2025/2026

Course: Open Source Software (OSS)

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Module Objectives:
To introduce

Introduce to the principles, tools, and practices of Free and Open Source Software (FOSS) to enable them to use, evaluate, and contribute effectively.

Content of the Module:

Chapter 1: Information Technologies

1.1. Definitions
1.2. Tools
1.2.1. Hardware

- **Computers**: desktop PCs, laptops, servers, workstations.
- **Communication networks:** routers, switches, modems, optical fibers, Wi-Fi.
- **Peripherals:** printers, scanners, keyboards, mice, cameras, sensors.
- **Mobile devices:** smartphones, tablets, personal digital assistants (PDAs).
- **Smart chips:** RFID, NFC, embedded processors, IoT (Internet of Things) sensors.

Content of the Module :

Chapter 1: Information Technologies

1.2. Tools

1.2.2. Software

- **Operating systems:** Windows, Linux, macOS, Android, iOS.
- **Business applications:** ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), human resource management software, accounting software, etc.
- **Office software:** word processors (Word), spreadsheets (Excel), presentation tools (PowerPoint), collaboration tools (Google Workspace, Microsoft 365).

1.3. Applications

- **Communication spaces:** Internet, Intranet, Extranet.
- **Multimedia:** audio conferencing, video conferencing.
- **Electronic Data Interchange (EDI).**
- **Workflows.**

Content of the Module :

Chapter 2: Open Source Tools

2.1 Introduction (history, advantages / disadvantages, and licensing)

2.2 Development Environment (Introduction to Linux, Introduction to code editors)

2.3 Office Suite (Libre Office suite)

2.4 Collaboration (Storage and sharing)

2.5 Contributing to an open source project

❖ 1. Definitions:

- **Information Technology (IT)** : refers to the set of technical means, both **hardware** and **software**, that enable the collection, processing, storage, transmission and protection of information in digital form.

- It encompasses **computers, networks, operating systems, databases, software applications, and communication devices**, all of which are used to support human, professional, scientific, and industrial activities.

❖ 1. Definitions:

Information and Communication Technologies (ICT)

- To define Information and Communication Technologies, we are supposed to define the following three aspects: **Information**, **Communication**, and **Technology**. consistently performs the same work cycle for which it has been programmed.

❖ 1. Definitions:

- **Communication** is the way in which information circulates within the organization. It occurs through a network that includes at least a sender, a transmission channel, and a recipient (the receiver).
- **Information**

has two meanings:

1. From a technical standpoint,” ***information is a sign, a symbol, an element that can be transmitted and stored”***.
2. Information in the sense of information: ‘’***data that provides knowledge or information about an object or an event”***.

❖ 1. Definitions:

- **Technology** is the application of a design technique to the realization of a product. Information and Communication Technologies encompass all techniques that contribute to digitizing and digitalizing information, processing it, storing it, and making it available to one or more users.
- The immediate impact of Information and Communication Technologies can be summarized in four essential points:
  1) **Time compression;**
  2) **Space compression;**
  3) **Compression of stored information;**
  4) **Flexibility of use**

1.2. Tools
1.2.2. Hardware

1. Desktop PCs

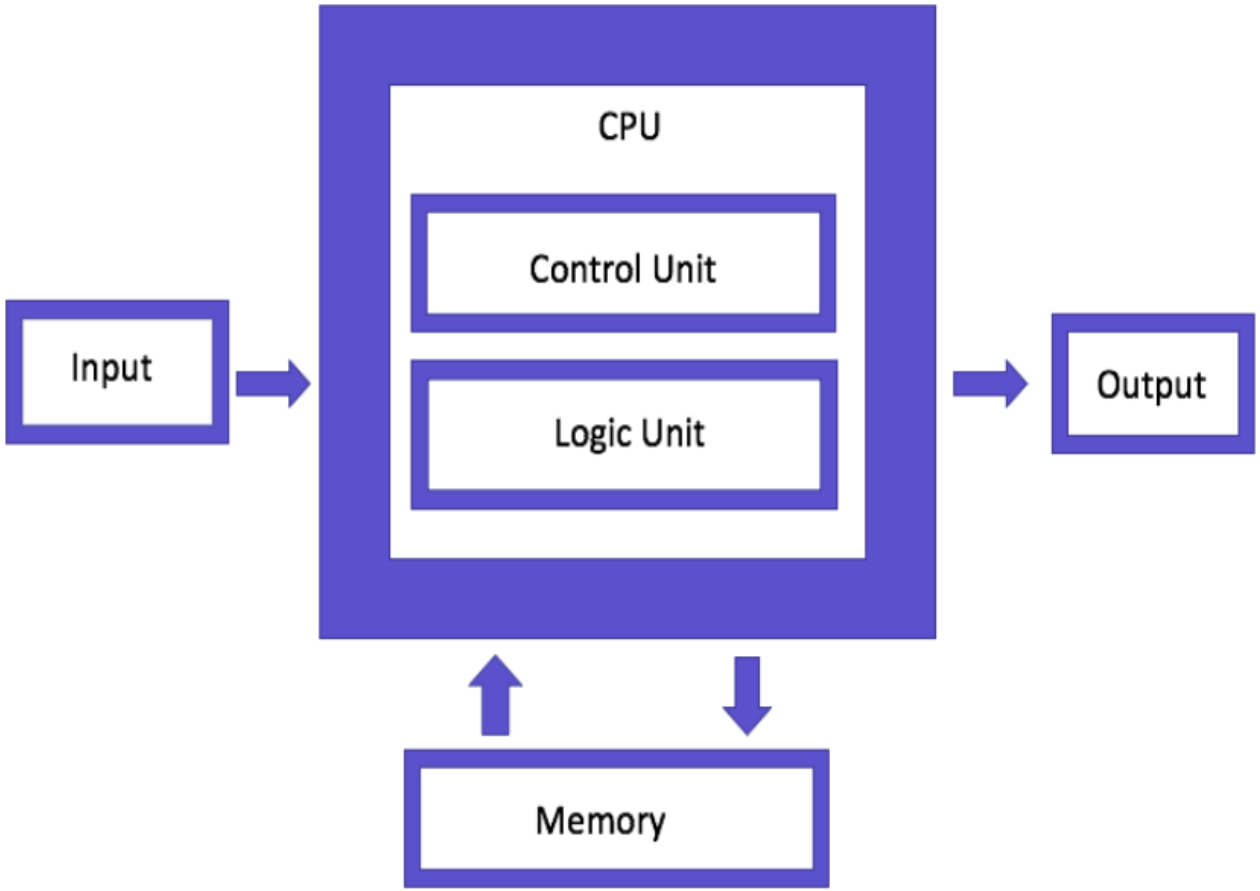
- Desktop computers are designed for both personal and professional use. They are usually **fixed in one location** (office or home) and consist of separate components such as a CPU case, monitor, keyboard, and mouse.

- They offer **enough processing power and storage capacity** to handle tasks like office work, web browsing, multimedia, and software development. Desktops are also easier to **upgrade** (adding more RAM, storage, or graphics cards) compared to laptops.

