

## Współczesne systemy komputerowe

### Zarządzanie sprzętem

#### Informacje o systemie komputerowym

- W katalogu /proc umieszczone są wirtualne pliki zawierające bardzo dużo informacji o działającym systemie, można je przeglądać poleceniami **cat**, **grep**, **egrep**
- Wyświetl urządzenia w systemie

```
root@debian:~# cat /proc/devices
Character devices:
 1 mem
 4 /dev/vc/0
 4 tty
 4 ttyS
 5 /dev/tty
 5 /dev/console
 5 /dev/ptmx
 6 lp
 7 vcs
10 misc
13 input
21 sg
29 fb
99 ppdev
116 alsa
128 ptm
136 pts
180 usb
189 usb_device
249 hidraw
250 bsg
251 watchdog
252 rtc
253 tpm
254 gpiochip

Block devices:
259 blkext
 8 sd
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
```

- Procesor

```
root@debian:~# cat /proc/cpuinfo
processor                : 0
vendor_id               : AuthenticAMD
cpu family              : 20
model                   : 2
model name              : AMD C-70 APU with Radeon(tm) HD Graphics
stepping                : 0
microcode               : 0x6000626
cpu MHz                 : 958.474
cache size              : 512 KB
physical id             : 0
siblings                : 1
core id                 : 0
cpu cores               : 1
apicid                  : 0
initial apicid         : 0
fdiv_bug                : no
f00f_bug                : no
coma_bug                : no
fpu                     : yes
fpu_exception           : yes
cpuid level             : 5
wp                      : yes
flags                   : fpu vme de pse tsc msr mce cx8 apic mtrr pge mca cmov pat pse36 clflush mmx
                        fxsr sse sse2 fxsr_opt rdtscp rep_good extd_apicid eagerfpu pni monitor ssse3
                        cr8_legacy vmmcall arat
bugs                    : fxsave_leak sysret_ss_attrs spectre_v1 spectre_v2
bogomips                : 1916.94
clflush size            : 64
cache_alignment         : 64
address sizes           : 36 bits physical, 48 bits virtual
power management:
```

- Urządzenia wejścia-wyjścia

```
root@debian:~# cat /proc/ioprots
0000-001f : dma1
0020-0021 : pic1
0040-0043 : timer0
0050-0053 : timer1
0060-0060 : keyboard
0064-0064 : keyboard
0070-0071 : rtc_cmos
           0070-0071 : 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
0cf8-0cff : PCI conf1
```

```

4000-4003 : ACPI PM1a_EVT_BLK
4004-4005 : ACPI PM1a_CNT_BLK
4008-400b : ACPI PM_TMR
4020-4021 : ACPI GPE0_BLK
d000-d00f : 0000:00:01.1
  d000-d00f : ata_piix
d010-d017 : 0000:00:03.0
  d010-d017 : e1000
d020-d03f : 0000:00:04.0
d100-d1ff : 0000:00:05.0
  d100-d1ff : Intel 82801AA-ICH
d200-d23f : 0000:00:05.0
  d200-d23f : Intel 82801AA-ICH
d240-d247 : 0000:00:0d.0
  d240-d247 : ahci
d250-d257 : 0000:00:0d.0
  d250-d257 : ahci
d260-d26f : 0000:00:0d.0
  d260-d26f : ahci

```

- Przerwania

```

root@debian:~# cat /proc/interrupts
CPU0
 0:      1016   XT-PIC  timer
 1:      2199   XT-PIC  i8042
 2:         0   XT-PIC  cascade
 8:         0   XT-PIC  rtc0
 9:         0   XT-PIC  acpi
10:     18501   XT-PIC  enp0s3
11:     26853   XT-PIC  ahci[0000:00:0d.0], ohci_hcd:usb1, snd_intel8x0
12:       155   XT-PIC  i8042
14:         0   XT-PIC  ata_piix
15:      2436   XT-PIC  ata_piix
NMI:         0  Non-maskable interrupts
LOC:    427441  Local timer interrupts
SPU:         0  Spurious interrupts
PMI:         0  Performance monitoring interrupts
IWI:         0  IRQ work interrupts
RTR:         0  APIC ICR read retries
RES:         0  Rescheduling interrupts
CAL:         0  Function call interrupts
TLB:         0  TLB shutdowns
TRM:         0  Thermal event interrupts
THR:         0  Threshold APIC interrupts
DFR:         0  Deferred Error APIC interrupts
MCE:         0  Machine check exceptions
MCP:         8  Machine check polls
ERR:         0
MIS:         0
PIN:         0  Posted-interrupt notification event
PIW:         0  Posted-interrupt wakeup event

