

## COMPUTER NETWORKS (CN) VIVA MASTER NOTES

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### ◆ 1. What is a Computer Network?

**Full form:** — (*No abbreviation*)

**Definition:**

A **computer network** is a collection of **two or more connected devices (computers, servers, routers, etc.)** that can **communicate, share data, and resources** (like printers or files).

**Example:**

Internet, LAN (Local Area Network), MAN (Metropolitan Area Network), WAN (Wide Area Network).

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### ◆ 2. Advantages of Networking

1. Resource and file sharing
2. Centralized data management
3. Cost-effective communication
4. Internet access sharing
5. Backup and reliability

### ◆ 3. Define Node and Link

- **Node:** Any device connected to a network (e.g., PC, router, switch).
- **Link:** The **communication path** between two nodes (wired or wireless).

### ◆ 4. What is a Server and a Client?

- **Server:** Provides resources/services (like web pages or files).
- **Client:** Requests and uses those services (like a browser accessing a web server).

### ◆ 5. Define Bandwidth and Data Rate

- **Bandwidth:** Maximum capacity of a network channel (in bits per second, bps).
- **Data Rate:** Actual amount of data transmitted per second.

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- ◆ **6. What is Latency or Delay?**

**Latency** is the **time taken** by a data packet to travel from the sender to the receiver. Measured in **milliseconds (ms)**.

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- ◆ **7. Define Protocol and Why It's Needed**

**Definition:**

A **protocol** is a **set of rules** that define how data is formatted, transmitted, and received over a network.

**Example:** HTTP, TCP/IP, FTP, DNS, etc.

**Need:** Ensures devices can communicate correctly and reliably.

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- ◆ **8. What are Network Topologies?**

**Definition:**

Network topology is the **arrangement of devices and connections** in a network.

**Types of Topologies:**

1. **Bus Topology:** One main cable (bus) connects all nodes.  
→ Easy to set up but one break stops communication.
2. **Star Topology:** All nodes connect to a **central hub/switch**.  
→ Easy to manage; best for LANs.
3. **Ring Topology:** Devices connected in a circle.  
→ Data moves in one direction.
4. **Mesh Topology:** Each device connects to every other.  
→ Highly reliable but costly.
5. **Tree Topology:** Combination of star and bus (hierarchical).
6. **Hybrid Topology:** Mix of multiple types.

**Best:** ★ **Star topology** — easy maintenance, scalable, and fault-tolerant.

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- ◆ **9. OSI Model (Open Systems Interconnection)**

**Full form:** OSI – *Open Systems Interconnection*

**Definition:**

A **theoretical model** with **7 layers** that define how data is transmitted across networks.

<b>Layer No</b>	<b>Name</b>	<b>Function</b>	<b>Example</b>
7	Application	User interface	HTTP, FTP, SMTP
6	Presentation	Data formatting/encryption	SSL, JPEG
5	Session	Manage sessions	RPC
4	Transport	Reliable delivery	TCP, UDP
3	Network	Routing	IP, ICMP
2	Data Link	Framing, MAC addressing	Ethernet, Switch
1	Physical	Bit transmission	Cables, NIC

**Mnemonic:** “All People Seem To Need Data Processing”

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#### ◆ 10. TCP/IP Model

**Full form:** TCP/IP – *Transmission Control Protocol / Internet Protocol*

<b>Layer</b>	<b>Function</b>	<b>Example Protocols</b>
Application	User interaction	HTTP, FTP, DNS
Transport	End-to-end delivery	TCP, UDP
Internet	Routing	IP, ICMP
Network Access	Data transfer	Ethernet, ARP

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#### ◆ 11. What is Encapsulation & Decapsulation?

- **Encapsulation:** Wrapping data with headers/trailers as it moves *down the OSI layers* (before sending).
  - **Decapsulation:** Removing headers/trailers as it moves *up the layers* (on receiving).
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#### ◆ 12. What is Throughput?

The **actual rate** of successful data transfer over a network (in bits per second).

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#### ◆ 13. Transmission Medium

**Definition:**

The **physical path** used to carry signals between sender and receiver.

## **Types:**

- **Guided (Wired):** Twisted Pair, Coaxial, Fiber Optic.
  - **Unguided (Wireless):** Radio waves, Microwaves, Infrared.
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## ◆ **14. Port Number**

### **Definition:**

A **16-bit identifier** that helps distinguish network applications on a device.

Example: HTTP(80), HTTPS(443), FTP(21), DNS(53).

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## ◆ **15. IP Addressing**

**Full form:** IP – *Internet Protocol*

### **Definition:**

A unique logical address assigned to each device on a network.

- **IPv4:** 32-bit (e.g., 192.168.1.1)
  - **IPv6:** 128-bit (e.g., 2001:db8::1)
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## ◆ **16. MAC Address**

**Full form:** MAC – *Media Access Control*

### **Definition:**

A **hardware address** assigned to every network interface card (NIC).

Example: 00:1A:2B:3C:4D:5E

Works at **Data Link Layer (Layer 2)** — used for local communication.

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## ◆ **17. Router and Gateway**

- **Router:** Forwards packets between networks using IP addresses (Layer 3).
  - **Gateway:** Connects networks using *different protocols* (works on all layers).
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## ◆ **18. Switch**

### **Definition:**

A **switch** connects multiple devices in a LAN and forwards frames using **MAC addresses**.  
(Works on **Layer 2 – Data Link.**)

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## ◆ 19. UTP Cable

**Full form:** UTP – *Unshielded Twisted Pair*

**Definition:**

A **network cable** made of 4 pairs of copper wires twisted to reduce noise.

