People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research

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Chapter 4

Networks & Internet

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1. **Introduction:**

    Computer networks and the Internet are essential tools in everyday life. They enable people to communicate instantly, share information, and access services such as education, business, healthcare, and entertainment. Through networks and the Internet, users can send emails, attend online classes, search for information, and use digital platforms efficiently. Understanding the importance of networks and the Internet helps individuals use technology effectively and responsibly in their daily activities.

2. **Computer Networks**

- **Definition of a computer network:** is an interconnection among two or more computers or computing devices. When the devices are connected, data and other resources, such as printers, computers, and laptops, are shared. The network is connected using wires like cables or wireless using WIFI.

- **Types of networks:**

    ❖ **PAN (Personal Area Network):**

    is a type of computer network designed to connect computers and digital devices within the immediate vicinity of a single individual. It typically covers a short range, usually up to about **10 meters**, which is why it is referred to as a *personal* network. A PAN commonly includes devices such as computers, smartphones, tablets, printers, Personal Digital Assistants, and various entertainment devices, including speakers and video game consoles.

Figure 1: Types of Computer Networks (PAN)

❖ **LAN (Local Area Network):**is a network that is used to link devices in a single office, building, or campus of up to a short distance. LAN is restricted in size.
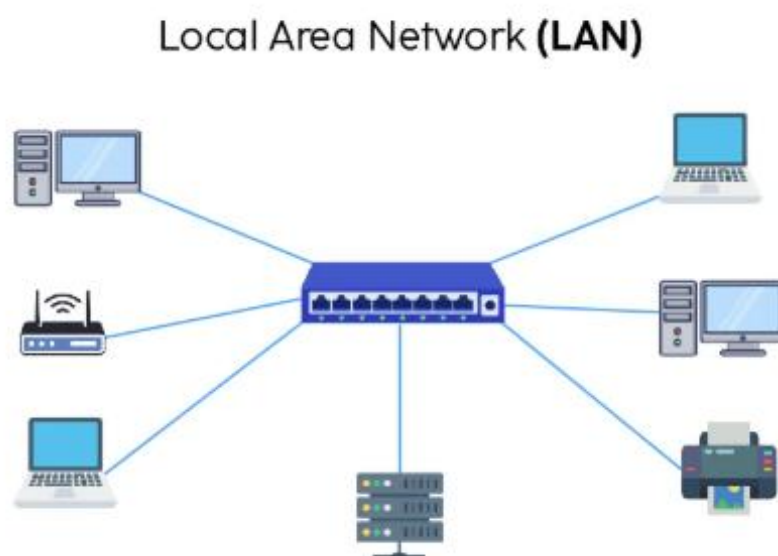

Figure 2: Types of Computer Networks (LAN)

- ❖ **MAN (Metropolitan Area Network):**is a computer network that connects computers within a metropolitan area, which could be a single large city, multiple cities and towns, or any given large area with multiple buildings.
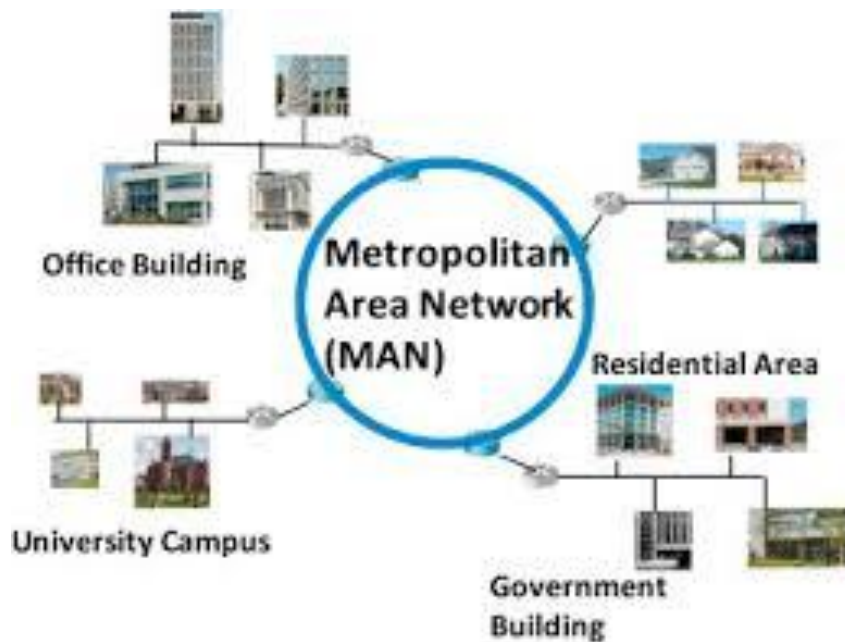