```

- Informacje o pamięci

```

root@debian:~# cat /proc/meminfo
MemTotal:      1029056 kB
MemFree:       200544 kB
MemAvailable:  525000 kB
Buffers:       42664 kB

```

```

Cached:          410864 kB
SwapCached:      0 kB
Active:          509328 kB
Inactive:        271352 kB
Active(anon):    327752 kB
Inactive(anon):  7048 kB
Active(file):    181576 kB
Inactive(file):  264304 kB
Unevictable:     0 kB
Mlocked:         0 kB
HighTotal:       139208 kB
HighFree:        1840 kB
LowTotal:        889848 kB
LowFree:         198704 kB
SwapTotal:       1011708 kB
SwapFree:        1011708 kB
Dirty:           24 kB
Writeback:       0 kB
AnonPages:       327148 kB
Mapped:          154616 kB
Shmem:           7660 kB
Slab:            33320 kB
SReclaimable:   22960 kB
SUnreclaim:     10360 kB
KernelStack:    2632 kB
PageTables:      4740 kB
NFS_Unstable:   0 kB
Bounce:         0 kB
WritebackTmp:   0 kB
CommitLimit:    1526236 kB
Committed_AS:   2605648 kB
VmallocTotal:   122880 kB
VmallocUsed:    0 kB
VmallocChunk:   0 kB
HardwareCorrupted: 0 kB
AnonHugePages:  0 kB
ShmemHugePages: 0 kB
ShmemPmdMapped: 0 kB
HugePages_Total: 0
HugePages_Free: 0
HugePages_Rsvd: 0
HugePages_Surp: 0
Hugepagesize:   4096 kB
DirectMap4k:    24568 kB
DirectMap4M:    884736 kB

```

- Lista partycji

```

root@debian:~# fdisk -l
Disk /dev/sda: 10 GiB, 10737418240 bytes, 20971520 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x717aa925

Device     Boot      Start         End      Sectors   Size Id Type
/dev/sda1  *                2048 18946047 18944000    9G 83 Linux
/dev/sda2                18946048 20969471  2023424   988M 82 Linux swap / Solaris

Disk /dev/sdb: 8 GiB, 8589934592 bytes, 16777216 sectors

```

```
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x609626de

Device      Boot      Start          End      Sectors   Size Id Type
/dev/sdb1                2048      2099199      2097152    1G  b W95 FAT32
/dev/sdb2          2099200 16777215 14678016    7G  5 Extended
/dev/sdb5          2101248  4055039  1953792    954M 83 Linux
/dev/sdb6          4057088  7962623  3905536    1.9G 83 Linux
/dev/sdb7          7964672 16777215  8812544    4.2G 83 Linux
```

- Urządzenia PCI

```
root@debian:~# 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 82371AB/EB/MB PIIX4 IDE (rev 01)
00:02.0 VGA compatible controller: InnoTek Systemberatung GmbH VirtualBox Graphics Adapter
00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02)
00:04.0 System peripheral: InnoTek Systemberatung GmbH VirtualBox Guest Service
00:05.0 Multimedia audio controller: Intel Corporation 82801AA AC'97 Audio Controller (rev 01)
00:06.0 USB controller: Apple Inc. KeyLargo/Intrepid USB
00:07.0 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:0d.0 SATA controller: Intel Corporation 82801HM/HEM (ICH8M/ICH8M-E) SATA Controller [AHCI mode] (rev 02)
```

