Chapter 01 : ICT – Concepts & definitions

1. Introduction

In this module, the learner will be able to discover the different parts of a computer, as well as some of the key concepts of Information and Communication Technologies for Education (ICTE), such as those related to online learning and to web technologies:

- Understand what information and communication technology for education (ICTE) is and give examples of its practical applications in daily and academic life.

- Understand what computer hardware is, know the factors that affect computer performance, and know about computer devices.

- Understand what software is and give examples of common application software and operating system software.

- Understand and define the concepts and the different tools necessary for the creation and publication of a n online course such as editorial channels, learning management systems and MOOCs.

- Recognize the techniques associated with the use of Web and Internet technologies.

- Recognize the usefulness of the different office software such as the Microsoft Office suite, and learn to use word processing software such as Word Office.

2. IT (Information Technology), ICT and ICTE

IT (information technology) encompasses all the technology we use to collect, process, protect and store information. It refers to hardware, software (computer programs), and computer networks.

ICT (Information and Communication Technologies)

This concept involves the transfer and use of all kinds of information. ICTs constitute the foundation of the economy and a driver of social change in the 21st century. Distance is no longer a problem when it comes to accessing information; for example, working from home, distance learning, online banking, and e-government are now possible from anywhere with an internet connection and computing device.

ICTE (Information and Communication Technologies for Education)

ICTE are an extension of ICT, it is a set of computer and multimedia tools and software (Texts, Images, Sound, Videos, etc.) which can be integrated into a course or training for online teaching (distance learning).), face-to-face teaching or blended teaching (online and face-to-face).

2.1. Role of ICT

ICT encompasses all hardware and software resources enabling:

➔ **Information processing**, with the use of various processing techniques and materials

➔ **The transmission of information** through networks and means of computer exchange.

➔ **Storing information** on backup media.

2.2. ICT Services

ICTs offer users several services such as:

➔ visual and vocal transmission;

➔ the transmission of data;

➔ the exchange of information via the internet;

➔ the diffusion of multimedia documents.

2.3. Application areas :

ICT is used in the fields of health, agriculture, tourism, administration and several other fields.

In this document, we take the field of online teaching and learning (e-learning) through several platforms and example such as the Moodle platform applied in our university Mohammed Lamine Debaghine Setif 02, which we can access using this URL : https://cte.univ-setif2.dz/moodle/.

Figure 1 shows the main connection interface of the Setif02 University Moodle platform.

Figure 1: The main connection interface of the Setif02 University Moodle platform.

This platform has several advantages and offers numerous services, it allows:

- **Students:** to follow their course online, to communicate and learn online.

- **Teacher:** to provide lessons and exercises to students, to plan live sessions to present lessons, and to supervise their students remotely.

To access the Moodle platform, simply type the keywords 'CTE setif 2' on the Google search engine, then click on the first link which redirects you to the platform. Another easier option is to directly access the platform via the address: https://cte.univ-setif2.dz/moodle/

