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عمور احمد

Department of Exact Sciences
Specialty: Computer Science

Course Handout for:

1st Year PEP English Students
2nd Year PES French Students
2nd Year PEM Physics Students

Computing

Proposed by:
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Dedication

For my students ...

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Abstract

This course provides an introduction to computer science, accessible to first year PEP (Primary Education Teacher) students at ENS Oran Ammour-Ahmed. It covers the basic concepts of computer science and e-learning.

In the first part, students explore computers and their main components, including the CPU, memory, storage devices, input/output devices, and peripherals, understanding how these elements work together to process, store, and manage information. Students also learn the basic operations of a computer, including how to use software applications and organize digital files effectively.

The second part focuses on TICE and online learning, introducing the fundamental concepts of e-learning and the use of digital learning tools such as interactive educational apps, multimedia resources, and educational games. Students are also introduced to learning management systems (LMS) like Moodle or Google Classroom, which allow teachers to share lessons, assign tasks, communicate with students, and track learning progress. The course covers strategies for integrating technology in teaching, including how to design interactive activities, quizzes, and collaborative projects that enhance student engagement.

Overall, this course equips students with the knowledge to understand how computers function, how to use digital tools effectively, and how modern technologies can enhance teaching and learning in primary education, providing a strong foundation for further development in digital pedagogy and educational innovation.

key words : Computing, Software, Hardware, Informa-

tion and Communication Technologies for Education, ICTE, E-learning, Computer science.

Foreword

This document is based on a course for first-year Primary Education Program (PEP) students in Information and Communication Technologies for Education (ICTE) and e-learning. It provides an introduction to the Digital World. It presents a thorough exploration of the basic principles of digital technology for education, including:

- Digital learning tools: software and applications used to support teaching young learners, such as interactive exercises, educational games, and multimedia resources.
- E-learning platforms: online systems that allow teachers and students to access lessons, submit and review activities, and communicate remotely.
- Integration of technology in primary teaching: methods and strategies for using digital tools effectively to enhance student engagement and learning outcomes in primary classrooms.
- Basic principles of online learning: understanding how children learn in digital environments and how to design in-

teractive, accessible, and age-appropriate learning experiences.

This manuscript is designed for beginning primary education teachers, whether students in their first year or anyone interested in understanding how ICTE and e-learning can support teaching and learning in primary schools. It serves as a foundation for further study in digital education and innovative teaching methods.

The document is organized into two parts as follows:

- The first part focuses on the essential concepts of computing, tracing the historical evolution of computers from their earliest forms to modern devices. It explores the core components of a computer, including the processor, memory, and storage, as well as the various input and output peripherals that facilitate human-computer interaction. In addition, the book delves into the operating system, explaining its vital role in managing hardware, software, and overall system functionality.
- The second part, on TICE & E-learning, presents the fundamental concepts of online learning and how modern technologies can support teaching and learning. It introduces students to digital tools, interactive platforms, and strategies for using technology effectively in education.

Subject sheet

Target audience

This course is intended for students who are new to computer science, as well as anyone interested in understanding the fundamentals of computing. This course is designed for students at ENS Oran Ammour-Ahmed, specifically :

- First-year PEP English students,
- Second-year PES French students,
- Second-year PEM Physics students.

Prerequisites

- None

Objectives

This course enables students to:

- Understand the fundamental principles of computer science;

- Master basic concepts related to computer science and the functioning of computers;
- Become familiar with the computing environment, including hardware and software;
- Acquire the basics of the Internet, as well as the skills necessary to use it effectively for research purposes;
- Deepen their knowledge of the various types of ICT, while developing a thorough understanding of their nature and diversity;
- Select the appropriate ICT tools based on specific needs in different teaching and learning situations.

The Lessons

This is an annual program consisting of:

- 1.5 hours online class session per week, on the Moodle platform.

Coefficient

The course has a coefficient of **1**.

Part I : The computer & its components

This section introduces the fundamental concepts related to computers, with a focus on their main hardware and software components, which are essential for understanding how a computer system operates.

Chapter 1: History of Computers

Contents

1.1 Introduction

The term computer science was coined in 1962 by Philippe Dreyfus. It is derived from the contraction of the words information and automatic. The history of computer science is marked by humanity's desire to automate tasks that were previously done manually, especially calculations. Over the centuries, the goal has been to calculate faster and minimize errors as much as possible, see Figure (1.1). This need for calculation led to the development of the first calculating machines.

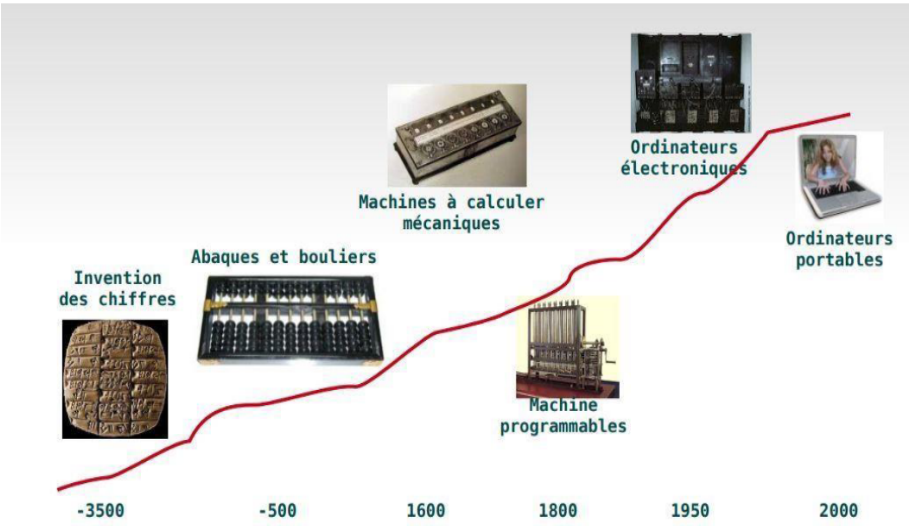


Figure 1.1: Evolution of Computers

Since the day it was created, the computer has evolved at an ever-increasing pace. Many researchers have aimed to improve this machine to replace humans in their routine tasks. Its evolution continues to accelerate and shows no signs of slowing down!

In this chapter, we will explore the evolution of computers,

focusing on the key characteristics of each generation

1.2 First generation (1945-1955)

he first generation of computers (1940s–1950s) was characterized by the fact that their instructions were specifically designed for the particular task each computer was built to perform. Each machine had its own unique set of binary codes, known as Machine Language, which dictated exactly how it should operate, see Figure (1.2)

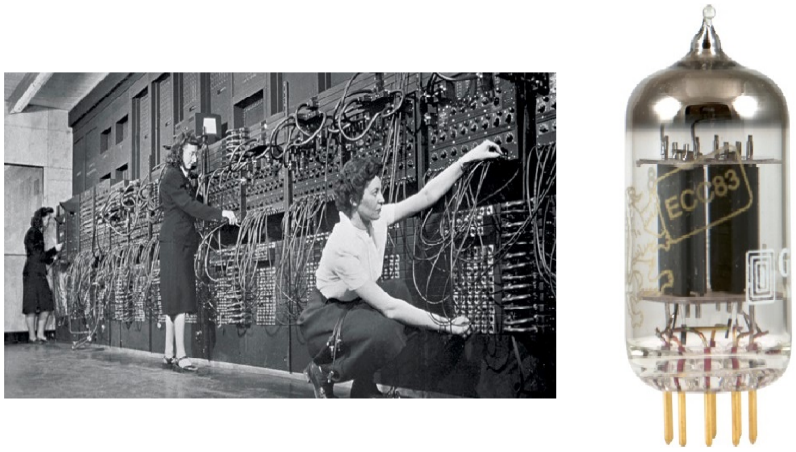


Figure 1.2: Switch Panel & Vacuum Tubes

Programming these computers was extremely difficult and time-consuming, and their processing speed was very limited compared to modern standards.

Another defining feature of first-generation computers was the use of vacuum tubes, which generated a lot of heat and made the machines enormous in size. These computers were often

programmed manually by flipping switches or using punched cards.

Despite these limitations, first-generation computers were a major breakthrough, as they allowed scientists and engineers to perform complex calculations much faster than with manual methods. They were mainly used for scientific research, military applications, and large-scale calculations.

1.3 Second generation (1955-1965)

The second generation of computers marked a major technological shift with the introduction of transistors instead of vacuum tubes. Transistors were smaller, faster, more reliable, and consumed much less electricity, which allowed computers to become more compact and efficient, see Figure (1.3).

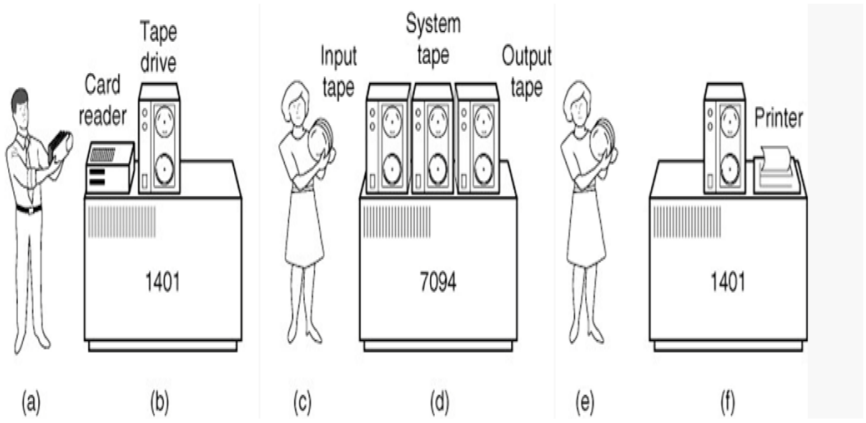


Figure 1.3: Batch Processing

Programs were still written in assembly language, but higher-level languages such as FORTRAN and COBOL became widely

used, making programming easier and more accessible. Data storage evolved from magnetic drums to magnetic tapes and disks, which improved both speed and reliability.

Unlike the first generation, the separation between programmers and operators became less rigid, as computers required less manual intervention and could handle more complex calculations. However, specialized personnel were still needed to manage and maintain the machines.

1.4 Third generation (1965-1980)

The third generation of computers was characterized by the introduction of integrated circuits (ICs), which combined multiple electronic components on a single small silicon chip, see Figure (1.4).

This innovation allowed computers to become smaller, faster, more reliable, and energy-efficient, as more components could now be placed on a single support.

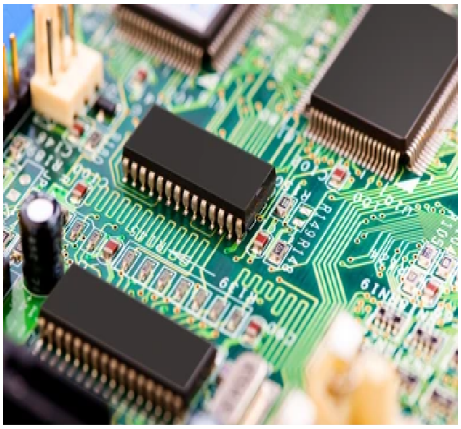


Figure 1.4: Integrated Circuit

Although transistors had already improved upon vacuum tubes, they still generated significant heat and consumed considerable energy, which could damage sensitive internal components. Integrated circuits addressed many of these issues and marked a major step forward in computer design.

Another key development of the third generation was the emergence of operating systems (OS). These systems allowed multiple programs to run simultaneously on the same machine, while a central program managed and coordinated main memory and other resources. This made computers much more flexible and efficient, reducing the need for constant manual intervention by operators.

