70.94    359072   1486368
0
07:33:42      1647232    2297224   2177800    56.94     3356      827396    5095788    70.93    359072   1486300
0
07:33:47      1647232    2297224   2177800    56.94     3356      827396    5095788    70.93    359072   1486376
0
Average:      1647235    2297227   2177797    56.94     3356      827396    5096003    70.94    359072   1486348
0
```

Utilisez l'option **-S** pour visualiser les statistiques concernant le Swap :

```
[root@centos8 ~]# sar -S 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      30/06/21      _x86_64_(8 CPU)

07:31:58      kbswpfree  kbswpused  %swpused  kbswpcad   %swpcad
07:32:03      3358716      0        0.00        0        0.00
07:32:08      3358716      0        0.00        0        0.00
07:32:13      3358716      0        0.00        0        0.00
Average:      3358716      0        0.00        0        0.00
```



## Statistiques des E/S

Utilisez l'option **-b** pour visualiser les statistiques concernant les E/S :

```
[root@centos8 ~]# sar -b 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_      (8 CPU)

09:24:49      tps      rtps      wtps    bread/s    bwrtn/s
09:24:54      0.00      0.00      0.00      0.00      0.00
09:24:59      1.20      0.00      1.20      0.00     20.20
09:25:04      0.00      0.00      0.00      0.00      0.00
Average:      0.40      0.00      0.40      0.00      6.73
```

## Statistiques des E/S par Disque

Utilisez l'option **-d** pour visualiser les statistiques concernant les E/S par disque :

```
[root@centos8 ~]# sar -d 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      29/06/21      _x86_64_      (8 CPU)

09:25:45      DEV      tps      rkB/s      wkB/s    areq-sz    aqu-sz    await    svctm    %util
09:25:50      dev8-0      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:50      dev8-16     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:50      dev11-0     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:50      dev253-0    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:50      dev253-1    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

09:25:50      DEV      tps      rkB/s      wkB/s    areq-sz    aqu-sz    await    svctm    %util
09:25:55      dev8-0      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:55      dev8-16     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:55      dev11-0     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:25:55      dev253-0    0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
```

|          |          |      |       |       |         |        |       |       |       |
|----------|----------|------|-------|-------|---------|--------|-------|-------|-------|
| 09:25:55 | dev253-1 | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |
| 09:25:55 | DEV      | tps  | rkB/s | wkB/s | areq-sz | aqu-sz | await | svctm | %util |
| 09:26:00 | dev8-0   | 0.60 | 0.00  | 0.30  | 0.50    | 0.01   | 13.00 | 13.00 | 0.78  |
| 09:26:00 | dev8-16  | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |
| 09:26:00 | dev11-0  | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |
| 09:26:00 | dev253-0 | 0.60 | 0.00  | 0.50  | 0.83    | 0.01   | 12.67 | 13.00 | 0.78  |
| 09:26:00 | dev253-1 | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |
| Average: | DEV      | tps  | rkB/s | wkB/s | areq-sz | aqu-sz | await | svctm | %util |
| Average: | dev8-0   | 0.20 | 0.00  | 0.10  | 0.50    | 0.00   | 13.00 | 13.00 | 0.26  |
| Average: | dev8-16  | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |
| Average: | dev11-0  | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |
| Average: | dev253-0 | 0.20 | 0.00  | 0.17  | 0.83    | 0.00   | 12.67 | 13.00 | 0.26  |
| Average: | dev253-1 | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |

La colonne **DEV** indentifie les disques par leurs majeurs et mineurs. Pour voir les informations avec les noms des disques, ajoutez l'option **-p** :

```
[root@centos8 ~]# sar -p -d 5 3
Linux 4.18.0-305.3.1.el8.x86_64 (centos8.ittraining.loc)      30/06/21      _x86_64_      (8 CPU)

07:48:32      DEV      tps      rkB/s      wkB/s      areq-sz      aqu-sz      await      svctm      %util
07:48:37      sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:37      sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:37      sr0      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:37  cl_centos8-root      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:37  cl_centos8-swap      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

07:48:37      DEV      tps      rkB/s      wkB/s      areq-sz      aqu-sz      await      svctm      %util
07:48:42      sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:42      sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:42      sr0      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:42  cl_centos8-root      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
07:48:42  cl_centos8-swap      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
```

|          |                 |      |       |       |         |        |       |       |       |      |
|----------|-----------------|------|-------|-------|---------|--------|-------|-------|-------|------|
| 07:48:42 | DEV             | tps  | rkB/s | wkB/s | areq-sz | aqu-sz | await | svctm | %util |      |
| 07:48:47 | sda             | 0.40 | 0.00  | 0.40  | 1.00    | 0.02   | 56.00 | 56.50 | 2.26  |      |
| 07:48:47 | sdb             | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |      |
| 07:48:47 | sr0             | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |      |
| 07:48:47 | cl_centos8-root |      | 0.40  | 0.00  | 0.80    | 2.00   | 0.02  | 56.00 | 56.50 | 2.26 |
| 07:48:47 | cl_centos8-swap |      | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  | 0.00 |
|          |                 |      |       |       |         |        |       |       |       |      |
| Average: | DEV             | tps  | rkB/s | wkB/s | areq-sz | aqu-sz | await | svctm | %util |      |
| Average: | sda             | 0.13 | 0.00  | 0.13  | 1.00    | 0.01   | 56.00 | 56.50 | 0.75  |      |
| Average: | sdb             | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |      |
| Average: | sr0             | 0.00 | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  |      |
| Average: | cl_centos8-root |      | 0.13  | 0.00  | 0.27    | 2.00   | 0.01  | 56.00 | 56.50 | 0.75 |
| Average: | cl_centos8-swap |      | 0.00  | 0.00  | 0.00    | 0.00   | 0.00  | 0.00  | 0.00  | 0.00 |

Les options de la commande sar sont :

```
[root@centos8 ~]# sar --help
Usage: sar [ options ] [ <interval> [ <count> ] ]
Main options and reports (report name between square brackets):
  -B      Paging statistics [A_PAGE]
  -b      I/O and transfer rate statistics [A_IO]
  -d      Block devices statistics [A_DISK]
  -F [ MOUNT ]
          Filesystems statistics [A_FS]
  -H      Hugepages utilization statistics [A_HUGE]
  -I { <int_list> | SUM | ALL }
          Interrupts statistics [A_IRQ]
  -m { <keyword> [,...] | ALL }
          Power management statistics [A_PWR_...]
          Keywords are:
          CPU      CPU instantaneous clock frequency
          FAN      Fans speed
          FREQ     CPU average clock frequency
          IN       Voltage inputs
```

