

OSI Reference Model - Upper Layers

by Sophia



WHAT'S COVERED

In this lesson, you will learn about the OSI reference model, and the primary functions of each of its upper three layers.

Specifically, this lesson will cover the following:

1. The Open Systems Interconnection (OSI) Reference Model

1a. OSI Layer 7: The Application Layer

1b. OSI Layer 6: The Presentation Layer

1c. OSI Layer 5: The Session Layer

1. The Open Systems Interconnection (OSI) Reference Model

The **Open Systems Interconnection (OSI) reference model** is a conceptual framework that helps us understand how one computer or digital device communicates with another computer or digital device across a data network.



BIG IDEA

The OSI model provides information technologists with a way to talk about how networks work by providing useful common points of reference. Those specific points of reference are called layers, and the OSI model has seven of them.

Before getting into the details of the seven-layer OSI model, consider another situation that uses layers as a model when building something.

IN CONTEXT

A popular fast food restaurant chain may use a 13-layer model to build its big hamburger sandwich in a

very specific way so that your sandwich tastes exactly the same whether you buy it in New York City, London, Tokyo, or anywhere else in the world. The model might list a specific order for how the sandwich is constructed. For example, it could include a bottom bun, secret sauce, chopped onions, chopped lettuce, American cheese, a beef patty, a middle bun, secret sauce, chopped onions, chopped lettuce, pickle chips, a beef patty, and a top bun. Your taste experience might change significantly if, for example, someone made your sandwich with pickles on the bottom bun instead of under the top burger patty. The sandwich might not work at all if a restaurant worker built your sandwich by placing American cheese and secret sauce underneath the bottom bun. A model that defines the specific order of how to build the sandwich helps to ensure each customer's taste experience is predictable and satisfying.

Similarly, when your computer needs to communicate with another computer, the steps for how that happens needs to be consistent for both computers. If it is not consistent, communication would be impossible.



BIG IDEA

- The seven layers of the OSI model define how computers and other digital devices communicate with each other across a network.
- The OSI model does this in a way that enables computers and digital devices from all manufacturers to work together. Information technologists often use the term “interoperate” meaning “to work together.”
- The OSI model enables **interoperability** so that your computer or digital device can communicate with other computers or digital devices whether they were made in the United States, Finland, India, China, Japan, or any other place in the world.

The OSI model is only a conceptual model that is used as a reference to understand and talk about how data networks operate in theory. In practice, all digital networks today use the **TCP/IP** protocol suite to move data from one computer to another across a data communications network. You will learn about TCP/IP later in the course.



KEY CONCEPT

The OSI model has seven layers, and they are listed here from top to bottom:

- Layer 7: Application
- Layer 6: Presentation
- Layer 5: Session
- Layer 4: Transport
- Layer 3: Network
- Layer 2: Data Link
- Layer 1: Physical

This image describes the layers in detail including their functions:

Application	- File, print, message, database, and application services
Presentation	- Data encryption, compression, and translation services
Session	- Dialog control
Transport	- End-to-end connection
Network	- Routing
Data Link	- Framing
Physical	- Physical topology

The OSI model is hierarchical, and there are beneficial characteristics of the layered model. Understand that the primary purpose of the OSI is to allow different vendors' network hardware to interoperate seamlessly.

KEY CONCEPT

The most important advantages gained by using the OSI layered model include the following:

- It divides network communication processes into smaller and simpler components, thus aiding component development, design, and troubleshooting.
- It allows multiple-vendor development through the standardization of network components.
- It encourages industry standardization by defining the specific functions that occur at each layer of the model.
- It allows various types of network hardware and software to communicate.
- It prevents changes in one layer from affecting other layers, facilitating development and making application programming much easier.

Next, you will learn about how the top three layers of the OSI model define the rules that determine how the applications working within host machines communicate with each other as well as with end users. The bottom four layers define how the actual data is transmitted from end to end, and you will learn about those in the next lesson.

BIG IDEA

The OSI reference model is a conceptual framework that provides a way to understand how data networks function.

TERMS TO KNOW

Open Systems Interconnection (OSI) Reference Model

A conceptual framework that helps us understand how one computer or digital device can communicate with another computer or digital device.

Interoperability

To work together.

TCP/IP

A standard for computer network communication, used in particular for the internet.

1a. OSI Layer 7: The Application Layer

The **application layer** of the OSI model is the place where users actually communicate or interact with the computer. Technically, users communicate with the network stack through **application programming interfaces**, or APIs, that connect the application in use with the operating system of the computer.

The application layer sends data from an application, like File Transfer Protocol (FTP), to the application layer of the destination host, and may control for data integrity and error recovery. The application layer comes into play only when it is apparent that access to the network will be needed soon. Take the case of your computer's browser, e.g., Chrome or Firefox.



DID YOU KNOW

You could uninstall every trace of networking components from a system, such as TCP/IP, the network interface card, and so on, and you could still use your browser to view a local **HTML** document without a problem. But without the APIs in the application layer, it would be impossible to retrieve an HTML document using **HTTP** or download a file with **FTP** or **TFTP** from a remote computer.

The application layer acts as an interface between the application program—which isn't part of the layered structure—and the next layer below by providing ways for the application to send information down through the **protocol stack**. In other words, a browser doesn't reside within the application layer; it interfaces with application layer protocols when it needs to access remote resources.

Accessing network resources is important because computer applications sometimes require more than just desktop resources. Often, they unite, communicating components from more than one network application. A prime example is when you use an email app to compose a message that includes an attachment, and you use File Explorer in Windows to select and attach that file.