Then, you click on the "**Login**" or "**connect**" button.. you enter your username and your password (the password is your date of birth days/month/year, and the username is your student card number).
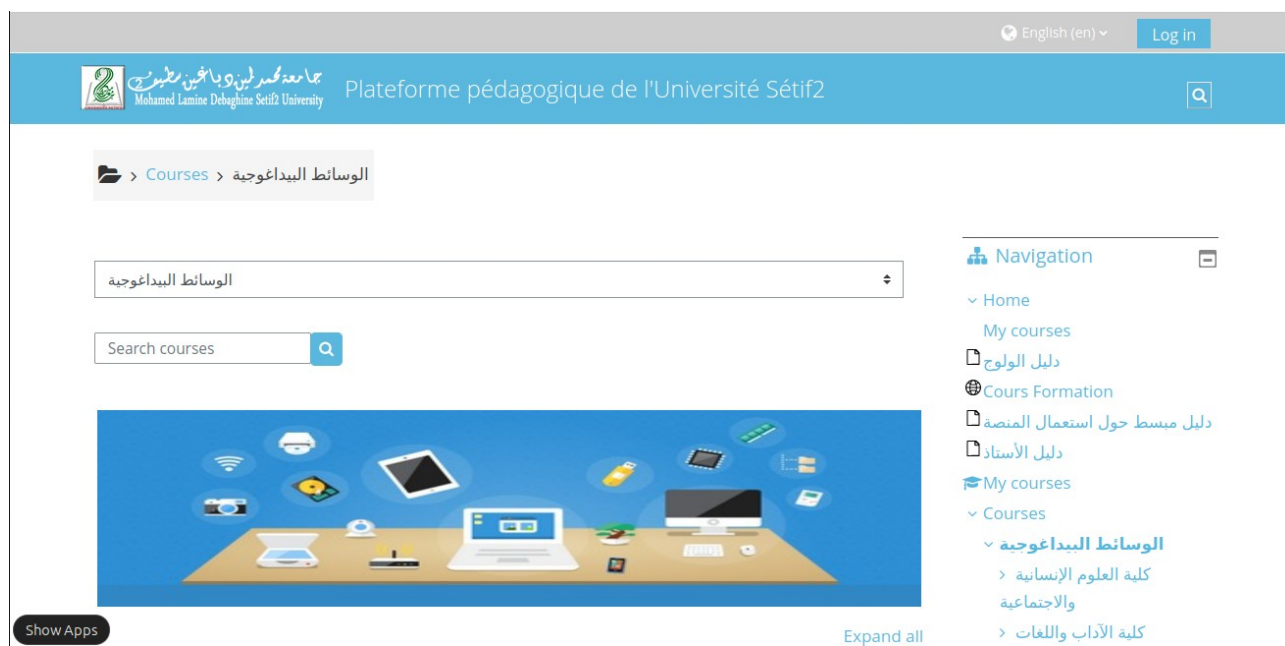
Figure 2: The home page of the Moodle platform of the University of Sétif 02
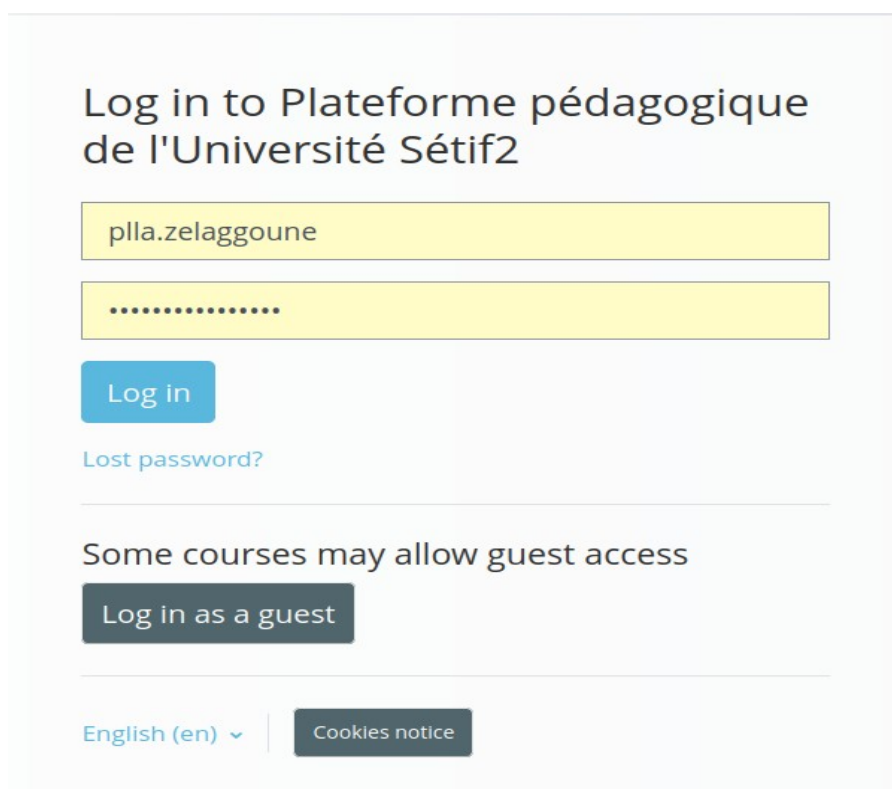

Figure 3: The Moodle platform login page

To join a course on the Moodle platform, simply navigate to the path of the course space. For example, if you wish to consult the 'ICTE' course space that intended for 1st year Licence's students in the French department, you click on 'Faculty of letters and languages', then 'Department of

French language and literature', then you choose the 'semester 01', the 'Licence 01' level, and finally you search for and click on the 'ICTE' course.