```
    TEMP    Devices temperature
    USB     USB devices plugged into the system
-n { <keyword> [,...] | ALL }
    Network statistics [A_NET_...]
    Keywords are:
    DEV     Network interfaces
    EDEV    Network interfaces (errors)
    NFS     NFS client
    NFSD    NFS server
    SOCK    Sockets (v4)
    IP      IP traffic          (v4)
    EIP     IP traffic          (v4) (errors)
    ICMP    ICMP traffic        (v4)
    EICMP   ICMP traffic        (v4) (errors)
    TCP     TCP traffic          (v4)
    ETCP    TCP traffic          (v4) (errors)
    UDP     UDP traffic          (v4)
    SOCK6   Sockets (v6)
    IP6     IP traffic          (v6)
    EIP6    IP traffic          (v6) (errors)
    ICMP6   ICMP traffic        (v6)
    EICMP6  ICMP traffic        (v6) (errors)
    UDP6    UDP traffic          (v6)
    FC      Fibre channel HBAs
    SOFT    Software-based network processing
-q        Queue length and load average statistics [A_QUEUE]
-r [ ALL ]
    Memory utilization statistics [A_MEMORY]
-S        Swap space utilization statistics [A_MEMORY]
-u [ ALL ]
    CPU utilization statistics [A_CPU]
-v        Kernel tables statistics [A_KTABLES]
-W        Swapping statistics [A_SWAP]
-w        Task creation and system switching statistics [A_PCSW]
```

-y TTY devices statistics [A\_SERIAL]

## Modules usb

L'**USB** (*Universal Serial Bus*) est un bus de données qui peut offrir des taux de transfert jusqu'à 480Mb/s sous la version 2.0 et jusqu'à 4.8 Gb/s sous la version 3.0. Les modules nécessaires pour les contrôleurs USB sont :

| Version USB | Module      | Nom Complet                                 |
|-------------|-------------|---------------------------------------------|
| 1.0\1.1     | <b>UHCI</b> | <i>Universal Controller Host Interface</i>  |
|             | <b>OHCI</b> | <i>Open Controller Host Interface</i>       |
| 2.0         | <b>EHCI</b> | <i>Enhanced Host Controller Interface</i>   |
| 3.0         | <b>XHCI</b> | <i>Extensible Host Controller Interface</i> |

Le tableau suivant liste les modules couramment chargés en fonction du périphérique utilisé :

| Module               | Type de Périphérique                                |
|----------------------|-----------------------------------------------------|
| <b>usb_storage</b>   | Supports de masse                                   |
| <b>usbhid</b>        | Périphériques HID ( <i>Human Interface Device</i> ) |
| <b>snd-usb-audio</b> | Cartes son usb                                      |
| <b>usbvidéo</b>      | Cartes vidéo et d'acquisition                       |
| <b>irda-usb</b>      | Périphériques infrarouges                           |
| <b>usbnet</b>        | Cartes réseaux usb                                  |

Les modules peuvent être chargés par un des moyens suivants :

- INITrd,
- Le processus init (systemd),
- kmod, d'une manière dynamique et transparente lors du branchement du périphérique,
- udev,
- manuellement.

## udev

Depuis le noyau Linux 2.6 Linux est capable de détecter des périphériques branchés à chaud. Cette technologie s'appelle le **hotplugging**. Le *hotplugging* est obtenu grâce à l'utilisation de trois composants :

- Udev,
- HAL,
- Dbus.

Les rôles de chaque composant sont les suivants :

- Udev se charge de créer et supprimer d'une manière dynamique les nœuds dans le répertoire **/dev**,
- HAL obtient des informations à partir d'Udev et crée un fichier au format XML représentant le périphérique branché. Il informe ensuite Nautilus en utilisant le Dbus,
- Dbus joue le rôle d'un bus système qui est utilisé pour la communication inter-processus.

Lors de démarrage de Linux, Udev joue un rôle important :

- Au démarrage **tmpfs** est monté sur **/dev**,
- Udev copie les éventuels nœuds statiques de **/lib/udev/devices** vers **/dev**,
- le démon **udevd** collecte des données appelées **uevents** du noyau et cherche une règle correspondante dans le répertoire **/lib/udev/rules.d/**,
- Udev crée les nœuds et liens symboliques spécifiés dans la règle identifiée,
- Udev stocke les règles contenues dans **/lib/udev/rules.d/\*.rules** en mémoire,
- En cas de modification des ces règles, Udev met à jour la mémoire.

Udev repose sur le filesystem **sysfs** monté sur **/sys** qui permet de rendre les périphériques visibles à Udev dans l'*User Space*. Par exemple, lors du branchement d'une clé USB, Udev crée **/dev/sdb1** automatiquement et utilise les informations contenues dans le fichier **/lib/modules/`uname -r`/modules.alias** pour trouver le pilote nécessaire :

Le fichier de configuration principal d'Udev est **/etc/udev/udev.conf** :

```
[root@centos8 ~]# cat /etc/udev/udev.conf
# see udev.conf(5) for details
#
```

```
# udevd is also started in the initrd. When this file is modified you might
# also want to rebuild the initrd, so that it will include the modified configuration.

#udev_log="info"
```

Les fichiers de règles se trouvent dans **/lib/udev/rules.d/** :

```
[root@centos8 ~]# ls /lib/udev/rules.d/
01-md-raid-creating.rules      70-uaccess.rules
10-dm.rules                   70-wacom.rules
11-dm-lvm.rules               71-biosdevname.rules
11-dm-mpath.rules             71-nvmf-iopolicy-netapp.rules
11-dm-parts.rules             71-prefixdevname.rules
13-dm-disk.rules              71-seat.rules
39-usbmuxd.rules              73-idrac.rules
40-elevator.rules             73-seat-late.rules
40-libgphoto2.rules           75-net-description.rules
40-redhat.rules               75-probe_mtd.rules
40-usb-blacklist.rules        75-rdma-description.rules
40-usb_modeswitch.rules       77-mm-cinterion-port-types.rules
50-udev-default.rules         77-mm-dell-port-types.rules
60-alias-kmsg.rules           77-mm-ericsson-mbm.rules
60-block.rules                77-mm-fibocom-port-types.rules
60-cdrom_id.rules             77-mm-haier-port-types.rules
60-drm.rules                  77-mm-huawei-net-port-types.rules
60-evdev.rules                77-mm-longcheer-port-types.rules
60-fido-id.rules              77-mm-mtk-port-types.rules
60-input-id.rules             77-mm-nokia-port-types.rules
60-libfprint-2-autosuspend.rules 77-mm-pcmcia-device-blacklist.rules
60-net.rules                  77-mm-quectel-port-types.rules
60-persistent-alsa.rules      77-mm-sierra.rules
60-persistent-input.rules     77-mm-simtech-port-types.rules
60-persistent-storage.rules   77-mm-telit-port-types.rules
60-persistent-storage-tape.rules 77-mm-ublox-port-types.rules
```

|                                       |                                          |
|---------------------------------------|------------------------------------------|
| 60-persistent-v4l.rules               | 77-mm-usb-device-blacklist.rules         |
| 60-raw.rules                          | 77-mm-usb-serial-adapters-greylist.rules |
| 60-rdma-ndd.rules                     | 77-mm-x22x-port-types.rules              |
| 60-rdma-persistent-naming.rules       | 77-mm-zte-port-types.rules               |
| 60-sensor.rules                       | 78-sound-card.rules                      |
| 60-serial.rules                       | 80-drivers.rules                         |
| 60-tpm-udev.rules                     | 80-iio-sensor-proxy.rules                |
| 61-gdm.rules                          | 80-libinput-device-groups.rules          |
| 61-gnome-bluetooth-rfkill.rules       | 80-mm-candidate.rules                    |
| 61-gnome-settings-daemon-rfkill.rules | 80-net-setup-link.rules                  |
| 61-scsi-sg3_id.rules                  | 80-udisks2.rules                         |
| 62-multipath.rules                    | 81-kvm-rhel.rules                        |
| 63-fc-wwpn-id.rules                   | 84-nm-drivers.rules                      |
| 63-md-raid-arrays.rules               | 85-nm-unmanaged.rules                    |
| 63-scsi-sg3_symlink.rules             | 85-regulatory.rules                      |
| 64-btrfs.rules                        | 90-alsa-restore.rules                    |
| 64-md-raid-assembly.rules             | 90-bolt.rules                            |
| 65-libwacom.rules                     | 90-fwupd-devices.rules                   |
| 65-md-incremental.rules               | 90-iprutils.rules                        |
| 65-sane-backends.rules                | 90-libinput-fuzz-override.rules          |
| 66-kpartx.rules                       | 90-nm-thunderbolt.rules                  |
| 68-del-part-nodes.rules               | 90-pulseaudio.rules                      |
| 69-btattach-bcm.rules                 | 90-rdma-hw-modules.rules                 |
| 69-cd-sensors.rules                   | 90-rdma-ulp-modules.rules                |
| 69-dm-lvm-metad.rules                 | 90-rdma-umad.rules                       |
| 69-libmtp.rules                       | 90-vconsole.rules                        |
| 69-md-clustered-confirm-device.rules  | 91-drm-modeset.rules                     |
| 70-hypervfcopy.rules                  | 95-cd-devices.rules                      |
| 70-hypervkvp.rules                    | 95-dm-notify.rules                       |
| 70-hypervvss.rules                    | 95-upower-csr.rules                      |
| 70-joystick.rules                     | 95-upower-hid.rules                      |
| 70-mouse.rules                        | 95-upower-wup.rules                      |
| 70-nvmf-autoconnect.rules             | 98-kexec.rules                           |
| 70-power-switch.rules                 | 99-qemu-guest-agent.rules                |



|                         |                           |
|-------------------------|---------------------------|
| 70-printers.rules       | 99-systemd.rules          |
| 70-spice-vdagentd.rules | 99-vmware-scsi-udev.rules |
| 70-touchpad.rules       |                           |



**Important :** Il vous est possible d'ajouter des règles si besoin est. Dans ce cas, créez un fichier **99-local.rules** et éditez-le au lieu d'éditer les fichiers existants.

Comme indique le nom de chaque fichier, le contenu est composé de règles à l'attention d'udev. Le fichier des règles par défaut est le **50-udev-default.rules** :

