2.2.5 OSI Layers Facts

This lesson covers the following topics:

- OSI model layer functions
- TCP/IP model layers
- Model comparison

OSI Model Layer Functions

The following table describes the functions performed at each OSI model layer.

Layer	Description and Keywords

Application (Layer 7)	The Application layer integrates network functionality into the host operating system and enables communication between network clients and services.
	
	- The Application layer does not include specific applications that provide services, but rather provides the capability for services to operate on the network.
	- Most Application layer protocols operate at multiple layers down to the Session and even Transport layers. However, these protocols are classified as Application layer protocols because they start at the Application layer (the Application layer is the highest layer they operate in).
	- Services typically associated with the Application layer include:
	    ○ Hypertext Transfer Protocol (HTTP)
	    ○ Telnet
	    ○ File Transfer Protocol (FTP)
	    ○ Trivial File Transfer Protocol (TFTP)
	    ○ Simple Network Management Protocol (SNMP)

Presentation (Layer 6)	The Presentation layer formats (presents) data in a form compatible for receipt by the Application layer or the destination system. Specifically, the Presentation layer: - Formats and translates data between systems.

	- Negotiates data transfer syntax between systems. It converts character sets to the correct format. - Encapsulates data into message envelopes. It encrypts and compresses the data. - Restores data through decryption and decompression.
Session (Layer 5)	The Session layer manages the sessions in which data are transferred. A *session* refers to each client connection. Session layer functions include: - Management of multiple sessions. A server can concurrently maintain thousands of sessions. - Assignment of a session ID number to each session to keep data streams separate. - The setup, maintenance, and teardown of communication sessions.
Transport (Layer 4)	The Transport layer provides a transition between the upper and lower layers of the OSI model. The transition makes the upper and lower layers transparent to each other. Transport layer functions include: - End-to-end flow control. - Port and socket number assignment. - Segmentation, sequencing, and combination. - Connection services, either reliable (connection-oriented) or unreliable (connectionless) delivery of data. A data *segment* is a unit of data at the Transport layer.
Network (Layer 3)	The Network layer describes how data is routed across networks and on to the destination. Network layer: - Identifies hosts and networks by using logical addresses. - Maintains a list of known networks and neighboring routers. - Determines the next network point where data should be sent. To select the optimal path for data, routers use a routing protocol that takes various factors into account, such as the number of hops in the path, link speed, and link reliability. A *packet* is a data segment at the Network layer.
Data Link (Layer 2)	Logical Link Control (LLC)	The Data Link layer defines the rules and procedures for hosts as they access the

		Physical layer. These rules and procedures define:
	Media Access Control (MAC)	- How physical network devices are identified on the network by defining a unique hardware address (physical or MAC address). - How and when devices have access to the LAN and can transmit on the network medium (media access control and logical topology). - How to verify that the data received from the Physical layer is error free (using parity and cyclic redundancy check (CRC)). - How devices control the rate of data transmission between hosts (flow control). The Data Link layer has two sublayers: - The LLC is the upper sublayer. It: - Is an interface between the MAC sublayer and the Network layer. - Provides flow control and transmission for analog and/or digital streams of over a shared link for the logical link. - The MAC layer is the lower sublayer. The MAC sublayer: - Controls the hardware. - Provides flow control and transmission for analog and/or digital streams of over a shared link. *Frames* are data segments at the Data Link layer. Switches, bridges and NICs, and WAPs function in Layer 2.
	Physical (Layer 1)	The Physical layer of the OSI model sets standards for sending and receiving electrical signals between devices. Protocols at the Physical layer identify: - Conversion of digital data (bits) to electric pulses, radio waves, or pulses of light. - Specifications for cables and connectors. - The physical topology. *Bits* are data segments at the Physical layer. NICs, repeaters, hubs, WAPs, and modems function in Layer 1.

TCP/IP Model Layers

The TCP/IP model incorporates the general concepts and structure of the OSI model. The layers of the TCP/IP model are as follows:

Layer	Description
Application	The Application layer corresponds to the Session, Presentation, and Application layers of the OSI model. Protocols associated with the Application layer include: • FTP • HTTP • Telnet • Simple Mail Transfer Protocol (SMTP) • Domain Name System (DNS) • SNMP
Transport	The Transport layer matches the Transport of the OSI model. This layer is responsible for: • Error checking and reliable packet delivery. • Breaking the data stream into segments. • Assigning sequence numbers so the packets can be reassembled correctly on the remote side after transport. Protocols associated with the Transport layer include: • Transport Control Protocol (TCP) • User Datagram Protocol (UDP)
Internetwork	The Internetwork layer is comparable to the Network layer of the OSI model. It is responsible for moving packets through a network. This involves: • Addressing hosts. • Making routing decisions to identify how the packet traverses the network.

Protocols associated with the Internetwork layer include:

- Address Resolution Protocol (ARP)
- Internet Control Message Protocol (ICMP)
- Internet Group Management Protocol (IGMP)

Network	The Network layer, (sometime called the Link Layer) corresponds to the Physical and Data Link layers of the OSI model. It is responsible for describing the physical layout of the network and formatting messages on the transmission medium.

> (i) The TCP/IP model focuses specifically on the functions in the Internet layer and Transport layers. All other functions of the traditional OSI model are encompassed in the first and fourth layers.

Model Comparison

The following graphic shows how the two networking models map to each other:

OSI Model

Application
Presentation
Session
Transport
Network
Data Link
Physical

TCP/IP Model

Application
Transport
Internetwork
Network