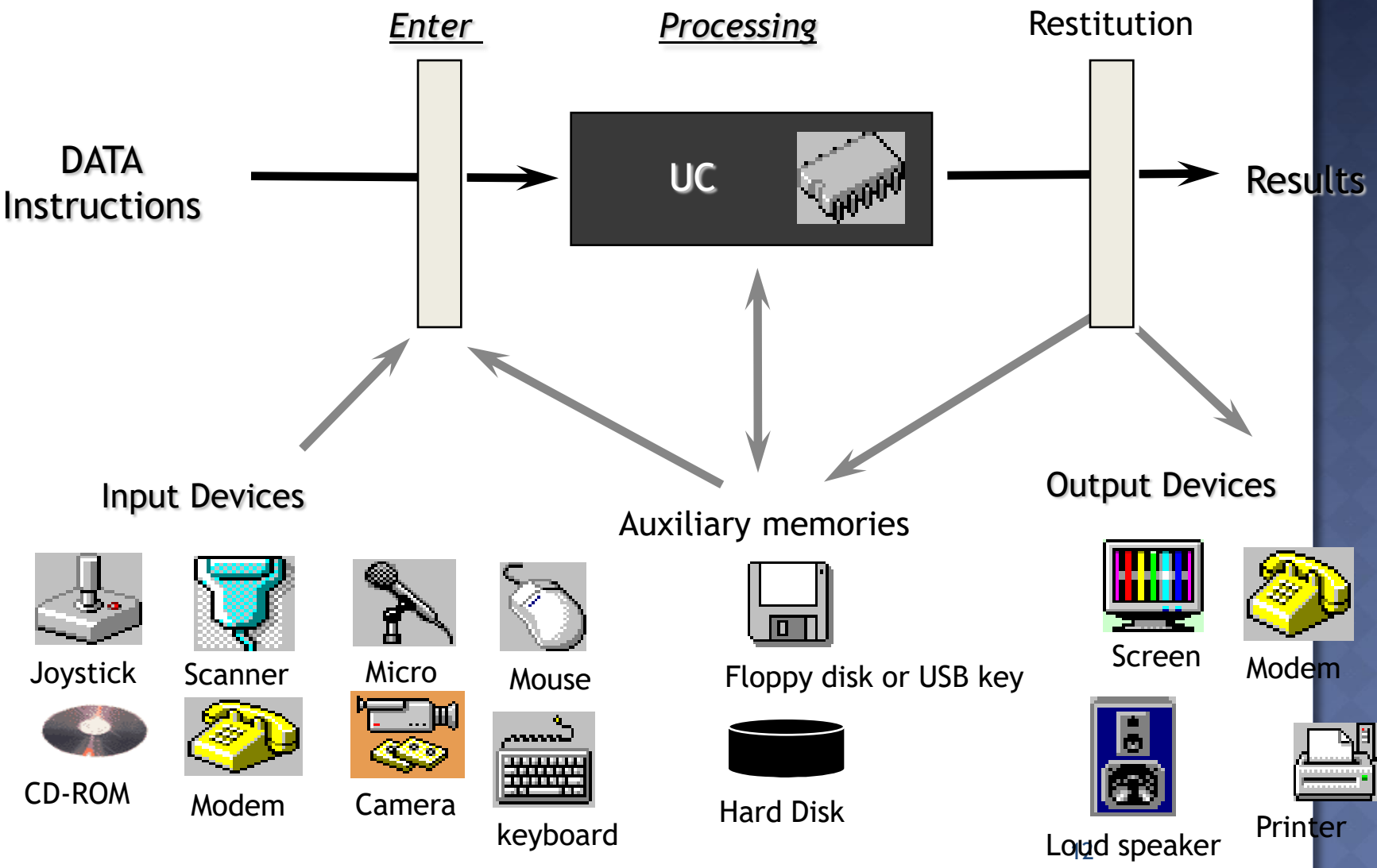
1.2. Tools

1.2.2. Hardware (Computer)

Von Neumann Architecture



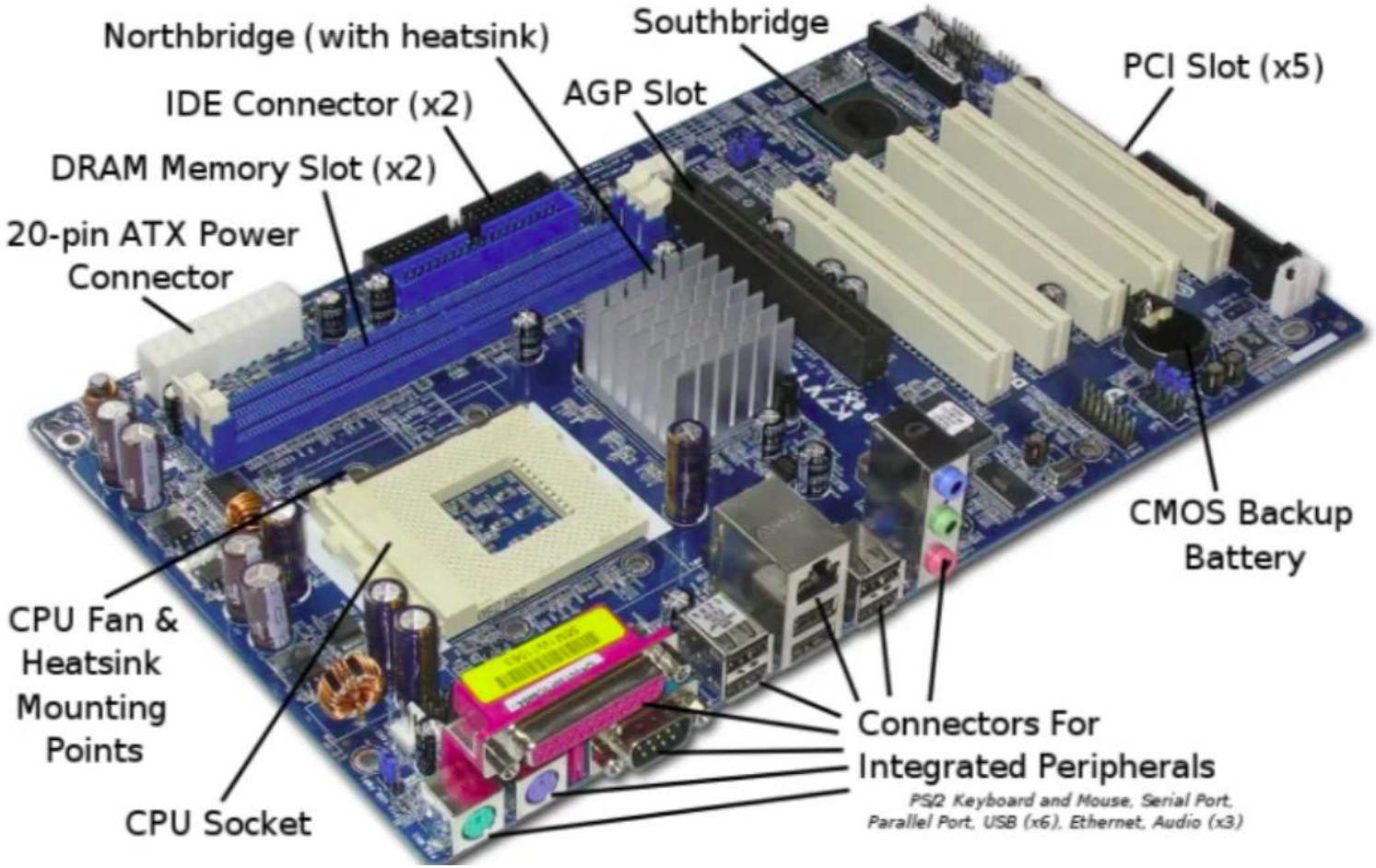
1.2. Tools
1.2.2. Hardware (Computer)



❖ 1.2. Tools

1.2.2. Hardware (Computer)

Motherboard



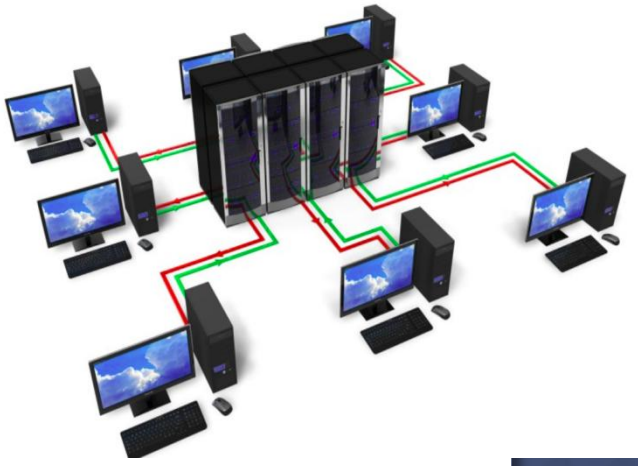
1.2. Tools
1.2.2. Hardware

2. Laptop

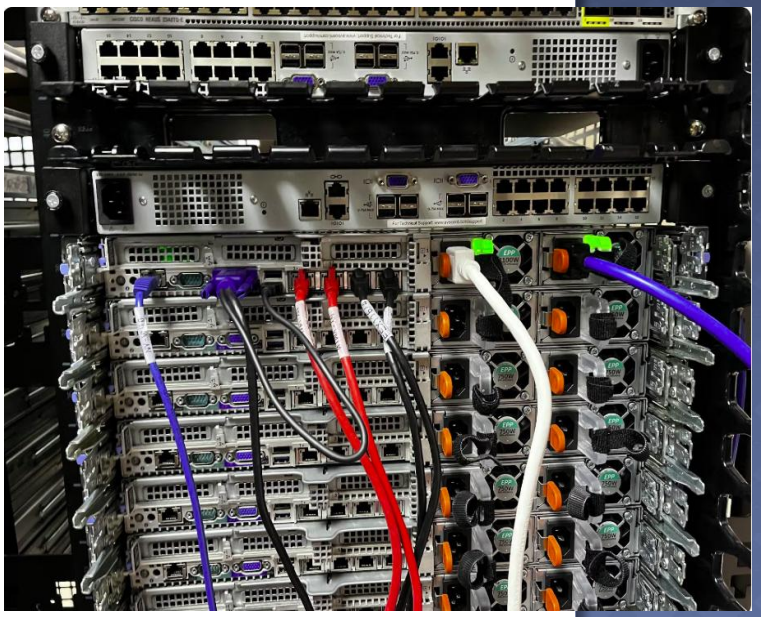
- A **laptop** is a lightweight and portable personal computer. It combines in a single unit the screen, keyboard, touchpad, internal components (processor, memory, storage, etc.), and a rechargeable battery. Like a desktop computer, it runs various software but with the advantage of **mobility**.

1.2. Tools
1.2.2. Hardware

3.Servers



- Servers are **high-performance machines** dedicated to providing services and resources to multiple users over a network.
  They can host:
  - Websites and applications,
  - Databases,
  - Email services,
  - File storage systems.
- Servers ensure **centralized management, security, and reliability**, often running 24/7 without interruption. They are essential in **companies, universities, and data centers** where large-scale resource sharing is required.



1.2. Tools
1.2.2. Hardware

4.Workstations

- Workstations are **specialized, high-end computers** designed for tasks that require **intensive computing power**.
  Examples of applications include:
- **3D modeling and animation**,
- **Scientific simulations**,
- **Engineering design (CAD/CAE)**,
- **Artificial Intelligence and data analysis**.
- Workstations usually have **powerful processors, large memory capacity, and advanced graphics cards**, ensuring maximum **performance and reliability**. They are often used by **engineers, scientists, and researchers**.

