# CompTIA Network+ Exam Files

# The OSI Model

The OSI Model (Open Systems Interconnection Model) us a conceptual framework used to describe the functions of a networking system. The OSI model characterizes computing functions into a universal set of rules and requirements in order to support interoperability between different products and software. In the OSI reference model, the communications between a coimputing system are split into seven different layers: **Physical Layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer.**

Created at a time when network computing was in its infancy, the OSI was published in 1984 by the International Organization of Standardization (ISO). Though it does not always map directly to specific systems, the OSI Model is still used today as a means to describe Networ Architecture.

# The 7 Layers of the OSI Model

## Physical Layer

The Lowest layer of the OSI Model is concerned with electronically or optically transmitting raw unstructured data bits across the network from the physical layer of the sending device to the physical layer of the receiving device. It can include specifications such as voltages, pin layout, cabling, and radio frequencies. At the physical layer, one might find “physical” resources such as network hubs, cabling, repeaters, network adapters or modems.

This layer includes the physical equipment involved in the data transfer, such as the cables andswitches. This is also the layer where the data gets converted into a bit stream, hwioch is a string of 1s and 0s . the physical layer of both devices must also agree on a signal convention so that the 1s can be distinguished from the 0s on both devices.

## Data Link Layer

At the Data Link layer, directly connected nodes are used to perform node-to-node data transfer where data is packaged into frames. The data link layer also corrects errors that may have occurred at the physical layer.

The data link layer encompasses two sub-layers of its own. The first, media access control (MAC), provides flow control and multiplexing for device transmissions over a network. The second, the logical link control (LLC). Provides flow and error control over the physical medium as well as identifies line protocols.

The data link layer is very similar to the network layer except the data link layer facilitates data transfer between two devices on the same network. The data link layer takes packets from the network layer and breaks them into smaller pieces called frames. Like the network laer, the data link is also responsible for flow control and error control in intra-network communication (The transport layer only does flow control and error control for inter-network communications).

## Network Layer

The network layer is responsible for receiving frames from the data link layer, and delivering them to their intended destinations, based on the addresses contained inside the frame. The network layer finds the destinations by using logical addresses, such as IP (internet protocol) addresses. At the layer, routers are a crucial component used to quite literally route information where it needs to go between networks.

The network layer is responsible for facilitating data transfer between two different networks. If the two devices communicate on the same network, then the network layer is unnecessary. THe network layer breaks up segments from the transport layer into smaller units, called packets, on the sender’s device, and reassembles these packets on the receiving device. The network layer also finds the best physical path for the data to reach its destination; this is known as routing.

Network layer protocols include IP (internet protocol), ICMP (Internet Control Message Protocol), the IGMP (Internet Group Message Protocol), and the IPsec suite.

## Transport Layer

The transport layer manages the delivery and error checking of data packets. It regulates the size, sequencing, and ultimately the transfer of data between systems and hosts. One of the most common examples of the transport layer is TCP or the Transmission Control Protocol.

Layer 4 is responsible for end-to-end communication between the two devices. This includes taking data from the session layer and breaking it up into chunks called segments before sening it to layer 3. THe transport layer on the receiving device is responsible for reassembling the segments into data the session layer can consume.

The transport layer is also responsible for flow control and error control. Flow control determines an optimal speed of transmission to ensure that a sender with a dast connection does not overwhelm a receiver end by ensuring that the data received is complete, and requesting a retransmission if it isn’t.

Transport layer protocols include the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).

## Session Layer

The session layer controls the conversations between different computers. A session or connection between machines is set up, managed, and terminated at layer 5. Session layer services also include authentication and reconnection.

This is the layer responsible for opening and closing communication between the two devices. The time between when the communication is opened and closed is known as the session. The session layer ensures that the session stays open long enough to transfer all the data being exchanged, and then promptly closes the session in order to avoid wasting resources.

The session layer also synchronized data transfer with checkpoints. For examples, if a 100 megabyte file is being transferred, the session layer could set acheckpoint every 5 megabytes. In the case of a disconnect or a crash after 52 megabytes have been transferred, the session could be resumed from the last checkpoint, meaning only 50 more megabytes of data need to be transferred. Without the checkpoints, the entire transfer would have to begin again from scratch.

## Presentation Layer

The presentation layer formats or translates data for the application based on the syntax or semantics that the application accepts. Because of this, it at times is also called the syntax layer. This layer can also handle the encryption and decryption required by the application layer.

This layer is primarily responsible for preparing data so that it can be used by the application layer; in other words, layer 6 makes the data presentable for applications to consume and read. The presentation layer is responsible for things such as **translation**, **encryption**, and **compression** of data.

Two communicating devices communicating may be using different encoding methods, so layer is responsible for translating incoming data into a syntax that the application layer of the receiving device can understand.

If the devices are communicating over an encrypted connection, layer 6 is responsible for adding the encryption on the sender’s end as well as decoding the encryption on the receiver’s end so that it can presen the application layer with unencrypted, readable data.

Finally the presentation layer is responsible for compressing data it receives from the application layer before deliivering it to layer 5. This helps improve the speed and efficiency of communication by minimizing the amount of data that will be transferred.

## Application Layer

At this layer, both the end user and the application layer interact directly with the software application. This layer sees network services provided to end-user applications such as a web browser or Office 365. The application layer identifies communication partners, resources availability, and synchronizes communication.

This is the only layer that **directly interacts** with data from the **user.** Software applications like **web browsers** and email clients rely on the application layer to initiate communications. But it should be made clear that client software is responsible for the protocols and data manipulation that the software relies on to present meaningful data to the user.

Application layer protocols include **HTTP** as well as **SMTP** (simple mail transfer protocol).

## How Data flows through the OSI Model

In order for human-readable information to be transferred over a network from one device to another, the data must travel down the seven layers of the OSI model on the sending device and then travel up the seven layers on the receiving end.

For example: Mr. Cooper wants to send Ms. Palmer an email. Cooper compresses his message in an email application on his laptop and then hits send. His email application will pass his message over to the application layer, which will pick a protocol (SMTP) and pass the data along to the presentation layer. THe presentation layer will then compress the data and then it will hit the session layer, which will initialize the communication session.

The data will then hit the sender’s transportation layer where it will be egmented, then those segments will be broken up into packers at the network layer, which will be broken down even further into frames at the data link layer. The data link layer will then deliver those frames to the physical layer, which will convert the bitstream from 1s to 0s and send it through a physical medium such as a cable.

Once Palmer’s computer receives the bitstream through a physical medium (such as her wifi), the data will flow through the same series of layers on her device (in the opposite order), until it reaches the application layer. The application layer will then feed the human-readable data along to Palmer’s email software, which will allow her to read Cooper’s email on her laptop screen.

### Simplified

| Layer 7 | **Application Layer** | Human-computer interaction layer where applications can **access the network services** |
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| Layer 6 | **Presentation Lyaer** | Ensures that data is in a usable format and is where the data **encryption/decryption occurs** |
| Layer 5 | **Session Layer** | Maintain connections and is responsible for **controlling ports and sessions** |
| Layer 4 | **Trasnport Layer** | **Transmits data** using transmission protocols including **TCP** and **UDP** |
| Layer 3 | **Network Layer** | Decides which **Physical path** the **data** will take |
| Layer 2 | **Data Link Layer** | Defines the **format of data** on the network |
| Layer 1 | **Physical Layer** | Transmits raw **bit stream** over the **physical medium** |