```
[root@centos8 ~]# cat /lib/udev/rules.d/50-udev-default.rules | more
# do not edit this file, it will be overwritten on update

# run a command on remove events
ACTION=="remove", ENV{REMOVE_CMD}!="", RUN+="$env{REMOVE_CMD}"
ACTION=="remove", GOTO="default_end"

SUBSYSTEM=="virtio-ports", KERNEL=="vport*", ATTR{name}=="?*", SYMLINK+="virtio-ports/${attr{name}}"

# select "system RTC" or just use the first one
SUBSYSTEM=="rtc", ATTR{hctosys}=="1", SYMLINK+="rtc"
SUBSYSTEM=="rtc", KERNEL=="rtc0", SYMLINK+="rtc", OPTIONS+="link_priority=-100"

SUBSYSTEM=="usb", ENV{DEVTYPE}=="usb_device", IMPORT{builtin}="usb_id", IMPORT{builtin}="hwdb --subsystem=usb"
ENV{MODALIAS}!="", IMPORT{builtin}="hwdb --subsystem=$env{SUBSYSTEM}"

ACTION!="add", GOTO="default_end"

SUBSYSTEM=="tty", KERNEL=="ptmx", GROUP="tty", MODE="0666"
SUBSYSTEM=="tty", KERNEL=="tty", GROUP="tty", MODE="0666"
SUBSYSTEM=="tty", KERNEL=="tty[0-9]*", GROUP="tty", MODE="0620"
```

```
SUBSYSTEM=="tty", KERNEL=="sclp_line[0-9]*", GROUP="tty", MODE="0620"
SUBSYSTEM=="tty", KERNEL=="ttypsclp[0-9]*", GROUP="tty", MODE="0620"
SUBSYSTEM=="tty", KERNEL=="3270/tty[0-9]*", GROUP="tty", MODE="0620"
SUBSYSTEM=="vc", KERNEL=="vcs*|vcsa*", GROUP="tty"
KERNEL=="tty[A-Z]*[0-9]|ttymxc[0-9]*|pppox[0-9]*|ircomm[0-9]*|noz[0-9]*|rfcomm[0-9]*", GROUP="dialout"

SUBSYSTEM=="mem", KERNEL=="mem|kmem|port", GROUP="kmem", MODE="0640"

SUBSYSTEM=="input", GROUP="input"
SUBSYSTEM=="input", KERNEL=="js[0-9]*", MODE="0664"

SUBSYSTEM=="video4linux", GROUP="video"
SUBSYSTEM=="graphics", GROUP="video"
SUBSYSTEM=="drm", KERNEL!="renderD*", GROUP="video"
SUBSYSTEM=="dvb", GROUP="video"
SUBSYSTEM=="media", GROUP="video"
SUBSYSTEM=="cec", GROUP="video"

SUBSYSTEM=="drm", KERNEL=="renderD*", GROUP="render", MODE="0666"
SUBSYSTEM=="kfd", GROUP="render", MODE="0666"

SUBSYSTEM=="sound", GROUP="audio", \
    OPTIONS+="static_node=snd/seq", OPTIONS+="static_node=snd/timer"
--More--
```

Chaque règle prend la forme suivante :

KEY, [KEY, ...] NAME [, SYMLINK]

Chaque KEY est un champ au format **type=valeur** qui doit correspondre à un périphérique unique. La valeur de type peut prendre plusieurs formes :

| Type   | Description                                          | Exemples          |
|--------|------------------------------------------------------|-------------------|
| BUS    | Type de bus                                          | usb, scsi, ide    |
| KERNEL | Le nom par défaut du périphérique donné par le noyau | hda, ttyUSB0, lp0 |

| Type            | Description                                                                                                                                                                                            | Exemples           |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| SUBSYSTEM       | Le nom noyau du sous-système, généralement identique à la valeur du BUS                                                                                                                                | usb, scsi          |
| DRIVER          | Le nom du pilote qui contrôle le périphérique                                                                                                                                                          | usb-storage        |
| ID              | Le numéro du périphérique sur son bus                                                                                                                                                                  | PCI bus id, USB id |
| PLACE           | Ne concerne que les périphériques USB et donne la position topologique du périphérique sur son bus                                                                                                     | S/O                |
| SYSFS{filename} | Le nom du fichier dans /sys pour le périphérique. Ce fichier contient le fabricant, le label, le numéro de série et UUID du périphérique. La vérification de jusqu'à 5 fichiers est possible par règle | S/O                |
| PROGRAM         | Ceci permet à Udev d'appeler un programme externe pour nommer un périphérique                                                                                                                          | S/O                |
| RESULT          | Valeur à comparer au résultat de PROGRAM                                                                                                                                                               | S/O                |

NAME et SYMLINK sont utilisées pour stipuler ce que Udev doit faire avec le périphérique :

| Type    | Description                                                 | Exemples |
|---------|-------------------------------------------------------------|----------|
| NAME    | Le nom du nœud dans /dev                                    | S/O      |
| SYMLINK | Le ou les lien(s) symbolique(s) qui pointe(nt) vers le NAME | S/O      |

## La commande udevadm

Pour obtenir de l'information sur un périphérique il convient d'utiliser la commande **udevadm** :

