

Networking



Networking Fundamentals

1.1.1 OSI Model

What are the layers of the OSI model and what is the function of each layer?

Overview

The student will be able to compare and contrast the Open Systems Interconnection (OSI) model layers and encapsulation concepts .

Grade Level(s)

10, 11, 12

Cyber Connections

- Threats & Vulnerabilities
- Networks & Internet
- Hardware & Software

This content is based upon work supported by the US Department of Homeland Security's Cybersecurity & Infrastructure Security Agency under the Cybersecurity Education Training and Assistance Program (CETAP).

Teacher Notes:

CompTIA N10-008 Network+ Objectives

Objective 1.1

- Compare and contrast the Open Systems Interconnection (OSI) model layers and encapsulation concepts.
 - OSI Model
 - Layer 1 – Physical
 - Layer 2 – Data Link
 - Layer 3 – Network
 - Layer 4 – Transport
 - Layer 5 – Session
 - Layer 6 – Presentation
 - Layer 7 – Application

The OSI Model

In 1978, the International Standards Organization (ISO) began to develop its OSI framework architecture. The Open System Interconnection Reference Model (OSI Reference Model or OSI Model) describes layered communications and computer network protocol & transmission design. It is a tool to visualize how data moves in a network - from the bit level to the “human” level. It divides data movement into seven layers: the Application, Presentation, Session, Transport, Network, Data Link, and Physical Layers from top to bottom. Here are the seven layers of the OSI model:

Layer 1: Physical

The *physical layer*, also the lowest layer, defines the electrical and physical specifications for devices. It represents the relationship between a device and a physical medium. It includes the layout of pin, voltages, cable specification, hubs, repeaters, network adapters, host bus adapters, and more: 0's and 1's. This is where data is transferred as 0's and 1's.

Layer 2: Data Link

The *data link* layer provides the functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the Physical Layer.

MAC Address is used at this layer. Switches function at this layer.

Teacher Notes:

Layer 3: Network

The *network layer* provides the functional and procedural means of transferring data from a source to a destination via one or more networks. Routers and IP addressing function at this level. This layer decides what is the best path that the data should take across the network.

Layer 4: Transport

The *transport layer* provides transparent data transfer between end users, providing reliable data transfer services to the upper layers. The Transport Layer controls the reliability of a given link through flow control, segmentation/desegmentation, and error control. This is the layer where data is transmitted using protocols like TCP and UDP.

Layer 5: Session

The *session layer* controls the dialogues (connections) between computers. It establishes, manages, and terminates the connections between the local and remote applications.

Layer 6: Presentation

The *presentation layer* establishes a context between Application Layer entities. This layer provides independence from differences in data representation (e.g., encryption) by translating from application to network format and vice versa. This layer formats and encrypts data to be sent across a network, allowing compatibility problems. This is where the data starts to become a usable format for the user/applications.

Layer 7: Application

The *application layer* is the OSI layer closest to the end-user, which means that both the OSI application layer and the user interact directly with the software application. Application layer functions typically include: identifying communication partners, and determining resource availability. This is the layer that the user of the system can interact with.

Teacher Notes:

OSI Model			
	Data unit	Layer	Function
Host layers	<i>Data</i>	7. Application	Network process to application
		6. Presentation	Data representation, encryption and decryption
		5. Session	Interhost communication
	<i>Segments</i>	4. Transport	End-to-end connections and reliability, Flow control
Media layers	<i>Packet</i>	3. Network	Path determination and logical addressing
	<i>Frame</i>	2. Data Link	Physical addressing
	<i>Bit</i>	1. Physical	Media, signal and binary transmission