Figure 3: Types of Computer Networks (MAN)

- ❖ **WAN (Wide Area Network):**is a type of computer network that covers a large geographical area, such as cities, countries, or even continents. It connects multiple local area networks (LANs) and other networks through public or private telecommunication systems. WANs enable long-distance communication and data exchange between computers and devices. The most common and well-known example of a Wide Area Network is the Internet.
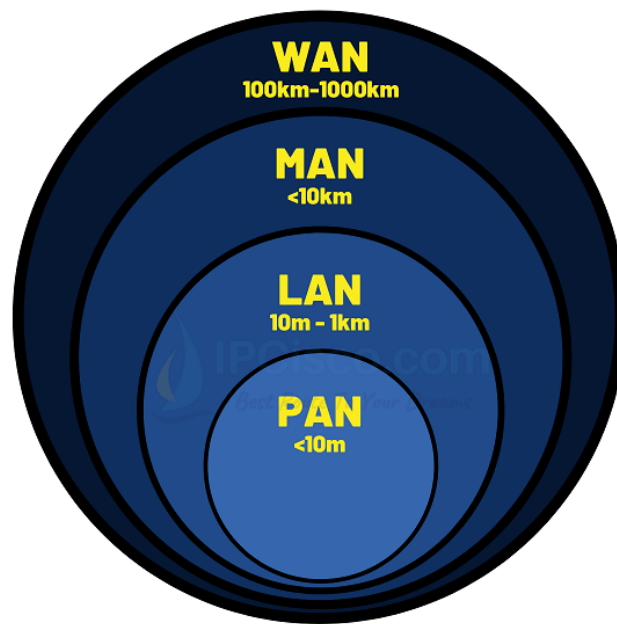
Figure 4: Comparison of Network Types

- **Basic network components**
  - ❖ **Devices:** Network devices are the physical components used to connect computers and other equipment to a network.

- A **computer** is an end device in a network that **sends and receives data**. It acts as a client when requesting services from servers and can also share resources with other devices on the network.
- A **router** connects different networks together and directs data packets to their correct destinations.
- A **modem** allows a computer or network to connect to the Internet by converting digital data into signals suitable for transmission.

  - ❖ **IP address:** is a unique numerical identifier assigned to each device connected to a network or the Internet. It allows devices to identify each other and communicate correctly. Without an IP address, data cannot be sent or received between devices on a network.

3. The Internet:

- **Definition of the Internet:** The Internet is a collection of computers around the world connected to each other via a high-speed series of networks. The Internet becomes the main method in exchanging cultures and transferring knowledge between people. All connected computers and networks exchange information and use various services. Hence, the Internet is not the World Wide Web (WWW or W3). The World Wide Web (or Web) is just one of the services that the Internet offers to its users although it is the most commonly used service. The Internet is the global system of interconnected computer networks. The Internet carries an unlimited range of information resources and services, such as the interlinked hypertext documents and applications of the Web, electronic mail, telephony, and file sharing

- **History of the Internet**
  The idea of the Internet began in the 1960s, when the U.S. Department of Defense created a network called ARPANET to connect computers in universities and research centers.
  Its main goal was to share information quickly and securely among researchers. In the 1980s, this network expanded to include more institutions. In 1991, the World Wide Web was introduced, allowing people to browse websites easily.
  Since then, the Internet has developed and become an essential part of our daily lives in communication, education, work, and entertainment.

- **Client–server model: The Client–Server Model** is a network architecture in which multiple computers (clients) request and receive services from a central computer (server). This model organizes network communication so that servers provide resources, data, or services, and clients use these services.
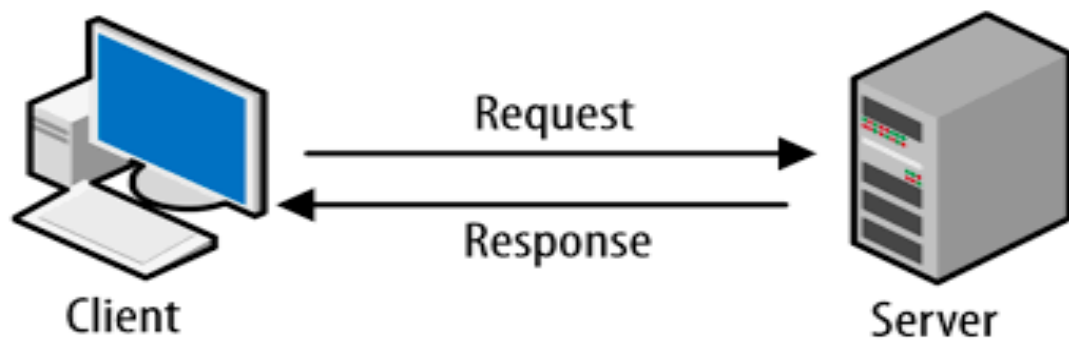
Figure 5: Client–Server Model