```
[root@centos8 ~]# udevadm info --query=all -n /dev/sda
P: /devices/pci0000:00/0000:00:07.0/ata3/host2/target2:0:0/2:0:0:0/block/sda
N: sda
S: disk/by-id/ata-QEMU_HARDDISK_QM00005
S: disk/by-id/scsi-0ATA_QEMU_HARDDISK_QM00005
S: disk/by-id/scsi-1ATA_QEMU_HARDDISK_QM00005
S: disk/by-id/scsi-SATA_QEMU_HARDDISK_QM00005
S: disk/by-path/pci-0000:00:07.0-ata-1
E: DEVLINKS=/dev/disk/by-path/pci-0000:00:07.0-ata-1 /dev/disk/by-id/scsi-SATA_QEMU_HARDDISK_QM00005
/dev/disk/by-id/ata-QEMU_HARDDISK_QM00005 /dev/disk/by-id/scsi-0ATA_QEMU_HARDDISK_QM00005 /dev/disk/by-id/scsi-1ATA_QEMU_HARDDISK_QM00005
E: DEVNAME=/dev/sda
E: DEVPATH=/devices/pci0000:00/0000:00:07.0/ata3/host2/target2:0:0/2:0:0:0/block/sda
```

```
E: DEVTYP=disk
E: ID_ATA=1
E: ID_ATA_FEATURE_SET_SMART=1
E: ID_ATA_FEATURE_SET_SMART_ENABLED=1
E: ID_ATA_SATA=1
E: ID_ATA_WRITE_CACHE=1
E: ID_ATA_WRITE_CACHE_ENABLED=1
E: ID_BUS=ata
E: ID_MODEL=QEMU_HARDDISK
E: ID_MODEL_ENC=QEMU\x20HARDDISK\x20\x20\x20
E: ID_PART_TABLE_TYPE=dos
E: ID_PART_TABLE_UUID=b39ec5c8
E: ID_PATH=pci-0000:00:07.0-ata-1
E: ID_PATH_TAG=pci-0000_00_07_0-ata-1
E: ID_REVISION=2.5+
E: ID_SCSI=1
E: ID_SCSI_INQUIRY=1
E: ID_SERIAL=QEMU_HARDDISK_QM00005
E: ID_SERIAL_SHORT=QM00005
E: ID_TYPE=disk
E: ID_VENDOR=ATA
E: ID_VENDOR_ENC=ATA\x20\x20\x20\x20\x20
E: MAJOR=8
E: MINOR=0
E: SCSI_IDENT_LUN_ATA=QEMU_HARDDISK_QM00005
E: SCSI_IDENT_LUN_T10=ATA_QEMU_HARDDISK_QM00005
E: SCSI_IDENT_LUN_VENDOR=QM00005
E: SCSI_IDENT_SERIAL=QM00005
E: SCSI_MODEL=QEMU_HARDDISK
E: SCSI_MODEL_ENC=QEMU\x20HARDDISK\x20\x20\x20
E: SCSI_REVISION=2.5+
E: SCSI_TPGS=0
E: SCSI_TYPE=disk
E: SCSI_VENDOR=ATA
```

```
E: SCSI_VENDOR_ENC=ATA\x20\x20\x20\x20\x20
E: SUBSYSTEM=block
E: TAGS=:systemd:
E: USEC_INITIALIZED=8735808
```

## Les options de la commande

Les options de la commande udevadm sont :

```
[root@centos8 ~]# udevadm --help
udevadm [--help] [--version] [--debug] COMMAND [COMMAND OPTIONS]
```

Send control commands or test the device manager.

Commands:

|              |                                  |
|--------------|----------------------------------|
| info         | Query sysfs or the udev database |
| trigger      | Request events from the kernel   |
| settle       | Wait for pending udev events     |
| control      | Control the udev daemon          |
| monitor      | Listen to kernel and udev events |
| test         | Test an event run                |
| test-builtin | Test a built-in command          |

```
[root@centos8 ~]# udevadm info --help
udevadm info [OPTIONS] [DEVPATH|FILE]
```

Query sysfs or the udev database.

|                 |                              |
|-----------------|------------------------------|
| -h --help       | Print this message           |
| -V --version    | Print version of the program |
| -q --query=TYPE | Query device information:    |
| name            | Name of device node          |
| symlink         | Pointing to node             |

|                             |                                                                 |
|-----------------------------|-----------------------------------------------------------------|
| path                        | sysfs device path                                               |
| property                    | The device properties                                           |
| all                         | All values                                                      |
| -p --path=SYSPATH           | sysfs device path used for query or attribute walk              |
| -n --name=NAME              | Node or symlink name used for query or attribute walk           |
| -r --root                   | Prepend dev directory to path names                             |
| -a --attribute-walk         | Print all key matches walking along the chain of parent devices |
| -d --device-id-of-file=FILE | Print major:minor of device containing this file                |
| -x --export                 | Export key/value pairs                                          |
| -P --export-prefix          | Export the key name with a prefix                               |
| -e --export-db              | Export the content of the udev database                         |
| -c --cleanup-db             | Clean up the udev database                                      |

## Système de fichiers /sys

Le système de fichiers virtuel **/sys** a été introduit avec le noyau Linux **2.6**. Son rôle est de décrire le matériel pour udev.

Saisissez la commande suivante :

```
[root@centos8 ~]# ls -l /sys
total 0
drwxr-xr-x.  2 root root 0 Jul 12 08:15 block
drwxr-xr-x. 33 root root 0 Jul 12 08:15 bus
drwxr-xr-x. 57 root root 0 Jul 12 08:15 class
drwxr-xr-x.  4 root root 0 Jul 12 08:15 dev
drwxr-xr-x. 14 root root 0 Jul 12 08:15 devices
drwxr-xr-x.  6 root root 0 Jul 12 08:15 firmware
drwxr-xr-x.  9 root root 0 Jul 12 08:15 fs
drwxr-xr-x.  2 root root 0 Jul 12 08:15 hypervisor
drwxr-xr-x. 15 root root 0 Jul 12 08:15 kernel
drwxr-xr-x. 153 root root 0 Jul 12 08:15 module
```

```
drwxr-xr-x.  2 root root 0 Jul 12 08:15 power
```

Chaque répertoire contient des informations :

- **block**
  - contient des informations sur les périphériques bloc
- **bus**
  - contient des informations sur les bus de données
- **class**
  - contient des informations sur des classes de matériel
- **devices**
  - contient des informations sur la position des périphériques sur les bus
- **firmware**
  - contient, entre autre, des informations sur l'ACPI
- **module**
  - contient des informations sur les modules du noyau
- **power**
  - contient des informations sur la gestion de l'énergie
- **fs**
  - contient des informations sur les systèmes de fichiers

Pour illustrer ceci, saisissez la commande suivante :

```
[root@centos8 ~]# cat /sys/block/sda/sda1/size  
2097152
```

Ce chiffre correspond aux nombre de secteurs.

## LAB #4 - Limitation des ressources

## 4.1 - ulimit

Les ressources disponibles aux utilisateurs peuvent être limitées par l'utilisation de la commande **ulimit**.

La commande **ulimit** gère deux types de limite, la limite *hard* en utilisant l'option **-H** et la limite *soft* en utilisant l'option **-S**. Seul root peut positionner une limite *hard* et ceci à condition que la limite ne dépasse pas les ressources réelles.

La limite *soft* est la limite imposée à l'utilisateur par défaut tandis que la limite *hard* est la limite que l'utilisateur peut atteindre en utilisant la commande ulimit lui-même.

L'utilisateur root peut paramétrer les limites accordées en éditant la fichier **/etc/security/limits.conf** :