Programming languages such as FORTRAN, COBOL, and BASIC became more widespread, enabling easier and faster program development. Computers of this generation were used not only for scientific calculations but also for business applications, such as accounting, inventory management, and data processing.

1.5 Fourth Generation (1971–1990)

After the introduction of integrated circuits, the main focus of technological improvement shifted to reducing the size of these circuits while increasing their complexity and performance. This was achieved through Large Scale Integration (LSI), a technique that allowed hundreds of simple electronic components to be placed on a single silicon chip, see Figure (1.5)

	Level of Integration	Number of active devices per chip
1.	Small scale integration (SSI)	less than 100
2.	Medium scale integration (MSI)	100 - 10000
3.	Large scale integration (LSI)	1000 - 100,000
4.	Very large scale integration (VLSI)	over 100,000
5.	Ultra large scale integration (VLSI)	over 1 million

Figure 1.5: Large Scale Integration

LSI technology led directly to the development of microcomputers, which were smaller, more affordable, and accessible to businesses, schools, and even individual users. These computers marked a major step toward the personal computing revolution, making computing power available outside large organizations.

As a result, fourth-generation computers became faster, more reliable, and more energy-efficient, while also enabling more sophisticated software applications and the emergence of graphical user interfaces (GUIs) in later models.

1.6 Fifth Generation (1990 – present)

The advent of smartphones and tablets has revolutionized computing. Laptops have become lighter, more powerful, and portable, while applications increasingly dominate the user experience, see Figure (1.6)

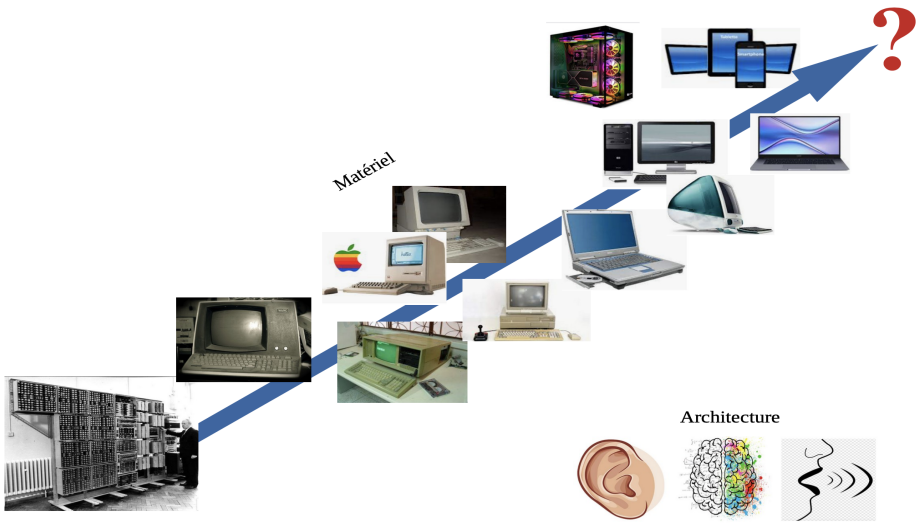


Figure 1.6: Evolution of Computers

Today, Artificial Intelligence (AI) and cloud computing play a central role in the evolution of computers. Users can now access powerful computing resources remotely, enabling flexible work, large-scale data processing, and advanced services without relying on local hardware.

The fifth generation of computers focuses on artificial intelligence (AI) and advanced computing technologies, see Figure (1.7),aiming to create machines capable of learning, reasoning, and making decisions. Unlike previous generations, which were primarily concerned with hardware improvements, fifth-generation systems emphasize software intelligence, parallel processing, and high-speed data handling.

Key innovations include the use of Very Large Scale Integration (VLSI), which allows millions of transistors to be placed on a single chip, enabling extremely powerful and compact processors. These computers also rely heavily on expert systems,

natural language processing, and neural networks, allowing applications such as voice recognition, image analysis, and automated decision-making.

Fifth-generation computers are increasingly connected through networks and the Internet, supporting distributed computing and enabling global collaboration and data sharing. This generation has transformed both businesses and daily life, with personal devices, smart technologies, and cloud computing becoming widespread.

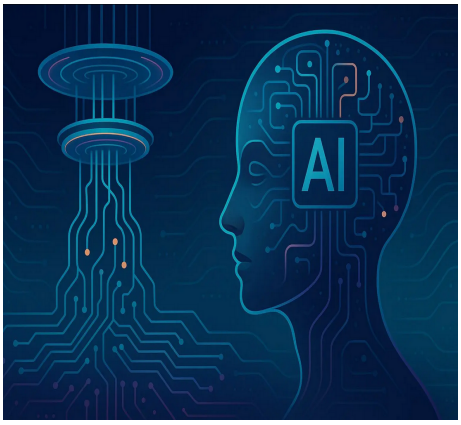


Figure 1.7: Quantum Computing and AI

1.7 What is computer Science ?

Computer science is the science of processing information (data) automatically.

Computer science is based on two essential elements:

- Hardware: A set of physical devices used to process information automatically.

- Software: A structured set of instructions describing an information processing task to be carried out by hardware.

In other words, computer science is the study of computers and computational systems—how they work, how they are designed, and how they are used to solve problems.

It focuses on:

- Algorithms: step-by-step methods for solving problems
- Programming: writing code to tell computers what to do
- Data: how information is stored, processed, and analyzed
- Computer systems: hardware, software, and operating systems Networks and the Internet
- Artificial intelligence and machine learning

In simple terms, computer science is about using computers to think, process information, and create solutions for real-world problems in areas like education, healthcare, business, science, and entertainment.

1.8 Fields of application

Computer science is applied in many areas of modern life and plays a crucial role in technological and digital development, see Figure (1.8).

Figure 1.8: Fields of application

It is used to automate tasks, process and manage data, simulate complex systems, and design intelligent and connected applications across various domains.

- Management and information systems
- Office automation and administrative applications
- Data processing and information management
- Simulation and modeling in science and engineering
- Embedded systems (automotive, medical devices, household appliances)
- Gaming and multimedia applications
- Artificial intelligence and machine learning
- Computer networks and Internet technologies
- Cybersecurity and data protection
- Cloud computing and e-learning systems.

1.9 Conclusion

In this chapter, we discussed the history of computers as well as their evolution, which highlight the remarkable progress of computer science, from large and energy-intensive machines to powerful, intelligent, and connected systems.

Each generation has introduced major technological innovations that have improved performance, reduced size and cost, and expanded fields of application. Today, computers play a central role in nearly all aspects of daily life, supported by artificial intelligence, cloud computing, and digital networks. Understanding this evolution provides a solid foundation for studying modern computing technologies and their impact on society and education.

The following chapter will be devoted to presenting the components of the computer.

Chapter 2: The Components of computer

Contents

2.1 Introduction

A computer is a complex system made up of several components that work together to process data and produce meaningful information. These components can be broadly classified into hardware and software. Hardware refers to the physical parts of the computer, while software consists of the programs and instructions that control its operation.

Understanding these components is essential for learning how computers operate and how they are used in various applications.

In this chapter, we present the main components of a computer system and explain their functions. A computer is composed of both hardware and software, which work together to process data and perform tasks.

2.2 What is a Computer?

A computer,see Figure (2.1), is an electronic machine capable of solving and processing problems by following the instructions of programs. It allows us to:

1. Acquire information.
2. Store information.
3. Process information.
4. Output information.

Figure 2.1: Desktop Computer

A computer is primarily a complex machine designed to store data and process it in order to transform and then display it on a screen or printer.

2.3 Functional Units of a Computer

In general, a computer must have the following functional units, see Figure (2.2):

- Processing Unit (Processor): The brain of the computer, which supervises the other units and performs processing tasks, including execution and calculations.
- Storage Units (Memory): The place where information is stored, including programs and data.
- Input and Output Units (Peripherals): These units are responsible for receiving input data and providing output.
- Communication Bus: Ensures connections between the different units, allowing them to exchange information efficiently.

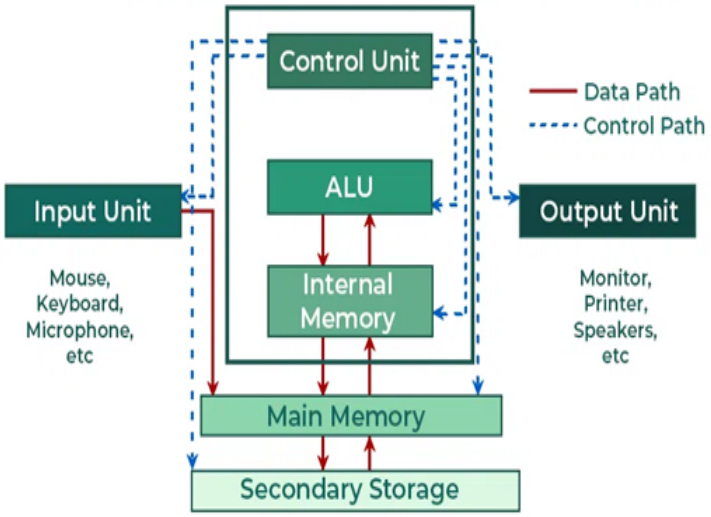


Figure 2.2: Functional Components of Computer

2.4 Computer's components

A computer is composed of several key components that work together to perform tasks efficiently. These components can be broadly divided into hardware and software.

1. Central Processing Unit (CPU) Also known as the processor, the CPU is the brain of the computer. It supervises the other components and executes instructions, performing calculations and processing data.

2. Memory and Storage Units These units are used to store information, including programs and data. They can be temporary (RAM) or permanent (hard drives, SSDs).

3. Input and Output Devices (Peripherals) These devices allow the computer to interact with the outside world. Input devices include keyboards, mice, and scanners, while output

devices include monitors, printers, and speakers.

4. Communication Bus The bus connects the different components, enabling them to exchange data and instructions efficiently.

Traditionally, a computer is made up of a central unit, which acts as the brain of the machine, and input/output peripherals such as the screen, keyboard, mouse, and speakers.

2.4.1 Central unit

The central unit represents the brain of the machine. It is a metal case that contains the main internal components of the computer, see Figure (2.3). It is composed of:

- **The power supply unit :** provides the computer with electrical power from the mains. It also contains a fan, which helps to cool the various components while the computer is running.
- **The CD/DVD drive :** is an optical drive that uses laser beams to read data stored on discs.
- **The hard disk :** serves as permanent storage for both data and software.
- **The motherboard :** is an electronic board that houses the main components responsible for data processing and for transferring information to other peripherals.

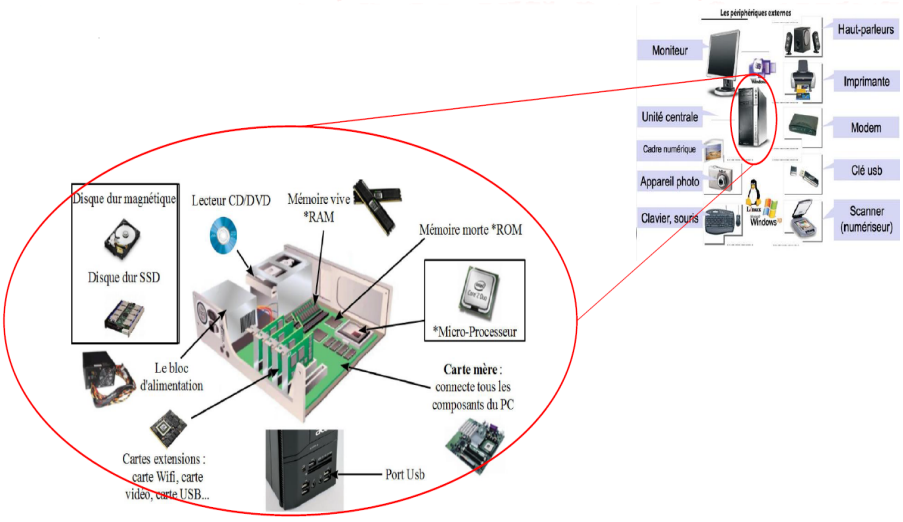


Figure 2.3: Central unit

In older computers, there was also a floppy disk drive, which is a magnetic drive that could read from and write to floppy disks. A floppy disk is a storage medium with limited capacity compared to modern storage devices.

