**Network Models**

Network models are **conceptual frameworks** that describe how data is transmitted across networks. The two most important models are:

Each layer in the OSI model performs a specific role and passes data to the layer above or below it.

**1. OSI Model (Open Systems Interconnection)**

This is a 7-layer model developed by ISO to standardize network communication.

|  |  |  |
| --- | --- | --- |
| **Layer No.** | **Layer Name** | **Function** |
| 7 | Application Layer | End-user services (e.g., web, email) |
| 6 | Presentation Layer | Data format, encryption, compression |
| 5 | Session Layer | Session control (start/stop sessions) |
| 4 | Transport Layer | Reliable data transfer (TCP/UDP) |
| 3 | Network Layer | Routing (IP addresses) |
| 2 | Data Link Layer | MAC addressing, error detection |
| 1 | Physical Layer | Cables, signals, hardware transmission |

**🧱 OSI Model – 7 Layers Explained**

Each layer in the OSI model performs a specific role and passes data to the layer above or below it.

**🔹 Layer 7: Application Layer**

* **Function:** Closest to the user. Provides network services directly to applications (e.g., browsers, email).
* **Examples:** HTTP, HTTPS, FTP, SMTP, DNS
* **Use Case:** You open a website using your browser — the browser uses HTTP here.

**🔹 Layer 6: Presentation Layer**

* **Function:** Translates data formats, encrypts/decrypts, compresses/decompresses.
* **Examples:** SSL/TLS, JPEG, ASCII, MP4
* **Use Case:** Data encryption via SSL/TLS in HTTPS occurs here.

**🔹 Layer 5: Session Layer**

* **Function:** Manages sessions — open, maintain, and terminate communication sessions.
* **Examples:** NetBIOS, RPC, PPTP
* **Use Case:** Video conferencing apps maintaining a session between two devices.

**🔹 Layer 4: Transport Layer**

* **Function:** Ensures reliable data transfer between systems. Provides **error recovery**, **flow control**, and **segmentation**.
* **Examples:** TCP, UDP
* **Use Case:** TCP ensures your email gets delivered completely and in order.

**🔹 Layer 3: Network Layer**

* **Function:** Responsible for **routing** and **logical addressing** (IP addresses).
* **Examples:** IP, ICMP, ARP, OSPF, BGP
* **Use Case:** Sending data from one city to another over different networks using IP routing.

**🔹 Layer 2: Data Link Layer**

* **Function:** Manages **MAC addressing**, **error detection**, and **framing** on the local network.
* **Examples:** Ethernet, Wi-Fi (IEEE 802.11), PPP, Switches
* **Use Case:** Your laptop sends data to a router using its MAC address.

**🔹 Layer 1: Physical Layer**

* **Function:** Transmits **raw bits** (0s and 1s) over a physical medium like cables or radio signals.
* **Examples:** Cables (Ethernet, Fiber), Hubs, Repeaters, Electrical signals, RF
* **Use Case:** Data travels through an Ethernet cable or over Wi-Fi radio waves.

**🧩 Data Flow in OSI**

When sending data:

* Data **starts at Layer 7** (Application) and **moves down to Layer 1** (Physical) on the sender’s side.
* It’s transmitted as bits over the medium.
* The receiver’s system **receives it at Layer 1** and moves **up to Layer 7** to reassemble the message.

**🔄 Mnemonic to Remember OSI Layers**

From Layer 7 → 1 (top-down):

**"All People Seem To Need Data Processing"**

From Layer 1 → 7 (bottom-up):

**"Please Do Not Throw Sausage Pizza Away"**

**2. TCP/IP Model (Internet Model)**

The **TCP/IP** model is a 4-layer model used in real-world internet communication.

| **Layer No.** | **TCP/IP Layer** | **Corresponds to OSI** |
| --- | --- | --- |
| 4 | Application Layer | OSI Layers 5, 6, 7 |
| 3 | Transport Layer | OSI Layer 4 |
| 2 | Internet Layer | OSI Layer 3 |
| 1 | Network Access Layer | OSI Layers 1 & 2 |

✅ **Real-World Relevance:** TCP/IP is what the internet is based on.

**📡 Common Network Protocols**

A **protocol** is a set of rules for data communication. Here are some key ones:

| **Protocol** | **Layer** | **Purpose/Function** |
| --- | --- | --- |
| **HTTP/HTTPS** | Application | Web browsing / Secure web communication |
| **FTP** | Application | File transfer |
| **SMTP/POP3/IMAP** | Application | Email sending/receiving |
| **DNS** | Application | Domain name to IP address resolution |
| **TCP** | Transport | Reliable connection-based communication |
| **UDP** | Transport | Fast, connectionless communication |
| **IP** | Internet | Routing and addressing |
| **Ethernet** | Data Link | LAN data transmission |
| **Wi-Fi (IEEE 802.11)** | Data Link | Wireless LAN |