

Computer Networks – Overall Flow & Concept Summary (UNIT I-VI)

This summary explains **how data communication works from basics to wireless networks**, in a **simple, connected, and easy-to-remember flow**.

1. Fundamentals of Data Communication (UNIT-I)

Communication begins with **sending data from one device to another**.

- Data can be **analog or digital**
- Communication modes decide direction:
- Simplex (one-way)
- Half duplex (two-way, one at a time)
- Full duplex (two-way simultaneously)

During transmission, signals face problems like **attenuation, noise, and delay**.

To send data efficiently: - Data is encoded into signals - Switching is used: - Circuit switching (dedicated path) - Packet switching (Internet)

Networks are organized using **layers** to reduce complexity. - OSI model (7 layers) - TCP/IP model (4 layers)

2. Data Link Layer – Reliable Link Communication (UNIT-II)

Once raw bits travel on the medium, the **Data Link Layer** ensures **error-free delivery between two directly connected devices**.

Key ideas: - Data is divided into **frames** - Flow control avoids overwhelming the receiver - Error control detects and corrects errors

Protocols like: - Stop-and-Wait - Go-Back-N - Selective Repeat

help in reliable delivery.

When many devices share a channel, **MAC protocols** (ALOHA, CSMA/CD, CSMA/CA) control access.

3. Network Layer – Finding the Path (UNIT-III)

The **Network Layer** is responsible for moving packets **across multiple networks**.

Main concepts: - Logical addressing (IP addresses) - Routing (choosing best path)

Important protocols: - IP – packet delivery - ARP – IP to MAC mapping - ICMP – error reporting - IGMP – multicast management

Routing algorithms decide paths: - Distance vector (RIP) - Link state (OSPF) - Path vector (BGP)

Subnetting and NAT help manage IP addresses efficiently.

4. Transport Layer – End-to-End Communication (UNIT-IV)

The **Transport Layer** ensures **process-to-process communication** between applications.

Key responsibilities: - Port-based delivery - Error control - Flow control - Congestion control

Two main protocols: - **UDP**: Fast, connectionless, unreliable - **TCP**: Reliable, connection-oriented

TCP uses: - 3-way handshake - Sliding window - Congestion control mechanisms

Sockets provide interface for application communication.

5. Application Layer – User Services (UNIT-V)

The **Application Layer** provides services directly to users.

Common protocols: - HTTP – web communication - FTP – file transfer - Telnet – remote login - Email – SMTP, POP, IMAP - DHCP – automatic IP assignment - DNS – domain name to IP resolution

These protocols enable everyday Internet services.

6. Wireless Networks – Mobility & Reach (UNIT-VI)

Wireless networks allow communication **without cables**.

Key ideas: - WLANs use IEEE 802.11 (Wi-Fi) - Adhoc networks: no access point - Infrastructure networks: access point based

Wireless uses **CSMA/CA** for access control.

Other wireless technologies: - Bluetooth – short-range - Satellite networks – global coverage - GEO – broadcasting - MEO – navigation - LEO – low latency internet

Overall Flow (One-Line Memory Trick)

Data is created → encoded → framed → routed → transported → delivered to applications → over wired or wireless networks

Final Big Picture

- Lower layers handle **data movement**
 - Middle layers handle **path & reliability**
 - Upper layers handle **user services**
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End of Overall Summary