

## Współczesne systemy komputerowe

### Zarządzanie partycjami i systemami plików

#### Utworzenie dodatkowego dysku wirtualnego

- Przy wyłączonej maszynie wirtualnej, dodaj kolejny dysk, wybierz z menu **VirtuaBox Manager** ⇒ **Machine | Settings...**
  - W sekcji **Storage** wybierz **Storage Tree | Controler: SATA**
  - Wybierz przycisk (symbol dyskietki z zielonym plusem) **Adds a new attachment to the storage tree...** i następnie **Add Hard Disk**
  - W oknie dialogowym naciśnij przycisk **Create new disk** i w kolejnym wybierz format **VDI** i zaakceptuj przyciskiem **Next**
  - Wybierz opcję **Dynamically allocated** i zaakceptuj przyciskiem **Next**
  - Ustaw własną nazwę dysku, zaakceptuj proponowany rozmiar **8 GB** i utwórz dysk przyciskiem **Create**
- W kolejnym oknie wciśnij przycisk **OK** i uruchom maszynę wirtualną

#### Partycje w konsoli tekstowej

- Sprawdź układ partycji na dysku, dyski IDE są urządzeniami o nazwie **/dev/hdx**, **SATA** i **SCSI** są oznaczone przez **/dev/sdx**
- Partycje podstawowe mają numery od **1** do **4**, dyski logiczne zaczynają się zawsze od **5** (bez względu na liczbę partycji podstawowych (dla tablicy partycji typu Intel)

```
root@debian:~# fdisk -l
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

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
```

- Uruchom narzędzie **fdisk** i sprawdź partycje na dysku komendą **m**

```
root@debian:~# fdisk /dev/sdb

Welcome to fdisk (util-linux 2.29.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x609626de.
```

```
Command (m for help): m
```

```
Help:
```

```
DOS (MBR)
```

- a toggle a bootable flag
- b edit nested BSD disklabel
- c toggle the dos compatibility flag

```
Generic
```

- d delete a partition
- F list free unpartitioned space
- l list known partition types
- n add a new partition
- p print the partition table
- t change a partition type
- v verify the partition table
- i print information about a partition

```
Misc
```

- m print this menu
- u change display/entry units
- x extra functionality (experts only)

```
Script
```

- I load disk layout from sfdisk script file
- O dump disk layout to sfdisk script file

```
Save & Exit
```

- w write table to disk and exit
- q quit without saving changes

```
Create a new label
```

- g create a new empty GPT partition table
- G create a new empty SGI (IRIX) partition table
- o create a new empty DOS partition table
- s create a new empty Sun partition table

- Sprawdź partycję na dysku komendą **p**

```
Command (m for help): p
```

```
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
```

- Utwórz nowa partycję podstawową FAT32 o wielkości 1GB

```
Command (m for help): n
```

```
Partition type
```

- p primary (0 primary, 0 extended, 4 free)
- e extended (container for logical partitions)

```
Select (default p): p
```

```
Partition number (1-4, default 1): 1
```

```
First sector (2048-16777215, default 2048):
```

```
Last sector, +sectors or +size{K,M,G,T,P} (2048-16777215, default 16777215): +1G
```

```
Created a new partition 1 of type 'Linux' and of size 1 GiB.
```

```

Command (m for help): t
Selected partition 1
Partition type (type L to list all types): l

 0 Empty                24 NEC DOS               81 Minix / old Lin   bf Solaris
 1 FAT12                 27 Hidden NTFS Win    82 Linux swap / So  c1 DRDOS/sec (FAT-
 2 XENIX root           39 Plan 9              83 Linux             c4 DRDOS/sec (FAT-
 3 XENIX usr            3c PartitionMagic     84 OS/2 hidden or   c6 DRDOS/sec (FAT-
 4 FAT16 <32M          40 Venix 80286        85 Linux extended   c7 Syrix
 5 Extended             41 PPC PReP Boot     86 NTFS volume set  da Non-FS data
 6 FAT16                42 SFS                87 NTFS volume set  db CP/M / CTOS / .
 7 HPFS/NTFS/exFAT    4d QNX4.x              88 Linux plaintext  de Dell Utility
 8 AIX                  4e QNX4.x 2nd part    8e Linux LVM         df BootIt
 9 AIX bootable        4f QNX4.x 3rd part    93 Amoeba            e1 DOS access
 a OS/2 Boot Manag    50 OnTrack DM          94 Amoeba BBT        e3 DOS R/O
 b W95 FAT32           51 OnTrack DM6 Aux   9f BSD/OS            e4 SpeedStor
 c W95 FAT32 (LBA)    52 CP/M               a0 IBM Thinkpad hi  ea Rufus alignment
 e W95 FAT16 (LBA)    53 OnTrack DM6 Aux   a5 FreeBSD          eb BeOS fs
 f W95 Ext'd (LBA)    54 OnTrackDM6        a6 OpenBSD          ee GPT
10 OPUS                55 EZ-Drive           a7 NeXTSTEP         ef EFI (FAT-12/16/
11 Hidden FAT12       56 Golden Bow         a8 Darwin UFS       f0 Linux/PA-RISC b
12 Compaq diagnost    5c Priam Edisk        a9 NetBSD            f1 SpeedStor
14 Hidden FAT16 <3    61 SpeedStor         ab Darwin boot      f4 SpeedStor
16 Hidden FAT16       63 GNU HURD or Sys   af HFS / HFS+       f2 DOS secondary
17 Hidden HPFS/NTF    64 Novell Netware     b7 BSDI fs          fb VMware VMFS
18 AST SmartSleep     65 Novell Netware     b8 BSDI swap        fc VMware VMKCORE
1b Hidden W95 FAT3    70 DiskSecure Mult  bb Boot Wizard hid  fd Linux raid auto
1c Hidden W95 FAT3    75 PC/IX             bc Acronis FAT32 L  fe LANstep
1e Hidden W95 FAT1    80 Old Minix         be Solaris boot     ff BBT
Hex code (type L to list codes): b
Changed type of partition 'Linux' to 'W95 FAT32'.