The components of the motherboard

1. Microprocessor : It is the brain of the machine. It processes and controls information and is also called the CPU (Central Processing Unit), see Figure (2.4). It enables data exchange between the different components (hard disk, RAM, graphics card, etc.), manipulates digital information encoded in binary form (0 and 1), and executes program instructions stored in memory. Its performance is expressed in hertz (Hz).

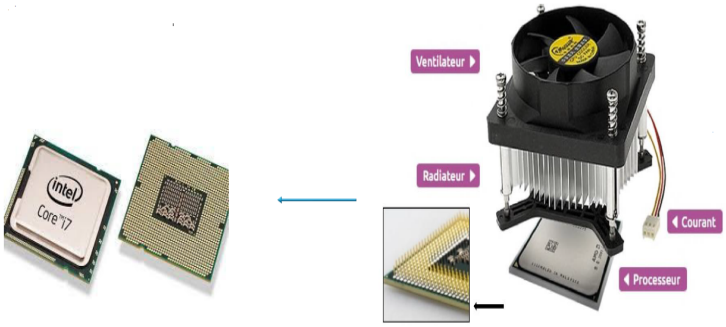


Figure 2.4: Processor

The processor consists of units:

- Calculation Unit (ALU - Arithmetic and Logic Unit): The ALU is the calculation unit embedded in the microprocessor. It performs addition, subtraction, inversion, and logical functions such as AND and OR.
- Control Unit: Also known as the control or sequencer unit, it commands and controls the system's operation, particularly the data path.

2. Stack : The battery is responsible for keeping the internal clock up to date when the computer is powered off.

3. Expansion connectors : Expansion connectors are slots available on the motherboard designed to hold expansion cards. An expansion card acts as an interface between the motherboard and peripheral devices.

- The AGP (Accelerated Graphics Port) expansion connector is a slot specifically reserved for the graphics card.

- The PCI (Peripheral Component Interconnect) expansion connectors are slots where various expansion cards of the computer are installed. Among these expansion cards, we can mention:
  - Graphics card: An expansion card whose role is to generate and display images on the screen.
  - Sound card: An expansion card that allows sound output on the computer.
  - Network card: An expansion card that enables a computer to connect to a network.

4. Memory : The term "memory" refers to any device capable of recording, storing information for as long as possible, and retrieving it on demand. There are two types of memory in a computer system.

1. **RAM (Random Access Memory)**: also called main memory or internal memory, is a type of volatile memory that stores data while programs are being executed, see Figure (2.5). The contents of this memory are lost when the system is powered off.

Figure 2.5: Random Access Memory

2. **ROM (Read Only Memory)** : is a type of non-volatile memory whose contents do not change unless the user deliberately modifies or erases them. It allows information to be stored long term, even when the computer is turned off, see Figure (2.6).

   The computer's ROM stores the essential data required for system startup.

   Examples: Hard disk, USB flash drive, CD, DVD.

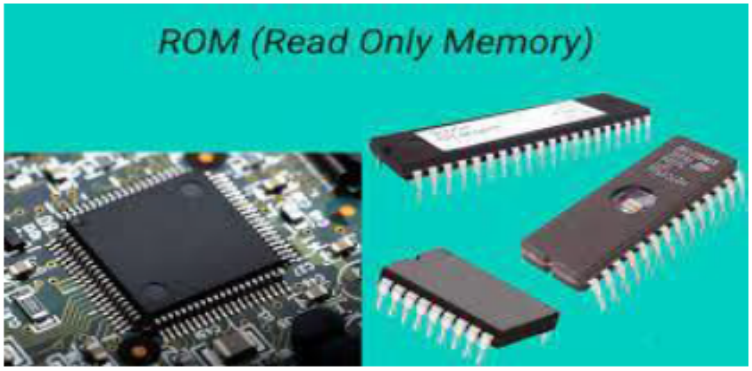


Figure 2.6: Random Only Memory

The Main memory (RAM) represents the working space of

the computer. It is the primary storage area for the information used by the processor, see Figure (2.7). To run a program on a computer, it must be loaded from the hard drive into the main memory.

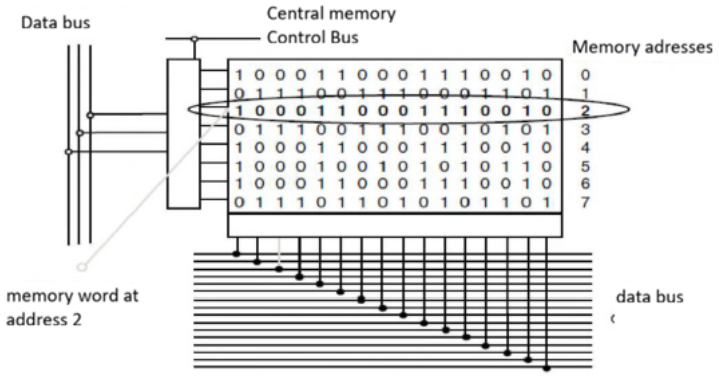


Figure 2.7: Representation of Data inside RAM

Two factors influence the execution time of a program (the performance of a machine): the access time of the main memory and its capacity.

In coputing, to measure memory size (storage capacity), we use the byte. One byte = 8 bits. A bit (binary digit) can hold either a 0 or a 1 (so, only two possible values).

A file is a collection of bits. A set of bits forms what is called a binary word.

The binary language is the only one that computers understand. To simplify measurements, multiples of the byte (a set of 8 bits) are used, which should not be confused with the English definition of the byte, written as Byte (with a capital B).

Since a bit is not sufficient to express all available file sizes, units of measurement (such as centimeter, meter, and kilometer,

for example) have been established.

- Un Kilo Byte (KB) =1024 Byte
- Un Mega Byte (MB) =1024^2Byte
- Un Giga Byte (GB)=1024^3 Byte
- Un Tera Byte (TB)= 1024^4 Byte

2.4.2 Peripherals

Among the input and output units, we find:

- Mouse: A pointing device used to interact with the computer.
- Keyboard: A set of keys that allows users to enter and input data for the computer to process. There are two common types of keyboards:
  - AZERTY keyboard : Named after the first six letters on the top-left row of keys: A-Z-E-R-T-Y. Mainly used in France, Belgium, and some French-speaking countries.
  - QWERTY keyboard : Named after the first six letters on the top-left row of keys: Q-W-E-R-T-Y. It is the standard layout in the United States, the UK, and many other countries.
- Monitor (Screen): Allows users to view and display information provided by the computer.

- Speakers: Allow users to hear sounds generated by the computer.
- Microphone: Allows users to input sound into the computer.

  Webcam: Used to capture moving images (video).
- Scanner: Used to digitize documents for use on the computer.
- ...

2.5 Classification of peripherals

Each component of a computer has a specific role, see Figure (2.8):

The microprocessor (CPU) receives, processes, and transmits information.

The hard disk stores information.

Input devices (such as keyboards and mice) capture data and send it to the microprocessor for processing.

Output devices (such as printers, speakers, and disc burners) convert processed information into a form that can be understood outside the computer, such as displaying it on a screen or printing it on paper.

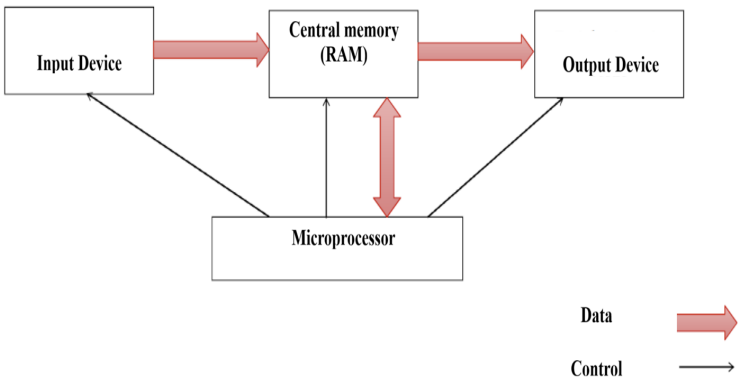


Figure 2.8: General Diagram of a Computer

Peripherals connected to a computer are responsible for performing input and/or output operations to and from the system.

Peripherals can be classified into three main types:

- Input devices – devices that send information to the computer.
- Output devices – devices that receive and display or output information from the computer.
- Input/Output (I/O) devices – also called storage or multimodal devices, which can both send and receive information.

2.6 Conclusion

In this chapter, we explored the main components of a computer and their specific roles. We saw that the CPU acts as the brain of the machine, processing instructions and managing

data, while memory units store information temporarily or permanently. Input devices allow the computer to receive data from users, and output devices communicate processed information to the outside world. We also learned about expansion cards, buses, and storage devices, which ensure the efficient functioning and communication of all components.

Understanding these components provides a solid foundation for studying how computers operate, how software interacts with hardware, and how modern systems are designed to process, store, and exchange information efficiently.

Chapter 3: Software and Operating System

Contents

3.1 Introduction

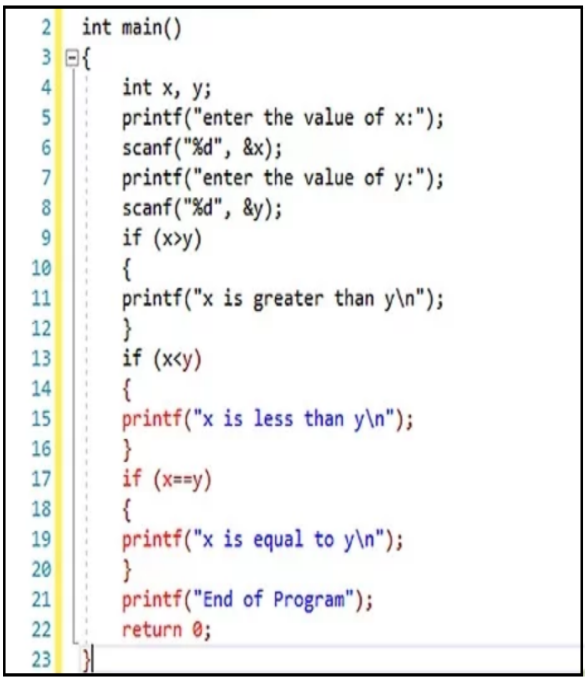
A computer cannot function without software, which consists of the programs and instructions that tell the hardware how to perform tasks. Software allows users to communicate with the computer, run applications, and manage data efficiently.

In this chapter, we will explore the fundamental concepts of computing to introduce students to the field. We will begin by defining what a computer program is, explaining its role in performing tasks on a computer. Next, we will present the operating system, which serves as the foundation for the computer's operation, managing programs and hardware resources.

3.2 What is a program ?

A program is a set of instructions written in a programming language, see Figure (3.1), that tells a computer how to perform a specific task. Programs are executed by the computer's processor (CPU) and can range from simple operations, like adding two numbers, to complex tasks, like running a video game or managing a database.