1.2. Tools
1.2.2. Hardware

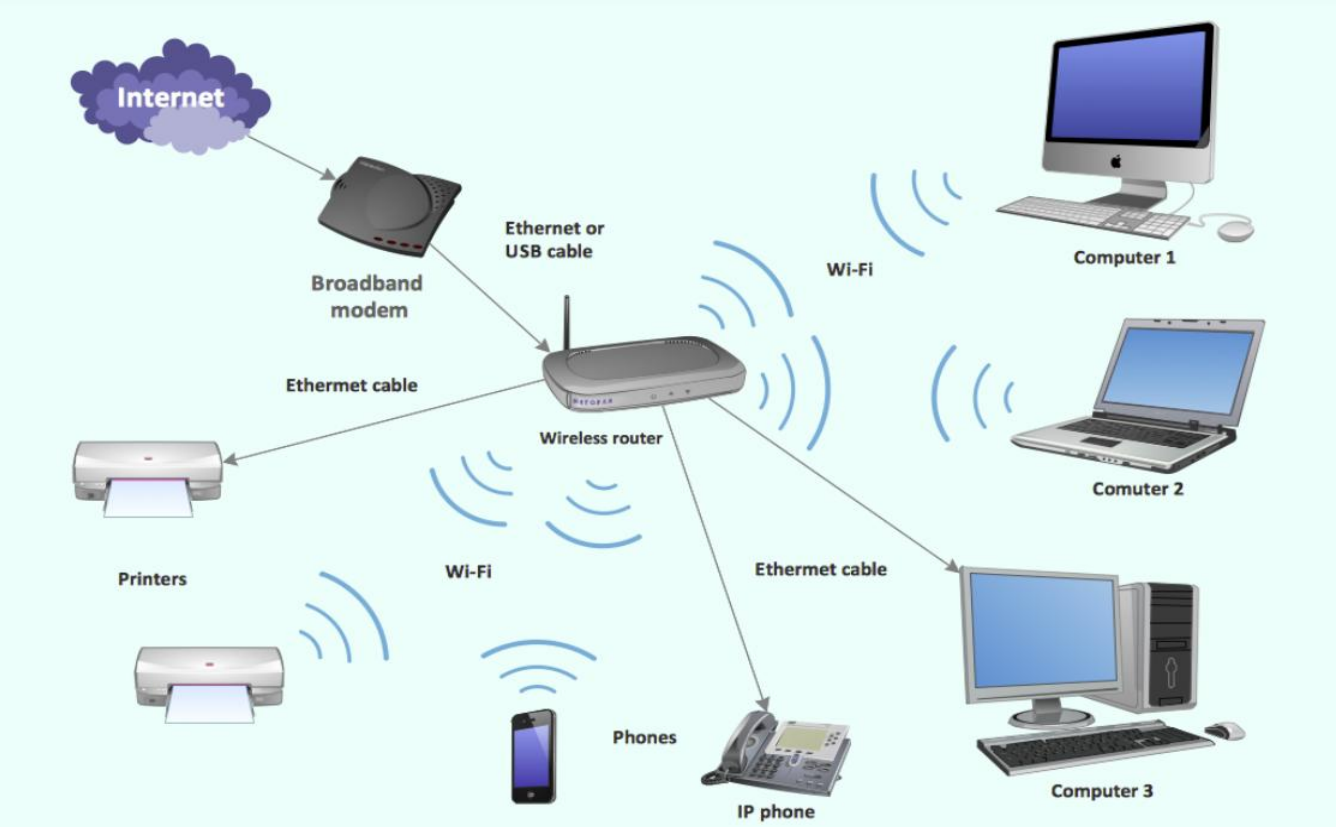
Communication Networks

- A **communication network** is a technical infrastructure that enables the **transmission, exchange, and sharing of data** (text, audio, video, files, etc.) between connected devices. These networks form the backbone of **modern computing**, powering the Internet and information systems.
- They rely on a combination of **hardware components and communication protocols** to ensure connectivity, efficiency, and reliability.
- **1. Routers**
- **Function**: Direct data traffic between different networks (e.g., between a local network and the Internet).
- **Role**: Choose the **optimal path** for data packets.
- **Example**: A home router that connects a household to the Internet.

1.2. Tools
1.2.2. Hardware

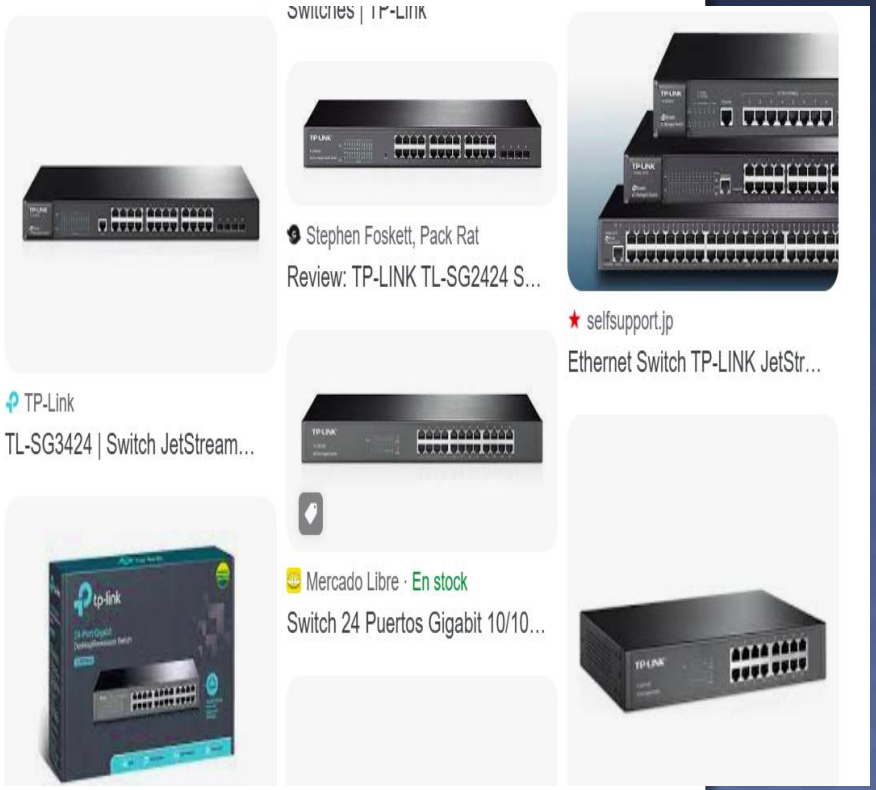
Communication Networks

1. Routers



1.2. Tools
1.2.2. Hardware

- **Communication Networks**
- **2. Switches**
- **Function**: Connect multiple computers and devices within a **local area network (LAN).**
- **Role**: Forward data only to the intended recipient device, reducing congestion.
- **Example**: A switch on a university campus connecting classrooms to the central network.



1.2. Tools
1.2.2. Hardware

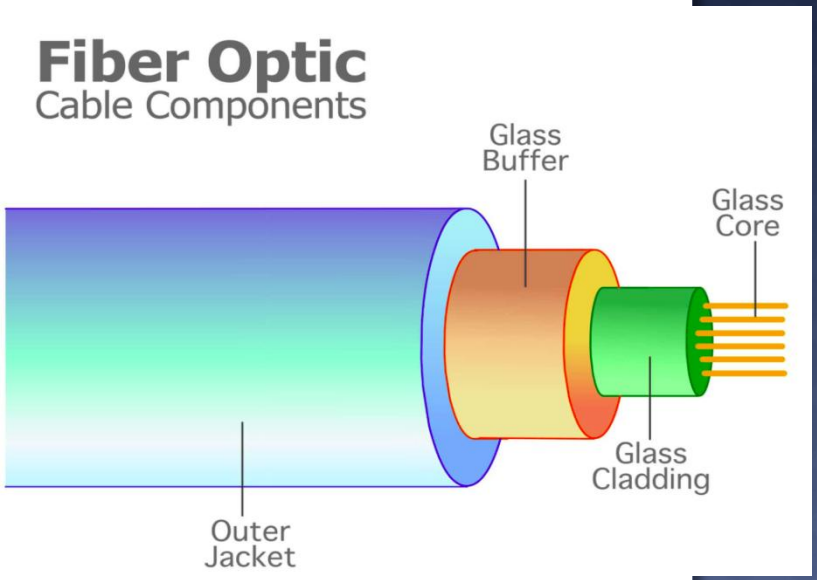
- **Communication Networks**
- **3. Modems**
- **Function**: Convert digital signals from computers into analog signals for transmission over telephone lines (and vice versa).
- **Role**: Provide Internet connectivity.
- **Example**: An ADSL modem connecting a home computer to the Internet.

