

1. Informacje o systemie komputerowym.

- W katalogu `/proc` umieszczone są wirtualne pliki zawierające bardzo dużo informacji o działającym systemie, można je przeglądać poleceniami `cat`, `grep`, `less`;
- Urządzenia w systemie;

```
suse:~ # 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
 9 st
10 misc
13 input
14 sound/mixer
14 sound/dsp
14 sound/audio
14 sound/adsp
21 sg
29 fb
99 ppdev
116 alsa
128 ptm
136 pts
180 usb
189 usb_device
202 cpu/msr
226 drm
252 hidraw
253 bsg
254 rtc
```

```
Block devices:
```

```
259 blkext
 7 loop
 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
```

- Procesor;

```
suse:~ # 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
cpu MHz      : 958.412
cache size   : 512 KB
fdiv_bug     : no
hlt_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 up extd_apicid pni monitor ssse3 cr8_legacy
             arat
bogomips    : 1916.82
clflush size : 64
cache_alignment : 64
address sizes : 36 bits physical, 48 bits virtual
power management:
```

- Urządzenia wejścia-wyjścia;

```
suse:~ # cat /proc/ioports
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 : vesafb
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-d25f : 0000:00:08.0
    d240-d25f : pcnet32_probe_pci
d260-d267 : 0000:00:0d.0
    d260-d267 : ahci
d270-d277 : 0000:00:0d.0
    d270-d277 : ahci
d280-d28f : 0000:00:0d.0
    d280-d28f : ahci

```

- Przerwania;

```

suse:~ # cat /proc/interrupts
          CPU0
 0:         373    XT-PIC-XT-PIC    timer
 1:         9777   XT-PIC-XT-PIC    i8042
 2:            0    XT-PIC-XT-PIC    cascade
 5:        66011   XT-PIC-XT-PIC    ahci, Intel 82801AA-ICH
 8:            2    XT-PIC-XT-PIC    rtc0
 9:       107208   XT-PIC-XT-PIC    acpi, vboxguest
10:        34905   XT-PIC-XT-PIC    eth0
11:            33   XT-PIC-XT-PIC    ohci_hcd:usb1
12:       10631   XT-PIC-XT-PIC    i8042
14:            0    XT-PIC-XT-PIC    ata_piix
15:       152025   XT-PIC-XT-PIC    ata_piix
NMI:            0    Non-maskable interrupts
LOC:     5551437   Local timer interrupts
SPU:            0    Spurious interrupts
PMI:            0    Performance monitoring interrupts
IWI:            0    IRQ work interrupts
RES:            0    Rescheduling interrupts
CAL:            0    Function call interrupts
TLB:            0    TLB shootdowns
TRM:            0    Thermal event interrupts
THR:            0    Threshold APIC interrupts
MCE:            0    Machine check exceptions
MCP:           188   Machine check polls
ERR:            0
MIS:            0

```

- Informacje o pamięci;

```

suse:~ # cat /proc/meminfo
MemTotal:       1027336 kB
MemFree:        268152 kB
Buffers:        139216 kB
Cached:         458380 kB
SwapCached:      0 kB

```

```

Active:          435972 kB
Inactive:       246396 kB
Active(anon):   84964 kB
Inactive(anon): 3952 kB
Active(file):   351008 kB
Inactive(file): 242444 kB
Unevictable:    0 kB
Mlocked:        0 kB
HighTotal:     139208 kB
HighFree:       1848 kB
LowTotal:      888128 kB
LowFree:       266304 kB
SwapTotal:     1051644 kB
SwapFree:      1051644 kB
Dirty:         4 kB
Writeback:     0 kB
AnonPages:     84768 kB
Mapped:        44872 kB
Shmem:         4144 kB
Slab:          62320 kB
SReclaimable:  54224 kB
SUnreclaim:    8096 kB
KernelStack:   1688 kB
PageTables:    2020 kB
NFS_Unstable:  0 kB
Bounce:        0 kB
WritebackTmp:  0 kB
CommitLimit:   1565312 kB
Committed_AS:  460080 kB
VmallocTotal:  122880 kB
VmallocUsed:   34472 kB
VmallocChunk:  80888 kB
HardwareCorrupted: 0 kB
AnonHugePages: 4096 kB
HugePages_Total: 0
HugePages_Free: 0
HugePages_Rsvd: 0
HugePages_Surp: 0
Hugepagesize:  4096 kB
DirectMap4k:   24568 kB
DirectMap4M:   884736 kB