Teachers can set their course as **open**, **closed with auto-registration**, and **closed with manual registration**:

1. if the course is **open**, students can join the course directly without any registration;

2. if the course is closed with self-registration, students can join the course by registering with the registration code or password given to them by their teacher;

3. If the course is **closed with manual registration**, students must wait for their teacher to register them.

   Note: if you find the course title followed by a key symbol ⌐ it means it is a closed course which requires registration (manual or automatic), otherwise it is an open course.

Figure 4 shows an example of the educational content of the ICTE module destinated to second year master's students during the 2022-2023 academic year.
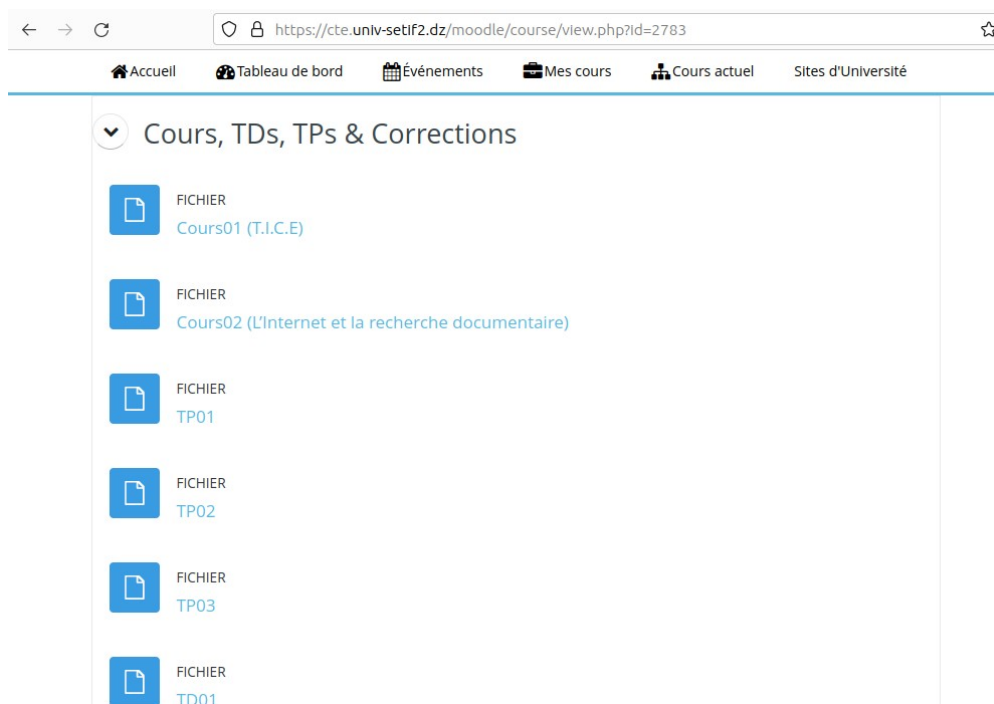

Figure 4: Content of the ICTE course on the Moodle platform.

3. Computer :

It is a programmable information processing system as defined by Alan Turing and which operates by sequential reading of a set of instructions, organized into programs, which cause it to execute logical and arithmetic operations.

It is a machine which allows the **acquisition of information** by the **input devices**, the **processing of a set of instructions** by the **calculation materials** and the **display of the results** by the **output devices.**

3.1. The components of a computer are:

The computer is made up of two main parts:

Figure 5: The computer components

3.1.1. Hardware

The concept of hardware includes computer components, the physical and tangible parts of the computer, i.e., electrical, electronic and mechanical parts which comprise a computer.

- **Personal computer (PC),** as the name suggests, is intended for personal use, as opposed to the server, which is used by a larger number of people simultaneously, from different locations, often via terminals. If you do not intend to move your computer frequently from one place to another, and at the same time you want maximal price/performance ratio, then you should use a desktop computer. In comparison to laptops or tablet computers, it is much larger in size, inconvenient to carry/move, consumes more electricity but has a much better price/performance ratio. Also, they are much easier to upgrade.

Figure 6: Personnel Computer

- **Laptop or tablet PC** is used by individuals who have the need to travel with a computer or simply use them for aesthetic reasons when computing power is not an issue. Laptop computers, as opposed to tablet PCs, more closely resemble a personal computer when it comes to data input. Data entry is done via keyboard and mouse, while the tablet PC data entry is done via touch screen.

