

5 Memories and Storage Devices

Topic

Various types of storage devices and their use

Learning objectives

Students will be able:

- to describe the functions of memory in a computer system
- to understand the difference between volatile and non-volatile memory
- to explain what a storage device is
- to describe the features of ROM and RAM
- to classify storage devices and their uses
- to discriminate between different types of magnetic drives and disks
- to give instruction and advice on how to protect data
- to explain the technical details of flash memory
- to describe flash-based devices
- to use technical vocabulary associated with magnetic and optical storage devices and media

Key words

Main memory, backing storage, volatile, non-volatile, RAM, ROM, magnetic disk, floppy disk, hard drive, portable hard drive, read/write head, spin, platter, format, track, sector, directory, partition, back up, access time, data transfer rate, fragmentation, defragmentation, to retrieve information

Optical drive, laser beam, DVD burner, dual/double layer, backward-compatible, Blue-ray disc, CD-ROM, CD-R, CD-RW, DVD-ROM, DVD-R, DVD-RW, HD-DVD

Flash memory card, USB flash drive, pen drive, card reader, hybrid hard drive

Main memory

The main memory is a group of chips inside the processing unit where data is held temporarily during its processing. This memory is instantly accessible on the contrary to the **backing storage** which is held outside the central processing unit.

The functions of the main memory:

- It holds programs (operating system, application programs). It holds data which has been input
- It stores data which are currently being processed
- It holds intermediate results and output data before sending to an output device

The main memory contains two different types of memory:

- **Read Only Memory (ROM)** – a non-volatile memory – data is held even when the power is switched off. It is used to hold data that cannot be changed by the user. Programs related to the operating system are stored on ROM chips when a computer is manufactured.
- **Random Access Memory (RAM)** – is volatile. Data is held on a chip only temporarily. When the power is switched off, the data disappears. RAM is used to hold both data and programs during processing. Most of the memory in a computer system is usually RAM. The capacity of RAM determines the number of programs you can run simultaneously and how fast they operate. It can be expanded by adding extra RAM chips.

Cache memory is a random access memory (RAM) that a computer microprocessor can access more quickly than it can access regular RAM. As the microprocessor processes data, it looks first in the cache memory and if it finds the data there (from a previous reading of data), it does not have to do the more time-consuming reading of data from a larger memory.

Backing stores

Backing stores hold data outside the central processing unit in some kind of storage medium. Access to backing stores is slightly slower than to the main memory but the data held is non-volatile. It is stored until it is deleted.

Magnetic storage

Magnetic devices store data magnetically. A disk drive spins the disk at high speed and reads its data or writes new data onto it.

Floppy disk

consists of a flexible sheet of plastic, coated with a **magnetisable** material - iron oxide. It spins at 360 **revolutions** per minute (rpm), so it is relatively slow. It can hold only 1.44 MB of data and is often called A: drive.



Hard disk

stores data on a stack of metal rotating disks called **platters**. PCs usually have an internal hard disk, which is used to keep the operating system, application programs and users' files easily available for use. A hard drive **spins** at over 7,200 rpm, it can store much more data and **retrieve** information much faster. The **read/write head** moves across the disk extremely close to the surface. A speck of dust can cause damage and for this reason it is normal to seal the hard disks inside the disk drive which also keep moisture away from the disk surface.



A new disk has to be **formatted** – the operation system organizes the disk surface into circular **tracks** and divides each track into **sectors**. The operating system creates a **directory** which records the specific location of **files**. When you **save** a file, the OS moves the **read/write head** of the drive towards empty sectors, records the data and writes an **entry** for the directory. When you open the file, the operating system looks for its entry in the directory, moves the read/write head to the correct sector and reads the file in the RAM area. The average time required for the read/write heads to move and find data is called **access time** and is measured in milliseconds (ms). **Transfer rate** is the rate of transmission of data from the disk to the CPU and is measured in megabytes per second.

A **portable hard drive** is an external unit which can be used to make a **backup** – a spare copy - of user's files or to transfer data between computers.

Optical storage

Optical discs can store data at much higher densities than magnetic disks and they are not affected by a magnetic field, which makes them secure and stable, but they are slower than hard drives.

Optical drives use a **laser beam** to read and write data. CDs and DVDs are 120 mm in diameter and 1.2 mm thick. They differ in internal structure and data capacity. The **tracks** in a DVD are very close together, so there can be more tracks. The **pits** in which data is stored are also smaller, so there are more pits per track. It results in much higher capacity of a DVD. (A CD can hold 650-700 MB, while a DVD can hold

4.7 GB.) Moreover a DVD can be double-sided and dual layer with a capacity of 17 GB.

CDs – Compact Discs exist in several formats:

- CD-ROMs are read-only units, you cannot change the data stored on them
- CD-R are recordable write-once discs
- CD-RW – rewritable discs enable a user to write onto them many times

DVDs – Digital Versatile Discs have also several formats:

- DVD-ROMs – read only units (games, encyclopaedias, films)
- DVD-R and DVD+R are recordable only once
- DVD-RW and DVD+RW are rewritable, can be erased and reused many times.