```

- Informacje o interfejsie SCSI;

```

suse:~ # cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: ATA      Model: VBOX HARDDISK   Rev: 1.0
  Type:   Direct-Access      ANSI SCSI revision: 05
Host: scsi2 Channel: 00 Id: 00 Lun: 00
  Vendor: VBOX     Model: CD-ROM          Rev: 1.0
  Type:   CD-ROM

```

- Sumaryczne informacje o sprzęcie;

```

suse:~ # hwinfo --short
cpu:
          AMD C-70 APU with Radeon(tm) HD Graphics, 958 MHz
keyboard:
  /dev/input/event0  AT Translated Set 2 keyboard
mouse:

```

```

/dev/input/mice VirtualBox USB Tablet
/dev/input/mice VirtualBox Mouse
monitor:
Generic Monitor
graphics card:
InnoTek Systemberatung VirtualBox Graphics Adapter
sound:
Intel 82801AA AC'97 Audio Controller
storage:
Intel 82371AB/EB/MB PIIX4 IDE
Intel 82801HBM/HEM (ICH8M/ICH8M-E) SATA AHCI Controller
network:
eth0 Intel PRO/1000 MT Desktop Adapter
eth1 AMD PCnet - Fast 79C971
network interface:
lo Loopback network interface
eth0 Ethernet network interface
eth1 Ethernet network interface
disk:
/dev/sda VBOX HARDDISK
partition:
/dev/sda1 Partition
/dev/sda2 Partition
/dev/sda3 Partition
/dev/sda5 Partition
/dev/sda6 Partition
/dev/sda7 Partition
/dev/sda8 Partition
/dev/sda9 Partition
cdrom:
/dev/sr0 VBOX CD-ROM
usb controller:
Apple KeyLargo/Intrepid USB
bios:
BIOS
bridge:
Intel 440FX - 82441FX PMC [Natoma]
Intel 82371SB PIIX3 ISA [Natoma/Triton II]
Intel 82371AB/EB/MB PIIX4 ACPI
hub:
Linux 3.0.13-0.27-default ohci_hcd OHCI Host Controller
memory:
Main Memory
unknown:
FPU
DMA controller
PIC
Timer
Keyboard controller
PS/2 Controller
InnoTek Systemberatung VirtualBox Guest Service
Unclassified device
Unclassified device
Unclassified device
Unclassified device
Unclassified device

```

- Lista partycji;

```
suse:~ # fdisk -l
```

```
Disk /dev/sda: 21.5 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders, total 41943040 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
Disk identifier: 0x000a86fa
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1		2048	2105343	1051648	82	Linux swap / Solaris
/dev/sda2	*	2105344	18876415	8385536	83	Linux
/dev/sda3		18876416	41943039	11533312	f	W95 Ext'd (LBA)
/dev/sda5		18878464	19920895	521216	83	Linux
/dev/sda6		19922944	22024191	1050624	83	Linux
/dev/sda7		22026240	23050239	512000	b	W95 FAT32
/dev/sda8		23052288	25149439	1048576	83	Linux
/dev/sda9		25151488	29345791	2097152	83	Linux

- Urządzenia PCI;

```
suse:~ # 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 Computer Inc. KeyLargo/Intrepid USB
00:07.0 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:08.0 Ethernet controller: Advanced Micro Devices [AMD] 79c970 [PCnet32 LANCE] (rev 10)
00:0d.0 SATA controller: Intel Corporation 82801HM/HEM (ICH8M/ICH8M-E) SATA Controller [AHCI mode] (rev 02)
```

- Urządzenia USB;

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

2. System plików sysfs.

- **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 interfejs;
 - **/sys/class**
 - **/sys/block**