Figure 7: A Laptop

- Computer working principle:

data are entered into a computer via input devices, then are processed and stored in a system unit, and are finally displayed by the output device.
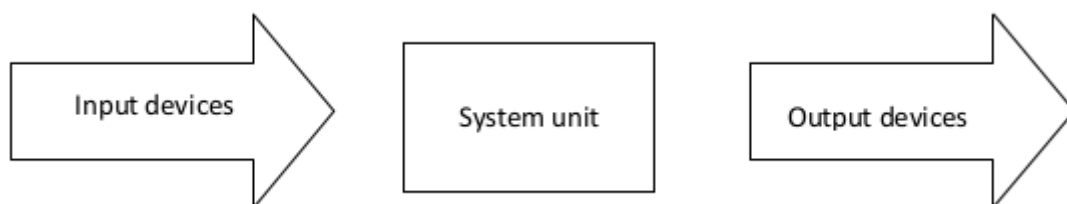
➔ SYSTEM UNIT

The system unit (case) contains a computer's vital parts. There are two basic types of cases:

- Desktop casing is placed on a desk in a horizontal orientation.

- Towers come in 3 sizes (mini-tower, mid-tower and full-tower) and it is vertically orientated.

Motherboard, MBO is computer's basic circuit, to which all computer components are connected, directly or indirectly. Devices are connected to the motherboard through a system bus. System bus connects all devices, ensures data flow and communication between different devices using predefined protocols.

Figure 8: A Motherboard

Protocol describes a manner in which communication between devices is defined. It enables them to address each other and defines how they should look for each other on either system bus or network

Central Processing Unit (CPU or processor) is a central part of a computer (and can be referred to as the computer's "brain"). It manages all other computer parts, monitors their mutual communication and performs arithmetic-logical operations. Processor speed is measured in hertz (or megahertz or gigahertz). Most famous manufacturers for personal computer processors are Intel and AMD.
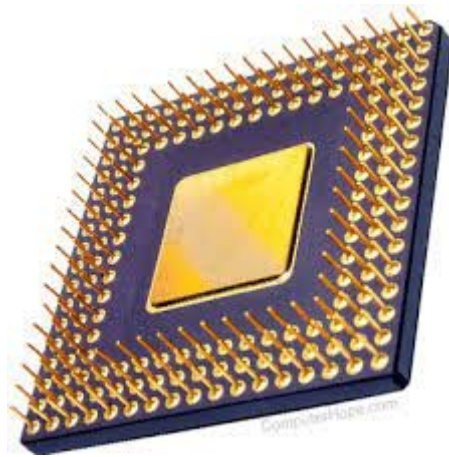
Figure 9: Central Processing Unit (CPU or processor)

Cache is a small capacity memory which allows quick access to data. By storing data from working memory in cache, the speed of communication between processor and RAM is increased. Microprocessors use three levels of fast cache, L1, L2 and L3, used to store often used data.
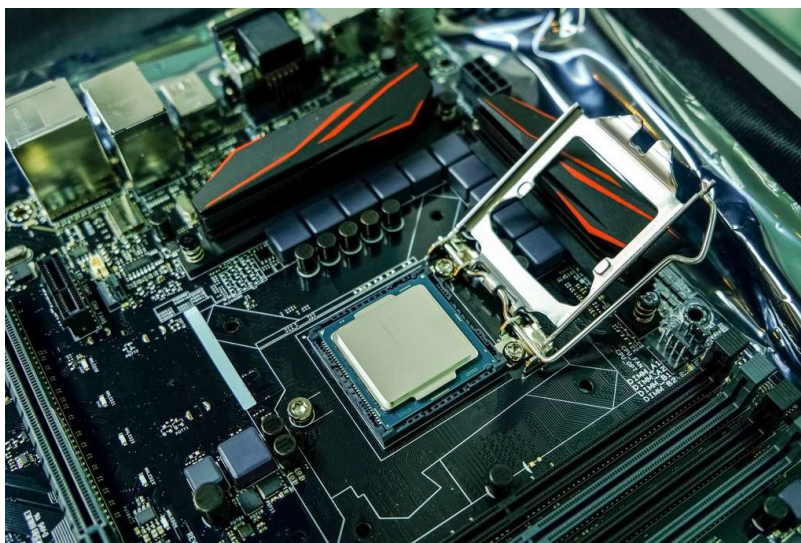

