The OSI Model

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What is the OSI Model?

The Open Systems Interconnection (OSI) is a seven layer model that helps technicians to recognize how devices communicate on network. The International Standards Organization (ISO) outlines the OSI model in ISO/IEC 7498-1.

The first three OSI layers are referred to as hardware layers. The fourth through seventh layer function as software layer, where the work is done virtually.

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

Layer 1 – Physical

The Physical Layer of the OSI Model provides a path to transmit and receive data bits while using medium such as coax cable, multiple conductor cable, fiber optic cable, and different frequencies that transmit without the aid of a manufactured conductor.

The first layer is able to monitor its operation and perform functions such as revealing errors, multiplexing, and collision detection to maintain the bit stream between two network devices.

Layer	1
Name	Physical
Description	The Physical Layer of the OSI Model provides the medium for bit transmission between two devices on a network
Network Devices	Hub, Repeater, Network Interface Card (NIC), Modem, Category 5 and 6 Cable, Fiber Optic Cable, Coax Cable, Wireless NICs

Layer 2 – Data Link

The Data Link Layer of the OSI Model uses the Logical Link Control (LLC) and the Media Access Control (MAC) to manage data frames being sent and received through the layer 1, physical medium.

The MAC sub-layer is responsible for addressing. The LLC sub-layer does synchronizes frames, error checking and flow control.

Layer	2
Name	Data Link
Description	The Data Link Layer of the OSI Model provides the physical addressing of the Network Interface Card (NIC) with Media Access Control (MAC) and synchronize frames, handles error checking and flow control with Logical Link Control (LLC).
Network Devices	Bridges and switches

Media Access Control (MAC)

Media Access Control (MAC) is a subcomponent of the second layer in the OSI model. The Media Access Control identification or MAC address is given to the network card or on computer's motherboard with an embedded NIC when it is manufactured.

The unique MAC address has six two digit hexadecimal numbers. An example would be 00-13-20-A6-E5-79. It is a 48 bit address that creates 281,474,976,710,656 or 281 trillion addresses. We can find the MAC address on our computer by using the TCP utility, IPCONFIG/all.

Hexa decimal	Binary Number	Hexa decimal	Binary Number
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

01-13-21-A6-E5-79 is 00000001-00010011-00100001-10100110-11100101-01111001

Logical Link Control

Logical Link Control (LLC) sub-layer handles error control, flow control, framing. The LLC sub-layer handles the flow of data frames going back and forth over the physical layer. The Ethernet packet has a standard format so the information can be easily handled.

The frame structure for an 802.3 Ethernet frame that contains the 802.2 LLC information

Preamble 7 bytes	SFD 1 byte	Destination Address 6 bytes	Source Address 6 bytes	Frame Length 2 bytes	DSAP 1 byte	SSAP 1 byte	Control 1 byte	Data 46 to 1500 bytes	Frame Check Sequence

The 802 frame begins with a repeating preamble and then the 8 bit Start Frame Delimiter (SFD). The destination address has the six byte mac address and the source address also has the six byte or 48 bit MAC address. The Frame Length is 2 bytes. The Destination Service Access Point (DSAP and Source Service Access Point (SSAP) is next. Then comes a 1 byte Control and then the data. Last is the Frame Check Sequence for error checking.

Layer 3 – Network

The Network Layer of the OSI Model is responsible for routing the packets through the interconnecting networks. The network layer is accountable for identifying the paths to other parts of the network and determines the path send packets.

Layer	3
Name	Network
Description	The Network Layer of the OSI Model is responsible for routing the packets through interconnecting networks.
Network Devices	Router

Layer 4 – Transport

The Transport Layer of the OSI Model is responsible for the successful delivery of packets over the network. Layer 4 segments the packets, attaches the sequence number, source and destination addresses, and reassembles the packets together at the destination.

This layer does error checking and if a packet is damaged during delivery, the transport function will request that the packet will be resent. Error free packets are reassembled at the destination.

Layer	4
Name	Transport
Description	The Transport Layer of the OSI Model responsible for the successful delivery of packets over the network.
Network Devices	None

Layer 5 – Session

The Session Layer of the OSI Model opens, manages and closes the dialogue between network devices. Programmers use Application Program Interfaces (API) to establish communications between applications.

Layer	5
Name	Session
Description	The Session Layer opens, manages and closes the dialogue between network devices.
Network Devices	None

Layer 6 – Presentation

The Presentation Layer of the OSI Model handles translation challenges between different types of manufactured machines, compression and decompression of data, and encryption and decryption of information for security.

Layer	6
Name	Presentation
Description	The Presentation Layer of the OSI Model handles translation services for different machines, compression and decompression of data and encryption and decryption of information for security.
Network Devices	None

Layer 7 – Application

The Application Layer of the OSI Model gives the user the means to access information over the network by providing services to the actual application such as email, browsers and file transfer programs.

Layer	7
Name	Application
Description	The Application Layer of the OSI Model gives the user the means to access information over the network by providing services to the actual application such as email, browsers and file transfer programs.
Network Devices	None

Describe the OSI Model?

Fill in the blanks to describe the OSI Model:

	Layer Name	Description	Hardware Functioning on
Layer 7			
Layer 6			
Layer 5			
Layer 4			
Layer 3			
Layer 2			
Layer 1			

Answer these Questions

1. How many layers in the OSI model?
2. What is the four bit number for the hexadecimal letter "C"?
3. What are the two subcomponent layers of the Data Link layer?
4. Name the three hardware layers of the OSI model.
5. How many bits in a MAC address?
6. What OSI layer is responsible for data compression?
7. A Network Interface Card operates on what OSI layer?
8. What OSI layer would determine paths using a routing table?
9. What OSI layer is responsible for reorganizing sent packets?
10. What OSI layer does a switch operate on?

Reference

ISO/IEC 7498-1, Information Technology –Open Systems Interconnection – Basic Reference Model: The Basic Model,, Second Edition, June 15, 1996, International Standard Organization, 1994, Geneva, Switzerland