```
[root@centos8 ~]# cat /etc/security/limits.conf
# /etc/security/limits.conf
#
#This file sets the resource limits for the users logged in via PAM.
#It does not affect resource limits of the system services.
#
#Also note that configuration files in /etc/security/limits.d directory,
#which are read in alphabetical order, override the settings in this
#file in case the domain is the same or more specific.
#That means for example that setting a limit for wildcard domain here
#can be overridden with a wildcard setting in a config file in the
#subdirectory, but a user specific setting here can be overridden only
#with a user specific setting in the subdirectory.
#
#Each line describes a limit for a user in the form:
#
#<domain>          <type> <item> <value>
#
#Where:
#<domain> can be:
#           - a user name
#           - a group name, with @group syntax
```



```
# - the wildcard *, for default entry
# - the wildcard %, can be also used with %group syntax,
#   for maxlogin limit
#
#<type> can have the two values:
# - "soft" for enforcing the soft limits
# - "hard" for enforcing hard limits
#
#<item> can be one of the following:
# - core - limits the core file size (KB)
# - data - max data size (KB)
# - fsize - maximum filesize (KB)
# - memlock - max locked-in-memory address space (KB)
# - nofile - max number of open file descriptors
# - rss - max resident set size (KB)
# - stack - max stack size (KB)
# - cpu - max CPU time (MIN)
# - nproc - max number of processes
# - as - address space limit (KB)
# - maxlogins - max number of logins for this user
# - maxsyslogins - max number of logins on the system
# - priority - the priority to run user process with
# - locks - max number of file locks the user can hold
# - sigpending - max number of pending signals
# - msgqueue - max memory used by POSIX message queues (bytes)
# - nice - max nice priority allowed to raise to values: [-20, 19]
# - rtprio - max realtime priority
#
#<domain>    <type>  <item>      <value>
#
#*           soft    core        0
#*           hard    rss         10000
#@student    hard    nproc       20
```

```
#@faculty      soft  nproc      20
#@faculty      hard  nproc      50
#ftp           hard  nproc      0
#@student      -     maxlogins   4

# End of file
```



**Important** : La valeur de la limite peut être un **nombre** ou le mot **unlimited**.

Par exemple, si root inscrit les deux ligne suivantes dans le fichier /etc/security/limits.conf :

```
...
trainee        soft  nofile     1024
trainee        hard  nofile     4096
...
```

la limite du nombre de fichiers ouverts simultanément par trainee est de 1 024. Par contre, trainee a la possibilité d'augmenter cette limite jusqu'à 4 096 en utilisant la commande suivante :

```
$ ulimit -n 4096
```

Pour consulter la liste des limites actuelles, il convient d'utiliser la commande ulimit avec l'option **-a** :

```
[root@centos8 ~]# ulimit -a
core file size          (blocks, -c) unlimited
data seg size           (kbytes, -d) unlimited
scheduling priority     (-e) 0
file size               (blocks, -f) unlimited
pending signals         (-i) 14702
max locked memory       (kbytes, -l) 64
max memory size         (kbytes, -m) unlimited
```

```
open files          (-n) 1024
pipe size           (512 bytes, -p) 8
POSIX message queues (bytes, -q) 819200
real-time priority  (-r) 0
stack size          (kbytes, -s) 8192
cpu time            (seconds, -t) unlimited
max user processes  (-u) 14702
virtual memory      (kbytes, -v) unlimited
file locks          (-x) unlimited
```

## Options de la commande

Les options de **ulimit** sont :

```
[root@centos8 ~]# help ulimit
ulimit: ulimit [-SHabcdefiklmnpqrstuvxPT] [limit]
  Modify shell resource limits.
  Provides control over the resources available to the shell and processes
  it creates, on systems that allow such control.
  Options:
    -S      use the `soft' resource limit
    -H      use the `hard' resource limit
    -a      all current limits are reported
    -b      the socket buffer size
    -c      the maximum size of core files created
    -d      the maximum size of a process's data segment
    -e      the maximum scheduling priority (`nice')
    -f      the maximum size of files written by the shell and its children
    -i      the maximum number of pending signals
    -k      the maximum number of kqueues allocated for this process
    -l      the maximum size a process may lock into memory
    -m      the maximum resident set size
    -n      the maximum number of open file descriptors
```

- p the pipe buffer size
- q the maximum number of bytes in POSIX message queues
- r the maximum real-time scheduling priority
- s the maximum stack size
- t the maximum amount of cpu time in seconds
- u the maximum number of user processes
- v the size of virtual memory
- x the maximum number of file locks
- P the maximum number of pseudoterminals
- T the maximum number of threads

Not all options are available on all platforms.

If LIMIT is given, it is the new value of the specified resource; the special LIMIT values 'soft', 'hard', and 'unlimited' stand for the current soft limit, the current hard limit, and no limit, respectively. Otherwise, the current value of the specified resource is printed. If no option is given, then -f is assumed.

Values are in 1024-byte increments, except for -t, which is in seconds, -p, which is in increments of 512 bytes, and -u, which is an unscaled number of processes.

Exit Status:

Returns success unless an invalid option is supplied or an error occurs.

## 4.2 - Groupes de Contrôle

Les **Groupes de Contrôles** (*Control Groups*) aussi appelés **CGroups**, sont une façon de contrôler et de limiter des ressources. Les groupes de contrôle permettent l'allocation de ressources, même d'une manière dynamique pendant que le système fonctionne, telles le temps processeur, la mémoire système, la bande réseau, ou une combinaison de ces ressources parmi des groupes de tâches (processus) définis par l'utilisateur et exécutés sur un système.

Les groupes de contrôle sont organisés de manière hiérarchique, comme des processus. Par contre, la comparaison entre les deux démontre que tandis que les processus se trouvent dans une arborescence unique descendant tous du processus init et héritant de l'environnement de leurs parents, les contrôles groupes peuvent être multiples donnant lieu à des arborescences ou **hiérarchies** multiples qui héritent de certains attributs de leurs groupes de contrôle parents.

Ces hiérarchies multiples et séparés sont nécessaires parce que chaque hiérarchie est attaché à un ou plusieurs **sous-système(s)** aussi appelés des **Contrôleurs de Ressources** ou simplement des **Contrôleurs**. Les contrôleurs disponibles sous RHEL/CentOS 7 sont :

- **blkio** - utilisé pour établir des limites sur l'accès des entrées/sorties à partir et depuis des périphériques blocs,
- **cpu** - utilisé pour fournir aux tâches des groupes de contrôle accès au CPU grâce au planificateur,
- **cpuacct** - utilisé pour produire des rapports automatiques sur les ressources CPU utilisées par les tâches dans un groupe de contrôle,
- **cpuset** - utilisé pour assigner des CPU individuels sur un système multicoeur et des noeuds de mémoire à des tâches dans un groupe de contrôle,
- **devices** - utilisé pour autoriser ou pour refuser l'accès des tâches aux périphériques dans un groupe de contrôle,
- **freezer** - utilisé pour suspendre ou pour réactiver les tâches dans un groupe de contrôle,
- **memory** - utilisé pour établir les limites d'utilisation de la mémoire par les tâches d'un groupe de contrôle et pour générer des rapports automatiques sur les ressources mémoire utilisées par ces tâches,
- **net\_cls** - utilisé pour repérer les paquets réseau avec un identifiant de classe (*classid*) afin de permettre au contrôleur de trafic Linux, **tc**, d'identifier les paquets provenant d'une tâche particulière d'un groupe de contrôle.
- **perf\_event** - utilisé pour permettre le monitoring des CGroups avec l'outil perf,
- **hugetlb** - utilisé pour limiter des ressources sur des pages de mémoire virtuelle de grande taille.

Pour visualiser les hiérarchies, il convient d'utiliser la commande **lssubsys** :