A program must be written carefully to ensure the computer performs the intended task correctly. Programs can be part of system software (like the operating system) or application software (like a word processor or web browser).



```c
int main()
{
    int x, y;
    printf("enter the value of x:");
    scanf("%d", &x);
    printf("enter the value of y:");
    scanf("%d", &y);
    if (x>y)
    {
    printf("x is greater than y\n");
    }
    if (x<y)
    {
    printf("x is less than y\n");
    }
    if (x==y)
    {
    printf("x is equal to y\n");
    }
    printf("End of Program");
    return 0;
}
```

Figure 3.1: Example of computinf program

A computer program is a set of instructions that allows a computer to perform a specific task. These instructions must be written in a programming language so that the computer can understand and execute them correctly. Programming languages therefore act as a bridge between humans and machines.

3.3 Classification of Programming Languages

Programming languages can be classified according to their level of proximity to the machine.

3.3.1 Low-level languages

Low-level languages are very close to machine language and are highly dependent on hardware. They provide direct control over

computer resources but are difficult to write, understand, and maintain.

Examples:

- Machine language
- Assembly language

3.3.2 High-level languages

High-level languages are closer to human language and are generally hardware-independent. They are easier to learn, use, and maintain. These languages allow developers to create applications more quickly and efficiently.

Examples:

- Python
- Java
- C++
- JavaScript

3.3.3 Compiled and interpreted languages

Compiled languages are translated into machine code before program execution (C, C++).

Interpreted languages are executed line by line by an interpreter (Python, JavaScript).

3.4 Classification of the software

Software can be classified into two main categories:

3.4.1 System Software

This type of software is responsible for managing and controlling the computer hardware and providing a platform for running application software. The operating system (OS) is the most important example of system software, as it coordinates the CPU, memory, and input/output devices, and provides a user interface. Other examples include device drivers and utility programs.

3.4.2 Application Software

Application software is designed to perform specific tasks for users, such as word processing, web browsing, graphic design, or gaming.

Example : Microsoft Word, Excel, Photoshop, web browsers like Chrome, and multimedia players, see Figure (3.2).

Figure 3.2: Application Software

3.5 Operating System

An operating system (OS) is a set of software that has two main functions:

- Allowing all computer components (hardware and software) to work together.
- Enabling interaction between the user and the computer, as well as with software.

This second function is so crucial that some people define operating systems as human-machine interfaces. Since this interaction is often done through visual elements (clicking on icons), we refer to it as a graphical user interface (GUI).

Today, operating systems are multitasking, meaning they can manage the execution of multiple programs simultaneously.

3.5.1 The Different Operating Systems

For computers, see Figure (3.3), the three most well-known operating systems are:

- Windows, developed by Microsoft, which is installed on most personal computers.
- GNU/Linux, an open-source software widely used on professional servers. Its main advantage is that it is free.
- OS X, developed by Apple, which comes pre-installed on all computers sold by the company.

For smartphones, see Figure (3.3), there are four main operating systems:

- Android, developed by Google, which is partially open-source.
- iOS, developed by Apple, installed on iPhones.
- Windows Phone, developed by Microsoft.
- Firefox OS, introduced by the Mozilla Foundation in 2013. Firefox OS is completely open-source.

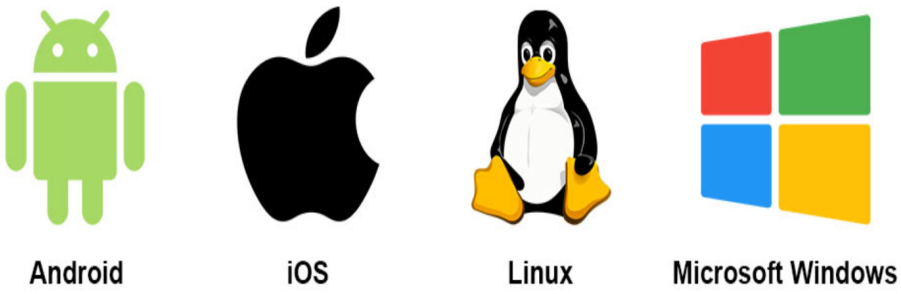


Figure 3.3: Example of operating system

3.5.2 Component of operating system

The operating system is composed of several key parts, see Figure (3.4):

- **Kernel**: The core of the OS, which contains all the basic system programs responsible for managing hardware and system resources.

- **Shell (User Interface)**: Acts as an intermediary between the user and the operating system, allowing users to give commands and interact with the computer.
- **File System (FS)**: Manages data storage, organization, and retrieval on disks and other storage devices.
- **Drivers**: Special programs often included with the OS that enable interaction with various peripherals such as the mouse, printer, speakers, game controllers, and hard drives. Drivers ensure the proper flow of input and output data between the computer and connected devices.

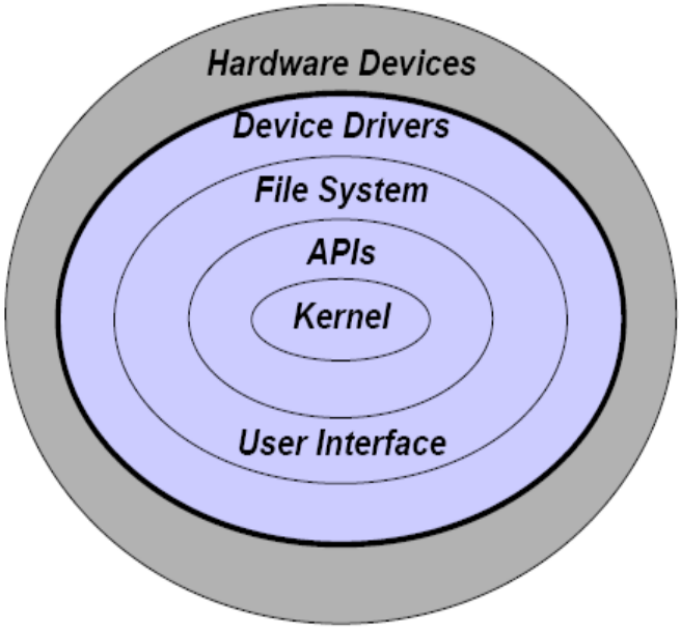


Figure 3.4: Component of operating system

3.5.3 Role of operating system

The operating system is a crucial system software that manages the computer's hardware and provides an interface for the user. Its main functions include:

- Managing the CPU(s) and memory, ensuring that programs and processes run efficiently.
- Controlling input and output devices such as the keyboard, mouse, touchscreen, monitor, hard drive, DVD drive, and memory card readers.
- Handling the display, including windows, menus, and other visual elements.
- Detecting and responding to user actions, such as clicks, typing, or touch gestures.
- a user interface, allowing users to interact with the computer and access files and programs. For example, the OS displays windows and presents the contents of storage devices such as hard drives, CDs, or DVDs.
- Managing data storage on secondary memory through disk management systems.

The OS acts as a bridge between the user and the hardware, coordinating resources, enabling program execution, and making the computer easy to use.

3.6 Windows Environment

The Windows environment is a graphical user interface provided by the Microsoft Windows operating system, see Figure (3.5). It allows users to interact easily with the computer through visual elements such as windows, icons, menus, and buttons, without requiring complex command knowledge.

Figure 3.5: Windows Environment

The Windows environment mainly uses the mouse and keyboard to perform actions such as launching programs, managing files and folders, and configuring system settings. This makes computer use more accessible, especially for beginners.

The main components of the Windows environment include:

- The Desktop: the main workspace where icons and shortcuts are displayed.
- The Taskbar: provides quick access to open applications and the Start Menu.
- The Start Menu: allows access to programs, settings, and power options such as shutdown and restart.
- Windows: display areas used to interact with applications and files.

The Windows environment plays an essential role in making the computer user-friendly, intuitive, and efficient for everyday tasks.

3.7 Comparison of Operating Systems

The following table (3.1) presents a comparison of the most commonly used operating systems. It highlights their main characteristics, advantages, and typical uses, helping students better understand the differences between Windows, Linux, and macOS.

In summary, each operating system has its own strengths and areas of use. Windows is widely adopted due to its ease of use and broad compatibility. Linux stands out for its flexibility, security, and open-source nature, making it suitable for technical and academic environments. macOS offers strong performance and seamless integration with Apple hardware, particularly for creative and professional users. Understanding these

Table 3.1: Comparison of Operating Systems

Feature	**Windows**	**Linux**	**macOS**
Developer	Microsoft	Open-source community	Apple
User Interface	Graphical, user-friendly	Graphical and command-line	Graphical, modern
Ease of Use	Easy for beginners	Medium (technical knowledge)	Easy and intuitive
Hardware Compatibility	Runs on most PCs	Runs on many platforms	Apple devices only
Cost	Paid license	Free	Included with Apple devices
Software Availability	Very wide	Wide, especially for development	Limited to Apple ecosystem
Common Use	Personal, education, business	Servers, education, research	Creative and professional work

differences helps users choose the operating system that best fits their needs.

3.8 Conclusion

In conclusion, this chapter has introduced the fundamental concepts of computing. We have explained what a computer program is and highlighted the importance of programming languages in enabling computers to execute instructions. We have also presented the operating system as an essential component that manages hardware resources and allows programs to run efficiently.

These basic concepts provide a solid foundation for understanding more advanced topics in computing.

The next chapter will focus on the representation and encoding of information, explaining how data is represented and processed in computing.

Chapter 4: Representation and Encoding of Information

Contents

4.1 Introduction

Information processed by computers comes in various forms:

- Numbers,
- Text,
- Images,
- Sounds,
- Videos,
- Programs,
- etc.

In a computer, all information is always represented in binary form *(BIT: Binary digIT)*, as a sequence of *0s* and *0s*, see Figure (4.1).

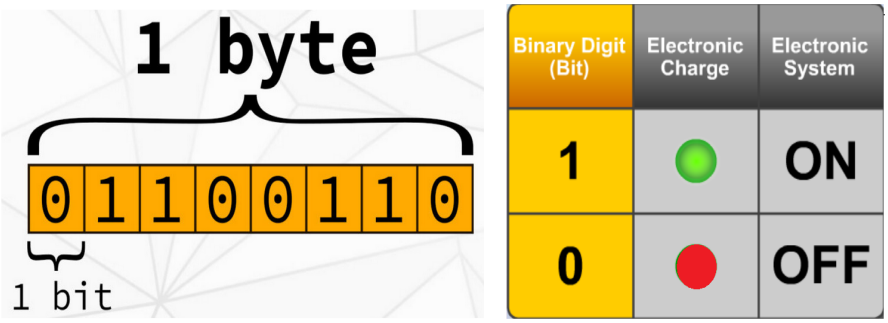


Figure 4.1: Binary digIT

Information encoding establishes an unambiguous correspondence, allowing the transition from one representation (called

external representation) to another (called *internal representation*, in binary form) based on a precise set of rules.

Example of the representation of number 35:

35 is the external representation of the number thirty-five.

Its internal representation in binary form will be a sequence of 0s and 1s: **100011**.

4.2 Numbering System

A numbering system describes the way numbers are represented. It is defined by:

- An alphabet: A set of symbols or digits.
- Rules for writing numbers: The arrangement and juxtaposition of symbols according to specific conventions.

Definition :

A numbering system is a method of representing numbers using a set of symbols called digits, where the number of symbols used determines the base of the system.

4.3 Representation of the Binary System

In the fields of automation, electronics, and computing, we use the binary system (Base 2). All numbers are written using only two digits: 0 and 1.

Just as we use the decimal system because we began counting with our ten fingers, we use the binary system because technological systems often have two stable states:

- A switch is either open or closed.
- A voltage is either present or absent.
- A magnetic field is oriented North-South or South-North.

Each state of a technological system is associated with a binary logical state. For example:

- The presence of a voltage is represented by 1.
- The absence of a voltage is represented by 0.

The binary digit, which can take these two states, is called a bit (*Binary Digit*).