client is a device or software that requests and uses services or resources provided by a server in a network. Clients rely on servers to access data, applications, or other network services

server is a computer or software system that provides services, data, or resources to multiple clients over a network. Servers respond to requests sent by clients and manage resources centrally.

- **How data travels on the Internet:** Data is sent in small pieces called packets. Each packet may take a different route to reach the destination. Packets travel through devices called routers that guide them toward the server. When the server receives the request (for a website, video, or email), it sends data back to your device in packets. This happens very fast – usually in milliseconds. **Data is Divided into Packets**

Divided into Packets	- Any message, file, or request (e.g., opening a website, sending an email) is broken into **small pieces called packets**. - Each packet contains part of the data along with metadata such as the **sender's IP**

	address, **receiver's IP address**, and **sequence number**.
Packets Travel Independently	• Packets may take **different routes** through the Internet depending on network traffic and routing efficiency. • Devices called **routers** guide the packets from one network to another toward the destination.
Reassembly at the Destination	• When all packets arrive at the receiving device, they are **reassembled** into the original data. • If some packets are missing or damaged, the system requests them again to ensure accurate transmission.
Very Fast Transmission	• Data packets travel through multiple routers and networks in **milliseconds**, allowing real-time communication such as video calls, emails, or browsing.

- **IP addresses:** An **IP address** is a unique numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication.

  It works like a **digital home address**, allowing devices to send and receive data accurately over the Internet.

- **Structure of an IPv4 Address:** An IPv4 address consists of four parts separated by dots.

- Example: 192.168.1.10

- Each part is a number between 0 and 255.

    o   The smallest value is 0.

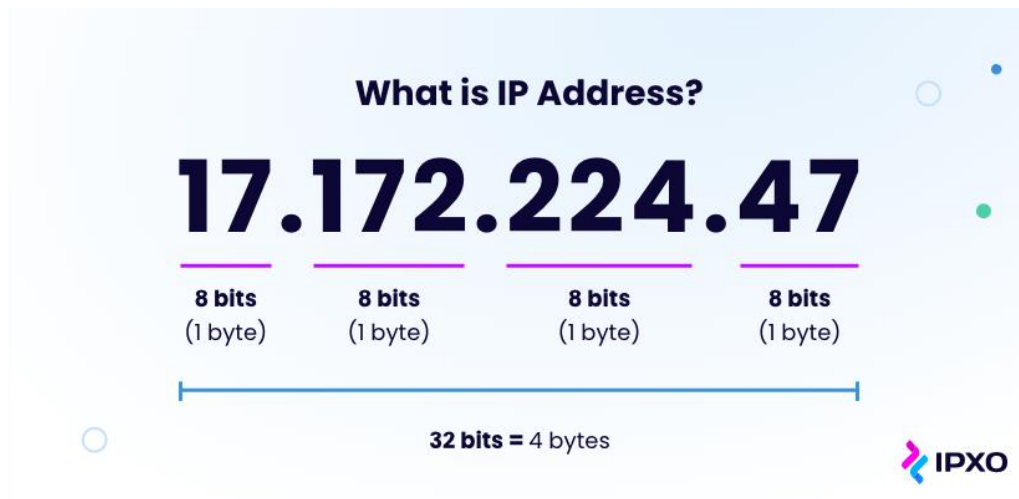   o   The largest value is 255.

Figure 6: IPv4 Address Structure

4. **Search Engines**: is an online tool that helps users find information on the Internet. Users enter **keywords or questions**, and the search engine retrieves relevant websites, documents, images, videos, and other resources from its index.

- **Difference between browser and search engine**

Feature	Browser	Search Engine
Definition	A software application used to access, display, and navigate websites.	An online tool that helps you find information on the Internet.

Function	Opens and displays web pages.	Searches and provides a list of relevant websites or data.
Examples	Chrome, Firefox, Edge	Google, Bing, Yahoo

- **How search engines work**

Search engines work in **three main steps**:

1. **Crawling**
   - Search engine robots (also called spiders or bots) visit web pages to collect data.
   - They follow links to discover new pages.

