

Unit 1 – Introduction to Computer Networks

♦ What is a Computer Network?

- A **computer network** is a system where **two or more computers are connected to share information and resources**.
 - Example: sharing files, printers, or internet connection.
 - Connection can be **wired (cables)** or **wireless (Wi-Fi)**.
-

💡 Advantages of Computer Networks

1. **Better Communication** – Easy to send messages or emails.
 2. **File Sharing** – Share data and files quickly.
 3. **Resource Sharing** – Use one printer or scanner for many computers.
 4. **Flexible Access** – Access files from anywhere in the network.
 5. **Internet Access** – All connected devices can use one internet connection.
 6. **Low Cost** – Reduces need for multiple devices.
-

Applications of Computer Networks

- **Business & Finance** – Online banking, stock trading.
 - **Email Services** – Send and receive messages.
 - **Teleconferencing** – Online meetings and video calls.
 - **File & Directory Services** – Central storage and access to files.
-

Types of Computer Networks

Networks are divided based on **size and area covered**:

1. LAN (Local Area Network)

- Covers **small area** like office, school, or building.
- Fast and inexpensive.
- Example: Wi-Fi network in a college.

2. MAN (Metropolitan Area Network)

- Covers a **city** or a group of nearby areas.
- Connects multiple LANs together.
- Example: Citywide cable TV network.

3. WAN (Wide Area Network)

- Covers a **large area**, even across countries.
- Connects multiple LANs and MANs.
- Example: **Internet** is the best example of a WAN.

Transmission Media

Medium that **carries data** from sender to receiver.

1. Guided Media (Wired)

Data travels through a **physical cable**.

a. Twisted Pair Cable

- Two copper wires twisted together.
- Cheap, easy to install.
- Types:
 - **UTP (Unshielded)** – Used in phones, LAN.
 - **STP (Shielded)** – Used for outdoor or high-speed data.

b. Coaxial Cable

- Has an inner wire, insulator, outer shield, and plastic cover.
- Used in **TV cables**.
- High speed and less noise.

c. Fiber Optic Cable

- Made of **glass or plastic**, carries data as **light signals**.
- **Very fast**, long-distance communication.
- Used for **internet backbone and telecommunication**.

2. Unguided Media (Wireless)

Data travels through **air using electromagnetic waves**.

a. Radio Waves

- Transmit in all directions.
- Used in **FM radio, mobile phones**.
- Can pass through walls.

b. Microwaves

- Point-to-point communication using antennas.
- Used in **mobile phones, satellites**.
- Can be **terrestrial (earth-based)** or **satellite**.

c. Infrared Waves

- Used for **short range** communication.
- Example: **TV remote**, file sharing between two mobiles.
- Cannot pass through walls.

Network Topologies

It is the **arrangement of computers (nodes)** in a network.

1. Bus Topology

- All computers connected to a **single cable**.
- Simple and cheap, used in small networks.
- If cable fails, whole network stops.

2. Ring Topology

- Each device connected in a **circular ring**.
- Data moves in **one direction**.
- Failure in one device breaks the network.

3. Star Topology

- All computers connected to a **central hub/switch**.
- Easy to manage and troubleshoot.
- If hub fails → entire network fails.

4. Mesh Topology

- Every computer is connected to every other.

- Very reliable but costly.
- Used in **high-security systems**.

5. Tree Topology

- Hierarchical structure like a tree.
- Combines **Star + Bus topology**.
- Used in **WAN** and large organizations.

6. Hybrid Topology

- Combination of two or more topologies.
 - **Flexible, scalable, and reliable.**
-



Internet, Intranet, Extranet

Internet

- A **global network** connecting millions of computers worldwide.

Intranet

- A **private network** used inside an organization (like school or company).
- Only authorized users can access it.

Extranet

- Allows **limited access** of intranet to outsiders (like vendors or clients).
-

◆ Network Edge and Core

- **Network Edge:** Computers and devices connected at the end (called **hosts or end systems**).
 - **Network Core:** Middle part that connects different networks using **switching techniques**.
-



Switching Techniques

How data is transferred between sender and receiver.

1. Circuit Switching

- A **dedicated path** is made before data transfer (like telephone call).
- Real-time, continuous connection.

- Example: Voice calls.

2. Packet Switching

- Data is divided into **small packets** and sent independently.
 - Used in **Internet and Email**.
 - More efficient and flexible.
-



Protocols

- A **set of rules** that define how data is sent and received.
 - Example: HTTP, FTP, TCP, IP, etc.
 - Just like humans follow language rules, computers follow **network protocols**.
-



OSI Model (Open Systems Interconnection)

Divides networking into **7 layers**. Each layer has a special function.

Layer	Function	Example
1. Physical	Transmit bits using cables	Cables, Hubs
2. Data Link	Error-free frame transfer	Switch, MAC address
3. Network	Routing & IP addressing	Router, IP address
4. Transport	Reliable delivery	TCP, UDP
5. Session	Manage sessions between devices	Login, recovery
6. Presentation	Translate, compress, encrypt data	SSL, Encryption
7. Application	User interface for network	HTTP, Email



TCP/IP Model

- Practical model used on the Internet.
- Has **5 layers**:
 1. Application
 2. Transport
 3. Network

- 4. Data Link
 - 5. Physical
 - Combines OSI's top layers (Application, Presentation, Session) into one.
-

Delay, Loss & Throughput

When sending data, several factors affect performance.

1. Delay

Time taken by data to travel.

- **Processing Delay:** Time to check packet.
- **Queuing Delay:** Waiting time in router queue.
- **Transmission Delay:** Time to push all bits on wire.
- **Propagation Delay:** Time for signal to travel in medium.

2. Packet Loss

- Some packets may not reach the destination due to congestion.
- Causes missing data or retransmission.

3. Throughput

- The **rate of successful data transfer** (bits per second).
 - High throughput = fast network.
-

Summary

- **Computer Network:** Connects computers to share data and resources.
- **Types:** LAN, MAN, WAN.
- **Media:** Guided (wired) and Unguided (wireless).
- **Topologies:** Bus, Ring, Star, Mesh, Tree, Hybrid.
- **Models:** OSI (7 layers) and TCP/IP (5 layers).
- **Performance:** Measured using delay, packet loss, and throughput.