



SRI AKILANDESWARI WOMEN'S COLLEGE, WANDIWASH

DATA COMMUNICATION & NETWORKS

Class : UG Computer Science

Ms. P. GUNAVATHI

Assistant Professor

Department of Computer Science

SWAMY ABEDHANADHA EDUCATIONAL TRUST, WANDIWASH

Network Architecture

Reference Models

There is two important network architectures:

- 🖥️ OSI reference model.
- 🖥️ TCP/IP reference model.

OSI(Open Systems Interconnection) Reference Model

- 📖 OSI stands for **Open Systems Interconnection**.
- 📖 It has been developed by ISO – ‘**International Organization of Standardization**’, in the year 1984.
- 📖 It is a **7 layer** architecture.
- 📖 OSI model divides the whole task into **seven smaller** and manageable tasks.
- 📖 Each layer is assigned a **particular task**.
- 📖 All these 7 layers work collaboratively to transmit the data from one person to another across the globe.

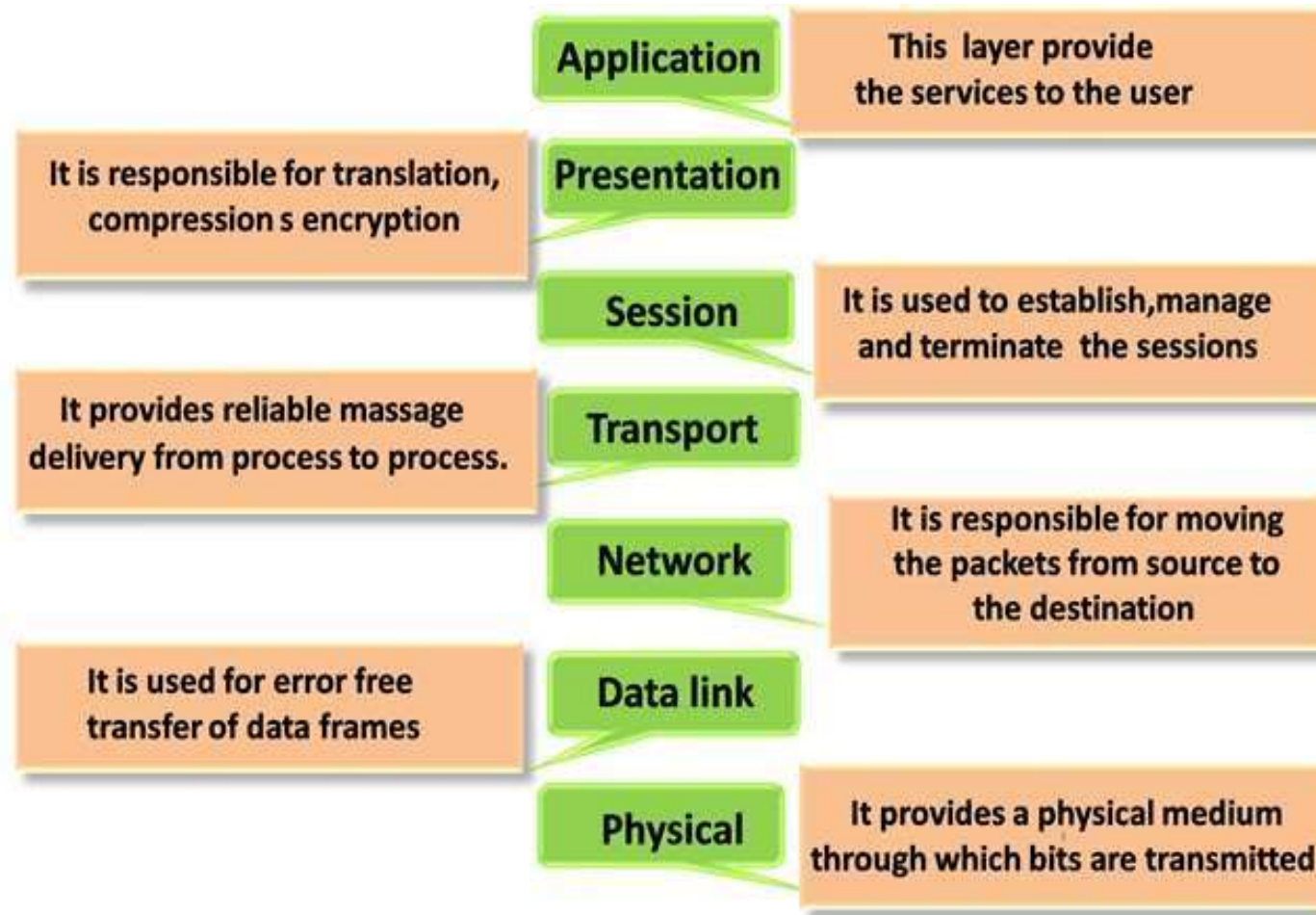
OSI Reference Model

7 LAYERS

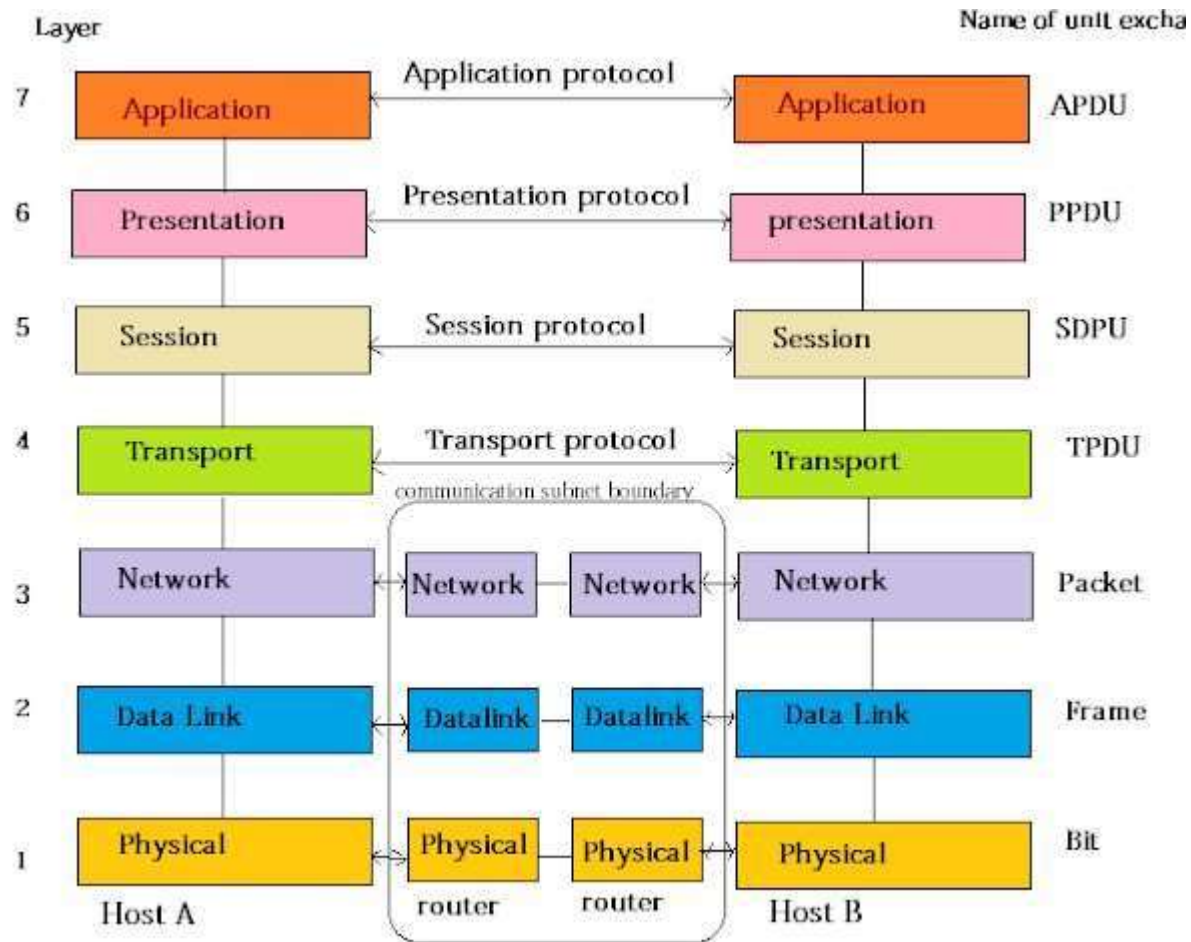


OSI Reference Model

7 LAYER - Each layer has different functions.



OSI Reference Model



OSI Reference Model

FUNCTIONS OF THE LAYERS:

1. Physical layer:

- 🖥️ It is the lowest layer of the OSI model.
- 🖥️ It is responsible for the **actual physical connection between the devices.**
- 🖥️ The physical layer contains information in the form of **bits.**
- 🖥️ The main functionality of the physical layer is to **transmit the individual bits** from one node to another node.
- 🖥️ When receiving data, this layer will get the signal received and convert it into **0's and 1's** and send them to the Data Link layer, which will put the frame back together.

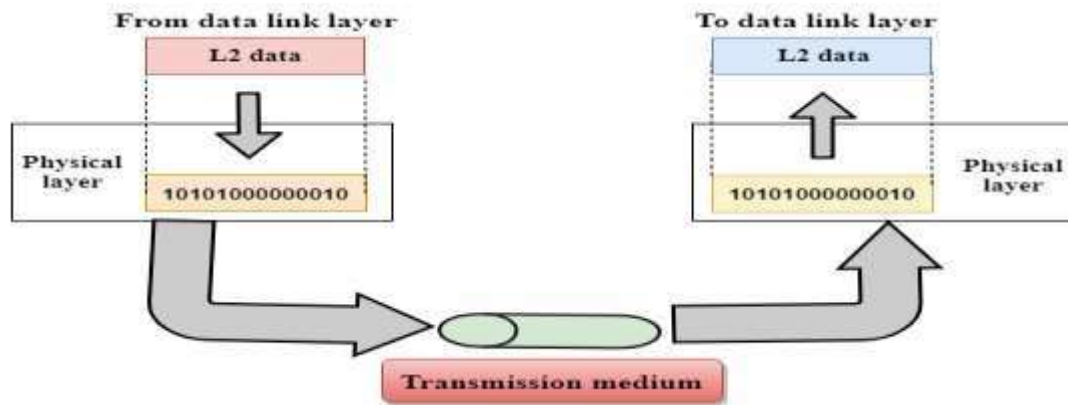
OSI Reference Model

Functions of the physical layers:

- 🖥️ **Line Configuration:** It defines the way how two or more devices can be **connected physically**.
- 🖥️ **Data Transmission:** It defines the transmission mode whether it is **simplex, half-duplex or full-duplex mode** between the two devices on the network.
- 🖥️ **Physical topology:** The physical topology defines **how device are connected to form a network**.
- 🖥️ **Bit rate control:** The Physical layer also defines the transmission rate i.e. the **number of bits sent per second**.

Functions of the physical layers:

Hub, Repeater, Modem, Cables are Physical Layer devices.



OSI Reference Model

2.Data link layer:

- 🖥️ The data link layer is responsible for the **node to node delivery of the message**.
- 🖥️ The main function of this layer is to make sure data transfer is **error-free** from one node to another, over the physical layer.
- 🖥️ When a packet arrives in a network, it is the responsibility of DLL to transmit it to the Host using its **MAC address**.
- 🖥️ It is mainly responsible for the **unique identification of each device** that resides on a local network.

OSI Reference Model

Functions of the Data Link layers:

Framing: The data link layer translates the physical layer's raw bit stream into packets known as **Frames**.

The Data link layer adds the **header and trailer** to the frame.

The header which is added to the frame contains the **hardware destination and source address**.



Physical Addressing: The Data link layer **adds a header to the frame**.

The frame is transmitted to the destination address **mentioned in the header**.

Data link layer adds physical addresses (MAC address) of sender and/or receiver in the header of each frame.