TERMS TO KNOW

Application Layer

The layer where users communicate with the network stack through application program interfaces, or APIs, that connect the application in use to the operating system of the computer.

Application Programming Interface (API)

The computer code in an application that calls for remote networked services.

HTML

Hypertext Markup Language; used to instruct browsers on how to format and display World Wide Web content.

HTTP

Hypertext Transfer Protocol; the protocol used most commonly to transfer webpages and accompanying data over the internet.

FTP

File Transfer Protocol, used to move a file from one computer to another with a guarantee of delivery.

TFTP

Trivial File Transfer Protocol, used to move a file from one computer to another without a guarantee of delivery.

Protocol Stack

An implementation of a computer networking protocol suite or protocol family, e.g., TCP/IP.

1b. OSI Layer 6: The Presentation Layer

The **presentation layer** gets its name from its purpose.



KEY CONCEPT

The presentation layer, as the name implies, presents data to the application layer. This is necessary because data is translated from the proprietary format of each application to a standard format for transmission. Then the presentation layer on the other end reverses that translation so the data is returned to its original format for the receiving application.

By providing translation services, the presentation layer ensures that the data transmitted by one system's application layer can be read and understood by the application layer on the system receiving that data. The OSI has protocol standards that define how standard data should be formatted. Tasks like data compression, decompression, encryption, and decryption are all associated with this layer. Some presentation layer standards may be involved in multimedia operations.



TERM TO KNOW

Presentation Layer

The layer that presents data to the application layer and is responsible for data translation and computer code formatting.

1c. OSI Layer 5: The Session Layer

The **session layer** is responsible for setting up, managing, and then tearing down communications sessions between networked computers. This layer also provides communications control between devices. It coordinates communication between systems and serves to organize their communication by offering three different modes: simplex, half duplex, and full duplex.



KEY CONCEPT

A **simplex** transmission is a one-way, or unidirectional, communication. For example, a conventional radio station broadcast that you may be listening to is a simplex transmission because you can receive the signal

on your radio, but you cannot transmit messages back to the radio station.



KEY CONCEPT

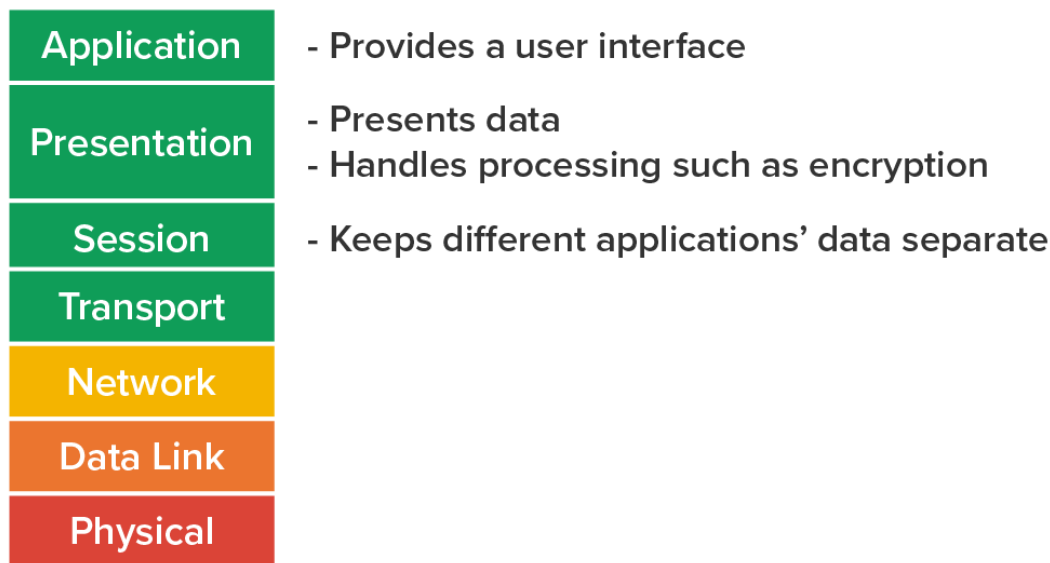
A **half-duplex** transmission is a communication in which you can both transmit and receive signals but only one way at a time. Think of the old-time walkie talkies in the movies where the people talking had to say “over” to indicate that they were going to stop talking and start listening.



KEY CONCEPT

A **full-duplex** transmission is a communication that allows you to speak and listen at the same time, for example, talking on a mobile phone.

The session layer keeps applications’ data separate from other applications’ data. For a good example, the session layer allows multiple web browser sessions on your desktop at the same time.



DID YOU KNOW

The TCP/IP model has its own multi-level structure, in which OSI layers 5, 6, and 7 are combined into a single layer. We will learn more about TCP/IP later in the course.



TERMS TO KNOW

Session Layer

Responsible for setting up, managing, and then tearing down communications sessions between networked computers.

Simplex

Unidirectional; a one-way transmission.

Half Duplex

Providing communication in both directions, but only one direction at a time, not simultaneously.

Full Duplex

Describing a duplex system in which both parties can communicate with each other simultaneously.



SUMMARY

In this lesson, you learned introductory information regarding the **Open Systems Interconnection (OSI) reference model**. You learned that it is a conceptual framework for understanding how one computer or digital device can communicate with another computer or digital device across a data network. Finally, you learned that the upper three layers of the OSI model were introduced: the **application layer** (seven), the **presentation layer** (six), and the **session layer** (five).

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