```

- Sprawdź układ partycji na dysku

```

Command (m for help): p
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

```

- Utwórz partycję logiczną na pozostałej części dysku

```

Command (m for help): n
Partition type
  p   primary (1 primary, 0 extended, 3 free)
  e   extended (container for logical partitions)
Select (default p): e
Partition number (2-4, default 2):
First sector (2099200-16777215, default 2099200):
Last sector, +sectors or +size{K,M,G,T,P} (2099200-16777215, default 16777215):

Created a new partition 2 of type 'Extended' and of size 7 GiB.

```

- Utwórz trzy kolejne linuksowe dyski logiczne o wielkościach: **1G**, **2G** i na pozostałej części dysku

```
Command (m for help): n
All space for primary partitions is in use.
Adding logical partition 5
First sector (2101248-16777215, default 2101248):
Last sector, +sectors or +size{K,M,G,T,P} (2101248-16777215, default 16777215): +1GB

Created a new partition 5 of type 'Linux' and of size 954 MiB.
```

```
Command (m for help): n
All space for primary partitions is in use.
Adding logical partition 6
First sector (4057088-16777215, default 4057088):
Last sector, +sectors or +size{K,M,G,T,P} (4057088-16777215, default 16777215): +2GB

Created a new partition 6 of type 'Linux' and of size 1.9 GiB.
```

```
Command (m for help): n
All space for primary partitions is in use.
Adding logical partition 7
First sector (7964672-16777215, default 7964672):
Last sector, +sectors or +size{K,M,G,T,P} (7964672-16777215, default 16777215):

Created a new partition 7 of type 'Linux' and of size 4.2 GiB.
```

- Sprawdź i zapisz układ partycji

```
Command (m for help): p
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
```

```
Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.
```

- Sprawdź tablicę partycji widzianą przez jądro systemu

```
root@debian:~# cat /proc/partitions
major minor #blocks name
 11      0    1048575 sr0
  8      0    10485760 sda
  8      1     9472000 sda1
  8      2     1011712 sda2
```

- Jeśli nie będą widoczne wszystkie partycje, przeładuj tablicę poleceniem **partprobe**

```
root@debian:~# partprobe
```

```
root@debian:~# cat /proc/partitions
major minor #blocks name
11      0    1048575 sr0
 8      16    8388608 sdb
 8      17    1048576 sdb1
 8      18         1 sdb2
 8      21     976896 sdb5
 8      22    1952768 sdb6
 8      23    4406272 sdb7
 8      0    10485760 sda
 8      1     9472000 sda1
 8      2     1011712 sda2
```

## Tworzenie systemu plików

- Na partycji **/dev/sdb1** załóż system plików **FAT32**; następnie **ext2** na partycji **/dev/sdb5** i **ext4** na **/dev/sdb6**

```
root@debian:~# mkfs.vfat -n data /dev/sdb1
mkfs.fat 4.1 (2017-01-24)
mkfs.fat: warning - lowercase labels might not work properly with DOS or Windows
```

```
root@debian:~# mkfs.ext2 /dev/sdb5
mke2fs 1.43.4 (31-Jan-2017)
Creating filesystem with 244224 4k blocks and 61056 inodes
Filesystem UUID: 418836e8-0c6a-488c-8c3f-2f4521567a82
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376

Allocating group tables: done
Writing inode tables: done
Writing superblocks and filesystem accounting information: done
```

```
root@debian:~# mkfs.ext4 /dev/sdb6
mke2fs 1.43.4 (31-Jan-2017)
Creating filesystem with 488192 4k blocks and 122160 inodes
Filesystem UUID: 025592cb-630a-408c-9f0d-5cee6e4d9b2d
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done
```