Recording information onto a DVD is done by a **DVD burner** which records data by burning via a laser to a blank DVD disc.

There are two competing formats expected to replace current DVDs – **HD-DVD (High Definition DVD)** and **Blu-ray discs**. A Blu-ray disc has a capacity of 25GB in case of a single layer, 50GB – dual layer and 100GB – four layer. Blu-ray uses a blue-violet laser to read and write data (DVDs use a red laser) and can record and play back high definition digital audio and video, as well as computer data.

Flash memory

Flash memory is a type of non-volatile memory that can be electronically erased and reprogrammed. A flash memory chip is made up of millions of electronic cells. It retains the information in the chip when the power is turned off, which makes it ideal for use in digital cameras, laptops, video game cards, mobile phones and portable multimedia players.

Data is stored in several floating gate transistors, called **cells**. The chips are constructed with either NOR or NAND gates. NOR chips function like a main memory of the computer (in a camera internal software) while NAND works like a hard drive (in a camera it stores the images).

Use of flash memories:

- **USB flash drives** are used to save and move data files between computers. A small, portable flash memory card that plugs into a USB port and functions as a portable hard drive. USB flash drives are small



enough to be carried in a pocket and can plug into any computer with a USB drive. USB flash drives have less storage capacity than an external hard drive, but they are smaller and more durable because they do not contain any internal moving parts.

- **Flash memory cards** are used to store images on cameras, to back up data on PDAs, to record music on MP3 players, to store movies on MP4 players, etc. They are as small as a stamp but they are not always interchangeable between devices. Many computers include a flash card reader which enables the computer to read data directly from the memory card.



- Many computers have their **BIOS** (Basic Input/Output System) stored in a flash memory.

Hybrid hard drives combine a magnetic and disk and flash memory into one device.

Vocabulary

	Definition	Translation
access time	the time taken to fetch a piece of data.	
back up	to copy files from one disk to another	zálohovat
backing storage	A type of computer memory used to store data even with the power turned off.	záložní paměť
backward-compatible	Compatible with earlier models or versions of the same product	kompatibilní, slučitelný s předchozí verzí
Blu-ray disc	a new optical disc using a blue-violet laser to read and write data	Blu-ray disk
data transfer rate	the average speed at which data can be transmitted from one device to another, MB per second	přenosový výkon
directory	a list of files on a disk	adresář
DVD burner	a DVD drive that records information by burning via a laser to a blank DVD disc	vypalovačka DVD
flash card reader	a device that reads and records flash memory cards	čtečka paměťových karet
flash memory card	a card that contains a number of non-volatile memory chips to hold the data	paměťová karta
floppy disk	a disk made of flexible plastic material on which data is stored on magnetic tracks	disketa
format	to prepare a disk for use, the operating system marks tracks and sectors on its surface	formátovat

fragmentation	the condition of a disk in which files are divided into pieces scattered around the disk.	fragmentace
hard drive	a magnetic storage device that that reads and writes data on metal disks inside a sealed case	pevný disk
hybrid hard drive	a hard disk with integrated flash memory	hybridní disk
laser beam	a beam of monochromatic coherent light	laserový paprsek
main memory	the hardware section that holds the instructions and data currently being processed	hlavní/operační paměť
non-volatile memory	permanent memory able to hold data without power. ROM and flash memory	energeticky nezávislá paměť
optical drive	a storage device in which data is recorded by a laser beam	optický disk
pen drive	a flash drive	USB disk
platter	a magnetic plate, a part of a hard disk drive	jednotlivý pevný disk
portable hard drive	an external hard drive connected to the computer via USB	externí pevný disk
RAM	the part of the main memory which stores information temporarily while you are working	paměť RAM
read/write head	the part of a disk drive that reads and writes data on a magnetic disk	čtecí a zápisová hlava
retrieve	find from the memory	vyhledat
ROM	the part of the main memory where essential system instructions (BIOS) are permanently stored.	paměť ROM, jen na čtení
sector	a part of a track on a magnetic disk	sektor
spin	revolve quickly around the axis	rotovat
track	an area marked on a surface of a disk, used to organize information on a disk	stopa
USB flash drive	a USB storage device used to store and transport data	USB disk
volatile memory	temporary memory that doesn't hold information without power	energeticky závislá paměť

Summary

Storage devices are pieces of hardware which allow us to store information.

Backing stores hold data outside the central processing unit in some kind of storage medium.

