COMPUTER

6.1 Network as a System

1. **Definition:** A computer network is a group of connected devices that share data and resources.
2. **Types of Networks:**
    - **LAN (Local Area Network):** Small network in one location (e.g., office).
    - **WAN (Wide Area Network):** Large network covering big areas (e.g., internet).

Main Components of a Network:

- **Nodes:** Devices like computers, phones, printers.
- **Links:** Connections (wired or wireless).
- **Switch:** Sends data to correct device within a network.
- **Router:** Connects different networks and sends data to the correct destination.

Real-Life Example:

Sending files in an office uses switches and MAC addresses to deliver the file correctly.
Air travel is like packet switching: people (data) take different flights (paths) to reach the same destination.

6.1.1 Objectives of Computer Networks

1. **Resource Sharing:** Share printers, storage, etc.
2. **Data Communication:** Send data via emails, messages, and video calls.
3. **Connectivity & Collaboration:** Work together remotely using tools like Google Drive.

6.2 Fundamental Concepts in Data Communication

Definition: Data communication is the exchange of data between a sender and a receiver.

Basic Components:

1. **Sender:** Sends data.
2. **Receiver:** Gets data.
3. **Message:** The actual data.
4. **Protocol:** Set of rules for communication.
5. **Medium:** The path for data (e.g., cable, Wi-Fi).

6.3 Networking Devices

6.3.1 Switch

- **Definition:** Connects devices in a network and sends data to the right device using MAC addresses.
- **Function:** First, it broadcasts to all. Then, it learns addresses and sends directly.

6.3.2 Router

- **Definition:** Connects different networks and chooses the best path for data.
- **Function:** Uses a routing table to guide packets to the destination.

6.3.3 Access Point

- **Definition:** Connects wireless devices to a wired network using radio waves.
- **Function:** Sends and receives data between wireless devices and the network.

6.4 Network Topologies

Definition:

A network topology is the layout of devices in a network.

Types:

1. **Bus Topology:** All devices share one cable.
2. **Star Topology:** Devices connect to a central hub or switch.
3. **Ring Topology:** Devices connected in a circle.
4. **Mesh Topology:** Every device is connected to every other device.

6.5 Transmission Modes

Definition:

How data moves between devices.

Types:

1. **Simplex:** One-way only (e.g., keyboard to computer).
2. **Half-Duplex:** Two-way, but one at a time (e.g., walkie-talkies).

3. **Full-Duplex:** Two-way at the same time (e.g., phone call).

6.6 OSI Networking Model

Definition: A model with 7 layers to explain how data moves in a network.

7 Layers:

1. **Physical Layer:** Sends raw data through cables.
2. **Data Link Layer:** Controls errors and direct delivery between devices.
3. **Network Layer:** Finds the best path for data using IP addresses.
4. **Transport Layer:** Checks and controls data delivery.
5. **Session Layer:** Manages the start and end of communication.
6. **Presentation Layer:** Translates and encrypts data.
7. **Application Layer:** Provides services like email and browsing to users.

6.7 IPv4 and IPv6

6.7.1 IPv4

- **Definition:** Older version using 32-bit addresses (e.g., 192.168.0.1).
- **Total addresses:** About 4.3 billion.

6.7.2 IPv6

- **Definition:** Newer version using 128-bit addresses.
- **Purpose:** To provide more unique addresses due to internet growth.

6.8 Protocols and Network Services

6.8.1 Protocols

- **Definition:** Rules for data communication.
- **Examples:**
  - **HTTP:** For web pages.
  - **TCP/IP:** For internet communication.
  - **FTP:** For file transfer.
  - **SMTP:** For email.

6.8.2 DNS and DHCP

- **DNS:** Converts website names into IP addresses.
- **DHCP:** Gives IP addresses to devices automatically.

6.9 Network Security

6.9.1 Importance:

- Protects data from unauthorized access and attacks.
- Keeps network safe, private, and working.

6.9.2 Key Concepts:

- **Firewall:** Filters safe and unsafe traffic.
- **Encryption:** Converts data into secret form.
- **Password & Authentication:** Ensures only allowed users can access data.

6.9.3 Common Threats:

- **Malware:** Harmful software.
- **Phishing:** Fake emails/websites to steal data.
- **DoS Attack:** Overloads network.
- **Man-in-the-Middle:** Intercepts and changes messages.

6.10 Types of Networks

6.10.1 Personal Area Network (PAN):

- Connects personal devices over short distance (e.g., Bluetooth).

6.10.2 Local Area Network (LAN):

- Connects devices in one location (e.g., school, home).

6.10.3 Metropolitan Area Network (MAN):

- Connects networks in a city or campus.

6.10.4 Wide Area Network (WAN):

- Connects networks across cities or countries (e.g., internet).

6.10.5 Campus Area Network (CAN):

- Connects networks in a university or business park.

6.11 Real-World Applications of Networks

1. **Business:** Secure sharing of files, communication via intranets.
2. **Education:** Online learning, virtual classes, learning platforms.
3. **Healthcare:** Share patient data, remote consultations.

6.12 TCP/IP Protocol Suite

6.12.1 TCP/IP:

- The main protocol set used on the internet.

6.12.2 Key Protocols:

- **TCP:** Reliable data delivery.
- **IP:** Routing and addressing.
- **UDP:** Fast but less reliable delivery.
- **DNS:** Converts website names to IP.
- **DHCP:** Assigns IPs automatically.

6.13 Network Security Methods

1. **Firewalls:** Block harmful traffic.
2. **Encryption:** Protects data by making it unreadable to others.
3. **Antivirus:** Detects and removes harmful software.