4.3.1 Bit Combinations and Data Representation

With each additional bit, the number of possible combinations doubles. The total number of combinations is given by the formula: 2^N

where N is the number of bits.

A group of bits is called a word, see Figure (4.2), and a word of eight bits is known as a byte (octet).

Example: Number of Values in a Byte

With one byte (8 bits), we can represent: 2^8 =256 binary numbers, ranging from 0 to 255.

The rules for binary calculations follow the same principles as the decimal system, making it essential for storing and processing data in computing systems.

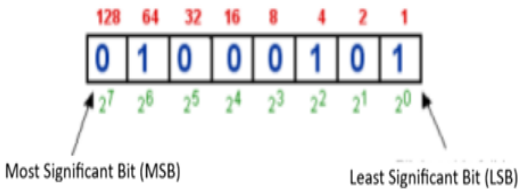


Figure 4.2: An 8 bit binary word

4.3.2 ASCII code

Binary allows encoding numbers that computer systems can process. However, a computer must also handle alphanumeric characters to store and transmit text. To encode these characters, each one is assigned a binary code.

This is known as *ASCII* encoding (*American Standard Code for Information Interchange*), see Figure (4.3).

Example:

The ASCII code for the letter A is 65, which corresponds to 01000001 in binary.

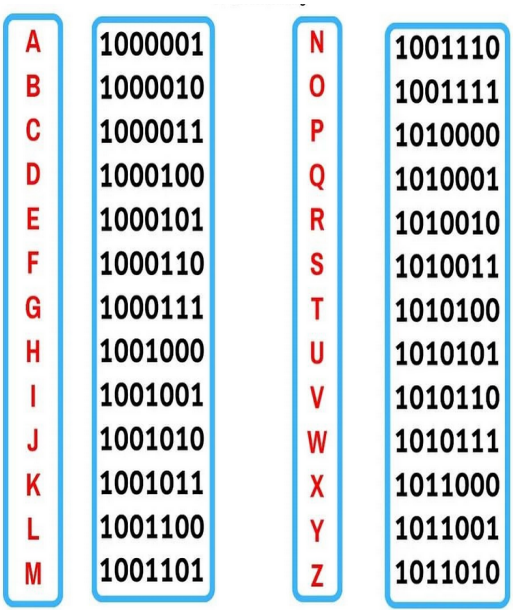


Figure 4.3: ASCII Binary Alphabet

4.4 Data representation

In computing, data representation refers to the way information is encoded and stored in a computer. Since computers operate using binary signals, all types of data must be represented using numbers. Different number systems are used to represent and manipulate data efficiently.

4.4.1 Decimal Representation

It is the most commonly used numbering system today. The numbers we typically use belong to Base 10 (the decimal system). We have ten different digits (0 to 9) to write all numbers.

In general, any Base N consists of N digits, ranging from *0* to *N-1*.

Example : Given a decimal number $N = 2348$, this number is the sum of 8 units, 4 tens, 3 hundreds, and 2 thousands.

We can express it as:

$$N = (2 \times 1000) + (3 \times 200) + (4 \times 10) + (8 \times 1)$$

$$N = (2 \times 10^3) + (3 \times 10^2) + (4 \times 10^1) + (8 \times 10^0)$$

Remark In the decimal system, 10 represents the base, and the exponents (from 0 to 3) indicate the positional value of each digit.

Regardless of the base:

- The rightmost digit always represents the units place (10^0 in base 10).
- The leftmost digit has the highest weight, corresponding to the highest power of the base.

This positional system applies to all numbering systems, including binary (base 2), octal (base 8), and hexadecimal (base 16).

4.4.2 Octal Representation

The octal system uses a numbering system with base 8 (octal comes from the Latin octo, meaning eight). Thus, a number expressed in base 8 can be written as follows: $(745)_8$.

Example The number 3476 is broken down as follows:

$$3476 = (3 \times 8^3) + (4 \times 8^2) + (7 \times 8^1) + (6 \times 8^0)$$

$$(3476)_{10} = (1854)_8.$$

4.4.3 Hexadecimal Representation

Handling numbers written in binary is difficult for humans, and converting them to decimal is not straightforward. This is why we prefer using the hexadecimal system (base 16).

To write numbers in base 16, we need 16 digits. For the first ten, we use the digits from the decimal system (0-9), and for the remaining six, we use letters from the alphabet, see Figure (4.4).

Figure 4.4: Hexadecimal Representation

Example

$$(A3F)_{16} = A \times 16^2 + 3 \times 16^1 + F \times 16^0$$

$$(A3F)_{16} = 10 \times 16^2 + 3 \times 16^1 + 15 \times 16^0$$

$$(A3F)_{16} = 2560 + 48 + 15 = (2623)_{10}$$

4.5 Conclusion

In this chapter, we examined how information is represented and encoded in computer systems. Since computers operate using binary logic, all types of data must be converted into numerical forms that the machine can process. We explored positional number systems—decimal, binary, octal, and hexadecimal—and showed how they are used to represent values efficiently.

In what follow, the second part of this course handout will be devoted to the presentation of ICT and e-learning.

Part II : ICT for Teaching and Learning

This section introduces the fundamental concepts related to computers, with a focus on their main hardware and software components, which are essential for understanding how a computer system operates.

Chapter 5: What are ICT in Education?

Contents

5.1 Introduction

Information and Communication Technologies (ICT) have transformed the way education is delivered and accessed. They include digital tools, software, and online platforms that help teachers and students communicate, learn, and manage educational content. Understanding ICT in education is essential for modern teaching and learning, as it enhances engagement, collaboration, and access to knowledge.

$$ICTE = ICT + Education$$

ICT in Education includes a set of tools designed and used to create, process, store, share, organize, retrieve, and read digital documents for teaching and learning purposes, see Figure (5.1).

Figure 5.1: Information and Communication Technologies

Definition ICT in Education thus encompasses all Information and Communication Technologies that are directly or indirectly

related to teaching activities. Rather than just a label, it is a field aimed at continuously improving education through the latest technologies. Indeed, ICT in Education serves as a source of innovation, introducing new approaches, fresh ideas, and innovative methods for teaching and training learners.

The list of technology applications in education is extensive:

- Online learning platforms
- Digital Workspaces (ENT)
- Serious games
- Digital training software
- ...

5.2 ICT Practices & Tools in Education

ICT offers pedagogical training using technology and tools in a wide variety of ways, from word processing to interactive applications. Here are some examples of tools and uses:

- **Basic software:** Word processors, spreadsheets, and presentation software.
- **Interactive digital textbooks:** Including videos and image galleries.
- **Collaborative work platforms:** Allowing students to share and work together remotely.

- **Multimedia databases (images, videos):** Enhancing lessons with visual content.
- **E-learning (online learning):** Ideal for distance learning, correspondence courses, and self-training.

These tools and methods make education more flexible, interactive, and accessible, catering to different learning needs.

The landscape of ICT in Education is vast and constantly evolving. Every year, new applications emerge (e.g., history lessons on Pinterest, educational content sharing via Freasyway), along with new tools (such as tables with integrated digital tablets and interactive whiteboards for teachers),see Figure (5.2), fostering a more modern and learner-centered pedagogy.

Figure 5.2: Interactive whiteboards

Information and Communication Technologies for Education encompass digital tools and products that can be used in educational and teaching contexts.

ICT in Education includes a set of tools designed and used to:

- Create
- Process
- Store
- Share
- Organize
- Retrieve
- Read
- ...

digital documents for teaching and learning purposes.

5.3 ICTE Tools

ICT tools refer to digital resources and applications used to support teaching, learning, and educational management. They help teachers and students create, share, and access information efficiently.

- **Interactive Whiteboard** : Connected to a computer and a projector, the Interactive Whiteboard (IWB) is part of an interactive display system designed for collective visualization. It combines the functionality of traditional board writing with the control and visual display capabilities of

a computer screen. The IWB is operated directly from its surface, merging the functions of chalk, marker, and mouse into a single interactive tool.

- **Interactive digital textbooks** : including videos, simulations, and image galleries.
- **Other ICT Tools Used in the Classroom**
  - **Digital Learning Environments (DLE):** These platforms are rapidly expanding in terms of implementation, technological capacity, and educational quality.
  - **Open and Distance Learning (ODL):** Gaining recognition as an effective educational approach.
  - **Open-source software:** Offering a growing range of free and accessible educational tools.
  - **Multimedia databases** : for accessing images, videos, and other educational content.
  - **Word processors, spreadsheets, and presentation software** : for creating and managing documents.

These advancements contribute to a more flexible, interactive, and inclusive learning experience.

5.4 Advantages & Disadvantages of ICT in Education

5.4.1 Advantages of ICT in Education

ICT provides numerous benefits for teaching and learning:

- Allow students to learn in a more diverse and interactive way through software offering role-playing games and programs that directly assess their work.
- Provide access to a vast amount of information and enable communication with people from around the world.
- Enhance learner motivation: thanks to ICT, teachers can easily use images to improve students' long-term visual memory.
- Facilitate the explanation of complex concepts, ensuring better understanding among learners.
- Make classes more interactive and lessons more engaging, which could improve attendance rates and student concentration.

5.4.2 Disadvantages of ICT in Education

- Encourages reliance on computers for exercises and practice, which may reduce traditional learning methods.
- Time-consuming for teachers and students: mastering new teaching and learning methods requires significant effort and familiarity with digital tools.
- Software complexity: some applications may be difficult to use, requiring additional training.
- Constant technological evolution: educators and learners must continuously adapt to new tools and updates.

- Technical failures: malfunctions require quick troubleshooting to avoid disrupting lessons.
- High costs: purchasing equipment, maintenance services, and software can be expensive.

While ICT enhances education, these challenges highlight the importance of proper training, technical support, and resource management for effective implementation.

5.5 Conclusion

Information and Communication Technologies (ICT) play a central role in modern education by providing tools and resources that enhance teaching and learning.

They enable the integration of digital content, interactive learning, communication, and collaboration between teachers and students.

Understanding ICT in education allows learners and educators to effectively use technology to improve the quality of education, support innovative teaching methods, and promote lifelong learning.

The next chapter will focus on computer networks and the Internet, exploring their concepts, structures, and role in enabling communication, information sharing, and access to digital resources worldwide.

Chapter 6: Network & Internet

Contents

6.1 Introduction

In today's world, communication and access to information have become essential, and digital technologies play a central role in these processes. Computer networks, the Internet, and the Web form the pillars of this global interconnection, enabling individuals, businesses, and institutions to exchange data, collaborate, and access a wide range of online resources.

This chapter aims to introduce the fundamental concepts of networks and the Internet, which are essential for developing strong computing skills and preparing for more advanced applications in the field of information and communication technologies.

6.2 What is a computer network ?

A computer network refers to interconnected computing devices (such as computers, printers, scanners, modems, routers, switches, etc.) that can communicate (send and receive messages) through a communication medium (either wired or wireless technologies), see Figure (6.1).

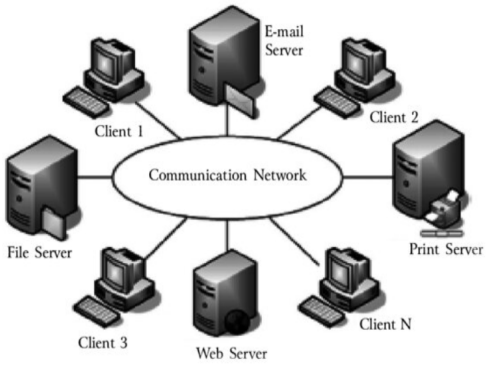


Figure 6.1: Computer Network

These devices exchange data and share resources within the network using a set of rules known as communication protocols.