Figure 10: Example of a cache memory

ROM (Read Only Memory) is a type of permanent, internal memory that is used solely for reading. BIOS (Basic Input/Output System), a program which is located in a separate ROM on the motherboard, and defines, as the name suggests, basic input/output system, is a good example. Please note that not all BIOS programs are stored in the ROM.
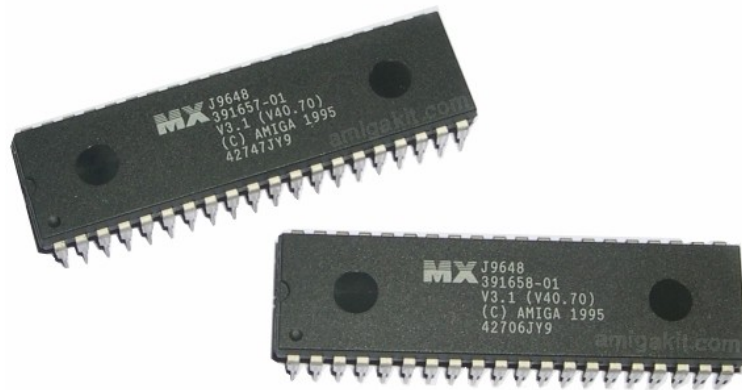
Figure 11: ROM (Read Only Memory)

RAM (Random Access Memory) is a working memory in which analyzed data and programs are stored, while computer runs. It allows reading and writing data, and is deleted/cleared when the computer shuts down.
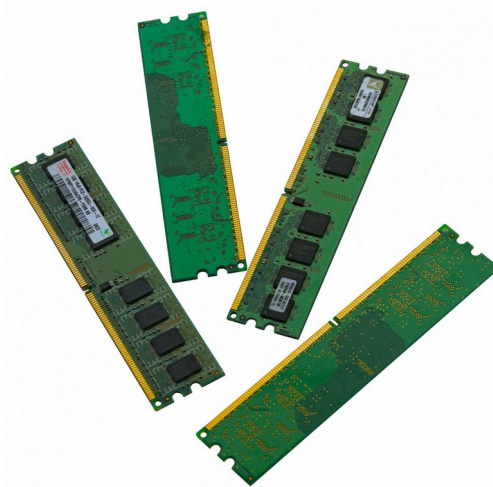
Figure 12: RAM (Random Access Memory)

Hard Disk Drive (HDD) is a place for permanent data storage (it does not delete/clear when computer shuts down). Its features are: large capacity, faster performance in comparison to optical devices but slower in comparison to RAM, and are used for permanent data storage. We can distinguish two HDD types : internal and external.

Solid State Drive (SSD) is a permanent data storage location. This hardware consists of solid-state semiconductor memories, as opposed to the older technology of hard drives, for which data is written to rapidly rotating magnetic media.
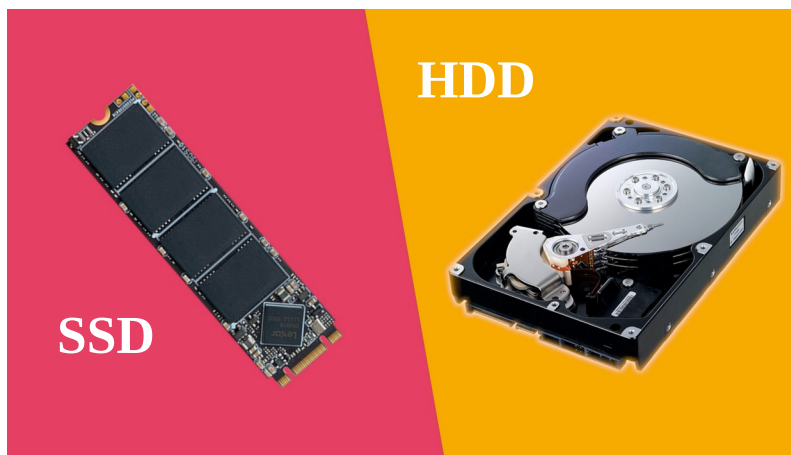
Figure 13: SSD & HDD

SSD	HDD
faster	**slow**
expensive	**cheaper**
non-mechanical (flash)	**mechanical (moving parts)**
shock resistant	**fragile**
ideal for storing operating systems, gaming applications and frequently used files	**ideal for storing additional data, such as movies, photos and documents**

Table 1: The differences between SSD and HDD

CD-ROM drive is used for reading CD media.

