Ch-8, 9 Computer Networks-I, II

1. Introduction to Computer Networks

- A **computer network** is a group of interconnected devices (computers, printers, etc.) that can communicate and share resources.
- Networks help in **data sharing**, **resource sharing**, **faster communication**, and **cost efficiency**.

2. Evolution of Networking

ARPANET

- Full form: **Advanced Research Projects Agency Network**
- Developed by the US Department of Defense in **1969**
- First network to implement the **TCP/IP protocol**
- Considered the **first prototype of the Internet**

NSFNET

- Full form: **National Science Foundation Network**
- Established in **1985**
- Backbone for connecting universities and research centers in the US
- Replaced ARPANET and helped evolve the **modern Internet**

INTERNET

- A **global network of networks** connecting millions of computers
- Provides services like **email, web browsing, file sharing, e-commerce**, etc.
- Uses the **TCP/IP protocol suite**

3. Data Communication Terminologies

Communication

- It is the process of sending and receiving **data (message)** between two devices (sender and receiver).

Components of Data Communication

Component	Description
Sender	The device that sends data
Receiver	The device that receives data
Message	The data to be transmitted
Transmission Medium	The physical path (cables, air, etc.)
Protocol	Set of rules that define data transfer format

Measuring Network Performance

Term	Description
Bandwidth	Maximum data transfer capacity of a medium (bps)
Data Transfer Rate	Actual speed of data transfer (bits/sec)
IP Address	Unique numeric address of a device on the network (e.g., 192.168.1.1)

4. Switching Techniques

Technique	Description
Circuit Switching	A dedicated communication path is established (like a phone call). Slower but reliable.
Packet Switching	Data is divided into packets and each packet may take different paths (used in Internet). Faster and efficient.

5. Transmission Media

Wired Communication Media

Medium	Description
Twisted Pair Cable	Two insulated copper wires twisted around each other. Low cost, short range.
Co-axial Cable	Single copper conductor with insulation and shielding. Used in cable TV.

Fiber Optic Cable	Uses light signals through glass fibers. Very high speed and long distance.

Wireless Communication Media

Medium	Description
Radio Waves	Used for mobile phones, radio. Long range, but prone to interference.
Microwaves	Used in satellite and wireless LANs. Needs line-of-sight.
Infrared	Used in TV remotes, short-range devices. No wall penetration.

6. Network Devices

Device	Description
Modem	Converts digital signals to analog and vice versa; used in Internet connection.
Ethernet Card	Also called **Network Interface Card (NIC)**; connects computer to LAN.
RJ45 Connector	A standard connector used for Ethernet cables in wired networks.
Repeater	Amplifies weak signals to extend the range of the network.
Hub	Broadcasts data to all connected devices; no filtering (used in small networks).
Switch	Forwards data to specific device based on MAC address (smarter than a hub).
Router	Connects different networks and routes data from one to another (used in home networks).
Gateway	Connects different networks using different protocols (e.g., LAN to Internet).
WiFi Card	Wireless NIC used to connect to wireless networks.

7. Network Types and Topologies

Types of Networks

Type	Full Form	Description
PAN	Personal Area Network	Short-range network (e.g., Bluetooth, USB)
LAN	Local Area Network	Covers small area (e.g., office, lab)
MAN	Metropolitan Area Network	Covers city area
WAN	Wide Area Network	Covers country/globe (e.g., Internet)

Network Topologies

Topology	Description	Advantage	Disadvantage
Bus	All devices connected to a single backbone cable	Easy to implement	If backbone fails, whole network fails
Star	All devices connected to a central hub/switch	Easy to troubleshoot	If hub fails, all devices affected
Tree	Hierarchical combination of star networks	Scalable	Complex to manage

8. Network Protocols

Protocol	Full Form	Purpose
HTTP	HyperText Transfer Protocol	Transfer of web pages
HTTPS	HTTP Secure	Secure web browsing with encryption
FTP	File Transfer Protocol	Uploading/downloading files from server
SMTP	Simple Mail Transfer Protocol	Sending emails
POP3	Post Office Protocol (v3)	Receiving emails
TCP/IP	Transmission Control Protocol/Internet Protocol	Core protocol for internet
PPP	Point-to-Point Protocol	Direct connection between two nodes
TELNET	Terminal Network	Remote login to a system
VoIP	Voice over Internet Protocol	Audio/video calling over Internet

9. Introduction to Web Services

WWW (World Wide Web)

- Collection of web pages accessed using the Internet.
- Uses **HTTP/HTTPS** to access web documents.

HTML (HyperText Markup Language)

- Language used to create web pages.
- Uses **tags** like <html>, <body>, <h1>, etc.

XML (Extensible Markup Language)

- Used to store and transport data in **structured** format.
- Custom tags can be defined by the user.

Domain Names

- Human-readable names for websites (e.g., www.google.com).
- Easier to remember than IP addresses.

URL (Uniform Resource Locator)

- The complete web address including protocol, domain, path
  Example: https://www.example.com/page.html

Website

- A collection of interlinked web pages hosted on a server.

Web Browser

- A software used to access websites (e.g., Chrome, Firefox, Edge).

Web Server

- A computer that stores web pages and delivers them to users.

Web Hosting

- A service that allows individuals or companies to make their website accessible via the Internet.