```
[root@centos8 ~]# lssubsys -am
bash: lssubsys: command not found...
Install package 'libcgroup-tools' to provide command 'lssubsys'? [N/y] y

* Waiting in queue...
The following packages have to be installed:
 libcgroup-0.41-19.el8.x86_64  Library to control and monitor control groups
 libcgroup-tools-0.41-19.el8.x86_64  Command-line utility programs, services and daemons for libcgroup
Proceed with changes? [N/y] y

* Waiting in queue...
* Waiting for authentication...
* Waiting in queue...
```

```
* Downloading packages...
* Requesting data...
* Testing changes...
* Installing packages...
cpuset /sys/fs/cgroup/cpuset
cpu,cpuacct /sys/fs/cgroup/cpu,cpuacct
blkio /sys/fs/cgroup/blkio
memory /sys/fs/cgroup/memory
devices /sys/fs/cgroup/devices
freezer /sys/fs/cgroup/freezer
net_cls,net_prio /sys/fs/cgroup/net_cls,net_prio
perf_event /sys/fs/cgroup/perf_event
hugetlb /sys/fs/cgroup/hugetlb
pids /sys/fs/cgroup/pids
rdma /sys/fs/cgroup/rdma
```

```
[root@centos8 ~]# lssubsys -am
cpuset /sys/fs/cgroup/cpuset
cpu,cpuacct /sys/fs/cgroup/cpu,cpuacct
blkio /sys/fs/cgroup/blkio
memory /sys/fs/cgroup/memory
devices /sys/fs/cgroup/devices
freezer /sys/fs/cgroup/freezer
net_cls,net_prio /sys/fs/cgroup/net_cls,net_prio
perf_event /sys/fs/cgroup/perf_event
hugetlb /sys/fs/cgroup/hugetlb
pids /sys/fs/cgroup/pids
rdma /sys/fs/cgroup/rdma
```

Sous RHEL/CentOS 8, **Systemd** organise les processus dans chaque CGroup. Par exemple tous les processus démarrés par le serveur Apache se trouveront dans le même CGroup, y compris les scripts CGI. Ceci implique que la gestion des ressources en utilisant des hiérarchies est couplé avec l'arborescence des unités de Systemd.

En haut de l'arborescence des unités de Systemd se trouve la tranche root - **-.slice**, dont dépend :

- le **system.slice** - l'emplacement des services système,
- le **user.slice** - l'emplacement des sessions des utilisateurs,
- le **machine.slice** - l'emplacement des machines virtuelles et conteneurs.

En dessous des tranches peuvent se trouver :

- des **scopes** - des processus créés par **fork**,
- des **services** - des processus créés par une **Unité**.

Les slices peuvent être visualisés avec la commande suivante :

```
[root@centos8 ~]# systemctl list-units --type=slice
UNIT                                LOAD    ACTIVE SUB    DESCRIPTION
-.slice                            loaded active active Root Slice
machine.slice                      loaded active active Virtual Machine and Container Slice
system-getty.slice                loaded active active system-getty.slice
system-lvm2\x2dvpvscan.slice       loaded active active system-lvm2\x2dvpvscan.slice
system-sshd\x2dkeygen.slice        loaded active active system-sshd\x2dkeygen.slice
system-systemd\x2dfsck.slice       loaded active active system-systemd\x2dfsck.slice
system-systemd\x2dhibernate\x2dresume.slice loaded active active system-systemd\x2dhibernate\x2dresume.slice
system-user\x2druntime\x2ddir.slice loaded active active system-user\x2druntime\x2ddir.slice
system-vncserver.slice            loaded active active system-vncserver.slice
system.slice                      loaded active active System Slice
user-1000.slice                   loaded active active User Slice of UID 1000
user-42.slice                    loaded active active User Slice of UID 42
user.slice                        loaded active active User and Session Slice
```

LOAD = Reflects whether the unit definition was properly loaded.

ACTIVE = The high-level unit activation state, i.e. generalization of SUB.

SUB = The low-level unit activation state, values depend on unit type.

13 loaded units listed. Pass --all to see loaded but inactive units, too.

To show all installed unit files use 'systemctl list-unit-files'.

L'arborescence des unités de Systemd est la suivante :

```
[root@centos8 ~]# systemd-cgls
Control group /:
-.slice
|  -user.slice
|  |  -user-42.slice
|  |  |  -session-c1.scope
|  |  |  |  -1317 gdm-session-worker [pam/gdm-launch-environment]
|  |  |  |  -1459 /usr/libexec/gdm-wayland-session --register-session gnome-session --autostart
|  |  |  |  /usr/share/gdm/greeter/autostart
|  |  |  |  |  -1856 /usr/libexec/gnome-session-binary --autostart /usr/share/gdm/greeter/autostart
|  |  |  |  |  -1882 /usr/bin/gnome-shell
|  |  |  |  |  -2059 /usr/bin/Xwayland :1024 -rootless -terminate -accessx -core -listen 4 -listen 5 -displayfd 6
|  |  |  |  |  -2132 ibus-daemon --xim --panel disable
|  |  |  |  |  -2135 /usr/libexec/ibus-dconf
|  |  |  |  |  -2138 /usr/libexec/ibus-x11 --kill-daemon
|  |  |  |  |  -2251 /usr/libexec/gsd-xsettings
|  |  |  |  |  -2261 /usr/libexec/gsd-ally-settings
|  |  |  |  |  -2268 /usr/libexec/gsd-clipboard
|  |  |  |  |  -2271 /usr/libexec/gsd-color
|  |  |  |  |  -2272 /usr/libexec/gsd-datetime
|  |  |  |  |  -2273 /usr/libexec/gsd-housekeeping
|  |  |  |  |  -2274 /usr/libexec/gsd-keyboard
|  |  |  |  |  -2275 /usr/libexec/gsd-media-keys
|  |  |  |  |  -2280 /usr/libexec/gsd-mouse
|  |  |  |  |  -2281 /usr/libexec/gsd-power
|  |  |  |  |  -2283 /usr/libexec/gsd-print-notifications
|  |  |  |  |  -2284 /usr/libexec/gsd-rfkill
|  |  |  |  |  -2285 /usr/libexec/gsd-screensaver-proxy
|  |  |  |  |  -2290 /usr/libexec/gsd-sharing
|  |  |  |  |  -2321 /usr/libexec/gsd-smartcard
|  |  |  |  |  -2328 /usr/libexec/gsd-sound
|  |  |  |  |  -2333 /usr/libexec/gsd-wacom
```