DVD drive is used for reading DVD discs. DVD disc capacity ranges from 4.7 to 18GB.

Figure 14: CD-ROM/DVD drive

Soundcard is a device used for sound creation and production by means of computer speakers.

Figure 15: La carte son

Graphics card is responsible for image processing and displaying it on a monitor. It has its own graphics processor and memory. Image quality depends on the strength of these components.
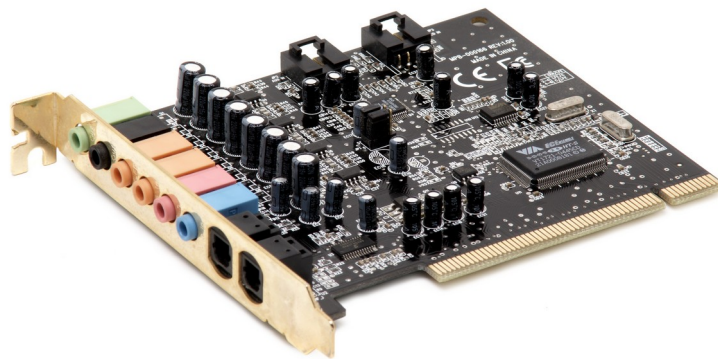

Figure 16: La carte graphique

Modem enables computers to communicate via telephone lines. They connect computers to the Internet.

Figure 17: Modem example

Connectors or ports are slots visible in the back and the front side of a computer.

Factors affecting computer performance:

- processor clock speed, amount of cache and number of kernels

- the amount of installed RAM

- graphics card- its memory and processor

- clockbus

- number of running applications

Applications use computing resources. The processor runs applications and performs code that defines applications; therefore processors get the most workload when it comes to running the application. In order for processors to execute the application, it is necessary for application code to be loaded into the system memory. As a result, running applications take up a certain amount of working memory. The more applications are running, the greater the load on the processor and RAM .That is why the computer's performance depends on both the processor (clock speed, number of cores, cache memory), and the amount of working memory, as well as the number of applications running.

Processor speed is measured in hertz (Hz), and due to a large working clock speed of today's processors, it is expressed in megahertz (MHz) or gigahertz (GHz). Besides the frequency, the processor performance depends on the number of operations that the arithmetic-logic unit (ALU) performs in one clock cycle.

Measurement units

Bit (binary digit) is the basic unit used to measure the amount of information. A **byte** or **octet** contains **eight bits**.

1 KB (kilobyte)- 1024 B (approx. 1000 B)

1 MB (megabyte)- 1024 KB (approx. 1000 KB)

1 GB (gigabyte) -- 1024 MB (approx. 1000 MB)

1 TB (terabyte) – 1024 GB (approx. 1000 GB)

Types of storage devices

Now we will discuss the different types of storage devices available in the market. These storage devices have their own specifications and uses. Some of the commonly used storage devices are:

1. **Primary Memory:** It is also called internal memory and main memory. It is a section of the processor that contains program instructions, input data and intermediate results. Its size is generally smaller. RAM (Random Access Memory) and ROM (Read Only Memory) are examples of primary storage.

2. **Secondary Memory:** Secondary storage is memory stored outside the computer. It is mainly used for permanent and long-term storage of programs and data. External hard drives, CDs, DVDs, USB sticks, SSDs, etc. are examples of secondary storage.

3. **Cloud and Virtual Storage:** Nowadays secondary memory has been upgraded to virtual storage devices or what is called cloud storage. We can store our files and other items in the cloud and the data is stored for as long as we pay for the cloud storage. Many companies provide cloud services, mainly Google, Amazon, Microsoft, etc. We can pay the rent for the amount of space we need and we get many benefits from it. Although it is actually stored on a physical device located in the service provider's data centers, the user does not interact with the physical device or its maintenance. For example, Amazon Web Services offers AWS S3 as a storage type where users can store data virtually instead of storing it on physical hard drives.

   There are also virtual storage services (cloud) that offer us the possibility of storing data for free, but with a limited quantity.

   All data may be lost; it must therefore be stored in several places, and virtual cloud storage offers us this advantage of storing our data securely without the risk of losing it.

