Working & Functionality of TCP/IP Model

TCP/IP Model

Introduction

- The main work of TCP/IP is to transfer the data of a computer from one device to another. The main condition of this process is to make data reliable and accurate so that the receiver will receive the same information which is sent by the sender. To ensure that, each message reaches its final destination accurately, the TCP/IP model divides its data into packets and combines them at the other end, which helps in maintaining the accuracy of the data while transferring from one end to another end.

History

- The TCP/IP model was created in the 1970s by the Defense Advance Research Project Agency (DARPA) as an open, vendor-neutral, public networking model. Like the OSI model, it describes general guidelines for designing and implementing computer protocols. It consists of four layers: Network Access, Internet, Transport, and Application.

Difference between TCP and IP

- `TCP` and `IP` are different protocols of Computer Networks.
- The basic difference between TCP(Transmission Control Protocol) and IP(Internet Protocol) is in the transmission of data.
- IP finds the destination of the data and TCP has the work to send and receive the data.

Layers of TCP/IP Model

- The TCP/IP model contains 4 layers:
  1. Application Layer
  2. Transport Layer

3. Network/Internet Layer(IP)
4. Network Access Layer

Layer Number	Layer Name	Function	Protocols
4	Application	Generates data, Requests the connection.	SMTP, HTTP/HTTPS, FTP, SSH
3	Transport	Establishes an error-free data connection, splits the data into smaller packets, obtains acknowledgement of the reception of data.	UDP, TCP
2	Internet	Sends the packets, ensures, the packets are sent accurately, route data to correct network.	IPv4, ICMP, ARP
1	Network Access	Adds the destination MAC address, Sends data between applications over the network, handles the physical infrastructure.	

Layer 1: The Application Layer

- The application layer is the highest layer of the model. It's what you, as a user, see and interact with when sending and receiving data. It's also what generates the data and requests the connection. The application layer would be your email system in the previous example of requesting time off from work.

Layer 2: The Transport Layer

- It establishes a reliable and error-free data connection between the application or device and the destination. The transport layer splits the data into smaller packets and numbers them in sequence. It determines:
  - The amount of data to be sent,
  - The data's destination, and
  - The data transmission rate (flow control).

Layer 3: The Internet Layer

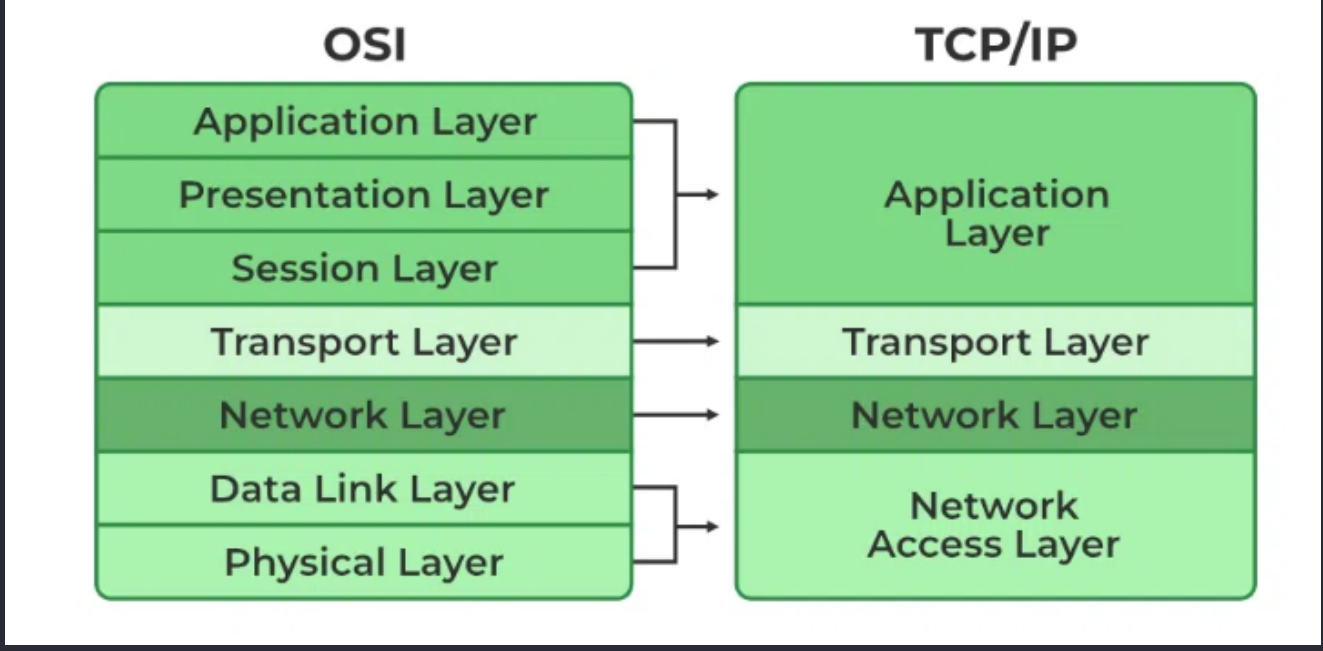
- The internet layer, also called the IP or network layer (though not to be confused with the network access layer, which we'll discuss momentarily), is responsible for sending the packets and ensures that the data is transferred as accurately as possible. It's a bit like the road traffic controller as it directs the flow and speed of traffic. It also provides the functions and procedural methods for the data sequences transfer.

Layer 4: The Network Access Layer

- The network access layer, also called the data link layer or physical layer, is the final layer in the TCP/IP model hierarchy. It corresponds to the data link layer and physical layer of the open systems interconnection (OSI) model
  - Adds the destination MAC address to data frames.
  - Transmits data between applications or devices over the network.
- It also handles the physical infrastructure enabling communication between devices over the internet. This includes:
  - Ethernet cables,
  - wireless networks,
  - network interface cards,
  - drivers, and more.

TCP/IP vs OSI Model

- The TCP/IP model has fewer layers than the OSI model. The OSI model has 7 layers and the TCP/IP model contains 4 layers.
- The OSI model's Application, Presentation, and session layers are merged into a single layer in the TCP/IP model. Also the Physical and Data Link layers are called the Network Access layer in the TCP/IP model.



- There are other differences between the two models besides the obvious difference in the number of layers.
  - OSI modle prescribes the steps needed to transfer data over a network, and it if very specific in it, defining which protocol is used in each layer and how.
  - The TCP/IP model is not that specific about which protocol to use and how to transfer data over the network.

Conclusion

- As an IT professional, having a strong understanding of the TCP/IP model and its uses will serve you well in your day-to-day responsibilities. With cyber attacks on the rise, knowing TCP/IP inside and out will enable you to protect your network infrastructure against external threats and optimize its design accordingly.