OSI Reference Model

Functions of the Data Link layers:

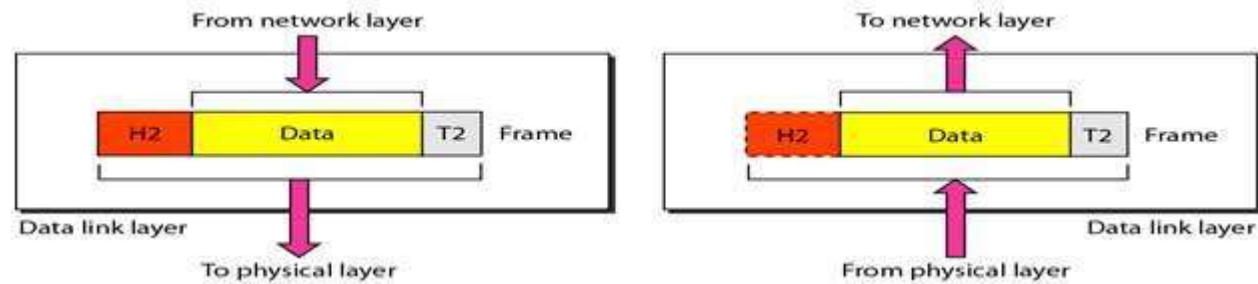
Flow Control: The data rate must be constant on both sides else the data may get corrupted thus , flow control coordinates that **amount of data that can be sent before receiving acknowledgement.**

Error Control: Error control is achieved by adding a calculated value **CRC (Cyclic Redundancy Check)** that is placed to the Data link layer's trailer which is added to the message frame before it is sent to the physical layer. If any error seems to occur, then the receiver sends the acknowledgment for the retransmission of the corrupted frames.

Access control: When a single communication channel is shared by multiple devices, MAC sub-layer of data link layer helps to determine **which device has control over the channel** at a given time.

OSI Reference Model

- 🖥️ Packet in Data Link layer is referred as **Frame**.
- 🖥️ **Switch & Bridge** are Data Link Layer devices.



OSI Reference Model

3. Network layer:

- 🖥️ The network is responsible for the **source to destination delivery of a packet** possibly across multiple networks.
- 🖥️ The sender & receiver's IP address are placed in the header by the network layer.

Functions of the Network Layers:

Logical addressing: A Network layer adds the **source and destination address to the header of the frame**. Addressing is used to **identify the device** on the internet.

Routing: Routing is the major component of the network layer, and it determines the **best optimal path out of the multiple paths** from source to the destination.

Segment in Network layer is referred as **Packet**.

OSI Reference Model

4. Transport layer:

- ❏ The Transport layer is a Layer 4 ensures that messages are transmitted **in the order** in which they are sent and there is no duplication of data.
- ❏ It is responsible for the End to End Delivery of the complete message.
- ❏ The transport layer also provides the **acknowledgement of the successful data** transmission and **re-transmits** the data if an error is found.
- ❏ It receives the data from the upper layer and converts them into **smaller units known as segments**.
- ❏ This layer can be termed as an end-to-end layer as it provides a **s** between source and destination to deliver the data reliably.
- ❏ The data in the transport layer is referred to as **Segments**.

OSI Reference Model

Functions of the Transport layers:

Service-point addressing: Computer often run several programs at the same time. The transport layer header therefore must include a type of address called a **service point address or port address** to communicate with **specific process**.

Segmentation and reassembly: When the transport layer receives the message from the upper layer, it **divides the message into multiple segments**, and each segment is assigned with a **sequence number that uniquely identifies each segment**. When the message has arrived at the destination, then the transport layer reassembles the message based on their sequence numbers.

OSI Reference Model

Connection control: Transport layer provides **two services Connection-oriented service and connectionless service.**

Connection Oriented Service: It is a three-phase process which include

- Connection Establishment
- Data Transfer
- Termination / disconnection

In this type of transmission, the receiving device **sends an acknowledgement, back to the source** after a packet or group of packet is received. This type of transmission is **reliable and secure.**

Connection less service: It is a one-phase process and includes Data Transfer. In this type of transmission, the **receiver does not acknowledge receipt of a packet.** This approach allows for much faster communication between devices. **Connection-oriented** service is more **reliable** than connectionless Service.

OSI Reference Model

Flow control: The transport layer also responsible for flow control but it is performed end-to-end rather than across a single link.