```
suse:~ # ls -l /sys/bus/usb/devices/1-1/
```

```

total 0
drwxr-xr-x 6 root root    0 Apr  5 22:53 1-1:1.0
-rw-r--r-- 1 root root  4096 Apr  6 01:00 authorized
-rw-r--r-- 1 root root  4096 Apr  6 01:00 avoid_reset_quirk
-rw-r--r-- 1 root root  4096 Apr  5 22:54 bConfigurationValue
-r--r--r-- 1 root root  4096 Apr  5 22:54 bDeviceClass
-r--r--r-- 1 root root  4096 Apr  5 22:54 bDeviceProtocol
-r--r--r-- 1 root root  4096 Apr  5 22:54 bDeviceSubClass
-r--r--r-- 1 root root  4096 Apr  6 01:00 bMaxPacketSize0
-r--r--r-- 1 root root  4096 Apr  5 22:54 bMaxPower
-r--r--r-- 1 root root  4096 Apr  5 22:54 bNumConfigurations
-r--r--r-- 1 root root  4096 Apr  5 22:54 bNumInterfaces
-r--r--r-- 1 root root  4096 Apr  5 22:54 bcdDevice
-r--r--r-- 1 root root  4096 Apr  5 22:54 bmAttributes
-r--r--r-- 1 root root  4096 Apr  6 01:00 busnum
-r--r--r-- 1 root root  4096 Apr  5 22:54 configuration
-r--r--r-- 1 root root 65553 Apr  6 01:00 descriptors
-r--r--r-- 1 root root  4096 Apr  6 01:00 dev
-r--r--r-- 1 root root  4096 Apr  5 22:54 devnum
-r--r--r-- 1 root root  4096 Apr  6 01:00 devpath
lrwxrwxrwx 1 root root    0 Apr  5 22:54 driver -> ../../../../../../bus/usb/drivers/usb
drwxr-xr-x 3 root root    0 Apr  6 01:00 ep_00
-r--r--r-- 1 root root  4096 Apr  5 22:54 idProduct
-r--r--r-- 1 root root  4096 Apr  5 22:54 idVendor
-r--r--r-- 1 root root  4096 Apr  6 01:00 manufacturer
-r--r--r-- 1 root root  4096 Apr  5 22:54 maxchild
drwxr-xr-x 2 root root    0 Apr  6 01:00 power
-r--r--r-- 1 root root  4096 Apr  6 01:00 product
-r--r--r-- 1 root root  4096 Apr  6 01:00 quirks
--w----- 1 root root  4096 Apr  6 01:00 remove
-r--r--r-- 1 root root  4096 Apr  5 22:54 speed
lrwxrwxrwx 1 root root    0 Apr  5 22:53 subsystem -> ../../../../../../bus/usb
-rw-r--r-- 1 root root  4096 Apr  5 22:53 uevent
-r--r--r-- 1 root root  4096 Apr  6 01:00 urbnum
-r--r--r-- 1 root root  4096 Apr  5 22:54 version
suse:~ # cat /sys/bus/usb/devices/1-2/manufacturer
Canon

```