- Urządzenia USB

```
root@debian:~# lsusb
Bus 001 Device 002: ID 80ee:0021 VirtualBox USB Tablet
Bus 001 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
```

- Zainstaluj pakiet **hwinfo** i sprawdź działanie polecenia **hwinfo --short**

## Informacje o systemie komputerowym

- **sysfs** jest wirtualnym (pliki tworzone są podczas pracy przez jądro) systemem plików zamontowanym w katalogu **/sys**
- W **/sys** znajdują się dwa katalogi reprezentujące sprzęt komputerowy
  - **/sys/bus**
  - **/sys/devices**
- I dwa reprezentujące interfejsy;
  - **/sys/class**
  - **/sys/block**

```
root@debian:~# ls -l /sys/bus/usb/devices/1-1/
total 0
drwxr-xr-x 5 root root    0 Mar 20 00:19 1-1:1.0
-rw-r--r-- 1 root root 4096 Mar 20 00:20 authorized
-rw-r--r-- 1 root root 4096 Mar 20 00:20 avoid_reset_quirk
```

```

-r--r--r-- 1 root root 4096 Mar 20 00:19 bcdDevice
-rw-r--r-- 1 root root 4096 Mar 20 00:20 bConfigurationValue
-r--r--r-- 1 root root 4096 Mar 20 00:19 bDeviceClass
-r--r--r-- 1 root root 4096 Mar 20 00:20 bDeviceProtocol
-r--r--r-- 1 root root 4096 Mar 20 00:20 bDeviceSubClass
-r--r--r-- 1 root root 4096 Mar 20 00:20 bmAttributes
-r--r--r-- 1 root root 4096 Mar 20 00:20 bMaxPacketSize0
-r--r--r-- 1 root root 4096 Mar 20 00:20 bMaxPower
-r--r--r-- 1 root root 4096 Mar 20 00:20 bNumConfigurations
-r--r--r-- 1 root root 4096 Mar 20 00:20 bNumInterfaces
-r--r--r-- 1 root root 4096 Mar 20 00:20 busnum
-r--r--r-- 1 root root 4096 Mar 20 00:20 configuration
-r--r--r-- 1 root root 65553 Mar 20 00:19 descriptors
-r--r--r-- 1 root root 4096 Mar 20 00:20 dev
-r--r--r-- 1 root root 4096 Mar 20 00:20 devnum
-r--r--r-- 1 root root 4096 Mar 20 00:20 devpath
lrwxrwxrwx 1 root root 0 Mar 20 00:20 driver -> ../../../../../../bus/usb/drivers/usb
drwxr-xr-x 3 root root 0 Mar 20 00:20 ep_00
-r--r--r-- 1 root root 4096 Mar 20 00:19 idProduct
-r--r--r-- 1 root root 4096 Mar 20 00:19 idVendor
-r--r--r-- 1 root root 4096 Mar 20 00:20 ltm_capable
-r--r--r-- 1 root root 4096 Mar 20 00:19 manufacturer
-r--r--r-- 1 root root 4096 Mar 20 00:20 maxchild
lrwxrwxrwx 1 root root 0 Mar 20 00:20 port -> ../1-0:1.0/usb1-port1
drwxr-xr-x 2 root root 0 Mar 20 00:20 power
-r--r--r-- 1 root root 4096 Mar 20 00:19 product
-r--r--r-- 1 root root 4096 Mar 20 00:20 quirks
-r--r--r-- 1 root root 4096 Mar 20 00:20 removable
--w----- 1 root root 4096 Mar 20 00:20 remove
-r--r--r-- 1 root root 4096 Mar 20 00:20 speed
lrwxrwxrwx 1 root root 0 Mar 20 00:19 subsystem -> ../../../../../../bus/usb
-rw-r--r-- 1 root root 4096 Mar 20 00:19 uevent
-r--r--r-- 1 root root 4096 Mar 20 00:20 urbnum
-r--r--r-- 1 root root 4096 Mar 20 00:20 version