2. **Indexing**
   - Collected data is **organized and stored** in the search engine's database (index).
   - This allows the engine to quickly retrieve relevant pages when needed.

3. **Ranking**
   - When a user searches, the engine **analyzes the query** and ranks pages by relevance.
   - Algorithms consider factors such as keywords, page quality, links, and user engagement.
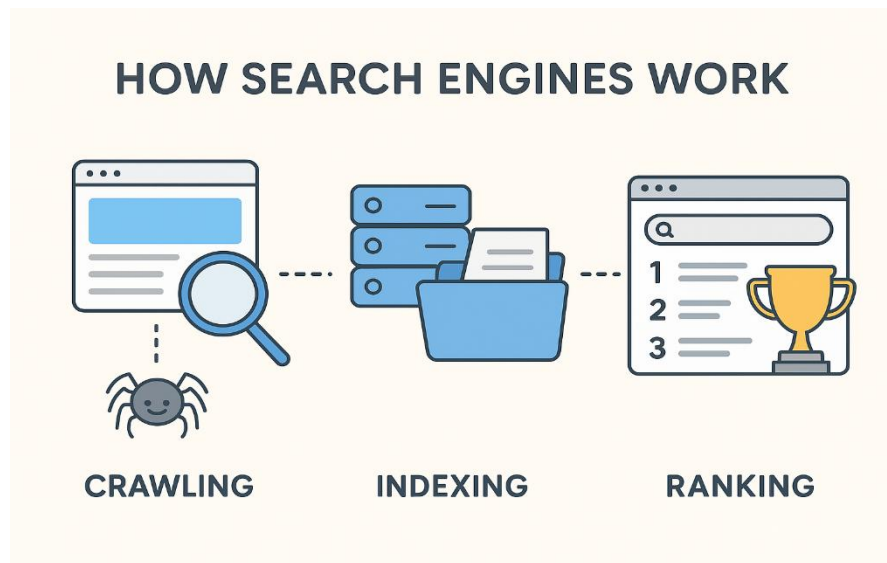   - Results are displayed in order from most to least relevant

Figure 7: How Search Engines Work

- **Examples of search engines**

  Google: Most popular search engine worldwide.

  Bing: Microsoft's search engine.

  Yahoo: One of the early search engines still in use.

5. **Domain Names and Domain Extensions**

   A domain is a human-readable web address that identifies and locates a website on the Internet. It replaces the numerical IP address with a simple name so users can easily find and access online resources.

   - **Domain Structure:**
     A website domain is made of several parts separated by dots.
     Each part has a specific role that helps identify and locate a website on the Internet.

   The main parts of a website are explained below:

✓ Protocol: The protocol defines the method used to transfer data between the user's browser and the website. The most common protocols are HTTP and HTTPS, with HTTPS being the secure version that encrypts the data exchanged between the user and the website. This encryption helps protect sensitive information such as passwords and personal data. Although the protocol usually appears before the domain name, it is not considered part of the domain itself. (Not part of the domain, but often appears before it.)

✓ Subdomain: The subdomain is an optional part of a website address that appears before the main domain name. It is used to organize and manage different sections or services of a website. The most common subdomain is "www", which stands for World Wide Web. However, websites may use other subdomains such as "mail", "blog", or "shop" depending on their content and services. Some websites function without using any subdomain at all.

✓ Second-Level Domain (SLD): The Second-Level Domain is the main and most important part of the domain name. It is chosen by the website owner and usually represents the name of a company, institution, organization, or brand. This part helps users easily recognize and remember the website. In the example "example.com", the word "example" is the Second-Level Domain.