A network allows for:

- Cost savings;
- Increased productivity;
- Efficient use of databases, enabling authorized users to consult and modify shared data;
- Improved security strategies, including centralized data management and potentially automated backups.

6.3 Categories of Computer Networks

Computer networks are categorized based on their size (number of devices) and geographical coverage, see Figure (6.2):

- **PAN (Personal Area Network)**: Connects devices within a few meters (e.g., Bluetooth connections).

- **LAN (Local Area Network)**: Suitable for a single site, such as an office or school.
- **MAN (Metropolitan Area Network)**: Covers a city or metropolitan area.
- **WAN (Wide Area Network)**: Spans large geographical areas, such as a country or even a continent.

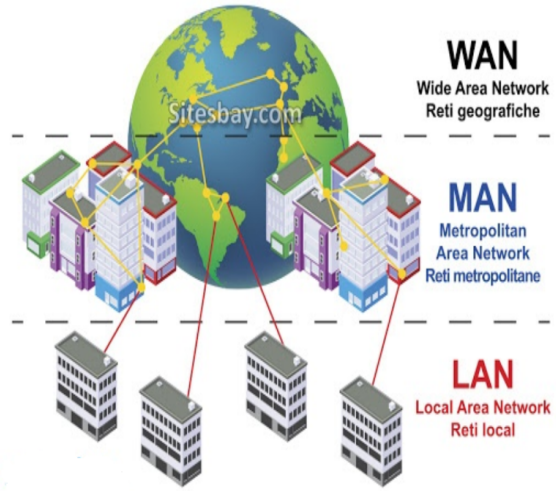


Figure 6.2: Type of Network

6.4 Network Topologies

The physical arrangement of a network's components is called physical topology, as shown in the Figure (6.3).

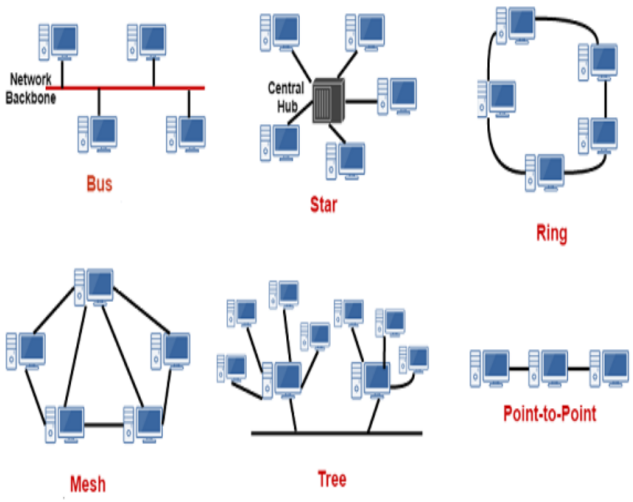


Figure 6.3: Topology of Network

6.4.1 Bus Topology

A bus-type network is open at its ends. Each PC is connected via a special connector. Some peripherals, such as printers, can also be directly connected to the network, provided they have a network adapter card.

6.4.2 Star Topology

In a star network, each node is connected to a central controller (or hub) using a separate cable. The controller is a device that receives a data signal from one of its inputs and retransmits it to all other connected devices, which can be computers, peripherals, or even other controllers.

6.4.3 Ring Topology

This is a local network where the nodes are connected in a closed loop.

6.4.4 Mesh Topology

In a mesh network, each device is connected to all other devices, providing multiple paths for data transmission and strong link redundancy. This topology is mainly used in WAN and wireless networks, where routers select the best route for data. Although highly reliable, mesh topology is expensive and difficult to maintain. Additionally, physical topology differs from logical topology, which describes how data flows in the network; Ethernet is the most common logical topology.

Remark None of these cabling plans is ideal, and the choice of one over the other will be influenced by cost considerations and the configuration of the site for which the network is intended.

6.5 Data Transmission Mode in a Network

There are several data transmission modes in a network. Here are the most common ones:

- **Broadcast Mode**: This mode involves sharing a single transmission medium. Every message sent by a device on the network is received by all other devices. A physical/logical address is included in the message, allowing each

device to determine whether the message is intended for it or not.

- **Point-to-Point Mode**: The physical medium (cable) connects only a pair of devices.

6.6 Internet Vs Intranet

This section provides information about internet and intranet, see Figure (6.4), including their definitions, applications, history. It also discusses internet protocols, internet domain names and how the internet works.

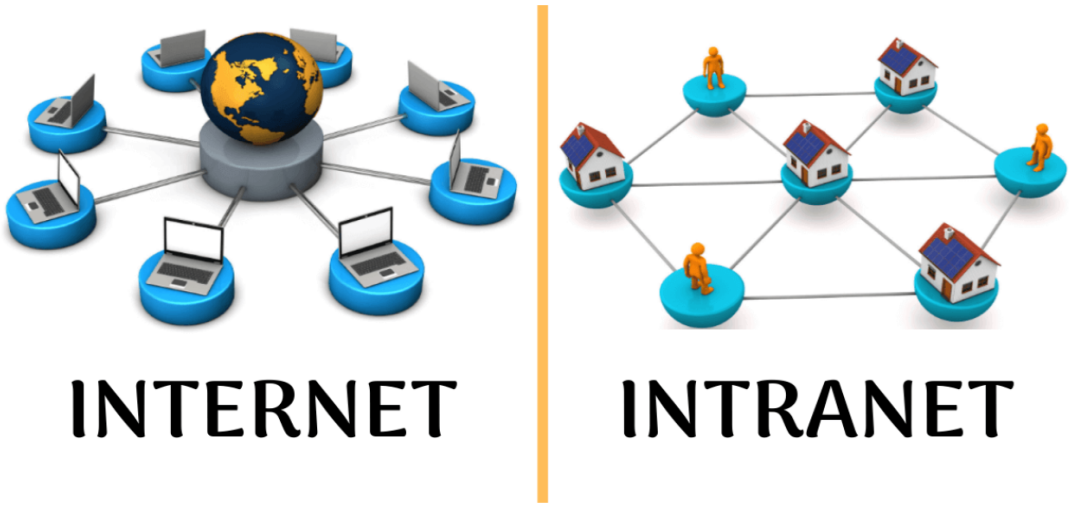


Figure 6.4: Internet et Intranet

6.6.1 What is internet ?

The term Internet is a generic name meaning Interconnection of Networks. It is the grouping of multiple networks, including LANs (universities and businesses) and WANs (campuses, cities,

metropolitan areas), among others.

The Internet is considered the world's largest computer network, connecting a rapidly growing global community. It is managed in a decentralized manner, based on cooperation and reciprocity. The Internet is a world wide network of computers accessible to anyone, anywhere in the world, with an unlimited number of users.

Each computer on the Internet has a unique Internet Protocol (IP) address, which identifies its location. Additionally, a computer can be accessed using a domain name, such as *http://www.ens-oran.dz/*.

The Domain Name System (DNS)is responsible for looking up domain names. If the requested name is found in the DNS, it returns the corresponding IP address; otherwise, the DNS sends an error message indicating that the name was not found.

6.6.2 What is Intranet ?

Simply put, an intranet is a network of interconnected PCs. The computers within an intranet network may or may not have access to the Internet. An intranet is a private network managed by an organization for the internal use of its employees and members.

6.6.3 Comparison between Internet and Intranet

The following table (6.1) presents a comparison between the internet and the intranet networks.

Table 6.1: Comparison between Internet and Intranet

Criterion	Internet	Intranet
Definition	A vast global network of computers accessible to everyone.	A private network of computers designed for a specific group of users.
Accessibility	Public and accessible worldwide.	Accessible only to authorized users, often within an organization.
Network Structure	Contains a large number of intranets.	Operates as a subset of the Internet with restricted access.
Number of Users	Unlimited number of users.	Limited number of users.
Traffic	Visitor traffic is unlimited.	Authorized traffic is restricted.
Information Type	Contains various and diverse sources of information.	Contains group- or organization-specific information.
Commercial Use	Has commercial potential and can generate revenue.	Not a commercial network.

6.7 World Wide Web

The Web, or World Wide Web (WWW), is a global hypertext information system accessible via the Internet. It allows users to browse and interact with documents (web pages) that are linked together through hyperlinks. These documents can contain text, images, videos, sounds, and other types of multimedia content.

The Web is based on three main technologies:

- **HTML** (HyperText Markup Language): The language used to structure and present content on web pages.
- **HTTP** (HyperText Transfer Protocol): The protocol that enables communication between browsers and web servers.

- **URL** (Uniform Resource Locator): The unique address used to identify each resource on the Web.

The Web has revolutionized the way information is shared and has paved the way for a wide range of online services, from news websites to social platforms, e-commerce, and e-learning.

6.7.1 Website

A website is a collection of interconnected web pages, hosted on a server and accessible via a URL (Uniform Resource Locator). Websites are designed to share information, provide services, or enable online interactions with users.

6.7.2 Main components of a website :

The main components of a website:

- Web pages: The different sections or documents of the site, usually built with HTML and CSS.
- Web server: The infrastructure that hosts the website files and makes them accessible via the Internet.
- Domain: The unique name of the website (e.g., www.example.com), allowing users to identify it easily.
- Content: Text, images, videos, and other media that make up the information presented on the site.

6.7.3 Types of Websites

A website can be static (fixed content) or dynamic (content generated based on user actions) in terms of its nature. Several types of websites can be distinguished as follows:

- Showcase Websites: Present a company, organization, or individual.
- E-commerce Websites: Enable the buying and selling of products or services online.
- Educational Websites: Provide learning resources and tools
- Social Networks: Facilitate interactions between users.
- Blogs: Regularly publish articles on a specific topic.
- Web Applications: Offer interactive services (e.g., messaging, collaborative tools).

6.7.4 Web browser

A web browser is a software or application that allows users to access and display web pages on the Internet. It serves as an interface between the user and the World Wide Web by translating files (HTML, CSS, JavaScript, etc.) into visual and interactive content that users can view and interact with.

The web browser connects to websites, downloads web page elements (text, images, audio, videos, etc.), and displays them on the screen. Thanks to webmail services, the browser also allows users to check, manage, send, and receive emails.

Starting in the 2000s, Internet Explorer, see Figure (6.5), became the most widely used web browser due to its default installation on Windows operating systems.

Figure 6.5: Internet Explorer

The web browsers have evolved significantly since their inception, both in terms of interface and functionality. There is a non-exhaustive list of the main browsers used on computers, smartphones, and tablets. There are five major software options for browsing the Internet, available on computers, tablets, and smartphones, see Figure (6.6).

Figure 6.6: Top Web Browsers

6.7.5 search engine

A search engine is, as its name suggests, a tool that allows users to search the Web (and also a personal computer) for resources,

content, documents, etc., using keywords. It is a software application designed to find resources on the web.

On the Internet, there are websites whose primary service is search, and they are therefore referred to as search engines. A search engine is essentially a website like any other, but its role is to browse the web and index all the sites it finds. When a user enters a query into the search engine, it displays results in order of relevance.

Example : Google, Bing, Yahoo, Yandex (Russia), Baidu (China), ... see Figure (6.7).

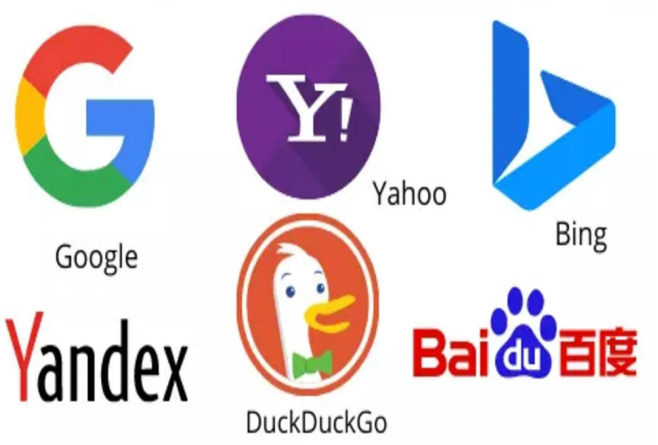


Figure 6.7: Examples of Search engines

6.8 Conclusion

This chapter presents the foundational knowledge necessary to develop strong computing skills and adapt to an increasingly connected world.