- Na partycji **/dev/sdb7** załóż system plików **ReiserFS**, wymaga to zainstalowania pakietu z odpowiednim oprogramowaniem

```
root@debian:~# apt update
Ign:1 http://ftp.pl.debian.org/debian stretch InRelease
Get:2 http://ftp.pl.debian.org/debian stretch Release [118 kB]
Hit:3 http://security.debian.org/debian-security stretch/updates InRelease
...
root@debian:~# apt install reiserfsprogs
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
...
```

```
root@debian:~# mkreiserfs /dev/sdb7 160000
mkreiserfs 3.6.25

Guessing about desired format.. Kernel 4.9.0-6-686 is running.
Format 3.6 with standard journal
Count of blocks on the device: 160000
Number of blocks consumed by mkreiserfs formatting process: 8216
Blocksize: 4096
Hash function used to sort names: "r5"
Journal Size 8193 blocks (first block 18)
Journal Max transaction length 1024
inode generation number: 0
UUID: d34623d2-d0de-43b5-b2f1-faf9b294865c
ATTENTION: YOU SHOULD REBOOT AFTER FDISK!
          ALL DATA WILL BE LOST ON '/dev/sdb7'!
Continue (y/n):y
Initializing journal - 0%....20%....40%....60%....80%....100%
Syncing..ok
ReiserFS is successfully created on /dev/sdb7.
```

- Utwórz podkatalogi **data1**, **data2**, **data3** i **data4** w katalogu **/export**

```
root@debian:~# mkdir -p /export/data{1,2,3,4}
```

```
root@debian:~# ls -l /export
total 12
drwxr-xr-x 2 root root 4096 Mar 13 15:13 data1
drwxr-xr-x 2 root root 4096 Mar 13 15:13 data2
drwxr-xr-x 2 root root 4096 Mar 13 15:13 data3
drwxr-xr-x 2 root root 4096 Mar 13 15:13 data4
```

- Dodaj następujące linie do pliku **/etc/fstab**

```
/dev/sdb1 /export/data1 vfat defaults 1 2
/dev/sdb5 /export/data2 ext2 defaults 1 2
/dev/sdb6 /export/data3 ext4 defaults 1 2
```

- Skorzystaj edytor **nano**

```
root@debian:~# nano /etc/fstab
```

- Zamontuj wszystkie systemy plików

```
root@debian:~# mount -a
```

- Wyświetl informacje o zamontowanych systemach plików (zwróć uwagę na wirtualne systemy plików, np.: **sysfs** i **proc**)

```
root@debian:~# mount
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
```

```
...  
/dev/sdb1 on /export/data1 type vfat  
    (rw,relatime,fmask=0022,dmask=0022,codepage=437,ioccharset=ascii,shortname=mixed  
    ,utf8,errors=remount-ro)  
/dev/sdb5 on /export/data2 type ext2  
    (rw,relatime,block_validity,barrier,user_xattr,acl)  
/dev/sdb6 on /export/data3 type ext4 (rw,relatime,data=ordered)
```

- Zamontuj partycję **/dev/sdb7** do katalogu **/export/data4**

```
root@debian:~# mount -t reiserfs /dev/sdb7 /export/data4
```

```
root@debian:~# mount | grep sdb  
/dev/sdb1 on /export/data1 type vfat  
    (rw,relatime,fmask=0022,dmask=0022,codepage=437,ioccharset=ascii,shortname=mixed  
    ,utf8,errors=remount-ro)  
/dev/sdb5 on /export/data2 type ext2  
    (rw,relatime,block_validity,barrier,user_xattr,acl)  
/dev/sdb6 on /export/data3 type ext4 (rw,relatime,data=ordered)  
/dev/sdb7 on /export/data4 type reiserfs (rw,relatime)
```

- Odmontuj partycję **/dev/sdb7**

```
root@debian:~# umount /export/data4
```

```
root@debian:~# mount | grep sdb  
/dev/sdb1 on /export/data1 type vfat  
    (rw,relatime,fmask=0022,dmask=0022,codepage=437,ioccharset=ascii,shortname=mixed  
    ,utf8,errors=remount-ro)  
/dev/sdb5 on /export/data2 type ext2  
    (rw,relatime,block_validity,barrier,user_xattr,acl)  
/dev/sdb6 on /export/data3 type ext4 (rw,relatime,data=ordered)
```

- Sprawdź (ostrożnie) działanie polecenia **fdisk**
- Przejrzyj manuale do poleceń **e2fsck**, **dumpe2fs** i **tune2fs**
- Poszukaj w internecie informacji o programie *GParted*
- Poszukaj w internecie informacji o dystrybucji *Parted Magic*