Error control: The transport layer is also responsible for Error control. Error control is performed end-to-end rather than across the single link. The sender transport layer ensures that message reach at the destination **without any error.**

OSI Reference Model

5. Session layer:

- ☞ The session layer is the network **dialog controller**.
- ☞ It **establishes, maintains and synchronizes** the interaction between communicating systems.

Functions of the Session layers:

Dialog Controller : The session layer allows two systems to start communication with each other in **half-duplex or full-duplex**.

Synchronization: Session layer adds some **checkpoints** when transmitting the data in a sequence. If some **error occurs** in the **middle of the transmission** of data, then the transmission will take place again from the checkpoint. This process is known as **Synchronization and recovery**.

OSI Reference Model

6. Presentation layer:

A Presentation layer is mainly concerned with the **syntax and semantics** of the information exchanged between the two systems.

Functions of the Presentation layers:

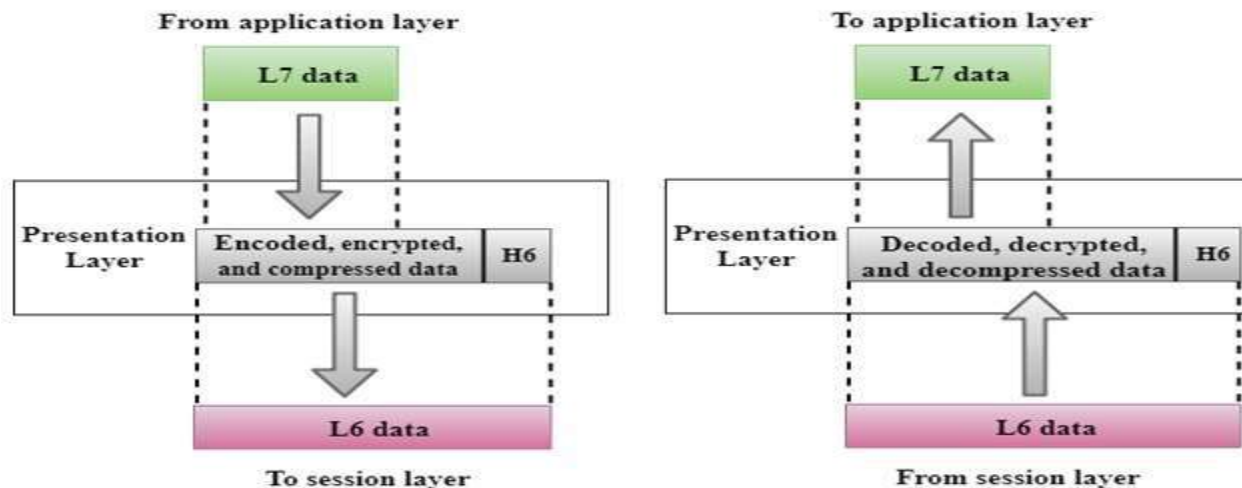
Translation: The processes in two systems exchange the information in the form of **character strings, numbers and so on.**

Encryption/ Decryption: The sender transforms the **original information to another form** and sends the resulting in scrambled message in the network. Decryption reverses the original process to transform the message back to its original form.

The **encrypted data** is known as the **cipher text** and the **decrypted data** is known as **plain text**. A key value is used for encrypting as well as decrypting data.

OSI Reference Model

Compression: Data compression is a process of compressing the data, i.e., it **reduces the number of bits** to be transmitted. Data compression is very important in multimedia such as **text, audio, video**.



OSI Reference Model

7.Application layer:

- 🖥️ An application layer serves as a window for users and application processes to access network service.
- 🖥️ This layer provides the network services to the **end-users**.
- 🖥️ Application Layer is also called as Desktop Layer.
- 🖥️ **Ex:** Application – Browsers etc.

Functions of the Application layers:

Network virtual terminal: A network virtual terminal is a software version of physical terminal and allows a user to **logon to a remote host**.

OSI Reference Model

File transfer, access and management (FTAM): This application allows a user to **access files in a remote computer, to retrieve files from a remote computer** and to manage or control files in a remote computer.

Mail services: An application layer provides the facility for **email forwarding and storage**.

Directory services: This application provides **distributed database sources and access** for global information about various objects and services.