```

suse:~ # ls -l /sys/block/sda/
total 0
-r--r--r-- 1 root root  4096 Apr  6 01:00 alignment_offset
lrwxrwxrwx 1 root root    0 Apr  6 01:00 bdi -> ../../../../../../virtual/bdi/8:0
-r--r--r-- 1 root root  4096 Apr  6 01:00 capability
-r--r--r-- 1 root root  4096 Apr  5 22:54 dev
lrwxrwxrwx 1 root root    0 Apr  5 22:54 device -> ../.././0:0:0:0
-r--r--r-- 1 root root  4096 Apr  6 01:00 discard_alignment
-r--r--r-- 1 root root  4096 Apr  6 01:00 events
-r--r--r-- 1 root root  4096 Apr  6 01:00 events_async
-rw-r--r-- 1 root root  4096 Apr  6 01:00 events_poll_msecs
-r--r--r-- 1 root root  4096 Apr  6 01:00 ext_range
drwxr-xr-x 2 root root    0 Apr  6 01:00 holders
-r--r--r-- 1 root root  4096 Apr  6 01:00 inflight
drwxr-xr-x 2 root root    0 Apr  6 01:00 power
drwxr-xr-x 3 root root    0 Apr  6 01:00 queue
-r--r--r-- 1 root root  4096 Apr  5 22:54 range
-r--r--r-- 1 root root  4096 Apr  5 22:54 removable
-r--r--r-- 1 root root  4096 Apr  6 01:00 ro
drwxr-xr-x 5 root root    0 Apr  5 22:53 sda1
drwxr-xr-x 5 root root    0 Apr  5 22:53 sda2
drwxr-xr-x 5 root root    0 Apr  5 22:53 sda3
drwxr-xr-x 5 root root    0 Apr  5 22:53 sda5
drwxr-xr-x 5 root root    0 Apr  5 22:53 sda6

