

OSI Reference Model

Commonly known as the OSI Reference Model, the **Open Systems Interconnection Reference Model** is an abstract layered representation of communications and computer network protocol design.

It is a standard reference model for communication between two end users in a network. The model is used in developing products and understanding networks.

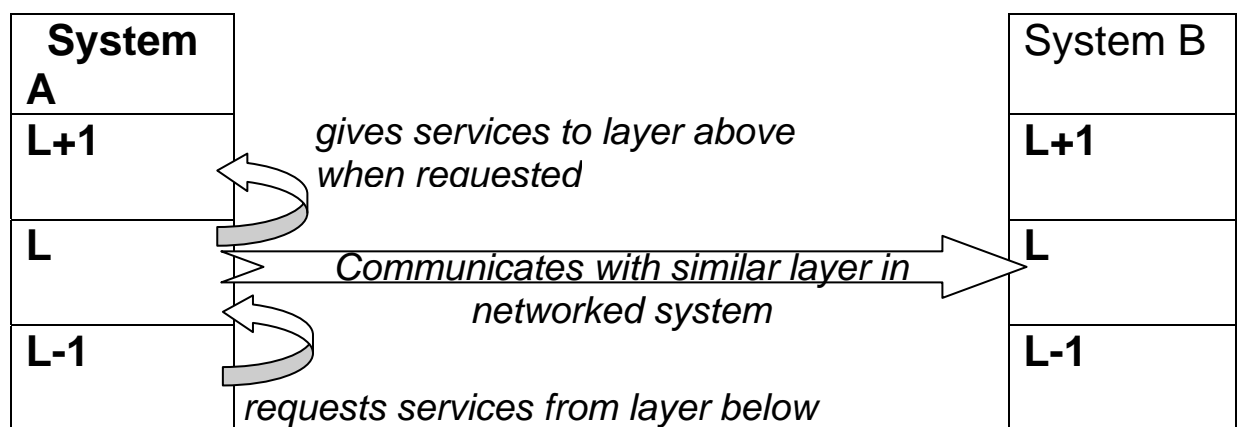
Basically, the OSI Model divides network architecture into seven layers. These can be generally grouped into Upper and Lower layers.

The **Upper** layers (5-7) deal with Application issues and generally are implemented only in software.

Lower layers (1-4) handle Data transport issues.

Communication in OSI model

Each layer (L) is collection of similar functions, and provides services to the layer above it (L+1), and receives services from the layer below it (L-1)



On each layer an *instance* provides services to the instances at the layer above and requests service from the layer below.

OSI Reference Model			
APPLICATION	7	Application Layer	Interacts with the OS or application, whenever the user chooses to transfer files, read messages or perform other network-related activities.
	6	Presentation Layer	Takes the data provided by the Application layer and converts it into a standard format that the other layers can understand (Formatting, Compression, Encryption)
	5	Session Layer	Establishes, maintains and ends communication with the receiving device
TRANSPORT	4	Transport Layer	Provides for error checking and recovery of data between the devices. Looks to see if data is coming from more than one application and integrates each application's data into a single stream for the physical network
	3	Network Layer	The way that the data will be sent to the recipient device is determined in this layer. Logical protocols, routing and addressing are handled here
	2	Data Link Layer	In this layer, the appropriate physical protocol is assigned to the data. Also, the type of network and the packet sequencing is defined
	1	Physical Layer	This is the level of the actual hardware. It defines the physical characteristics of the network such as connections, voltage levels and timing.

Layer 7: Application Layer

This is the closest layer to the end user, which means that both the OSI application layer and the end user interact directly with the software application. It supports end applications such as file transfer and database access. Some of the protocols that work at this layer include FTP (File Transfer Protocol) and SMTP (Simple Mail Transfer Protocol).

Layer 6: Presentation Layer

This layer provides services that interpret the meaning of the information exchanged, and allows for a variety of coding and conversion functions that are applied to the application layer. These functions ensure that information sent from the application layer of one system will be readable by the application layer of another system.

Layer 5: Session Layer

The layer provides the capability for cooperating applications to synchronize and manage their dialog and data exchange. It also provides the mechanism for opening, closing and managing a session between end-user application processes and deals with session and connection coordination

Layer 4. Transport Layer

This layer ensures that data from the source arrives at the destination correctly and in proper sequence. It breaks the message (from sessions layer) into smaller packets, assigns sequence number and sends them. E.g. of protocols that work at this level are TCP(Transport Control Protocol) and SPX (Sequence Packet Exchange).

3. Network Layer

The third layer routes data from one network node to others. It decides the best path in which to transmit a packet, using routing protocols. E.g. IP (Internet Protocol), IPX (Internet Protocol Exchange). Routers operate at the Network Layer.

2. Data Link Layer

This layer controls the transmission of blocks of data between network peers over a physical link. It monitors and resolves errors that may occur on the physical layer. It consists of two sub-layers:

- **Logical Link Control (LLC)** defines how data is transferred over the cable and provides data link service to the higher layers.
- **Medium Access Control (MAC)** defines who can use the network when multiple computers are trying to access it simultaneously (i.e. Token passing, Ethernet [CSMA/CD])

Bridges switches operate at the Data Link Layer.

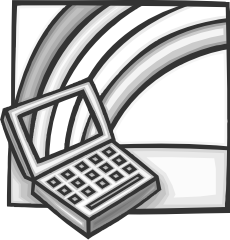
Layer 1: Physical Layer

This layer defines the hardware means of transmitting data. This is how raw bits are sent, rather than logical data packets. This layer defines electrical and mechanical properties, with the shapes and properties of the electrical connectors, the frequencies to broadcast on, the modulation scheme to use and similar low-level parameters, are specified here.

Hubs and repeaters operate at the physical layer

Activities

Task 1:



A **mnemonic device** is used to help remember information and sequences, similar to acronyms. For example to remember the order of the rainbow, I use the mnemonic of the name ROY G BIV is the Rainbow Bow (**R**ed, **O**range, **Y**ellow **G**reen **B**lue **I**ndigo **V**iolet)

Develop a mnemonic device to remember the layers of the OSI Reference Model

Check your Understanding:

1. Routers operate at which layer of the OSI model?
2. Bits are packaged into frames at which layer of the OSI model?
3. Which of the following are benefits of using a layered network model?
 - A . it specifies how changes to one layer must be propagated through the other layers
 - B . it facilitates troubleshooting
 - C . it focuses on details rather than general functions of networking
 - D . it breaks the complex process of networking into more manageable chunks
 - E . it allows layers developed by different vendors to interoperate.
4. The layers of the OSI model, from the top down, are:
5. Which layers are considered to be the upper layer protocols
6. Flow control takes place at which layer?
7. True or False: The network layer uses physical addresses to route data to destination hosts.

8. Error detection and recovery takes place at which layer?
9. Which layer handles the formatting of application data so that it will be readable by the destination system?
10. Which of the following are presentation layer standards?
 - A. MIDI
 - B. TIFF
 - C. JPEG
 - D. MPEG
 - E. GIF