➔ **Input devices:**

- **Mouse** is an input device that facilitates work with the graphical user interface (GUI). The mouse transmits hand movements and the screen displays the cursor (mouse pointer) movements. They are divided into mechanical and optical (with respect to a transfer movement), and wired and wireless (with respect to connection).

- **Keyboard** is used for data entry and issuing commands. They can also be wired or wireless.

- **Scanner** is used to load data (image, text, etc.) from the printed material into a computer. The result of scanning is an image, but with special programs, if we scan the text, we can get a text as a result. Software used to recognize text from image is called a text recognition tool.

- **Touchpad** is used for transmission of hand movement, but unlike working with a mouse, the user is the one who determines the position of the cursor by touching the touchpad.

- **Joystick:** mainly used in computer games. Unlike a mouse, it has many buttons which allow control over game objects.

- **Microphone** is a device that converts sound into an electrical signal, which can be stored on a computer. It is mainly used for sound recording, communication between players in online games, in combination with a webcam in video conferences.

- **Webcam** is a camera that stores video signal in a format appropriate for video transfer over the Internet in realtime.

- **Digital camera**, unlike analog camera, it stores photographs in digital format. It can be directly connected to a computer and photographs can be downloaded. Photograph quality is expressed in megapixels. More megapixels mean better quality of photograph, however more memory is occupied.

➔ **Output devices:**

- **Monitor** displays images from the computer, it enables us to see, work and control computers. In other words, working on a computer without a monitor would be inconceivable.

- **Projector** is a device used to project a computer image or other images from independent devices, such as DVD players, Blu-ray player, etc. onto canvas or a wall.

- **Printer** is a device used for printing data from a computer onto a paper. We distinguish between local printer (connected directly to the computer) and network printer (connected directly to network using a network card). Also, printers differ according to the print technology: dot matrix, laser, inkjet, thermal printer and plotter.

➔ **Input and output devices**

Storage devices, due to necessity for writing and reading data, they are classified as input/output devices.

Touch screen (i.e. monitor sensitive to touch) is output device while displaying computer image, and at the same time input device while receiving manual orders.

3.1.2. Software

Software is, unlike hardware, intangible part of the computer. It consists of a sequence of commands, written according to strict rules. Programs are written by programmers, in various programming languages.

Software types:

➔ **Operating system**

Operating system is a program which manages computer hardware. First computers did not have operating systems; they had programs that were directly loaded into the computer (e.g. punchcards). Today, computers have an operating system which loads into the computer's memory during its startup. Computer functions are based on its operating system. Within operating system, drivers (responsible for the functioning of a computer) and various utility programs (responsible for the functionality of a computer) are installed. The most famous operating systems are:

1. **Linux** (Debian, Ubuntu, Fedora, Knoppix,...) - open source software

2. **Microsoft Windows** (XP, Vista, 7,...) - proprietary software

3. **Mac OS** (Cheetah, Panther, Snow Leopard,...) - proprietary software

➔ **Application Software (Utility programs)**

Application Software (Utility programs) are all programs that users use to perform different tasks or for problem solving. Users, according to his/her needs, install the appropriate utility software. Computer functions and tasks that computers can perform are defined by the installed utility software. Utility software can often cost more than computer hardware unless the software is open source.

Common utility softwares are:

- ■ **Text processing** software is used for creating and forming text documents. Nowadays, they can contain images, charts and tables. Examples of such programs are LibreOffice Writer (open source software) and Microsoft Word (proprietary software).

- ■ **Spreadsheet calculations** software is used for performing various calculations and presentation of results in charts. Examples of such programs are LibreOffice Calc Writer (open source software) and Microsoft Excel (proprietary software).

■ Software for **presentations** is used to create professional presentations that consist of slides with graphical and textual elements. Such a presentation can afterwards be displayed as a "slide show" by using a projector. Examples of such programs are LibreOffice Impress (open source software) and Microsoft PowerPoint (proprietary software).

■ Software for **creating and managing database** helps to manage a collection of structured data. Examples of such programs are LibreOffice Base (open source software) and Microsoft Access (proprietary software).

Common utility software installed on a computer:

■ **office programs** - LibreOffice Microsoft Office

■ **antivirus programs** – Avira, Sophos, Kaspersky, Antivir etc.

■ **Internet browser**: Mozilla Firefox, Microsoft Edge, Opera, Safari, Google etc.