Computer networks and the Internet are now essential infrastructures for communication, information sharing, and access to

digital resources on a global scale. It also helps prepare students for more advanced applications of computing. By mastering basic network concepts, students can gain a better understanding of how information flows and how online services operate.

The next chapter provides an introduction to online learning.

Chapter 7: E-learning

Contents

7.1 Introduction

Online training, online learning, e-training, and e-learning represent modern educational approaches that use digital technologies to support teaching and learning, see Figure (7.1).

These methods allow learners to access courses remotely through educational platforms, websites, and virtual classrooms. E-learning promotes learner-centered education by encouraging autonomy, self-paced learning, and continuous interaction with instructors and peers.

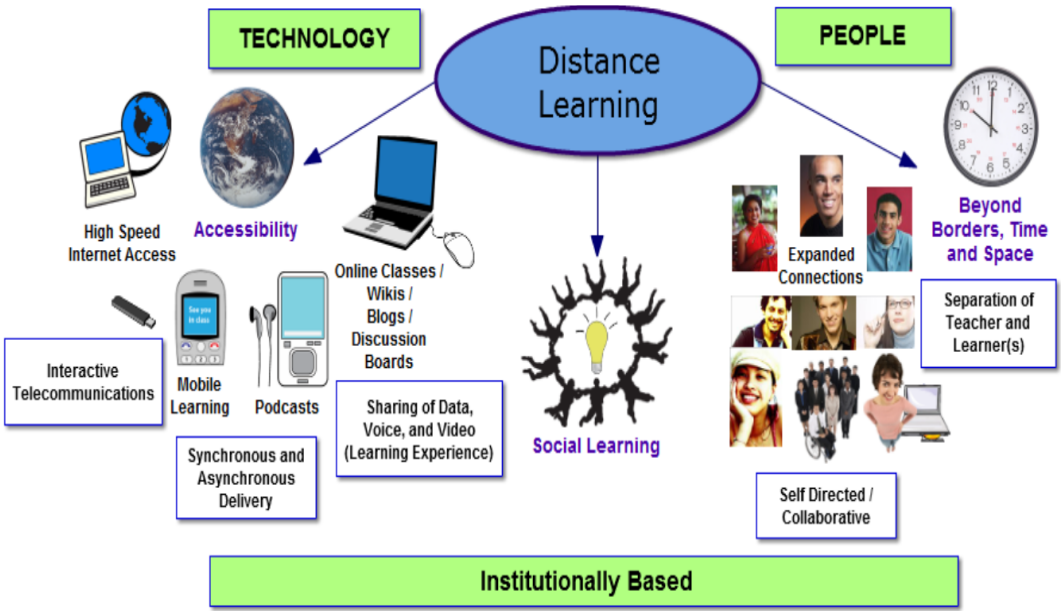


Figure 7.1: Distance learning

By combining multimedia resources, communication tools, and assessment activities, e-learning enhances motivation and engagement. It also supports lifelong learning by offering flexible and accessible educational opportunities adapted to the needs of students in today's digital world.

This chapter is dedicated to the presentation of distance education. It aims to introduce the fundamental concepts, operating modes, and digital tools used in online learning, while highlighting its role in the evolution of educational practices.

7.2 What is e-learning ?

According to the European Union, the e-learning is "*the use of new multimedia technologies and the Internet to enhance the quality of learning by facilitating access to resources and services, as well as remote exchanges and collaboration.*"

E-learning enhances the effectiveness of teaching and improves the quality of learning, see Figure (7.2).

Figure 7.2: E-learning

7.3 Typologies of Online Learning

- **From a Trainer-Learner Perspective:** When the teacher (trainer, resource person, coach, etc.) is physically close to their students, it is referred to as in-person training. If they are not in direct contact with the learner, it is called "distance learning", see Figure (7.3). Two scenarios can arise:

1. **100% Online Learning**: In this type of training, the learner follows the learning session entirely online and remotely. They do not interact directly face-to-face with the trainer(s). However, they can still benefit from remote tutoring via web conferencing tools, forums, chat, phone, or email.
2. **Blended Learning**: A mixed learning mode that combines online learning with traditional traditional face-to-face training.

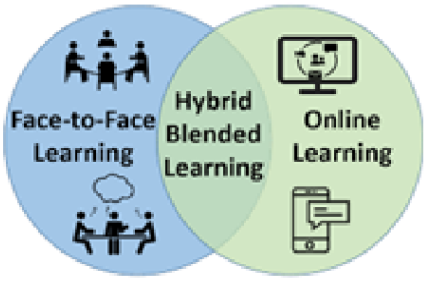


Figure 7.3: Online Learning

- **From a Communication Timing Perspective:** In this section, we'll explain what synchronous and asynchronous learning look like programs, how they work, and what are the benefits of each one, see Figure (7.4).

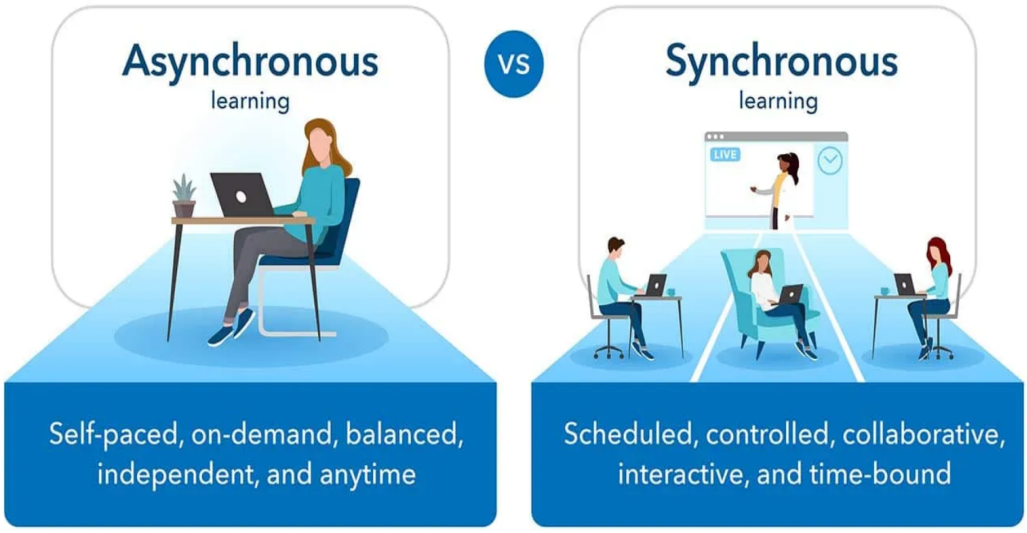


Figure 7.4: Synchronous and asynchronous communication

1. **Synchronous Tools**: If communication is direct and immediate, it is called synchronous learning (e.g., a teacher interacting with students in real-time, a chat session, or a video conference).

   Synchronous learning offers a more structured and interactive online education experience, making it a great option for students who thrive in a scheduled environment and benefit from real-time engagement.

2. **Asynchronous Tools**: If there is a delay between a question and its response, the system is considered asynchronous (e.g., forums and email are asynchronous communication tools).

   Asynchronous learning offers a wide range of benefits, especially for students juggling busy schedules, work responsibilities, or family obligations. Its flexible, self-paced structure makes it an ideal option for many stu-

dents who need more control over when and how they learn.

7.4 E-learning platform

An LMS (Learning Management System) is a technological system that integrates computerized tools for teaching and learning purposes. An E-learning platform aims to provide remote access to educational content, personalize learning, and facilitate online tutoring.

There are several terms used to describe educational platforms:

- LMS: Learning Management System
- CMS: Course Management System
- E-learning Platform
- Distance Learning Platform / Distance Training System
- FOAD Platform (Open and Distance Learning Platform)

An LMS provides the necessary tools for its three main users:

- Teacher / Trainer: Creates learning paths, develops educational content, and tracks learners' activity.
- Learner: Accesses or downloads learning materials and submits assignments for evaluation.
- Administrator: Installs and maintains the system, manages user access, and integrates with other information systems.

7.5 Components of an E-learning platform

An e-learning platform is made up of several key components that work together to support online learning, see Figure (7.5):

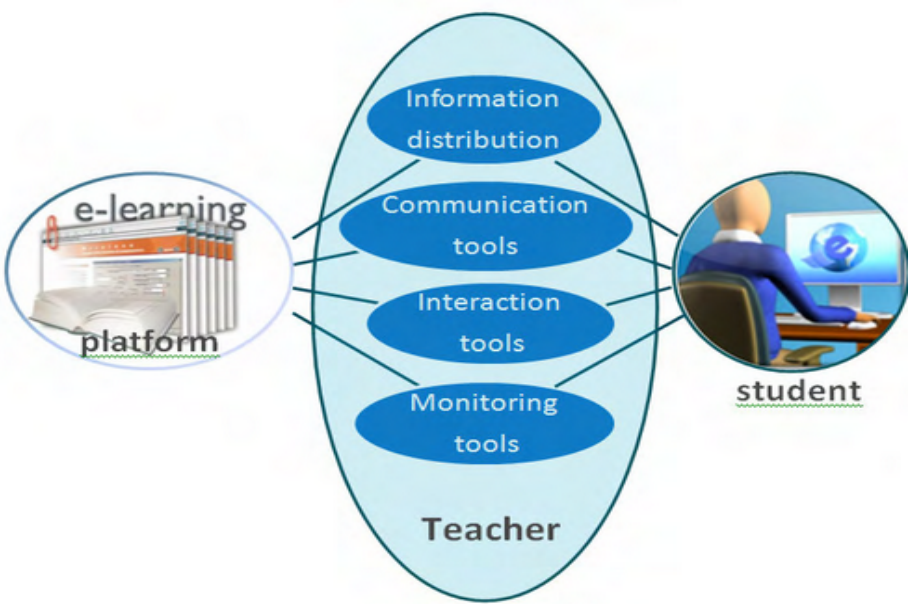


Figure 7.5: Components of an E-learning platform

- Navigation tools : Help users find their way and navigate within the system.
- Information tools: Enable users to search for information, access help resources, and visit other websites via hyperlinks.
- Communication tools: Facilitate interaction between learners and instructors, supporting both synchronous (chat, video conferencing) and asynchronous (forums) communication.

- Teaching and training tools : Include various resources such as PowerPoint presentations, exercises, multimedia content, etc.
- Management tools: Allow tracking of online activities, organizing students into work groups, managing registrations, and more.
- Collaboration tools: Enable group work and cooperative learning.
- Planning tools : Help set deadlines for assignments and schedule learning activities.

7.6 What is the purpose of an E-learning platform ?

An E-learning platform serves different purposes depending on whether the user is a learner or part of the teaching team. A Learning Management System (LMS) provides users with a set of tools that enable :

- Access to courses.
- Group and/or collaborative work.
- Communication between peers and with instructors.
- Document sharing.

On an educational platform :

The teaching team is responsible for:

- Creating pedagogical content and incorporating resources
- Managing learners and enrollments
- Managing and archiving content
- Tracking learners' activities
- Communicating with learners

The learners perform various tasks such as:

- Exploring internal and external documentary resources
- Navigating through the learning scenario
- Completing activities for evaluation purposes
- Participating in group work and/or projects.
- ...