There are three main groups of storage devices:

1. Magnetic storage stores data magnetically. A disk drive spins the disk at high speed and reads its data or writes new data onto it.
Floppy disks, hard disks
2. Optical storage use a laser beam to read and write data, CDs, DVDs
3. Flash memories - data is stored in several floating gate transistors, called cells. USB flash drives, flash memory cards

Tasks

1. Complete the recommendation with the following words:

virus scanner	backup	spinning	hard drive	turn
vibration	disk surface	loss	disk diagnosis utility	read/write head

How to protect your hard drive

- Don't hit or move your computer while the is spinning. Hard drives are very sensitive to and shocks, especially when the touches the rotating disk. It can scratch and damage the . This is known as head crash.
- Don't your computer off and on quickly. Wait at least ten seconds to ensure that the drive has stopped .
- Check your hard drive regularly using a like Windows ScanDisk.
- Install an up-to-date to minimize the risk of data or corruption
- your hard drive regularly

2. Study the scheme; label the parts of a hard drive:

surfaces

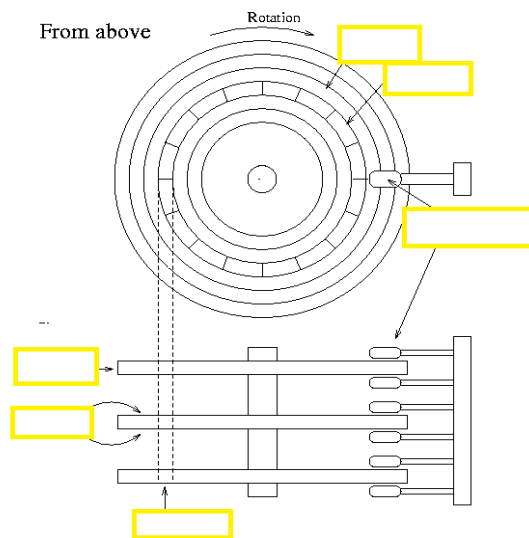
read/write head

platter

track

cylinder

sector



<http://www.linuxnetwork.com/docs/sag/hard-disk.html>

3. Listening: Infotech p 48

4. Match the word with a definition

- | | | |
|---|---|-------------------|
| 1 | the time required for the read/write heads to move and find data | a floppy disk |
| 2 | the rate of data transmission from the disk to the CPU | b transfer rate |
| 3 | the type of a hard drive that plugs into a socket at the back of a computer | c track |
| 4 | a circular area on a disk surface | d read/write head |
| 5 | a spare copy of the files | e access time |
| 6 | a device that reads and writes data on a magnetic disk | f format |
| 7 | to divide the surface of a disk into tracks and sectors | g backup |

8 rotate

h portable hard drive

a magnetic storage slower
9 than a hard drive with a
capacity 1.44MB

i spin

5. Complete the definitions with the words from the vocabulary section.

1. The CD and DVD formats that can be rewritten many times.
2. A device that records information by burning via a laser to a blank DVD disc.
3. A technology that uses a blue-violet laser to read and write data.
4. Permanent, able to hold data without power.
5. A type of drive that plugs into a USB port and lets you share photos, films, etc.
6. A peripheral device that reads flash memory cards.
7. A device that combines magnetic and optical storage.

6. Listening: Infotech p. 52

7. Listening: Infotech p. 60

8. In pairs discuss the most suitable storage device for the following purposes, use the phrases from the box.

- a. To hold operating system on a home desktop computer
- b. To hold your favourite music
- c. To hold an electronic encyclopaedia
- d. To transfer files between computers in a big company
- e. To read and write high definition video
- f. To hold and transfer your photos to a computer
- g. To make backup copies in a small company

Pro toto použití je nejvhodnější, protože.....	For this use is the most appropriate because.....
Pro tento účel je nejvhodnější, protože.....	For this purpose Is the most appropriate because.....
Doporučil bych....., protože.....	I would recommend because
.....se jeví jako nejvhodnější pro jeho.....	 appears the most suitable because of its
To závisí na	It depends on.....

9. Name as many flash based devices as possible. Choose one of them and write a short description.

Complete the information about the device:

What is it called?	
Who can use it?	
What does it look like?	
What is it used for?	
Advantages/disadvantages	
How is it connected to the computer?	

Stage 2

Use the table to write your description.

Stage 3

Check your description for grammar and spelling.

Questions

1. What does the main memory do?
2. What type of memory is temporary?
3. What type of memory includes instructions needed by the CPU?
4. What is a cache memory?
5. What is a storage device?
6. What is a backup?
7. What is a difference between a disk and a disc?
8. What is the principle of magnetic storage devices?
9. What magnetic storage devices do you know?
10. How does a hard drive work?
11. What is access time and transfer rate?
12. What is formatting a disk?
13. What is a head crash?
14. What do CD and DVD stand for?
15. What are the advantages and disadvantages of optical discs comparing with magnetic disks?
16. What is the principle of optical storage devices?
17. What is the difference between a DVD burner and a DVD recorder?
18. What are two probable successors to DVDs?
19. What is the source of the term Blu-ray?
20. What is a flash memory? Give advantages/disadvantages.
21. How is data stored in a flash memory?
22. Where are flash memory cards used?
23. Describe a pen drive.

24. What is a flash card reader?
25. What is a hybrid hard drive?

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