Used in Ethernet networks (Cat5, Cat6).

→ Max length ~100m.

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## ◆ 20. UDP

**Full form:** UDP – *User Datagram Protocol*

**Definition:**

A **connectionless and fast** transport layer protocol that sends **datagrams** without setup.  
(Used in streaming, gaming, DNS.)

**Port example:** DNS (53), DHCP (67, 68).

**OSI Layer:** Transport (Layer 4).

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## ◆ 21. TCP vs UDP

Feature	TCP	UDP
Type	Connection-oriented	Connectionless
Reliability	Reliable	Unreliable
Speed	Slower	Faster
Use	Web, Email	Streaming, DNS

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## ◆ 22. Socket

**Definition:**

A **socket** is an **endpoint of communication** between two programs over a network.

Identified by **IP + Port number**.

Used in **socket programming** for data transfer.

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## ◆ 23. Wireshark

**Definition:**

Wireshark is a **network protocol analyzer** that **captures and displays live packets**.

**Use:**

- Debugging and analyzing network traffic
  - Checking packet details (source, destination, protocol, port)
  - Studying network security issues
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#### ◆ 24. DNS

**Full form:** DNS – *Domain Name System*

**Definition:**

Translates **domain names** into **IP addresses** so browsers can locate websites.

Port: **53 (UDP/TCP)**

**Working:**

1. User types a domain (e.g., google.com).
  2. Resolver queries root → TLD → authoritative server.
  3. Returns IP to client.
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#### ◆ 25. DHCP

**Full form:** DHCP – *Dynamic Host Configuration Protocol*

**Definition:**

Automatically assigns **IP addresses** and **network details** (gateway, DNS) to devices.

Ports: **UDP 67 (server), UDP 68 (client)**.

Eliminates manual IP setup.

**Process (DORA):**

1. **Discover**
  2. **Offer**
  3. **Request**
  4. **Acknowledge**
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#### ◆ 26. HTTP

**Full form:** HTTP – *HyperText Transfer Protocol*

**Definition:**

Used to **transfer web pages** over the internet.

Port: **80 (TCP)**

Works at **Application Layer**.

Stateless and unencrypted.

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- ◆ **27. HTTPS**

**Full form:** HTTPS – *HyperText Transfer Protocol Secure*

**Definition:**

Same as HTTP but uses **SSL/TLS encryption** for secure communication.

Port: **443 (TCP)**.

Protects data from hackers and eavesdropping.

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- ◆ **28. FTP**

**Full form:** FTP – *File Transfer Protocol*

**Definition:**

Used to **transfer files** between client and server.

Ports: **20 (data) and 21 (control)**.

Works on **Application Layer**.

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- ◆ **29. SSH**

**Full form:** SSH – *Secure Shell*

**Definition:**

Used for **secure remote login and command execution**.

Encrypts data and replaces Telnet.

Port: **22 (TCP)**.

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- ◆ **30. SSL**

**Full form:** SSL – *Secure Sockets Layer*

**Definition:**

A **security protocol** that encrypts communication between browser and server.

Provides:

- **Encryption**
- **Integrity**
- **Authentication**

Replaced by **TLS (Transport Layer Security)**.

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- ◆ **31. TLS**

**Full form:** TLS – *Transport Layer Security*

**Definition:**

Successor to SSL, ensures **secure encrypted communication**.

Used in HTTPS.

Uses **asymmetric keys** for handshake and **symmetric encryption** for data transfer.

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◆ **32. IPsec**

**Full form:** IPsec – *Internet Protocol Security*

**Definition:**

A protocol suite for **securing IP communications** by encrypting and authenticating packets.

Used in **VPNs**.

- **AH (Authentication Header):** Authentication + Integrity
  - **ESP (Encapsulating Security Payload):** Encryption + Authentication
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◆ **33. POP3**

**Full form:** POP3 – *Post Office Protocol version 3*

**Definition:**

Used for **receiving emails** from mail servers to local clients.

Ports: **110 (default), 995 (SSL)**.

Downloads and usually deletes messages after retrieval.

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◆ **34. SMTP**

**Full form:** SMTP – *Simple Mail Transfer Protocol*

**Definition:**

Used to **send and forward** emails between mail servers.

Ports: **25 (default), 465 (SSL), 587 (TLS)**.

Works on **Application Layer**.

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◆ **35. S/MIME**

**Full form:** S/MIME – *Secure/Multipurpose Internet Mail Extensions*

**Definition:**

Used for **email encryption** and **digital signing** to ensure secure and verified emails.

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## ◆ 36. IPsec Modes Recap

- **Transport Mode:** Encrypts only data (payload).
  - **Tunnel Mode:** Encrypts entire IP packet.
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## ◆ 37. Resolver

### **Definition:**

A **DNS resolver** is a client component that queries DNS servers to find the IP of a given domain name.

Works in **forward lookup** (name → IP).

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## ◆ 38. Forward and Reverse DNS Lookup

Type	Converts	Example
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Forward Lookup Domain → IP google.com → 142.250.x.x

Reverse Lookup IP → Domain 142.250.x.x → google.com

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