1.2. Tools
1.2.2. Hardware

Communication Networks

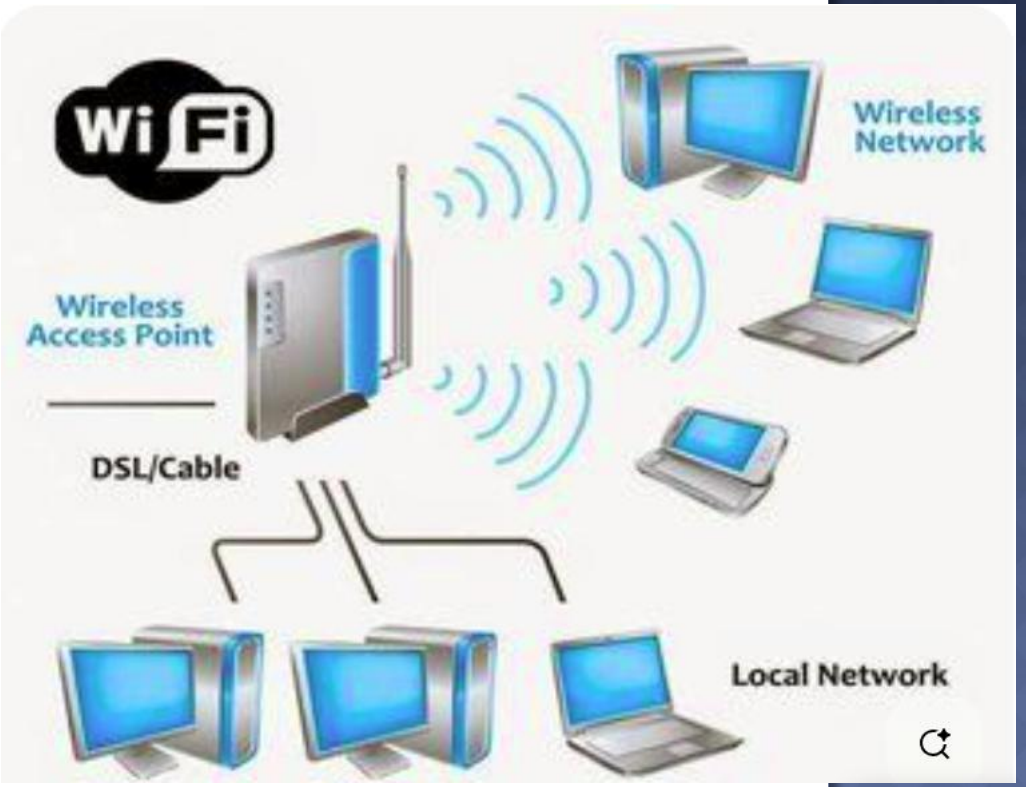
4. Optical Fibers

- **Function**: Transmission medium that uses **light signals** to carry data.
- **Advantages**: Extremely high bandwidth, large capacity, and minimal signal loss over long distances.
- **Example**: Submarine fiber optic cables forming the backbone of the global Internet.



1.2. Tools
1.2.2. Hardware

- **Communication Networks**
  - **5. Wi-Fi (Wireless Fidelity)**
  - **Function**: Enables **wireless communication** between devices.
  - **Role**: Provides Internet and local network access without physical cables.
  - **Example**: Connecting laptops and smartphones to a home or university network.



1.2. Tools
1.2.2. Hardware

- **Peripherals:**
- Printers, Scanners, Keyboards, Mice, Cameras.
- 1.Printers :
- **Printers**
- A printer is an output device that produces a paper copy (printout) of digital documents, including text, images, or graphics. Common types are inkjet, laser, and 3D printers.

1.2. Tools
1.2.2. Hardware

- **Peripherals:**
- **Printers, Scanners, Keyboards, Mice, Cameras.**
- **2. Scanners**
- A scanner is an input device that digitizes paper documents, photos, or images into electronic files.
- This allows easy storage, editing, and sharing on a computer.

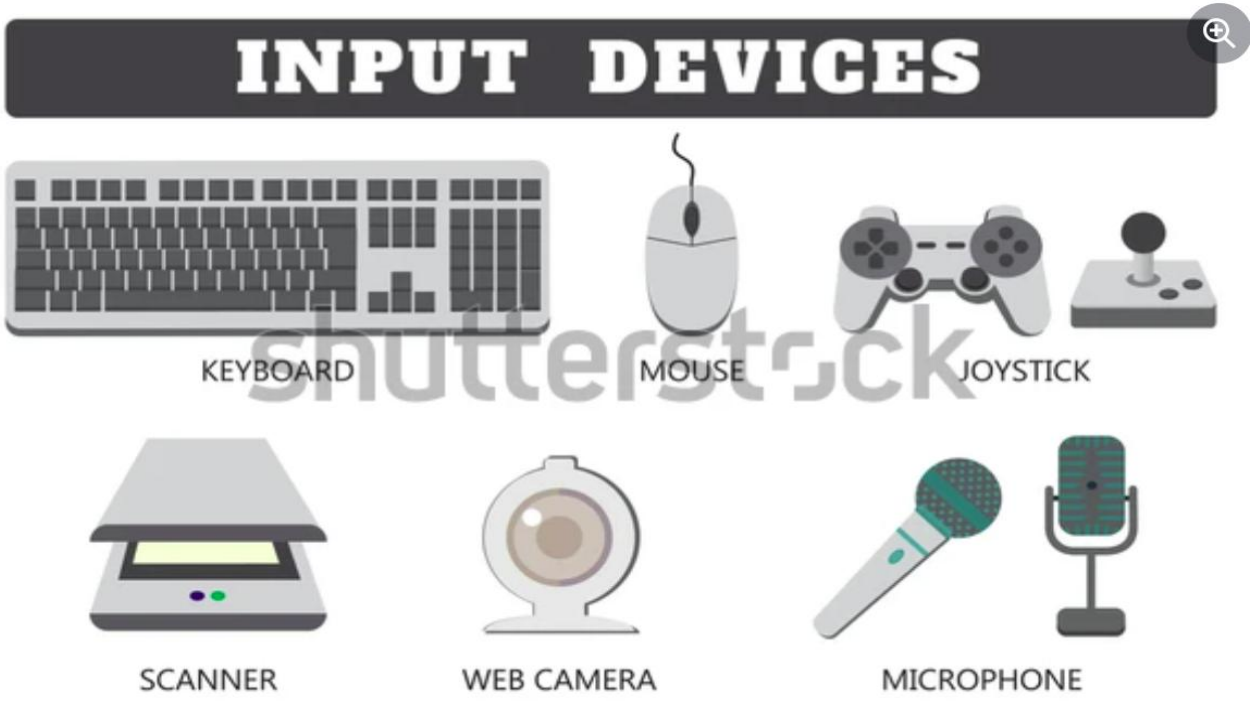
- **3. Cameras**
- A camera (such as a webcam) is an input device that captures still images or video and sends them to the computer. It is commonly used for video conferencing, photography, and multimedia recording.

1.2. Tools
1.2.2. Hardware

- **Peripherals:**
- **Printers, Scanners, Keyboards, Mice, Cameras.**
- **3.Keyboards**
- A keyboard is an input device made of keys that lets the user type text, commands, and shortcuts into a computer. It can be wired or wireless, with various layouts.
- **4. Mouse**
- A mouse is an input device used to move a pointer on the screen and interact with graphical elements. It can be optical, laser, wired, or wireless.

1.2. Tools
1.2.2. Hardware

- **Peripherals:**
- Scanners, Keyboards, Mice, Cameras.



1.2. Tools
1.2.2. Hardware

Peripherals:

Mobile devices: smartphones, tablets, personal digital assistants (PDAs).

Mobile devices are portable electronic systems that enable computing, communication, and data access anywhere and anytime. They combine **mobility**, **wireless connectivity**, and **processing capability**, making them central to modern digital life.

Main Characteristics

- **Portability:** small, lightweight, and easy to carry.
- **Connectivity:** support wireless communication technologies such as Wi-Fi, Bluetooth, 4G, and 5G.
- **Autonomy:** powered by rechargeable batteries for independent operation.
- **Multifunctionality:** integrate multiple tools — communication, navigation, multimedia, office work, etc

❖ 1.2. Tools
1.2.2. Hardware

◉ Peripherals:

Mobile devices: Types of Mobile Devices

- ◉ a) Smartphones
- ◉ Smartphones are advanced mobile phones with a built-in **operating system** (Android, iOS, etc.) capable of running various applications.
- ◉ **Functions:** phone calls, text messaging, web browsing, GPS navigation, camera use, and app execution.
- ◉ **Examples:** Samsung Galaxy, iPhone, Huawei P Series.
- ◉ **Uses:** communication, social media, e-commerce, online learning, and geolocation.

1.2. Tools
1.2.2. Hardware

Peripherals:

Mobile devices: Types of Mobile Devices

- b) Tablets
- Tablets are touchscreen mobile computers with larger screens (7–12 inches) that bridge the gap between smartphones and laptops.
- **Advantages:** larger display, longer battery life, comfortable reading experience.
- **Applications:** education, digital art, presentations, and video conferencing.

1.2. Tools
1.2.2. Hardware

- **Peripherals:** Mobile devices: personal digital assistants (PDAs).

Types of Mobile Devices

- c) PDAs (Personal Digital Assistants)
- PDAs are early handheld computers used for personal information management, popular before smartphones.
- **Features:** small screen, stylus input, and synchronization with computers.
- **Examples:** Palm Pilot, HP iPAQ.
- **Note:** most PDA functions are now integrated into modern smartphones.