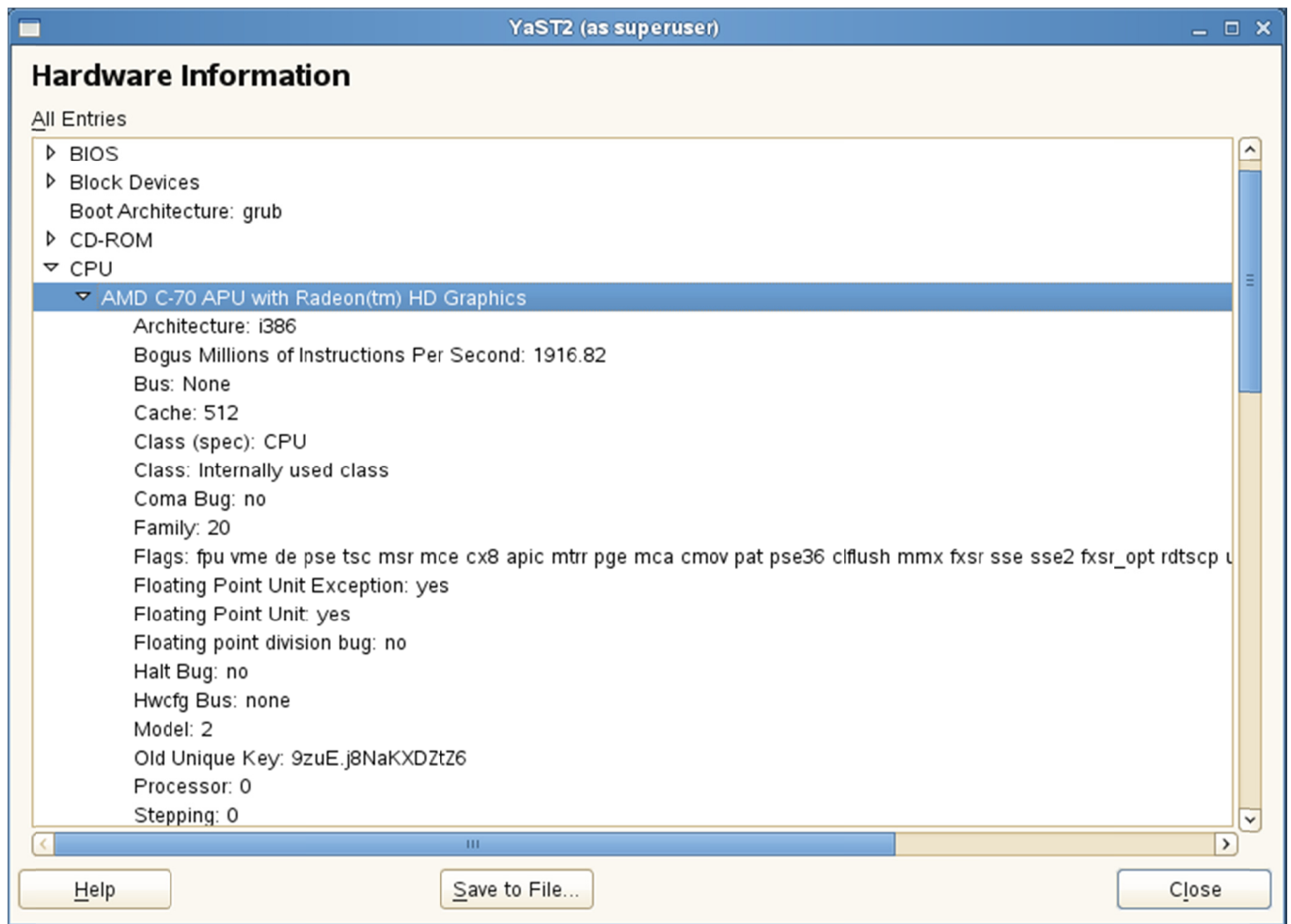
```

```

drwxr-xr-x 5 root root 0 Apr 5 22:53 sda7
drwxr-xr-x 5 root root 0 Apr 5 22:53 sda8
drwxr-xr-x 5 root root 0 Apr 5 22:53 sda9
-r--r--r-- 1 root root 4096 Apr 5 22:54 size
drwxr-xr-x 2 root root 0 Apr 6 01:00 slaves
-r--r--r-- 1 root root 4096 Apr 6 01:00 stat
lrwxrwxrwx 1 root root 0 Apr 5 22:53 subsystem ->
    ../../../../../../../../../../class/block
drwxr-xr-x 2 root root 0 Apr 6 01:00 trace
-rw-r--r-- 1 root root 4096 Apr 5 22:53 uevent
suse:~ # cat /sys/block/sda/sda1/size
2103296
suse:~ # ls -l /sys/block/sda/device
lrwxrwxrwx 1 root root 0 Apr 5 22:54 /sys/block/sda/device -> ../../../../0:0:0:0
suse:~ # cd /sys/block/sda/
suse:/sys/block/sda #
suse:/sys/block/sda # cd ../../../../0:0:0:0
suse:/sys/devices/pci0000:00/0000:00:0d.0/host0/target0:0:0/0:0:0:0 # ls -l
total 0
drwxr-xr-x 3 root root 0 Apr 5 22:53 block
drwxr-xr-x 3 root root 0 Apr 5 22:53 bsg
--w----- 1 root root 4096 Apr 6 01:00 delete
-r--r--r-- 1 root root 4096 Apr 6 01:00 device_blocked
-rw-r--r-- 1 root root 4096 Apr 6 01:00 dh_state
lrwxrwxrwx 1 root root 0 Apr 5 22:54 driver ->
    ../../../../../../../../../../bus/scsi/drivers/sd
-r--r--r-- 1 root root 4096 Apr 6 01:00 evt_media_change
lrwxrwxrwx 1 root root 0 Apr 6 01:00 generic -> scsi_generic/sg0
-r--r--r-- 1 root root 4096 Apr 6 01:00 iocounterbits
-r--r--r-- 1 root root 4096 Apr 6 01:00 iodone_cnt
-r--r--r-- 1 root root 4096 Apr 6 01:00 ioerr_cnt
-r--r--r-- 1 root root 4096 Apr 6 01:00 iorequest_cnt
-r--r--r-- 1 root root 4096 Apr 6 01:00 modalias
-r--r--r-- 1 root root 4096 Apr 5 22:54 model
drwxr-xr-x 2 root root 0 Apr 6 01:00 power
-rw-r--r-- 1 root root 4096 Apr 6 01:00 queue_depth
-rw-r--r-- 1 root root 4096 Apr 6 01:00 queue_ramp_up_period
-r--r--r-- 1 root root 4096 Apr 6 01:00 queue_type
--w----- 1 root root 4096 Apr 6 01:00 rescan
-r--r--r-- 1 root root 4096 Apr 6 01:00 rev
drwxr-xr-x 3 root root 0 Apr 5 22:53 scsi_device
drwxr-xr-x 3 root root 0 Apr 5 22:53 scsi_disk
drwxr-xr-x 3 root root 0 Apr 5 22:53 scsi_generic
-r--r--r-- 1 root root 4096 Apr 6 01:00 scsi_level
-rw-r--r-- 1 root root 4096 Apr 6 01:00 state
lrwxrwxrwx 1 root root 0 Apr 5 22:53 subsystem -> ../../../../../../../../../../bus/scsi
-rw-r--r-- 1 root root 4096 Apr 6 01:00 sw_activity
-rw-r--r-- 1 root root 4096 Apr 6 01:00 timeout
-r--r--r-- 1 root root 4096 Apr 5 22:54 type
-rw-r--r-- 1 root root 4096 Apr 5 22:53 uevent
-rw-r--r-- 1 root root 4096 Apr 6 01:00 unload_heads
-r--r--r-- 1 root root 4096 Apr 5 22:54 vendor
suse:/sys/devices/pci0000:00/0000:00:0d.0/host0/target0:0:0/0:0:0:0 # cat model
VBOX HARDDISK
suse:/sys/devices/pci0000:00/0000:00:0d.0/host0/target0:0:0/0:0:0:0 # cat state
running

```

- Uruchom program **YaST** i przejrzyj moduł **Hardware Information** z grupy **Hardware**;



3. 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`;