✓ Top-Level Domain (TLD): The Top-Level Domain is the last part of a website domain and is also known as the domain extension. It provides information about the type, purpose, or geographical origin of the website. Common top-level domains include ".com" for commercial websites, ".org" for organizations, ".edu" for educational institutions, ".gov" for government websites, and ".dz" for websites related to Algeria.
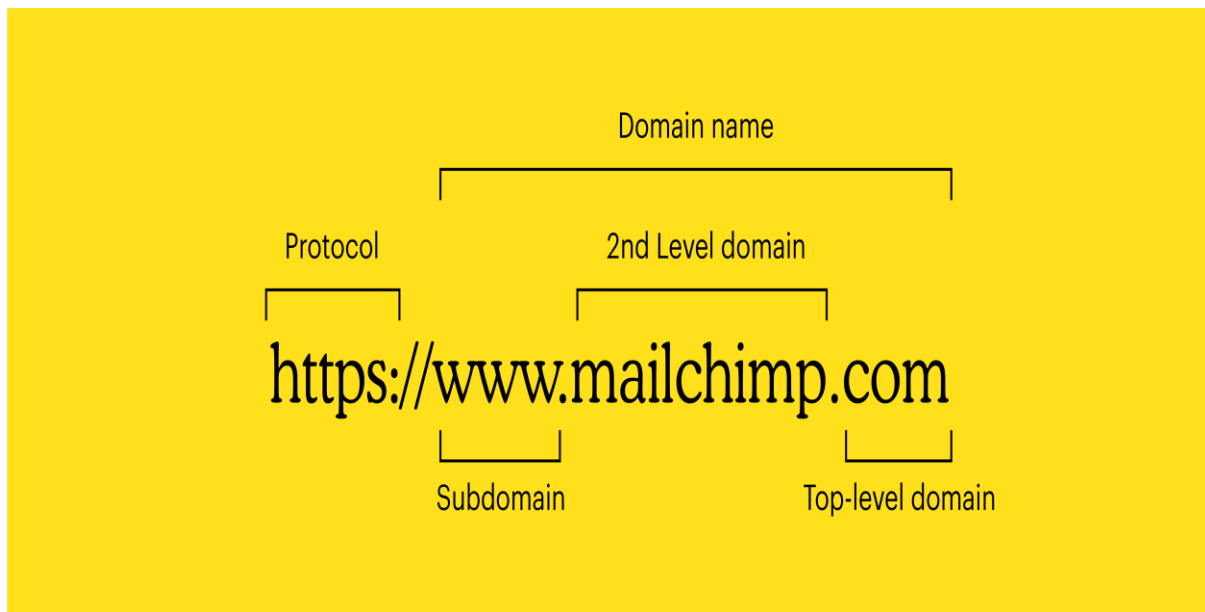
Figure 8: The main parts of a website

6. Effective Internet Searching:

When we search on the Internet, the results we see **depend entirely on what we type in the search bar**. The choice of words, phrases, or search operators determines which websites, documents, or files appear at the top of the results. This means that **even a small change in the keywords can produce very different results**.

- ✓ **Choosing the Right Keywords:** The first step in effective searching is selecting the **most important words** related to your topic. These words are called **keywords**. Instead of typing a full sentence or question, focus on the **main concepts**.
- ✓ **Using Search Operators:** Search operators are **special commands** that make searches more precise and efficient.

Search Operator	Function	Example
" " (Quotation Marks)	Searches for an **exact phrase** and shows results containing the	"computer network types"

	same words in the same order.	
site:	Limits the search to a **specific website or domain** to get more reliable sources.	computer networks site: edu
filetype:	Searches for a **specific type of file** such as PDF, DOC, or PPT.	client server model filetype: pdf
AND	Ensures that **all keywords must appear** in the search results.	LAN AND WAN AND MAN
OR	Shows results that contain **any of the keywords**.	LAN OR WAN OR MAN
- (Minus)	Excludes unwanted words from the search results.	network -wireless

✓ **Tips for Effective Searching:**

How to Perform an Ideal Search?

- Clearly define the research topic before initiating the search process.
- Select precise and relevant keywords that accurately represent the main concepts of the topic.
- Use appropriate search operators such as quotation marks, site: , and filetype: to refine and narrow down search results.
- Modify and combine keywords when necessary to improve the accuracy and relevance of the retrieved information.

Selecting Search Results

- Avoid selecting the first result without evaluation.

- Carefully read the title and summary provided for each search result.

- Choose sources that are directly related to the research topic and suitable for academic purposes.

Evaluating the Credibility of Sources

Even when search results appear relevant, it is essential to assess the reliability of the source.

- **Domain**: Websites using .edu, .gov, or .org domains are generally more reliable than .com or unfamiliar domains.

- **Author or Organization**: Identify the author or institution responsible for the content and verify their credibility.

- **Date of Publication**: Check whether the information is recent or outdated, especially for technology-related topics.

- **References**: Reliable academic sources usually include citations or references to other credible materials.

- **Language and Style**: Prefer content written in a professional, clear, and objective manner; avoid sources that use clickbait or sensational language.

7. How to Stay Safe on the Internet

To ensure safe Internet use, users should follow these basic guidelines:

- Use strong and unique passwords and avoid sharing them with others.

- Avoid clicking on suspicious links, pop-up advertisements, or unknown attachments.

- Always check website addresses and ensure they use **HTTPS**.

- Do not share personal or sensitive information on untrusted websites.

- Keep antivirus software and operating systems updated.