```

```

root@debian:~# ls -l /sys/block/sda/
total 0
-r--r--r-- 1 root root 4096 Mar 20 16:40 alignment_offset
-rw-r--r-- 1 root root 4096 Mar 20 16:40 badblocks
lrwxrwxrwx 1 root root 0 Mar 20 16:40 bdi -> ../../../../../../virtual/bdi/8:0
-r--r--r-- 1 root root 4096 Mar 20 16:40 capability
-r--r--r-- 1 root root 4096 Mar 20 00:19 dev
lrwxrwxrwx 1 root root 0 Mar 20 16:40 device -> ../.././2:0:0:0
-r--r--r-- 1 root root 4096 Mar 20 16:40 discard_alignment
-r--r--r-- 1 root root 4096 Mar 20 16:40 events
-r--r--r-- 1 root root 4096 Mar 20 16:40 events_async
-rw-r--r-- 1 root root 4096 Mar 20 16:40 events_poll_msecs
-r--r--r-- 1 root root 4096 Mar 20 16:40 ext_range
drwxr-xr-x 2 root root 0 Mar 20 16:40 holders
-r--r--r-- 1 root root 4096 Mar 20 16:40 inflight
drwxr-xr-x 2 root root 0 Mar 20 16:40 integrity
drwxr-xr-x 2 root root 0 Mar 20 16:40 power
drwxr-xr-x 3 root root 0 Mar 20 15:56 queue
-r--r--r-- 1 root root 4096 Mar 20 16:40 range
-r--r--r-- 1 root root 4096 Mar 20 15:56 removable
-r--r--r-- 1 root root 4096 Mar 20 15:56 ro
drwxr-xr-x 5 root root 0 Mar 20 00:19 sda1
drwxr-xr-x 5 root root 0 Mar 20 00:19 sda2
-r--r--r-- 1 root root 4096 Mar 20 15:56 size
drwxr-xr-x 2 root root 0 Mar 20 16:40 slaves
-r--r--r-- 1 root root 4096 Mar 20 16:40 stat

```

```
lrwxrwxrwx 1 root root 0 Mar 20 00:19 subsystem ->
  ../../../../../../../../../../class/block
drwxr-xr-x 2 root root 0 Mar 20 16:40 trace
-rw-r--r-- 1 root root 4096 Mar 20 00:19 uevent
```

```
root@debian:~# cat /sys/block/sda/sda1/size
18944000
```

```
root@debian:~# ls -l /sys/block/sda/device
lrwxrwxrwx 1 root root 0 Mar 20 16:40 /sys/block/sda/device -> ../../../../2:0:0:0
```

```
root@debian:~# cat /sys/block/sda/device/model
VBOX HARDDISK
```

```
root@debian:~# cat /sys/block/sda/device/state
running
```

## Moduły

- Jądro systemu może być kompilowane ze sterownikami i dodatkowymi funkcjonalnościami lub mogą one być ładowane do jądra w postaci modułu
- Moduły znajdują się w katalogu `/lib/modules/version/kernel`

```
root@debian:~# ls -l /lib/modules/4.9.0-6-686/kernel/
total 40
drwxr-xr-x 3 root root 4096 Mar 13 11:17 arch
drwxr-xr-x 3 root root 4096 Mar 13 11:19 crypto
drwxr-xr-x 68 root root 4096 Mar 13 11:18 drivers
drwxr-xr-x 58 root root 4096 Mar 13 11:19 fs
drwxr-xr-x 6 root root 4096 Mar 13 11:19 lib
drwxr-xr-x 2 root root 4096 Mar 13 11:19 mm
drwxr-xr-x 50 root root 4096 Mar 13 11:19 net
drwxr-xr-x 3 root root 4096 Mar 13 11:19 security
drwxr-xr-x 13 root root 4096 Mar 13 11:19 sound
drwxr-xr-x 3 root root 4096 Mar 13 11:19 virt
```

