📙 Study Guide: Computer Networks

1. What Is a Computer Network?

A system of interconnected devices that communicate using protocols.

Primary goals:

- Resource sharing
- Reliability
- Scalability
- Low latency and efficiency

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2. The OSI & TCP/IP Models

OSI 7-Layer Model

1. Physical
2. Data Link
3. Network
4. Transport
5. Session
6. Presentation
7. Application

TCP/IP 4-Layer Model

1. Link
2. Internet
3. Transport
4. Application

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3. Physical Layer

- Bits over medium (copper, fiber, wireless)
- Modulation, signaling, cabling standards

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4. Data Link Layer

Ethernet

- MAC addressing (48-bit)
- Collision domains & switches

Protocols

- ARP (IP ↔ MAC resolution)
- Error detection (CRC)

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5. Network Layer

IP Addressing

- IPv4: 32-bit
- IPv6: 128-bit
- Subnetting splits networks using subnet masks.

Routing

- Static vs dynamic
- Protocols:
    - OSPF (link-state)
    - BGP (public Internet routing)
    - RIP (distance-vector)

ICMP

- Ping, traceroute.

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6. Transport Layer

TCP

- Reliable, ordered, connection-oriented.
- Flow control (window sizes)
- Congestion control (slow start)
- Three-way handshake (SYN → SYN/ACK → ACK)

UDP

- Unreliable, lightweight, no ordering

- Used for gaming, VoIP, DNS

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7. Application Layer

- **HTTP/HTTPS** – web
- **SMTP / IMAP** – email
- **DNS** – host name → IP address

HTTP Basics

- Requests: GET, POST, PUT, DELETE
- Status codes: 200, 301, 404, 500

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8. Network Security Basics

- Firewalls
- VPNs & tunneling
- TLS encryption
- Symmetric vs asymmetric encryption
- Man-in-the-middle, SQL injection, DDoS

If you want, I can turn these into **PDFs**, **flashcards**, or **condensed one-page cheat sheets**—just tell me!