■ **programs for image editing**: Adobe Photoshop, Canvas, CorelDraw, Draw etc.

4. Networks

Computer network is comprised of at least two, connected, by wire or wireless, computers that can exchange data i.e. communicate. There are many reasons for connecting computers into a network, and some of them are:

• exchange of data between users that have network access,

• access to shared devices, such as network printers, network disks, etc.,

• enables user communication and socializing, etc.

Internet is the most famous and most widespread network with nearly 5.2 billion users and the number of users is still growing.

4.1. Types of Networks

Types of networks according to their size:

• **LAN (Local Area Network)** - a network that covers a relatively small geographical area- it connects computers within a firm or household by wire,

• **WLAN(Wireless Local Area Network)** - a network that covers a relatively small geographical area - it connects computers within a firm or household wirelessly,

• **WAN (Wide Area Network)**- a network that covers a relatively large geographical area - it connects a greater number of computers and local networks.

Terms: client / server

Relationship client - server is defined in the following manner: client sends requests and server responds to those requests. We can use Internet as the best known example. User's computer, connected to the Internet, sends requests to a certain web page (by entering page address into the Internet browser Address bar), and the server responds. Web page is loaded into the user's computer Internet browser as a result of server response. From this example, we can see that communication between client and server depends on connection speed (bandwidth). Since bandwidth is limited, the amount of data that can flow through network is limited too. Today, for instance, while purchasing access to mobile Internet, you will notice a limited amount of data that can be transferred within a package, i.e. amount of transferred data is what is charged.

Types of networks according to their architecture:

- **client-server** - all clients are connected to the server,

- **P2P (peer to peer)** - all computers are clients and servers at the same time.

INTERNET, INTRANET, EXTRANET

Internet ("network of all networks") is a global system comprised of interconnected computers and computer networks, which communicate by means of using TCP/IP protocols. Although, in its beginnings, it emerged from the need for simple data exchange, today it affects all domains of society.

Intranet is a private network of an organization to which only authorized employees have access (login and password).

Extranet is part of Intranet, to which independent collaborators have access.

4.2. Malicious programs

Malware (malicious + software) is a software, which infiltrates an operating system in a seamless manner, whether by human mistake or due to shortcomings of the operating system and software support, with malicious intentions. Malicious software includes:

- **Virus** is a malicious program with the possibility of self-replication. In a computer it seeks other files, trying to infect them and the ultimate goal is to spread to other computers. Depending on what malicious code it contains, it may cause more or less damage to your computer.

- **Worms** like viruses, they possess the ability of self-replication, however they cannot infect other programs. Their usual intent is to take control of your computer and allow remote control by opening, the so-called, 'backdoor'.

- **Trojan horses** can be presented in the form of games or files in e-mail attachments, with different purposes, such as: to allow remote control to your computer, delete data, allow spreading of viruses, send spam from the infected computer, etc. Unlike viruses and worms, it does not replicate and it needs to be executed, that is, it is not autonomous.

- **Spyware** is a program that secretly collects data about computer users (passwords, credit card numbers, etc.), therefore it spies on users. The most common spyware infections usually occur while visiting suspicious sites with illegal content.

- **Adware** is a program that uses collected data about a user in order to display advertisements in a way regarded as intrusive. It usually manifests itself in the form of many pop-up windows that display ads.

- **Hoax** is a false message being spread by e-mail in order to deceive users. Their goal is to obtain data of, for instance, a bank account, or persuade users to pay some fees in order to win the lottery (which they never applied for), or pay costs of money transfers from an exotic prince to help him withdraw money from a country that is falling apart and, in return, will receive an impressive award, etc.

Finally, here is some advice on additional protection against malicious programs :

- For everyday computer use (especially for Internet browsing), do not use an account with administrator privileges but a limited account, which has no authority for software installation. Use an Administrator account only when you need to administrate the system.

- Use professional programs for protection against malicious programs, they are not that expensive, 10-20 € per year, and provide complete protection. Be sure to regularly update your program for protection.

- Educate yourself, because nothing can protect you from reckless computer use. Be careful about opening unsolicited received e-mails, because you have to notice if it is of suspicious character, make sure websites you visit are safe, because only you have control over it. Also, check all external media with protection/security programs immediately after you connect them to a computer; do not use pirated software, it is considered a theft and they usually come with malware.