1.2. Tools
1.2.2. Hardware

Peripherals: Smart Chips

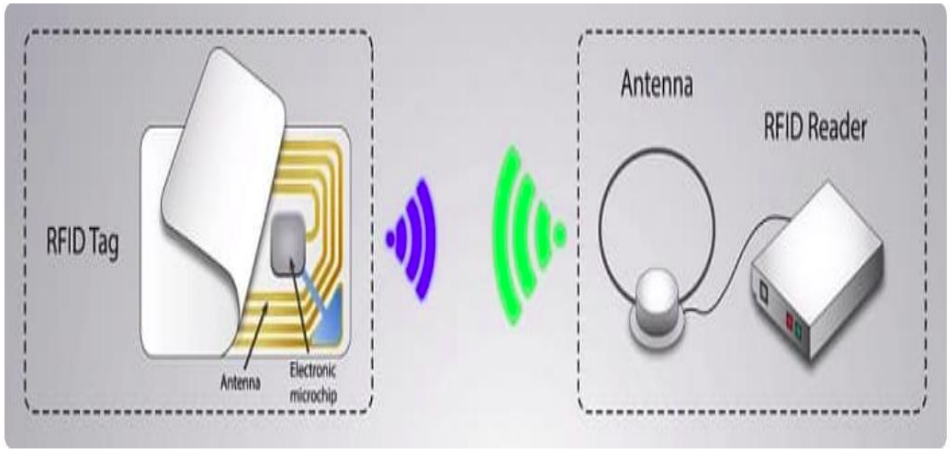
- **Smart chips** are microelectronic components that contain processing and storage capabilities, enabling data exchange, identification, and intelligent control. They are widely used in **embedded systems**, **IoT devices**, and **secure digital systems**.
- **General Concept**
- A smart chip typically includes a **microprocessor** or **microcontroller**, **memory units** (ROM, RAM, EEPROM), and sometimes **sensors** or **communication interfaces**.
- It can process data autonomously, execute programmed instructions, and communicate with other devices.

1.2. Tools
1.2.2. Hardware

- **Peripherals:** Types of Smart Chips
  - a) RFID (Radio Frequency Identification)
    - **Principle:** uses radio waves to automatically identify and track objects or people.
    - **Components:** RFID tag, reader, and antenna.
    - **Applications:** logistics, product tracking, access control, e-passports.
    - **Example:** university ID cards or access badges.

Components of RFID Technology

RFID technology consists of four components: RFID tags, antenna, RFID receiver (transceiver), and software.



1.2. Tools
1.2.2. Hardware

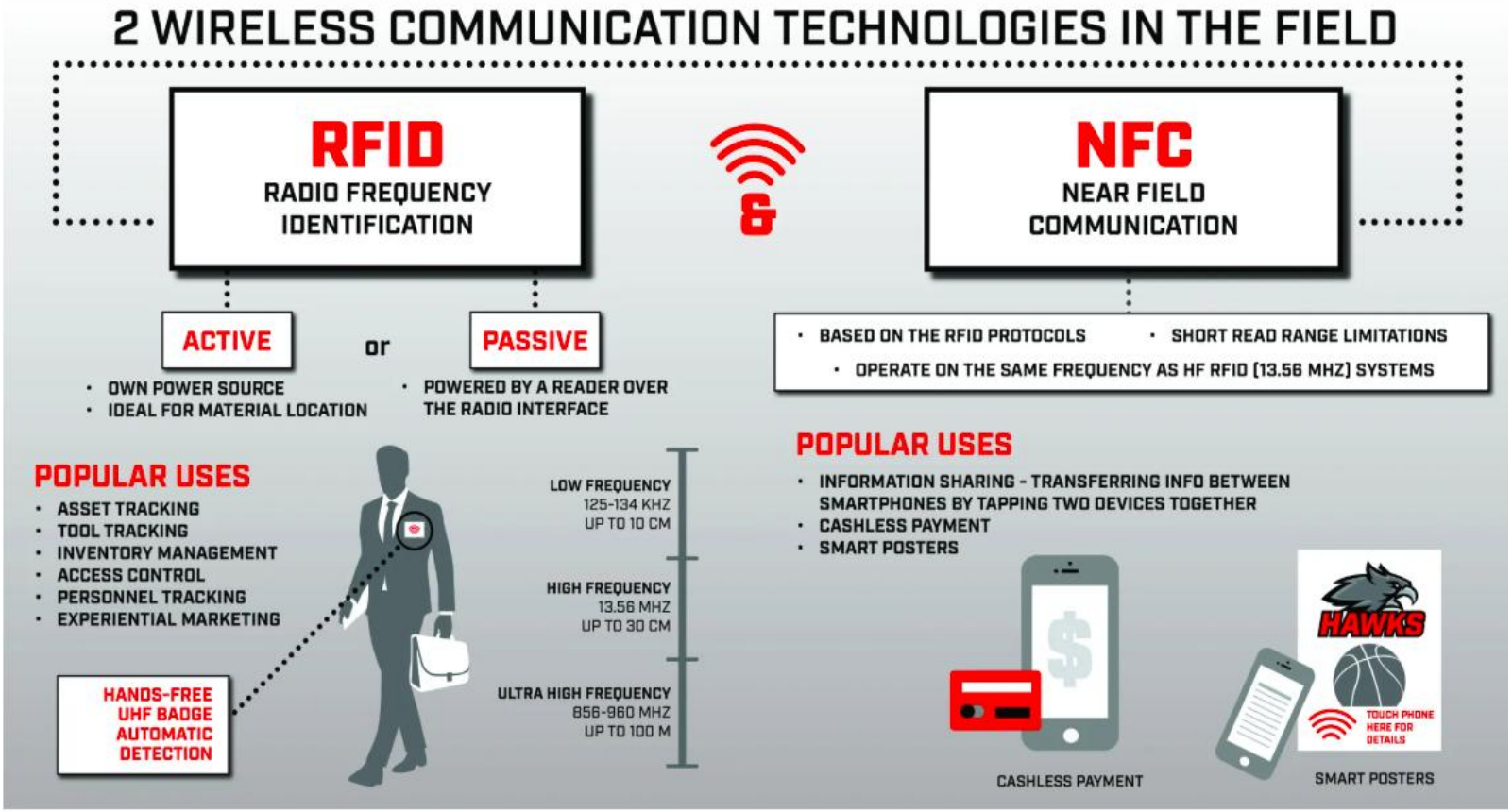
- **Peripherals:**

Types of Smart Chips

- b) NFC (Near Field Communication)
- **Principle:** short-range wireless communication technology derived from RFID (a few centimeters).
- **Applications:** contactless payments, ticketing, data exchange.
- **Example:** mobile payment using smartphones or smartwatches.

1.2. Tools
1.2.2. Hardware

- **Peripherals:** Types of Smart Chips : a) RFID (Radio Frequency Identification) and NFC (Near Field Communication)