```

└─2432 /usr/libexec/ibus-engine-simple
└─user@42.service
  └─xdg-permission-store.service
    └─2170 /usr/libexec/xdg-permission-store
  └─pulseaudio.service
    └─1455 /usr/bin/pulseaudio --daemonize=no --log-target=journal
  └─init.scope
    └─1357 /usr/lib/systemd/systemd --user
      └─1377 (sd-pam)
  └─at-spi-dbus-bus.service
    └─2090 /usr/libexec/at-spi-bus-launcher
    └─2095 /usr/bin/dbus-daemon --config-file=/usr/share/defaults/at-spi2/accessibility.conf --nofork --
print-address 3
  └─2098 /usr/libexec/at-spi2-registryd --use-gnome-session
  └─dbus.service
    └─1755 /usr/bin/dbus-daemon --session --address=systemd: --nofork --nopidfile --systemd-activation --
syslog-only
  └─2143 /usr/libexec/ibus-portal
└─user-1000.slice
  └─user@1000.service
    └─gvfs-goa-volume-monitor.service
      └─2369 /usr/libexec/gvfs-goa-volume-monitor
    └─xdg-permission-store.service
      └─2191 /usr/libexec/xdg-permission-store
    └─tracker-store.service
      └─2653 /usr/libexec/tracker-store
    └─evolution-calendar-factory.service
      └─2605 /usr/libexec/evolution-calendar-factory
      └─2706 /usr/libexec/evolution-calendar-factory-subprocess --factory all --bus-name
org.gnome.evolution.dataserver.Subprocess.Backend.Calendarx2605x2 --own-path /org/gnome/evolution>
    └─pulseaudio.service
      └─1456 /usr/bin/pulseaudio --daemonize=no --log-target=journal
    └─gvfs-daemon.service
      └─1896 /usr/libexec/gvfsd

```

```

└─1901 /usr/libexec/gvfsd-fuse /run/user/1000/gvfs -f -o big_writes
└─evolution-source-registry.service
└─2206 /usr/libexec/evolution-source-registry
└─gvfs-udisks2-volume-monitor.service
└─2243 /usr/libexec/gvfs-udisks2-volume-monitor
└─init.scope
└─1239 /usr/lib/systemd/systemd --user
└─1318 (sd-pam)
└─gvfs-gphoto2-volume-monitor.service
└─2269 /usr/libexec/gvfs-gphoto2-volume-monitor
└─at-spi-dbus-bus.service
└─1964 /usr/libexec/at-spi-bus-launcher
└─1969 /usr/bin/dbus-daemon --config-file=/usr/share/defaults/at-spi2/accessibility.conf --nofork --
print-address 3
└─1972 /usr/libexec/at-spi2-registryd --use-gnome-session
└─dbus.service
└─1786 /usr/bin/dbus-daemon --session --address=systemd: --nofork --nopidfile --systemd-activation --
syslog-only
└─2183 /usr/libexec/ibus-portal
└─2201 /usr/libexec/gnome-shell-calendar-server
└─2225 /usr/libexec/goa-daemon
└─2397 /usr/libexec/goa-identity-service
└─2721 /usr/libexec/dconf-service
└─evolution-addressbook-factory.service
└─2727 /usr/libexec/evolution-addressbook-factory
└─2771 /usr/libexec/evolution-addressbook-factory-subprocess --factory all --bus-name
org.gnome.evolution.dataserver.Subprocess.Backend.AddressBookx2727x2 --own-path /org/gnome/evo>
└─gvfs-mtp-volume-monitor.service
lines 44-86

```

En utilisant Systemd, plusieurs ressources peuvent être limitées :

- **CPUShares** - par défaut 1024,
- **MemoryLimit** - limite exprimée en Mo ou en Go. Pas de valeur par défaut,

- **BlockIOWeight** - valeur entre 10 et 1000. Pas de valeur par défaut,
- **StartupCPUShares** - comme CPUShares mais uniquement appliqué pendant le démarrage,
- **StartupBlockIOWeight** - comme BlockIOWeight mais uniquement appliqué pendant le démarrage,
- **CPUQuota** - utilisé pour limiter le temps CPU, même quand le système ne fait rien.



**Important** : Consultez le manuel `systemd.resource-control(5)` pour voir les paramètres CGroup qui peuvent être passés à `systemctl`.

## Limitation de la Mémoire

Commencez par créer le script **hello-world.sh** qui servira à générer un processus pour travailler avec les CGroups :

```
[root@centos8 ~]# vi hello-world.sh
[root@centos8 ~]# cat hello-world.sh
#!/bin/bash
while [ 1 ]; do
    echo "hello world"
    sleep 360
done
```

Rendez le script exécutable et testez-le :

```
[root@centos8 ~]# chmod u+x hello-world.sh
[root@centos8 ~]# ./hello-world.sh
hello world
^C
```

Créez maintenant un CGroup dans le sous-système **memory** appelé **helloworld** :

```
[root@centos8 ~]# mkdir /sys/fs/cgroup/memory/helloworld
```

Par défaut, ce CGroup héritera de l'ensemble de la mémoire disponible. Pour éviter cela, créez maintenant une limite de **40000000** octets pour ce CGroup :

```
[root@centos8 ~]# echo 40000000 > /sys/fs/cgroup/memory/helloworld/memory.limit_in_bytes
[root@centos8 ~]# cat /sys/fs/cgroup/memory/helloworld/memory.limit_in_bytes
39997440
```



**Important** - Notez que les 40 000 000 demandés sont devenus 39 997 440 ce qui correspond à un nombre entier de pages mémoire du noyau de 4Ko. ( 39 997 440 / 4096 = 9 765 ).

Lancez maintenant le script **helloworld.sh** :

```
[root@centos8 ~]# ./hello-world.sh &
[1] 35148

[root@centos8 ~]# hello world
[Entrée]

[root@centos8 ~]# ps aux | grep hello-world
root      35148  0.0  0.0 12724 2980 pts/1    S   08:48   0:00 /bin/bash ./hello-world.sh
root      35151  0.0  0.0 12136 1044 pts/1    S+  08:48   0:00 grep --color=auto hello-world
```

Notez qu'il n'y a pas de limite de la mémoire, ce qui implique l'héritage par défaut :

```
[root@centos8 ~]# ps -ww -o cgroup 35148
CGROUP
12:memory:/user.slice/user-1000.slice/session-7.scope,7:devices:/user.slice,4:pids:/user.slice/user-1000.slice/se
```

```
ssion-7.scope,2:blkio:/user.slice,1:name=systemd:/user.slice/user-1000.slice/session-7.scope
```

Insérer le PID de notre script dans le CGroup **helloworld** :

```
[root@centos8 ~]# echo 35148 > /sys/fs/cgroup/memory/helloworld/cgroup.procs
```

Notez maintenant l'héritage de la limitation de la mémoire - **12:memory:/helloworld** :

```
[root@centos8 ~]# ps -ww -o cgroup 35148
CGROUP
12:memory:/helloworld,7:devices:/user.slice,4:pids:/user.slice/user-1000.slice/session-7.scope,2:blkio:/user.slic
e,1:name=systemd:/user.slice/user-1000.slice/session-7.scope
```

Constatez ensuite l'occupation mémoire réelle :

```
[root@centos8 ~]# cat /sys/fs/cgroup/memory/helloworld/memory.usage_in_bytes
274432
```

Tuez le script **hello-world.sh** :

```
[root@centos8 ~]# kill 35148
[root@centos8 ~]# ps aux | grep hello-world
root      35307  0.0  0.0 12136 1112 pts/1    S+   08:55   0:00 grep --color=auto hello-world
[1]+  Terminated                  ./hello-world.sh
```

Créez un second CGroup beaucoup plus restrictif :

```
[root@centos8 ~]# mkdir /sys/fs/cgroup/memory/helloworld1
[root@centos8 ~]# echo 6000 > /sys/fs/cgroup/memory/helloworld1/memory.limit_in_bytes
[root@centos8 ~]# cat /sys/fs/cgroup/memory/helloworld1/memory.limit_in_bytes
4096
```

Relancez le script **hello-world.sh** et insérez-le dans le nouveau CGroup :

```
[root@centos8 ~]# ./hello-world.sh &
[1] 35389

[root@centos8 ~]# hello world
[Entrée]