7.7 Digital Communication Tools

Email (Electronic Mail): Used to send messages and documents to individuals or groups.

Instant Messaging Tools : such as WhatsApp, Microsoft Teams, or Messenger that allow real-time communication.

Discussion Forums : Online spaces where users can exchange ideas, ask questions, and share information.

Social Media Platforms : like Facebook, X (Twitter), and LinkedIn that enable information sharing and interaction.

Video Conferencing Tools : such as Zoom, Google Meet, or Microsoft Teams that support online meetings and virtual classes.

Collaborative Platforms (Digital learning environments) : like Moodle or Google Classroom that facilitate collaboration and learning management.

These tools play a crucial role in education, remote work, and daily communication by enabling fast, flexible, and efficient interaction.

7.8 E-learning in Algeria

According to specialists in pedagogy, e-learning and digital education are developing rapidly in Algeria. This evolution benefits students, teachers, and educational administrators alike. The integration of Information and Communication Technologies (ICT) has made it possible to bring teachers, learners, and parents together within the same digital environment, particularly through e-learning platforms such as the Tarbiatic network.

With the continuous advancement of technology, e-learning is becoming increasingly strengthened in Algeria through the implementation of several educational platforms. Among these, the experimental platform AVUnet (Algerian Virtual University) and the ICT portal can be cited.

These platforms provide learners with structured courses and interactive interfaces that allow access to learning content and facilitate communication among learners and with instructors. The use of digital technologies in pedagogical practices thus con-

tributes to improving the quality of the teaching–learning process and enhancing its overall effectiveness.

7.9 Example of an E-learning platform : Moodle

Moodle is the most well-known open-source LMS platform, supported by a strong community. Since its launch in 2002, the number of Moodle users has continuously grown across all countries and sectors.

Moodle was developed by *Martin Dougiamas* at Curtin University in Australia. During his doctoral research, he explored how social constructivism can enhance online teaching and learning.

Despite the presence of many competitors, Moodle remains one of the best open-source online learning platforms.

Figure (7.6) illustrates the homepage interface of the Moodle platform at ENS of Oran.

Figure 7.6: Moodle Platform Interface (ENS of Oran Ammour Ahmed)

Open Source: The use of Moodle is free for everyone and is not tied to any company. However, integrating additional services such as customization or course design may require payment.

Moodle's open-source approach means that it is continuously analyzed and improved to meet users' expectations. The latest version of Moodle, 4.2, was released on April 24, 2023.

Tested and Approved World wide : Powering approximately 80,000 websites worldwide, Moodle is trusted by both small and large institutions and organizations. Among them are several Algerian universities, such as:

- University of Constantine 1.
- University of Mascara Mustapha Stambouli.
- University of Oran 1 Ahmed Ben Bella.

- Higher Normal School of Oran Ammour Ahmed
- ....

Highly Flexible : Moodle can be customized by integrating plugins and external applications to achieve specific functionalities.

Interoperability : MOODLE promotes seamless integration and the use of content from various sources.

Extensive Documentation : Moodle provides comprehensive documentation on various topics related to the platform. Users can also reach out to the community through forums to get answers to their questions.

7.9.1 Roles and Permissions in Moodle

- A role is a set of permissions defined and applicable globally across a Moodle site.
- It can then be assigned to specific users within specific contexts.
- The combination of roles and contexts determines the extent to which a user is allowed to perform an action on a page.
- Roles help distribute responsibilities, making the use of Moodle highly dynamic.
- The most well-known examples of roles are teacher and student within the context of a course.

Note: adding or editing roles is entirely optional.

The main predefined roles are :

Teacher (editing teacher) : This is a site designer. They can perform all actions on the site, including modifying activities and grading students. However, they cannot add other editing teachers.

Teacher (non-editing teacher): This is an assistant in site management. They can grade students and communicate with them, but they cannot modify activities or course content. They also cannot edit the gradebook.

Student : They can participate in activities. Their name appears in the gradebook. They have no editing rights for course content or activities.

Guest : They have the same permissions as a student, but can also access the hidden parts of the site. A guest access code is created for each course to allow testing the site or to give access to users without a Polytechnique email account. The guest's name appears in the gradebook, and they can participate in activities.

Manager : They can perform all actions within a course space (managing users, adding/modifying/deleting resources and activities, etc.). However, they do not receive course notifications and do not appear in the list of teachers when browsing course categories.

7.9.2 What is a course in the Moodle sense ?

- A course is an online space accessible remotely through a web browser.
- Only authorized users can access this space.
- This space contains various elements that are placed, configured, and managed by the teacher(s) of the course.
- These elements are visible and usable by students enrolled in the course.
- Moodle manages “users” who are enrolled in “courses” with a specific “role” (such as “teacher,” “student,” or others).
- As a result, a person obtains different access rights depending on their role (in short: a teacher can modify the course, whereas a student can only view and use it).

7.9.3 Course Management in Moodle

A Moodle course is presented as a web page composed of different zones, as shown in Figure (7.7).

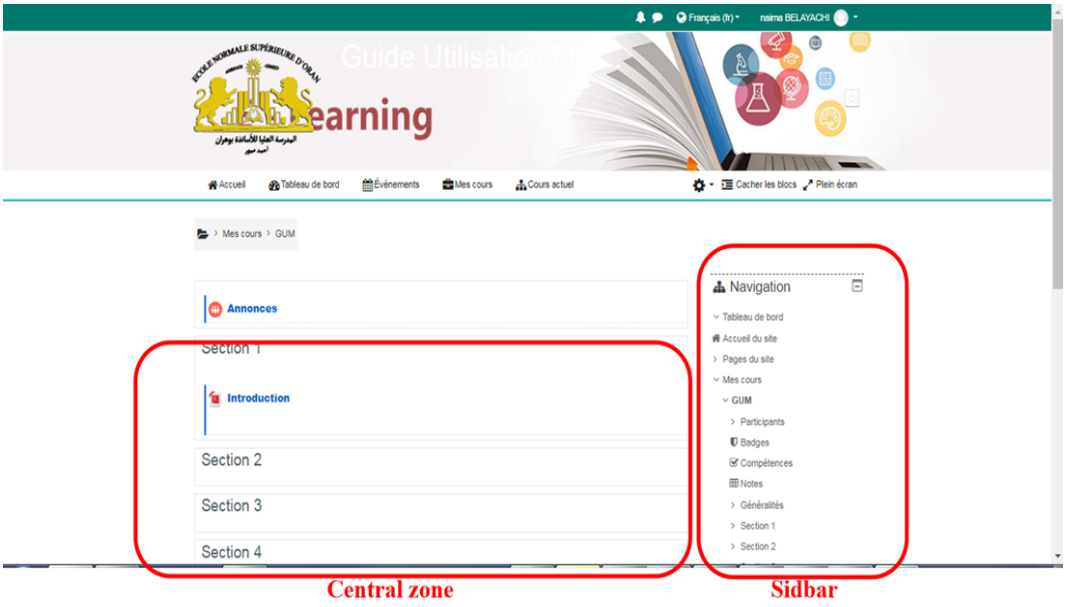


Figure 7.7: Course home page

Central zone : This is the main area that contains the course content. It is organized as a general information section, followed by numbered sections or dated weeks, depending on the course settings.

The number of sections can be adjusted, and each section can have an associated title.

Each section may contain:

- Resources (passive content)
- Activities (interactive content)

Side Columns (Left / Right Columns) : The side columns contain blocks: information frames that provide details about the course content and activities (e.g., list of enrolled students, recent course updates, calendar, etc.).

- Blocks can be placed and configured according to the teacher's needs for the course.
- Each block can be positioned in either the left or right column.
- If a column contains no blocks, it will not be displayed.

Users designated as teachers in a course can add, modify, and delete any type of content within that course.

Among the libraries of resources, activities, and blocks available in Moodle, it is the teacher's responsibility to select the elements they wish to include in their course according to their needs.

To manage the course content, the teacher has access to several tools that are not available to students.

Note: To manage the course content, the "Edition mode" must be activated.

A newly created course contains empty sections. It is the responsibility of the course teacher to choose and select the elements they wish to add and make available within these sections.

They can insert:

1. Resources (passive content): Online documents such as HTML, PDF, ZIP, SWF, DOC, ODT, XLS, etc., as well as labels (text or images used to present the course content).
2. Activities (interactive content): Forums, quizzes, assignments, questionnaires, chats, wikis, and other interactive tools.

Course Settings in Moodle

Creating a course requires filling out a few parameters in a form, see Figure (7.8).

The first three parameters (General) are mandatory when creating a course:

1. Full course name: This is the title of your course space on Moodle.

2. Short name: This name appears in the breadcrumb trail to facilitate navigation on the platform.

3. Course category: For example, Department of Exact Sciences.

4. Course visibility: This option determines whether the course appears in the course list. If the course is not visible (not available), only the course teachers (and administrators) can access it, while students cannot.

5. Course start date: This setting indicates the start of the first week of a course when using the weekly format.

6. Course end date: This date indicates whether the course should appear as past in the course list. It can also be used in custom reports.

7. Course ID number: If you have an official code for this course, you can enter it here; otherwise, it can be left blank.

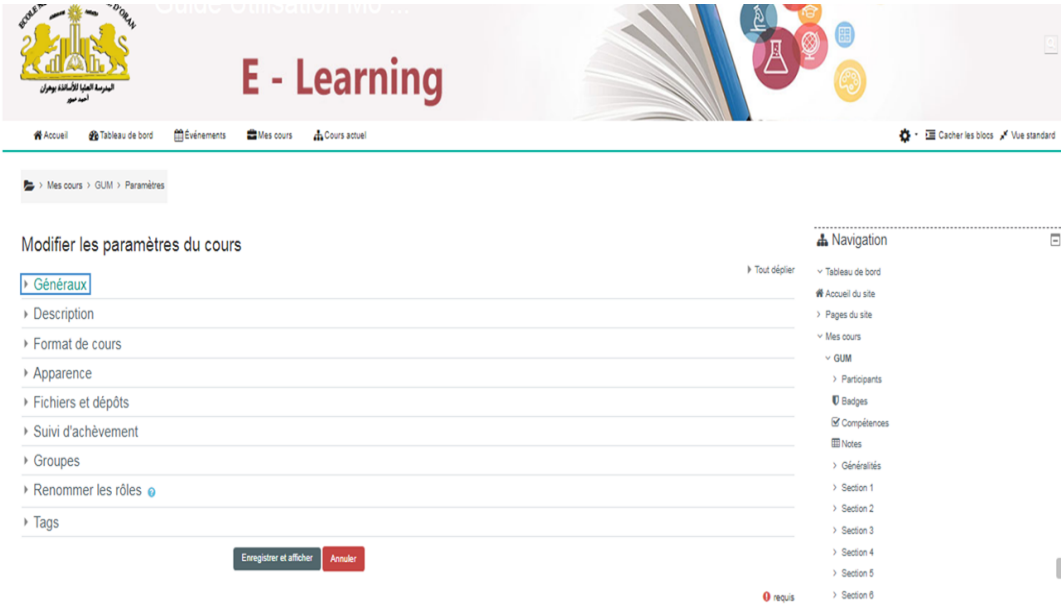


Figure 7.8: Course Settings in Moodle

7.10 Conclusion

E-learning has become an essential approach in modern education, offering flexible access to learning resources anytime and anywhere. Through e-learning platforms, learners can benefit from interactive content, communication tools, and continuous assessment.

This chapter provided an opportunity to introduce the basic notions and fundamental concepts of online learning through the presentation of the e-learning platform and its operating principles.

Understanding these principles helps students use digital learning environments effectively and prepares them for autonomous and lifelong learning in a technology-driven world.

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