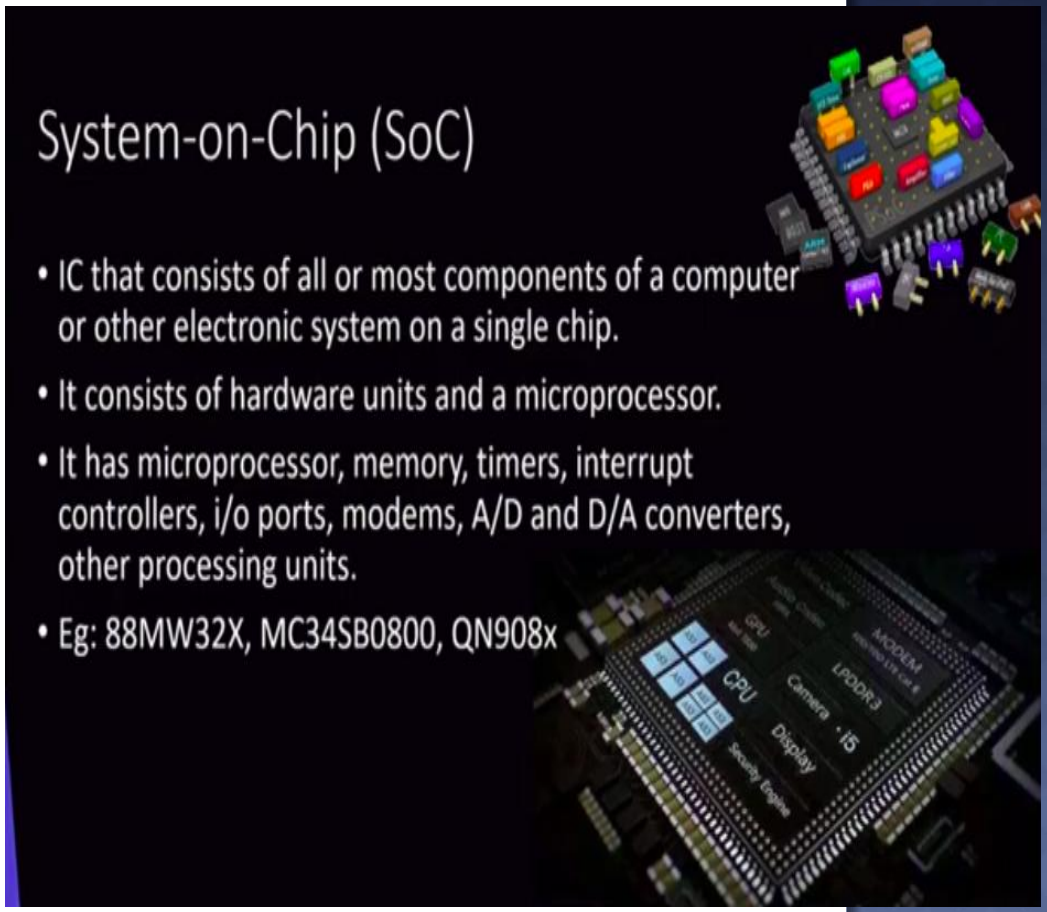
1.2. Tools
1.2.2. Hardware

- **Peripherals:**

Types of Smart Chips

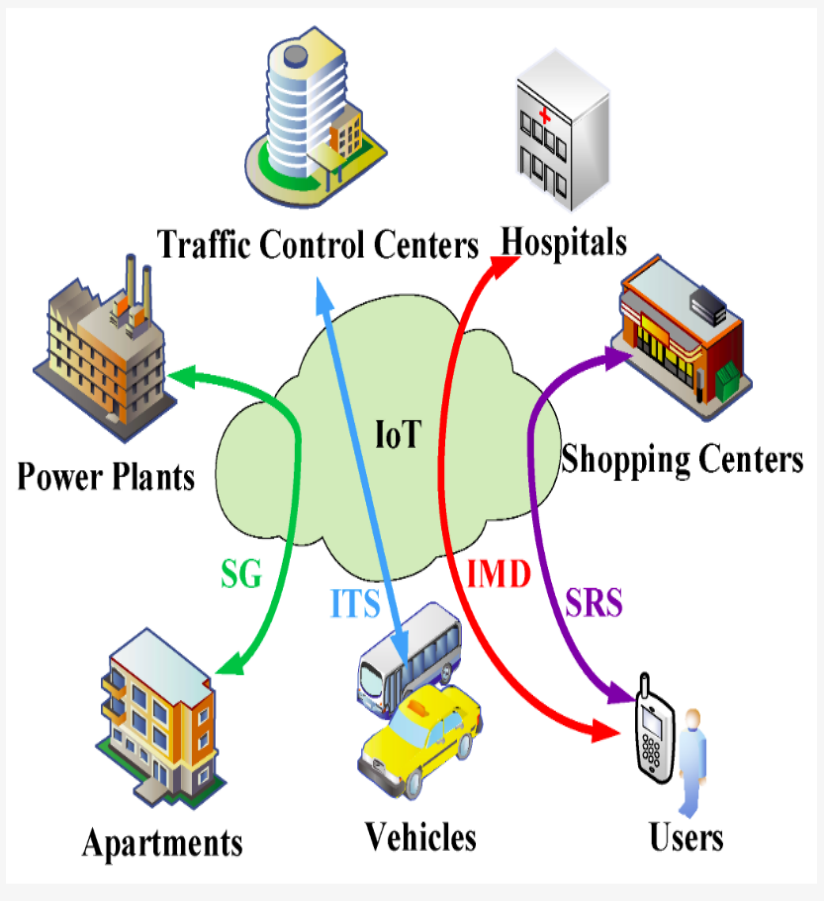
Embedded Processors

- **Definition:** microcontrollers or processors integrated into a system to perform dedicated control or monitoring tasks.
- **Applications:** robotics, automotive systems, smart homes, medical devices.
- **Example:** Arduino or Raspberry Pi used to control a temperature sensor.



1.2. Tools
1.2.2. Hardware

- **Peripherals:** Types of Smart Chips
- IoT (Internet of Things) Sensors
- **Principle:** detect physical phenomena (temperature, light, motion, pressure, etc.) and transmit collected data to the internet.
- **Applications:** smart cities, agriculture, healthcare, and industrial automation.
- **Example:** air quality sensors, smart thermostats, motion detectors.



1.2. Tools
1.2.2. Software

Definition of an Operating System (OS):

- An **operating system (OS)** is a fundamental software that acts as an intermediary between the computer's **hardware** and the **applications (software)** used by the user.
- It manages hardware resources (**processor**, **memory**, **devices**, files) and provides a stable and consistent environment for program execution.

1.2. Tools
1.2.2. Software

Definition of an Operating System (OS):

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1.2. Tools
1.2.2. Software

Functions of an Operating System (OS):

- Its main functions include:
- **Resource management:** handling the CPU, memory, storage devices, and peripherals.
- **File management:** organizing, reading, writing, and protecting data.
- **Process management:** launching, scheduling, and terminating programs.
- **User interface:** either text-based (e.g., Linux shell) or graphical (GUI) like Windows, macOS, or Android.
- **Security and communication:** managing user access, system protection, and network communication.

Examples : **Windows**, **Linux**, **macOS**, **Android**, and **iOS**.

1.2. Tools
1.2.2. Software

Types of Operating Systems

- **Single-tasking OS:** Only one program runs at a time (e.g., MS-DOS).
- **Multi-tasking OS:** Several programs can run simultaneously (e.g., Windows, Linux).
- **Real-Time OS (RTOS):** Designed for critical systems where responses must be immediate (e.g., robots, airplanes, medical devices).
- **Distributed OS:** Operates across multiple computers connected in a network, managing resources collectively.
- **Embedded OS:** Lightweight systems integrated into devices (e.g., smartphones, cars, smart TVs)

1.2. Tools
1.2.2. Software

Versions of Operating Systems

1. Windows (Microsoft)

- **Windows 1.0 (1985):** first graphical interface.
- **Windows 3.x (1990–1992):** more user-friendly, popularized PCs.
- **Windows 95 (1995):** 32-bit multitasking, Start Menu introduced.
- **Windows XP (2001):** stable and widely adopted.
- **Windows 7 (2009):** fast and efficient, highly popular.
- **Windows 8 (2012):** touch-oriented Metro interface.
- **Windows 10 (2015):** unified across PC/tablet, continuous updates.
- **Windows 11 (2021):** modern interface, optimized for cloud and gaming.

1.2. Tools
1.2.2. Software

- **Versions of Operating Systems**

2. Linux (Open Source, 1991-present)

- **Linux kernel created by Linus Torvalds (1991).**
- Versions = **distributions (distros)** adapted to different needs:
  - **Debian** (stability, servers).
  - **Ubuntu** (user-friendly, desktop use).
  - **Fedora** (latest technologies, frequent updates).
  - **Red Hat Enterprise Linux (RHEL)** (enterprise use).
  - **Kali Linux** (security and penetration testing).
- Each distribution updates regularly with new kernel versions.

1.2. Tools
1.2.2. Software

- **Business applications:** Enterprises use specialized software systems to coordinate and manage operations across departments.
- The main categories include : **ERP, SCM, CRM, and HCM systems** are all software categories used by businesses, but they have distinct functions:
- **ERP** (Enterprise Resource Planning) integrates all core business processes .
- **SCM** (Supply Chain Management) manages the flow of goods.

1.2. Tools
1.2.2. Software

- **Business applications**
- **CRM** (Customer Relationship Management) handles customer interactions .
- **HCM** (Human Capital Management) manages human resources functions.
- These systems can work independently or be integrated, often with ERP acting as a central hub

1.2. Tools
1.2.2. Software

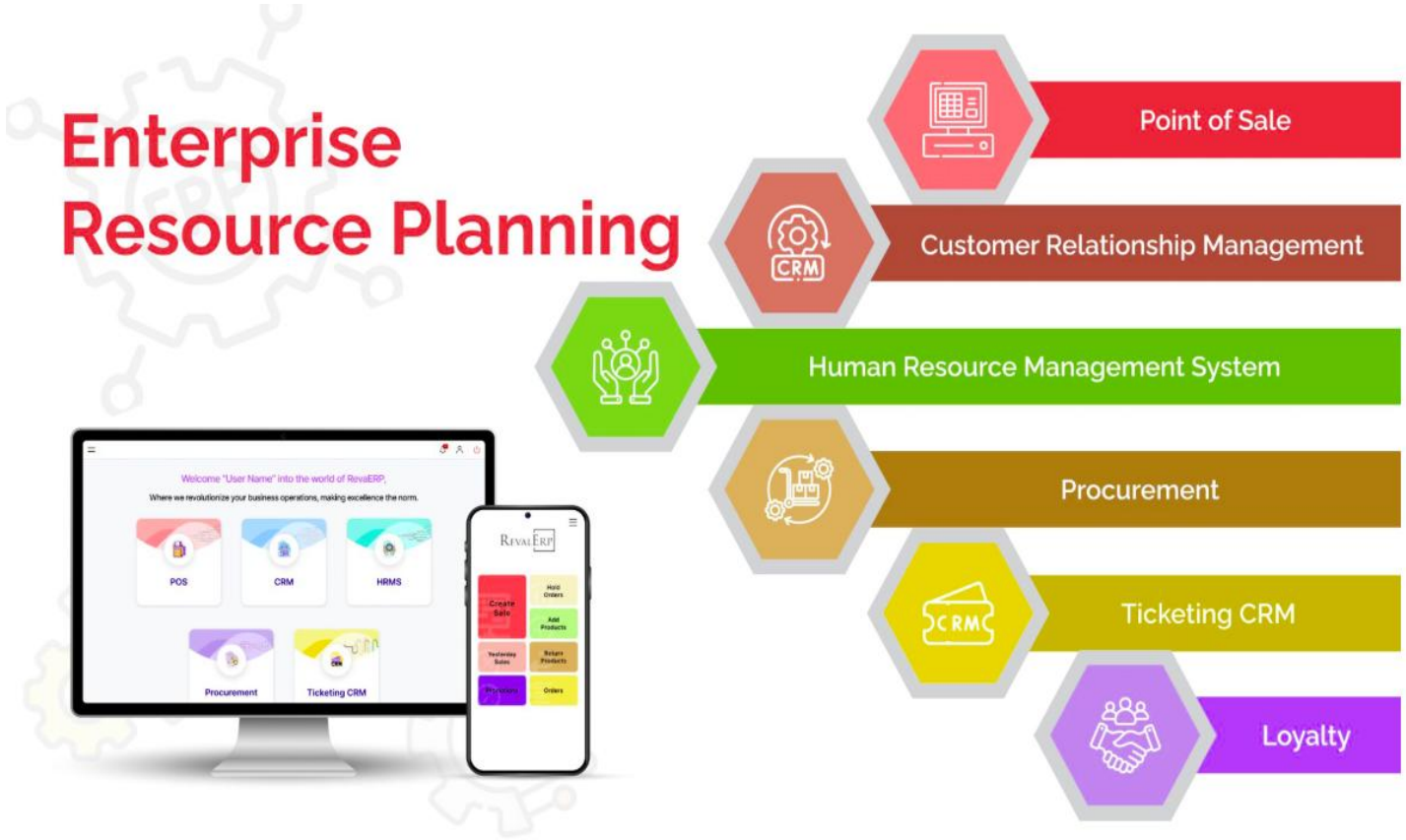
- **Business applications**
- **1. Enterprise Resource Planning (ERP) Systems**
- **Definition:** ERP systems are integrated platforms that unify and manage core business processes such as finance, accounting, project management, procurement, and supply chain operations.
- **Main Features:**
- Finance and accounting management
- Human resources and project management
- Analytics, reporting, and process automation
- Risk and compliance management
- **Benefits:**
- Streamlined and automated business processes
- Real-time data visibility and better decision-making
- Improved collaboration and customer service
- Examples: Oracle NetSuite, Odoo, Microsoft Dynamics 365, Sage Intacct.