- Aktualnie załadowane moduły można wyświetlić poleceniem `lsmod`

```
root@debian:~# lsmod
Module                Size  Used by
fuse                  90112  3
nls_ascii             16384  1
nls_cp437             16384  1
vfat                  20480  1
fat                   57344  1 vfat
reiserfs              225280  1
joydev                20480  0
evdev                 20480  12
serio_raw             16384  0
pcspkr                16384  0
snd_intel8x0          32768  4
snd_ac97_codec        98304  1 snd_intel8x0
ac97_bus              16384  1 snd_ac97_codec
snd_pcm               86016  2 snd_ac97_codec,snd_intel8x0
snd_timer             28672  1 snd_pcm
snd                   57344  12 snd_ac97_codec,snd_timer,snd_intel8x0,snd_pcm
soundcore             16384  1 snd
sg                    32768  0
battery              20480  0
```

```

ac                16384  0
button           16384  0
parport_pc       28672  0
ppdev            20480  0
lp               20480  0
parport          40960  3 lp,parport_pc,ppdev
ip_tables        20480  0
x_tables         20480  1 ip_tables
autofs4          36864  2
ext4             499712  3
crc16            16384  1 ext4
jbd2             77824  1 ext4
crc32c_generic   16384  4
fscrypto         24576  1 ext4
ecb              16384  0
xts              16384  0
lrw              16384  0
gf128mul         20480  2 lrw,xts
ablk_helper      16384  0
cryptd           20480  1 ablk_helper
aes_i586         20480  1
mbcache          16384  4 ext4
hid_generic      16384  0
usbhid           45056  0
hid              94208  2 hid_generic,usbhid
sr_mod           24576  0
sd_mod           40960  8
cdrom            49152  1 sr_mod
ata_generic      16384  0
ohci_pci         16384  0
ehci_pci         16384  0
ohci_hcd         45056  1 ohci_pci
ehci_hcd         65536  1 ehci_pci
ahci             36864  6
ata_piix         32768  0
libahci          28672  1 ahci
psmouse         131072  0
usbcore          184320  5 usbhid,ehci_hcd,ohci_pci,ohci_hcd,ehci_pci
libata           192512  4 ahci,ata_piix,libahci,ata_generic
e1000            114688  0
usb_common       16384  1 usbcore
i2c_piix4        20480  0
scsi_mod         180224  4 sd_mod,libata,sr_mod,sg

```

- Sprawdź, czy jest załadowany moduł o nazwie **joydev** (sterownik joysticka)

```

root@debian:~# lsmod | grep joydev
joydev          20480  0

```

- Wartość **0** w kolumnie **Used** oznacza, że nie jest używany
- Usuń moduł

```

root@debian:~# rmmod joydev

```

```

root@debian:~# lsmod | grep joydev

```



- Załaduj moduł

```
root@debian:~# modprobe joydev
```

```
root@debian:~# lsmod | grep joydev
joydev                20480  0
```

- Sprawdź informacje o module

```
root@debian:~# modinfo joydev
filename:             /lib/modules/4.9.0-6-686/kernel/drivers/input/joydev.ko
license:              GPL
description:          Joystick device interfaces
author:               Vojtech Pavlik <vojtech@ucw.cz>
alias:                input:b*v*p*e*-e*1,*k*2C0,*r*a*m*1*s*f*w*
alias:                input:b*v*p*e*-e*1,*k*130,*r*a*m*1*s*f*w*
alias:                input:b*v*p*e*-e*1,*k*120,*r*a*m*1*s*f*w*
alias:                input:b*v*p*e*-e*3,*k*r*a*6,*m*1*s*f*w*
alias:                input:b*v*p*e*-e*3,*k*r*a*8,*m*1*s*f*w*
alias:                input:b*v*p*e*-e*3,*k*r*a*2,*m*1*s*f*w*
alias:                input:b*v*p*e*-e*3,*k*r*a*0,*m*1*s*f*w*
depends:
retpoline:           Y
intree:              Y
vermagic:            4.9.0-6-686 SMP mod_unload modversions 686
```