🧩 Chapter 1 – Introduction to TCP/IP Networking

🌐 1. Perspectives on Networking

Networking allows computers and devices to communicate and share data.
In a network:

- Hosts (end devices) – computers, phones, or servers that send and receive data.
- Network devices – routers, switches, firewalls that move data between hosts.
- Links – cables or wireless connections that carry data.

👉 Example:
When you open a website, your computer sends a message through a switch, then a router, across the internet, to the web server.

Main goals of networking:

- Connect devices to share data and resources
- Provide communication (email, web, video, etc.)
- Ensure reliability (data must arrive correctly)

- Scalability (the network can grow easily)

🧱 2. TCP/IP Networking Model

TCP/IP is the most used networking model in the world.
It defines how data travels from one computer to another.

The 4 Layers of the TCP/IP Model:

Layer	Purpose	Example Protocols
1. Network Interface (Link)	Moves data through physical media	Ethernet, Wi-Fi
2. Internet Layer	Delivers packets between networks	IP, ICMP
3. Transport Layer	Manages end-to-end communication	TCP, UDP
4. Application Layer	Provides network services to users	HTTP, DNS, SMTP, FTP

✅ TCP/IP is based on protocols, and each layer has specific jobs.

Example:

When you browse a website:

- Application Layer → HTTP
- Transport Layer → TCP
- Internet Layer → IP
- Network Interface → Ethernet

Each layer passes data to the next one, step by step.

⚙️ 3. TCP/IP Data-Link and Physical Layers

These are the lowest layers in networking — they handle how bits move physically.

Data-Link Layer

- Works on local network communication (e.g., between your PC and switch).
- Uses MAC addresses.
- Example: Ethernet, Wi-Fi.
- It frames data and checks for errors.

Physical Layer

- Defines cables, connectors, signals, and electricity.
- Example: copper cables, fiber optics, radio waves.
- It sends bits (1s and 0s) over the medium.

👉 Together, these layers are responsible for actual data transmission across the network.

📦 4. Data Encapsulation Terminology

Encapsulation means wrapping data with extra information as it goes down through the layers.

Example:
When a message is sent:

1. Application layer creates data.
2. Transport layer adds a TCP header → called a segment.
3. Internet layer adds an IP header → called a packet.

4. Data-link layer adds a frame header and trailer → called a frame.

5. Physical layer converts it to bits → sent through cables.

When the receiver gets the data, the process is de-encapsulation (reverse order).

📜 5. Names of TCP/IP Messages

Each layer has its own name for the data it handles:

Layer	TCP/IP Message Name	Example
Application	Data	HTTP request
Transport	Segment (TCP) / Datagram (UDP)	TCP segment
Internet	Packet	IP packet
Network Interface	Frame	Ethernet frame
Physical	Bits	Electrical or optical signals

🧠 6. OSI Networking Model and Terminology

The OSI Model (Open Systems Interconnection) is a 7-layer theoretical model that helps understand networking concepts.

OSI Layers (Top to Bottom)

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

✅ The OSI model is not used directly in real networks, but it helps explain how data flows.

🔄 7. Comparing OSI and TCP/IP Layer Names and Numbers

OSI Model (7 Layers)	TCP/IP Model (4 Layers)	Examples
Application	Application	HTTP, DNS
Presentation	Application	(Integrated into Application layer in TCP/IP)
Session	Application	(Integrated)
Transport	Transport	TCP, UDP
Network	Internet	IP
Data Link	Network Interface	Ethernet, Wi-Fi
Physical	Network Interface	Cables, Fiber, Wireless

✅ Key Point:
TCP/IP combines the top three OSI layers (Application, Presentation, Session) into one Application layer.

🧾 Summary of the Whole Chapter:

- Networking connects devices and lets them communicate.
- TCP/IP is the main model used today.
- Data moves through layers, each adding headers (encapsulation).
- The OSI model helps explain networking with 7 layers.
- Every message has a specific name (segment, packet, frame, bits).
- Physical and Data-Link layers handle how data actually moves.