```
suse:~ # ls -l /lib/modules/3.0.13-0.27-default/kernel/
total 36
drwxr-xr-x  3 root root 4096 Mar 12 16:56 arch
drwxr-xr-x  3 root root 4096 Mar 12 16:56 crypto
drwxr-xr-x 54 root root 4096 Mar 12 16:56 drivers
drwxr-xr-x 39 root root 4096 Mar 12 16:56 fs
drwxr-xr-x  3 root root 4096 Mar 12 16:56 kdb
drwxr-xr-x  5 root root 4096 Mar 12 16:56 lib
drwxr-xr-x  2 root root 4096 Mar 12 16:56 mm
drwxr-xr-x 29 root root 4096 Mar 12 16:56 net
drwxr-xr-x  9 root root 4096 Mar 12 16:56 sound
```

- Aktualnie załadowane moduły można wyświetlić poleceniem `lsmod`;

```
suse:~ # lsmod
Module              Size  Used by
lp                  13351  0
parport_pc         40651  0
usb_storage        47999  0
```

```

st                44043  0
ide_cd_mod        35013  0
ide_core          112381 1 ide_cd_mo
...
ata_generic       12779  0
ata_piix          30472  0
ahci              25676  7
libahci           29651  1 ahci
libata            203655 4 ata_generic,ata_piix,ahci,libahci
scsi_mod          195051 11
                  usb_storage,st,sg,sr_mod,sd_mod,scsi_dh_alua,scsi_dh_emc,scsi_dh_hp_sw,scsi_dh_
                  rdac,scsi_dh,libata

```

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

```

suse:~ # lsmod | grep joydev
joydev          17300  0

```

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

```

suse:~ # rmmmod joydev
suse:~ # lsmod | grep joydev

```

- Załaduj moduł;

```

suse:~ # modprobe joydev
suse:~ # lsmod | grep joydev
joydev          17300  0

```

- Sprawdź informacje o module;

```

suse:~ # modinfo joydev
filename:         /lib/modules/3.0.13-0.27-default/kernel/drivers/input/joydev.ko
license:         GPL
description:     Joystick device interfaces
author:          Vojtech Pavlik <vojtech@ucw.cz>
srcversion:      55CAF0F7C897FE0327B094E
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*0,*m*1*s*f*w*
depends:
supported:      yes
vermagic:       3.0.13-0.27-default SMP mod_unload modversions 586TSC

```

- Konfiguracje modułów, które mają być ładowane podczas startu systemu, należy umieszczać w katalogu **/etc/modprobe.d**;
- Przejrzyj manual do poleceń **insmod** i **modprobe**, jaka jest różnica?
- Polecenie **depmod** tworzy plik **/lib/modules/version/modules.dep**, który zawiera zależności pomiędzy modułami, przejrzyj plik;
- Poszukaj w internecie informacji o usłudze **udev**;