[root@centos8 ~]# echo 35389 > /sys/fs/cgroup/memory/helloworld1/cgroup.procs
```

Attendez la prochaine sortie de **hello world** sur le canal standard puis constatez que le script s'arrête :

```
[root@centos8 ~]# hello world
[Entrée]
[1]+  Killed                  ./hello-world.sh
```

## La Commande cgcreate

Cette commande permet la création d'un CGroup :

```
[root@centos8 ~]# cgcreate -g memory:helloworld2
[root@centos8 ~]# ls -l /sys/fs/cgroup/memory/helloworld2/
total 0
-rw-rw-r--. 1 root root 0 Jul 13 10:39 cgroup.clone_children
--w--w----. 1 root root 0 Jul 13 10:39 cgroup.event_control
-rw-rw-r--. 1 root root 0 Jul 13 10:39 cgroup.procs
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.failcnt
--w--w----. 1 root root 0 Jul 13 10:39 memory.force_empty
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.kmem.failcnt
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.kmem.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.kmem.max_usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.kmem.slabinfo
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.kmem.tcp.failcnt
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.kmem.tcp.limit_in_bytes
```

```
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.kmem.tcp.max_usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.kmem.tcp.usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.kmem.usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.max_usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.memsw.failcnt
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.memsw.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.memsw.max_usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.memsw.usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.move_charge_at_immigrate
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.numa_stat
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.oom_control
-----. 1 root root 0 Jul 13 10:39 memory.pressure_level
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.soft_limit_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.stat
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.swappiness
-r--r--r--. 1 root root 0 Jul 13 10:39 memory.usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:39 memory.use_hierarchy
-rw-rw-r--. 1 root root 0 Jul 13 10:39 notify_on_release
-rw-rw-r--. 1 root root 0 Jul 13 10:39 tasks
```

Il n'existe cependant pas de commande pour affecter une limitation de la mémoire :

```
[root@centos8 ~]# echo 40000000 > /sys/fs/cgroup/memory/helloworld2/memory.limit_in_bytes
```

### La Commande cgexec

Cette commande permet d'insérer la limitation dans le CGroup **et** de lancer le script en une seule ligne :

```
[root@centos8 ~]# cgexec -g memory:helloworld2 ./hello-world.sh &
[1] 37670
```

```
[root@centos8 ~]# hello world
[Entrée]

[root@centos8 ~]#
```

### La Commande cgdelete

Une fois le script terminé, cette commande permet de supprimer le cgroup :

```
[root@centos8 ~]# ps aux | grep *.sh
root      37670  0.0  0.0 12724 3112 pts/1    S   10:41   0:00 /bin/bash ./hello-world.sh
root      37685  0.0  0.0 12136 1148 pts/1    S+  10:42   0:00 grep --color=auto hello-world.sh

[root@centos8 ~]# kill 37670

root@centos8 ~]# ps aux | grep *.sh
root      37726  0.0  0.0 12136 1156 pts/1    R+  10:43   0:00 grep --color=auto hello-world.sh
[1]+  Terminated                  cgexec -g memory:helloworld2 ./hello-world.sh

[root@centos8 ~]# cgdelete memory:helloworld2

[root@centos8 ~]# ls -l /sys/fs/cgroup/memory/helloworld2/
ls: cannot access '/sys/fs/cgroup/memory/helloworld2/': No such file or directory
```

### Le Fichier /etc/cgconfig.conf

Afin de les rendre persistants, il convient d'éditer le fichier **/etc/cgconfig.conf** :

```
[root@centos8 ~]# vi /etc/cgconfig.conf
[root@centos8 ~]# cat /etc/cgconfig.conf
#
```



```
# Copyright IBM Corporation. 2007
#
# Authors:      Balbir Singh <balbir@linux.vnet.ibm.com>
# This program is free software; you can redistribute it and/or modify it
# under the terms of version 2.1 of the GNU Lesser General Public License
# as published by the Free Software Foundation.
#
# This program is distributed in the hope that it would be useful, but
# WITHOUT ANY WARRANTY; without even the implied warranty of
# MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
#
#
# By default, we expect systemd mounts everything on boot,
# so there is not much to do.
# See man cgconfig.conf for further details, how to create groups
# on system boot using this file.
group helloworld2 {
    cpu {
        cpu.shares = 100;
    }
    memory {
        memory.limit_in_bytes = 40000;
    }
}
```



**Important** - Notez la création de **deux** limitations, une de 40 000 octets de mémoire et l'autre de **100 cpu.shares**. Cette dernière est une valeur exprimée sur 1 024, où 1 024 représente 100% du temps CPU. La limite fixée est donc équivalente à 9,77% du temps CPU.

Créez donc les deux CGroups concernés :

```
[root@centos8 ~]# cgcreate -g memory:helloworld2
[root@centos8 ~]# ls -l /sys/fs/cgroup/memory/helloworld2/
total 0
-rw-rw-r--. 1 root root 0 Jul 13 10:46 cgroup.clone_children
--w--w----. 1 root root 0 Jul 13 10:46 cgroup.event_control
-rw-rw-r--. 1 root root 0 Jul 13 10:46 cgroup.procs
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.failcnt
--w--w----. 1 root root 0 Jul 13 10:46 memory.force_empty
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.kmem.failcnt
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.kmem.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.kmem.max_usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.kmem.slabinfo
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.kmem.tcp.failcnt
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.kmem.tcp.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.kmem.tcp.max_usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.kmem.tcp.usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.kmem.usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.max_usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.memsw.failcnt
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.memsw.limit_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.memsw.max_usage_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.memsw.usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.move_charge_at_immigrate
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.numa_stat
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.oom_control
-----s---. 1 root root 0 Jul 13 10:46 memory.pressure_level
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.soft_limit_in_bytes
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.stat
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.swappiness
-r--r--r--. 1 root root 0 Jul 13 10:46 memory.usage_in_bytes
-rw-rw-r--. 1 root root 0 Jul 13 10:46 memory.use_hierarchy
-rw-rw-r--. 1 root root 0 Jul 13 10:46 notify_on_release
```

```
-rw-rw-r--. 1 root root 0 Jul 13 10:46 tasks
```

```
[root@centos8 ~]# cgcreate -g cpu:helloworld2
[root@centos8 ~]# ls -l /sys/fs/cgroup/cpu/helloworld2/
total 0
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cgroup.clone_children
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cgroup.procs
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.stat
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cpuacct.usage
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.usage_all
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.usage_percpu
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.usage_percpu_sys
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.usage_percpu_user
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.usage_sys
-r--r--r--. 1 root root 0 Jul 13 10:47 cpuacct.usage_user
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cpu.cfs_period_us
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cpu.cfs_quota_us
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cpu.rt_period_us
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cpu.rt_runtime_us
-rw-rw-r--. 1 root root 0 Jul 13 10:47 cpu.shares
-r--r--r--. 1 root root 0 Jul 13 10:47 cpu.stat
-rw-rw-r--. 1 root root 0 Jul 13 10:47 notify_on_release
-rw-rw-r--. 1 root root 0 Jul 13 10:47 tasks
```

### La Commande cgconfigparser

Appliquez le contenu du fichier **/etc/cgconfig.conf** grâce à l'utilisation de la commande **cgconfigparser** :

```
[root@centos8 ~]# cgconfigparser -l /etc/cgconfig.conf
[root@centos8 ~]# cat /sys/fs/cgroup/memory/helloworld2/memory.limit_in_bytes
36864
[root@centos8 ~]# cat /sys/fs/cgroup/cpu/helloworld2/cpu.shares
```

100

---

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---