Learn more about the TCP/IP model

In this reading, you will build on what you have learned about the Transmission Control Protocol/Internet Protocol (TCP/IP) model, consider the differences between the Open Systems Interconnection (OSI) model and TCP/IP model, and learn how they're related. Then, you'll review each layer of the TCP/IP model and go over common protocols used in each layer.

As a security professional, it's important that you understand the TCP/IP model because it describes the functions of various network protocols. The TCP/IP model is based on the TCP/IP protocols suite that includes all network protocols that support the main TCP/IP protocol. To reiterate from previous lessons, a network protocol, also known as an internet protocol, is a set of standards used for routing and addressing data packets as they travel between devices on a network. In this reading, you will learn which network protocols operate on which communication layers of the TCP/IP model. The two most common models available are the TCP/IP and the OSI model. These models are a representative guideline of how hosts communicate across a network. The examples provided in this course will follow the TCP/IP model.

The TCP/IP model

The **TCP/IP model** is a framework used to visualize how data is organized and transmitted across a network. This model helps network engineers and network security analysts conceptualize processes on the network and communicate where disruptions or security threats occur.

The TCP/IP model has four layers: the network access layer, internet layer, transport layer, and application layer. When troubleshooting issues on the network, security professionals can analyze which layers were impacted by an attack based on what processes were involved in an incident.

Network access layer

The network access layer, sometimes called the data link layer, deals with the creation of data packets and their transmission across a network. This layer corresponds to the physical hardware involved in network transmission. Hubs, modems, cables, and wiring are all considered part of this layer. The address resolution protocol (ARP) is part of the network access layer. Since MAC addresses are used to identify hosts on the same physical network, ARP is needed to map IP addresses to MAC addresses for local network communication.

Internet layer

The internet layer, sometimes referred to as the network layer, is responsible for ensuring the delivery to the destination host, which potentially resides on a different network. It ensures IP addresses are attached to data packets to indicate the location of the sender and receiver. The internet layer also determines which protocol is responsible for delivering the data packets and ensures the delivery to the destination host. Here are some of the common protocols that operate at the internet layer:

- **Internet Protocol (IP)**. IP sends the data packets to the correct destination and relies on the Transmission Control Protocol/User Datagram Protocol (TCP/UDP) to deliver them to the corresponding service. IP packets allow communication between two networks. They are routed from the sending network to the receiving network. TCP in particular retransmits any data that is lost or corrupt.
- **Internet Control Message Protocol (ICMP)**. The ICMP shares error information and status updates of data packets. This is useful for detecting and troubleshooting network errors. The ICMP reports information about packets that were dropped or that disappeared in transit, issues with network connectivity, and packets redirected to other routers.

Transport layer

The transport layer is responsible for delivering data between two systems or networks and includes protocols to control the flow of traffic across a network. TCP and UDP are the two transport protocols that occur at this layer.

Transmission Control Protocol

The **Transmission Control Protocol (TCP)** is an internet communication protocol that allows two devices to form a connection and stream data. It ensures that data is reliably transmitted to the destination service. TCP contains the port number of the intended destination service, which resides in the TCP header of a TCP/IP packet.

User Datagram Protocol

The **User Datagram Protocol (UDP)** is a connectionless protocol that does not establish a connection between devices before transmissions. It is used by applications that are not concerned with the reliability of the transmission. Data sent over UDP is not tracked as extensively as data sent using TCP. Because UDP does not establish network connections, it is used mostly for performance sensitive applications that operate in real time, such as video streaming.

Application layer

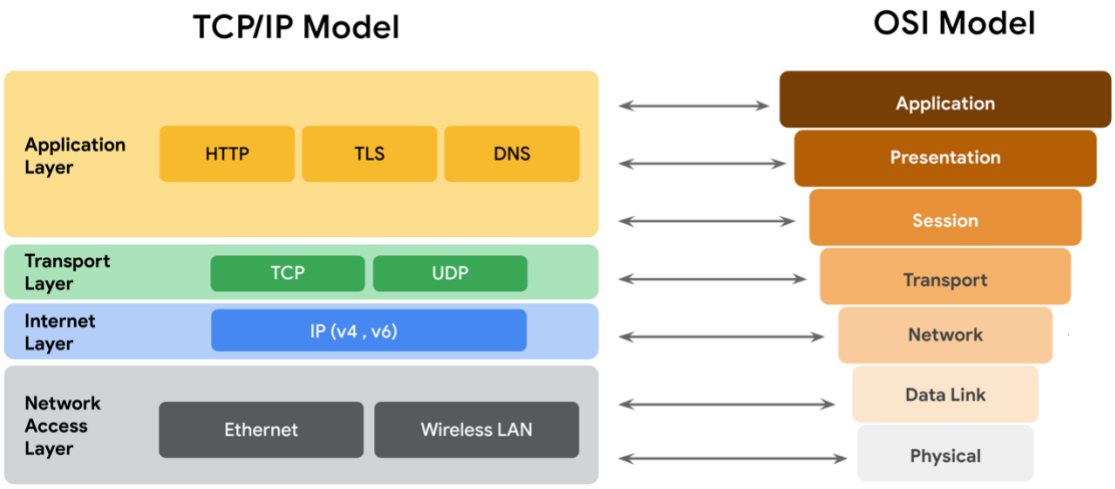
The application layer in the TCP/IP model is similar to the application, presentation, and session layers of the OSI model. The application layer is responsible for making network requests or responding to requests. This layer defines which internet services and applications any user can

access. Protocols in the application layer determine how the data packets will interact with receiving devices. Some common protocols used on this layer are:

- Hypertext transfer protocol (HTTP)
- Simple mail transfer protocol (SMTP)
- Secure shell (SSH)
- File transfer protocol (FTP)
- Domain name system (DNS)

Application layer protocols rely on underlying layers to transfer the data across the network.

TCP/IP model versus OSI model



The **OSI** visually organizes network protocols into different layers. Network professionals often use this model to communicate with each other about potential sources of problems or security threats when they occur.

The TCP/IP model combines multiple layers of the OSI model. There are many similarities between the two models. Both models define standards for networking and divide the network communication process into different layers. The TCP/IP model is a simplified version of the OSI model.

Key takeaways

Both the TCP/IP and OSI models are conceptual models that help network professionals visualize network processes and protocols in regards to data transmission between two or more systems. The TCP/IP model contains four layers, and the OSI model contains seven layers.