1.2. Tools
1.2.2. Software

- **Business applications**
- **2. Customer Relationship Management (CRM) Systems**
- **Definition:** CRM systems manage customer interactions, store client data, track sales, and automate marketing to improve service quality and retention.
- **Main Features:**
- Contact and lead management
- Sales tracking and forecasting
- Marketing automation
- Customer support and analytics
- **Benefits:**
- Stronger customer relationships and loyalty
- Centralized customer data for better service
- Improved marketing and sales performance
- **Examples:** Salesforce, HubSpot CRM, Microsoft Dynamics 365, Zoho CRM.

1.2. Tools
1.2.2. Software

- **Business applications: ERP.**



1.2. Tools
1.2.2. Software

- **Business applications**
- **3. Human Capital Management (HCM) Systems**
- **Definition:** HCM systems automate and manage the entire employee lifecycle recruitment, payroll, performance, and development to optimize workforce management.
- **Main Features:**
- Recruitment and on boarding
- Payroll and benefits administration
- Performance management
- Learning, training, and analytics
- **Benefits:**
- Efficient HR operations and workforce planning
- Better employee engagement and retention
- Data-driven insights into workforce performance
- **Examples:** SAP SuccessFactors, Oracle HCM, ADP Workforce Now.

1.2. Tools
1.2.2. Software

- **Office software:**
- **1. Word Processors (e.g., Microsoft Word)**

  A word processor is a software application used to create, edit, format, and print text documents. It allows users to insert images, tables, and apply styles to produce professional reports, letters, or papers.
- **2. Spreadsheets (e.g., Microsoft Excel)**

  A spreadsheet is a program that organizes data in rows and columns, allowing users to perform calculations, create charts, and analyze information using formulas and built-in functions.

1.2. Tools
1.2.2. Software

- **Office software:**
- **3. Presentation Tools (e.g., Microsoft PowerPoint)**

  A presentation tool is used to create visual slideshows that support oral presentations. It enables users to combine text, images, charts, videos, and animations to communicate ideas effectively.
- **4. Collaboration Tools (e.g., Google Workspace, Microsoft 365)**

  Collaboration tools are online platforms that allow multiple users to work together on shared documents, spreadsheets, or presentations in real time. They support communication, file sharing, and teamwork across different locations.

❖1.3. Applications

◉ 1.3.1.Communication Spaces:

- **1.Internet:** It is a hierarchy of interconnected networks linked by high-speed arteries and uses a protocol that operates based on the TCP/IP foundation. This protocol pair is employed to facilitate communication between machines.
- Internet took off in the 1990s with the advent of a navigation system that facilitated information search and management: The World Wide Web (WWW), the most commonly used interface on the telematic network Internet

❖1.3. Applications

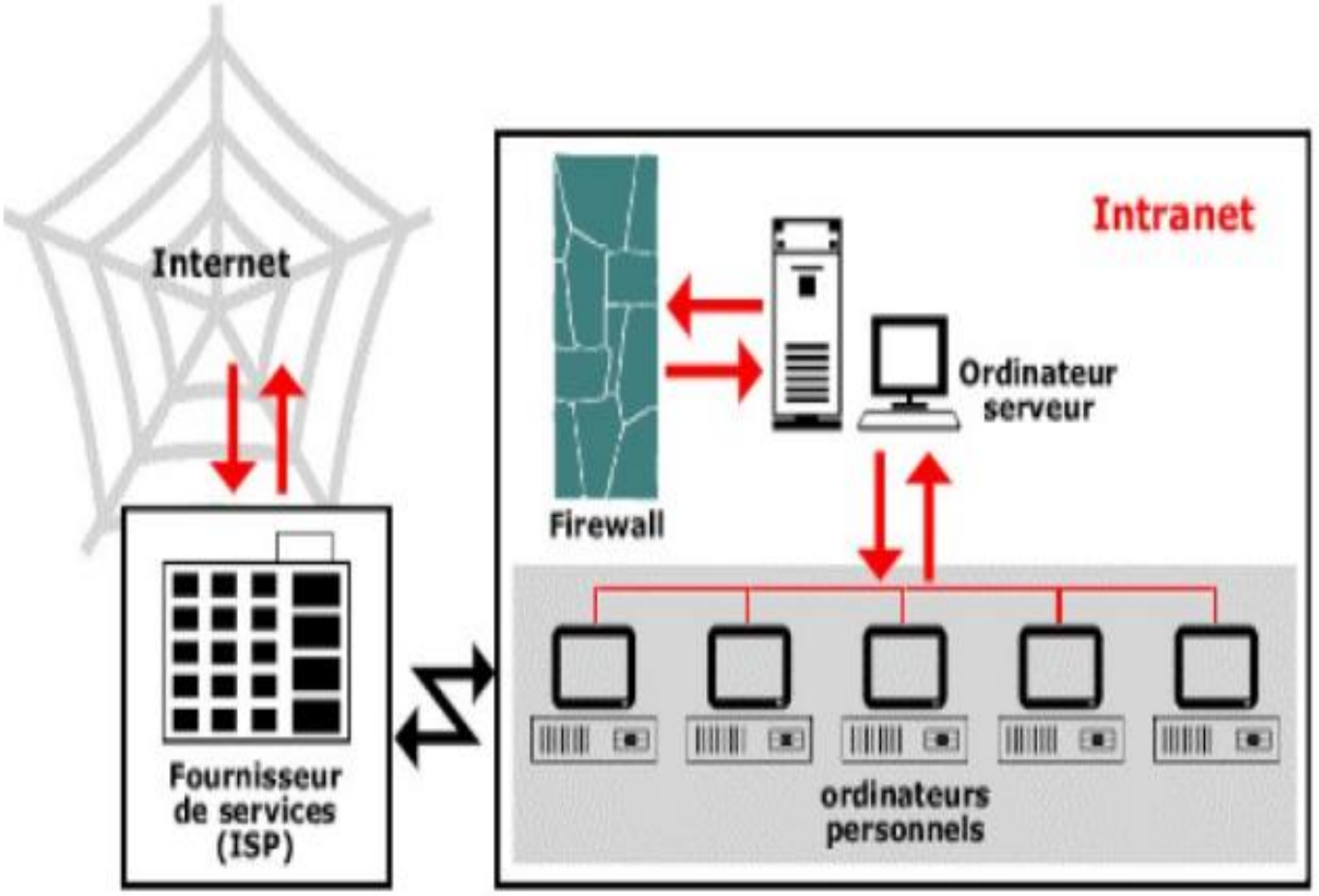
1.3.1.Communication Spaces:

- **2. Intranet:** An intranet is an internal network within the company that uses the same technology as the Internet. Computers located in subsidiaries or remote offices can also be connected to the intranet via a dedicated network.
- The intranet is therefore invisible to individuals outside the company.
- **The utility of an intranet includes:**
  - **Providing information about the company (bulletin board).**
  - **Providing technical documents.**
  - **Document search engine.**
  - **Exchange of data between colleagues**

❖1.3. Applications

1.3.1.Communication Spaces:

- 2. Intranet : The components of an Intranet



❖1.3. Applications

1.3.1.Communication Spaces:

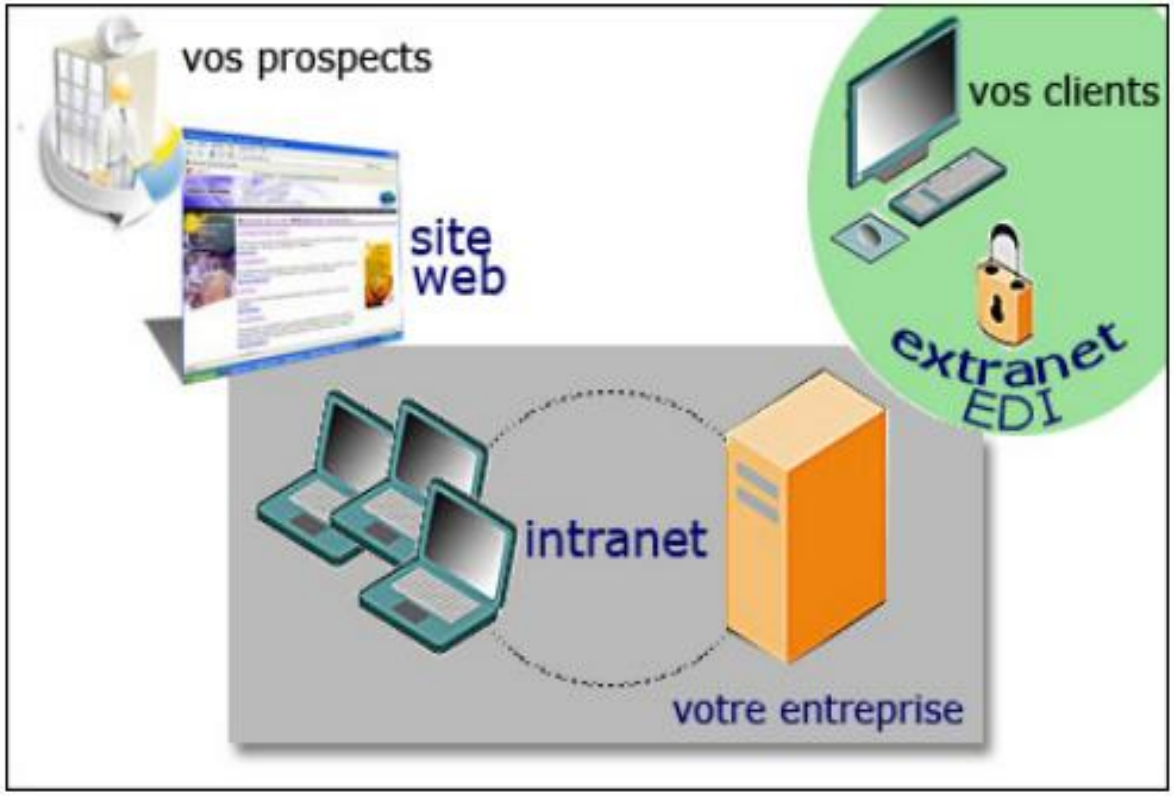
- **3. Extranet:** An extranet is an extension of the secure information system, allowing a company to grant access to confidential information only to specific external parties such as suppliers, clients, external executives, sales representatives, etc.

- It provides access to resources offered by the partner, such as email services, web-format information pages, downloadable documents, or forums .

❖1.3. Applications

1.3.1.Communication Spaces:

- The three components Internet, intranet, and extranet are intimately linked. It is evident because there would be no success in online commerce if the company's intranet is not in place, and if the extranet is not its extension



❖1.3. Applications

1.3.2 Multimedia: Audioconference, Videoconference

- **1. Audioconference:** While a phone conversation typically involves two individuals, audioconference, or teleconference, allows a larger number of participants to join a discussion over the phone.
- It is a mode of communication using the principle of Voice over IP (VoIP), and it is highly advantageous as it enables PC-to-PC calling, streamlining the infrastructure to a single type of cable, that of the company's computer network.

❖1.3. Applications

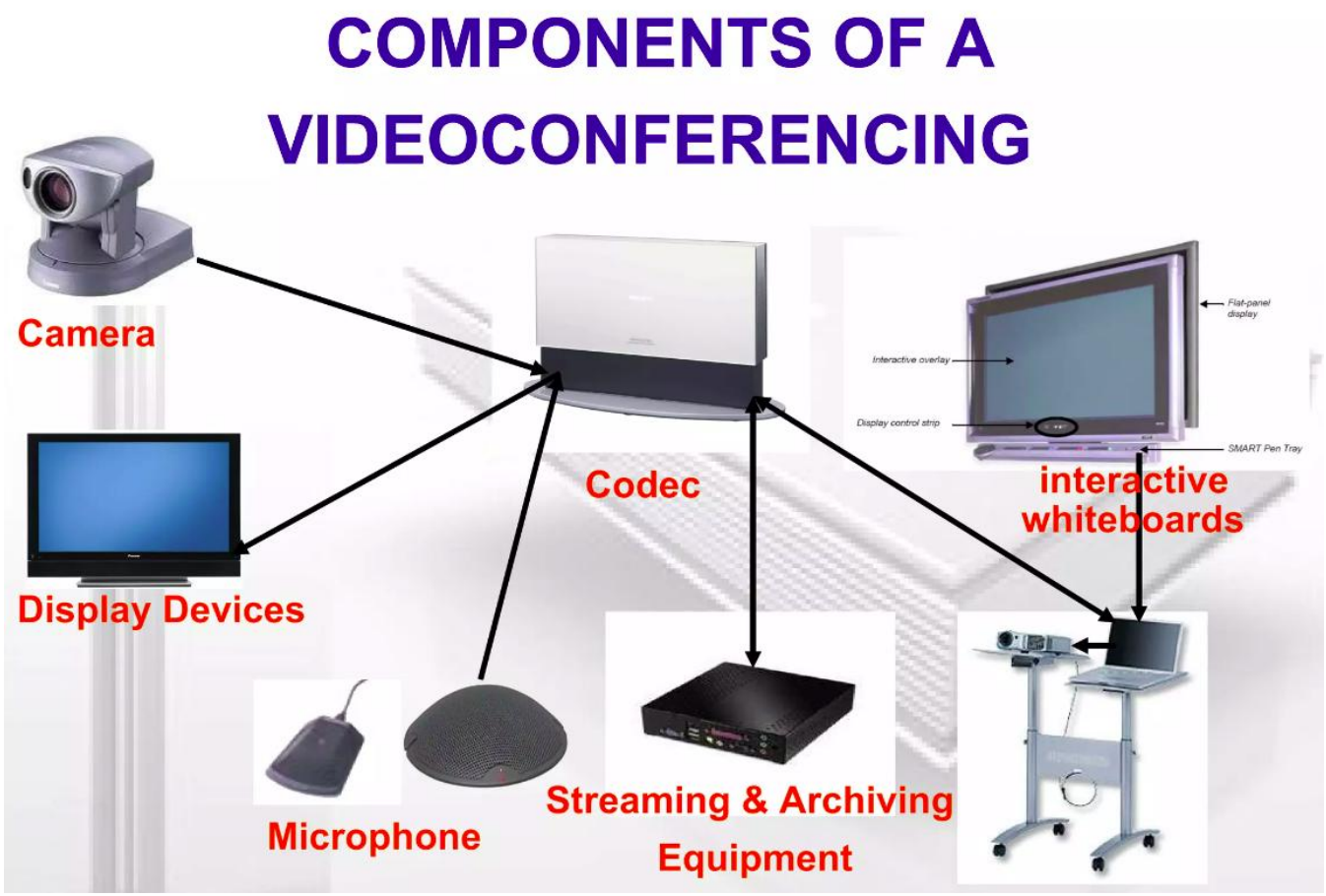
1.3.2 Multimedia: Audioconference, Videoconference

2. Videoconferences:

- The significance of videoconferencing lies in the proliferation of interactions among individuals separated by geographical distances, emphasizing collaboration rather than exclusion.
- While a phone conversation typically involves two individuals, audioconference, or teleconference, allows a larger number of participants to join a discussion over the phone.

❖1.3. Applications

- **1.3.2 Multimedia: Audioconference, Videoconference**
- 2. Videoconferences



❖1.3. Applications

1.3.2 Multimedia: Audioconference, Videoconference

1. Visioconference:

Video conferences play a pivotal role in enhancing communication by facilitating virtual meetings and collaborations. Here are some key aspects associated with video conferences:

- **Visual Interaction:** Video conferences enable face-to-face interactions among participants, fostering a more engaging and personal communication experience compared to audio-only meetings.
- **Remote Collaboration:** Participants from different geographic locations can connect seamlessly, promoting collaboration and reducing the constraints of physical distance.
- **Real-Time Communication:** Video conferences provide real-time communication, allowing immediate discussions, decision-making, and problem-solving among participants.

❖1.3. Applications

1.3.3 EDI - Electronic Data Interchange

What is EDI?

- Electronic Data Interchange (EDI) is a computer-to-computer exchange of commercial documents in a standard electronic format between business partners.

- Transitioning from physical exchange to electronic exchange offers businesses significant advantages, including cost reduction, improved processing speed, reduced errors, and enhanced relationships with their commercial partners

❖1.3. Applications

◉ 1.3.3 EDI - Electronic Data Interchange

❖1.3. Applications

1.3.3 EDI - Electronic Data Interchange

- The definition of a language and a communication infrastructure currently proposes EDI, **an essential component of e-commerce development.**

- **EDI** defines a set of standards and tools for exchanging structured business documents between remote computer applications connected by a network.

❖1.3. Applications

1.3.4 Workflow

- **What is Workflow? :** Workflow it is a process that automates the flow of information within a company.
- Various stakeholders are affected by the process, including employees and individuals responsible for tasks outside the company but related to it.