

TCP/IP Model

- The TCP/IP model is a framework that is used to model the communication in a network. It is mainly a collection of network protocols and organization of these protocols in different layers for modeling the network.
- It has four layers, Application, Transport, Network/Internet and Network Access.
- While the OSI model has seven layers, the 4 layer TCP/IP model is simpler and commonly used in today's Internet and networking systems.

Layers of TCP/IP Model

1. Application Layer

- The Application Layer is the top layer of the TCP/IP model and the one closest to the user. This is where all the apps you use like web browsers, email clients, or file sharing tools connect to the network. It acts like a bridge between your software (like Chrome, Gmail, or WhatsApp) and the lower layers of the network that actually send and receive data. It supports different protocols like HTTP (for websites), FTP (for file transfers), SMTP (for emails), and DNS (for finding website addresses).

2. Transport Layer

The Transport Layer is responsible for making sure that data is sent reliably and in the correct order between devices. It checks that the data you send like a message, file, or video arrives safely and completely. This layer uses two main protocols: TCP and UDP, depending on whether the communication needs to be reliable or faster. TCP is used when data must be correct and complete, like when loading a web page or downloading a file.

3. Internet Layer

The Internet Layer is used for finding the best path for data to travel across different networks so it can reach the right destination. It works like a traffic controller, helping data packets move from one network to another until they reach the correct device. This layer uses the Internet Protocol (IP) to give every device a unique IP address, which helps identify where data should go. The main job of this layer is routing deciding the best way for data to travel. It also takes care of packet forwarding (moving data from one point to another), fragmentation (breaking large data into smaller parts), and addressing.

4. Network Access Layer

The Network Access Layer is the bottom layer of the TCP/IP model. It deals with the actual physical connection between devices on the same local network like computers connected by cables or communicating through Wi-Fi. This layer makes sure that data can travel over the hardware, such as wires, switches, or wireless signals. It also handles important tasks like using MAC addresses to identify devices, creating frames (the format used to send data over the physical link), and checking for basic errors during transmission.

When Sending Data (From Sender to Receiver)

- Application Layer: Prepares user data using protocols like HTTP, FTP, or SMTP.
- Transport Layer (TCP/UDP): Breaks data into segments and ensures reliable (TCP) or fast (UDP) delivery.
- Internet Layer (IP): Adds IP addresses and decides the best route for each packet.
- Link Layer (Network Access Layer): Converts packets into frames and sends them over the physical network.

When Receiving Data (At the Destination)

- Link Layer: Receives bits from the network and rebuilds frames to pass to the next layer.
- Internet Layer: Checks the IP address, removes the IP header, and forwards data to the Transport Layer.
- Transport Layer: Reassembles segments, checks for errors, and ensures data is complete.
- Application Layer: Delivers the final data to the correct application (e.g., displays a web page in the browser).

Simpler Structure	TCP/IP has only 4 layers, compared to 7 in OSI, making it easier to implement and understand in real systems.
Protocol-Driven Design	TCP/IP was designed based on working protocols, while the OSI model is more of a theoretical framework.
Flexibility and Robustness	TCP/IP adapts well to different hardware and networks and includes error handling, routing, and congestion control.
Open Standard	TCP/IP is open, free to use, and not controlled by any single organization, helping it gain universal acceptance.
Actual Use vs Conceptual Model	The OSI model is great for education and design principles, but TCP/IP is the one actually used in real-world networking.