

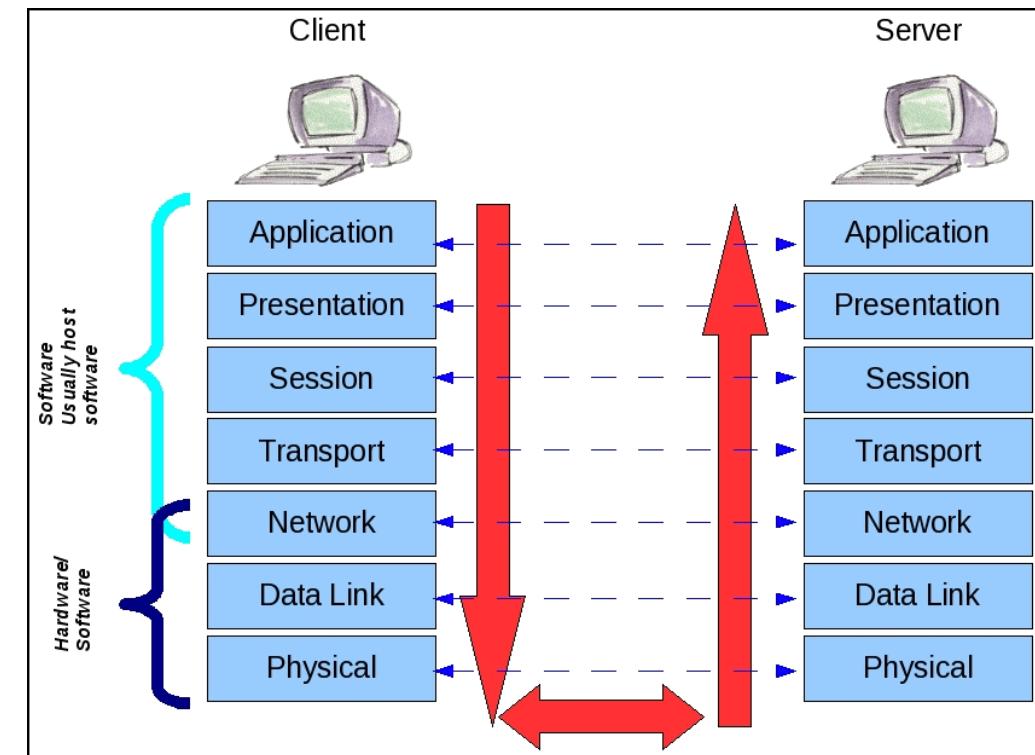
OSI MODEL LAYERS

Tasmia Jannat

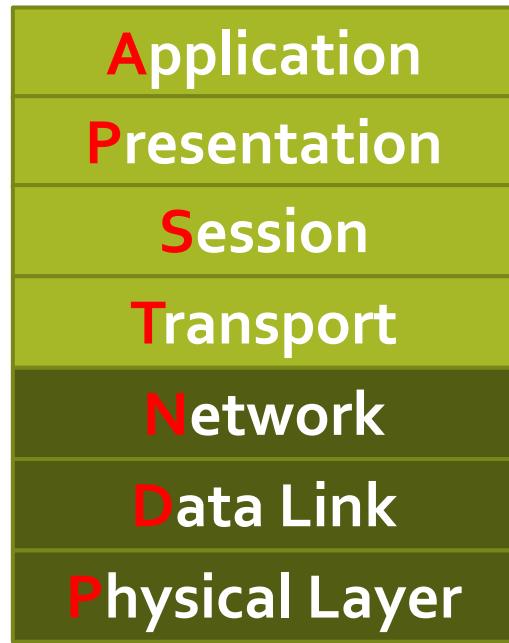
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OSI Model Introduction

- The **Open Systems Interconnection** (OSI) model describes **seven layers** that computer systems use to communicate over a network.
- It describes how information from a software application in one computer (**client**) moves **through a physical medium** to the software application in another computer (**Server**).
- **Open System?** OSI means that there's no fix host and server. It is **open to all** networking devices, which means any one could use the internet.

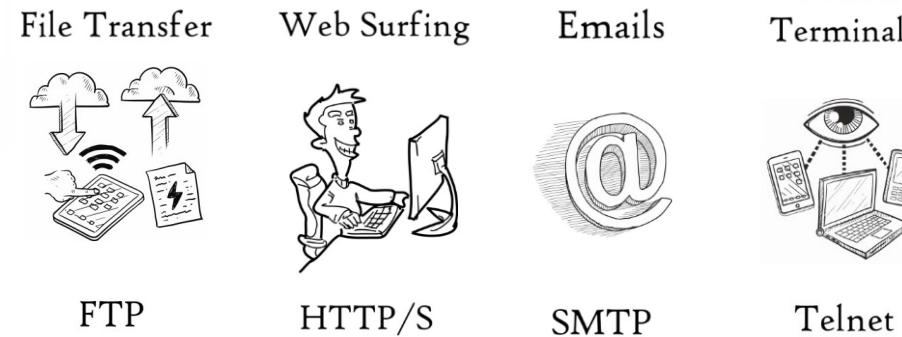


OSI Model Layers



- **Application Layer:**

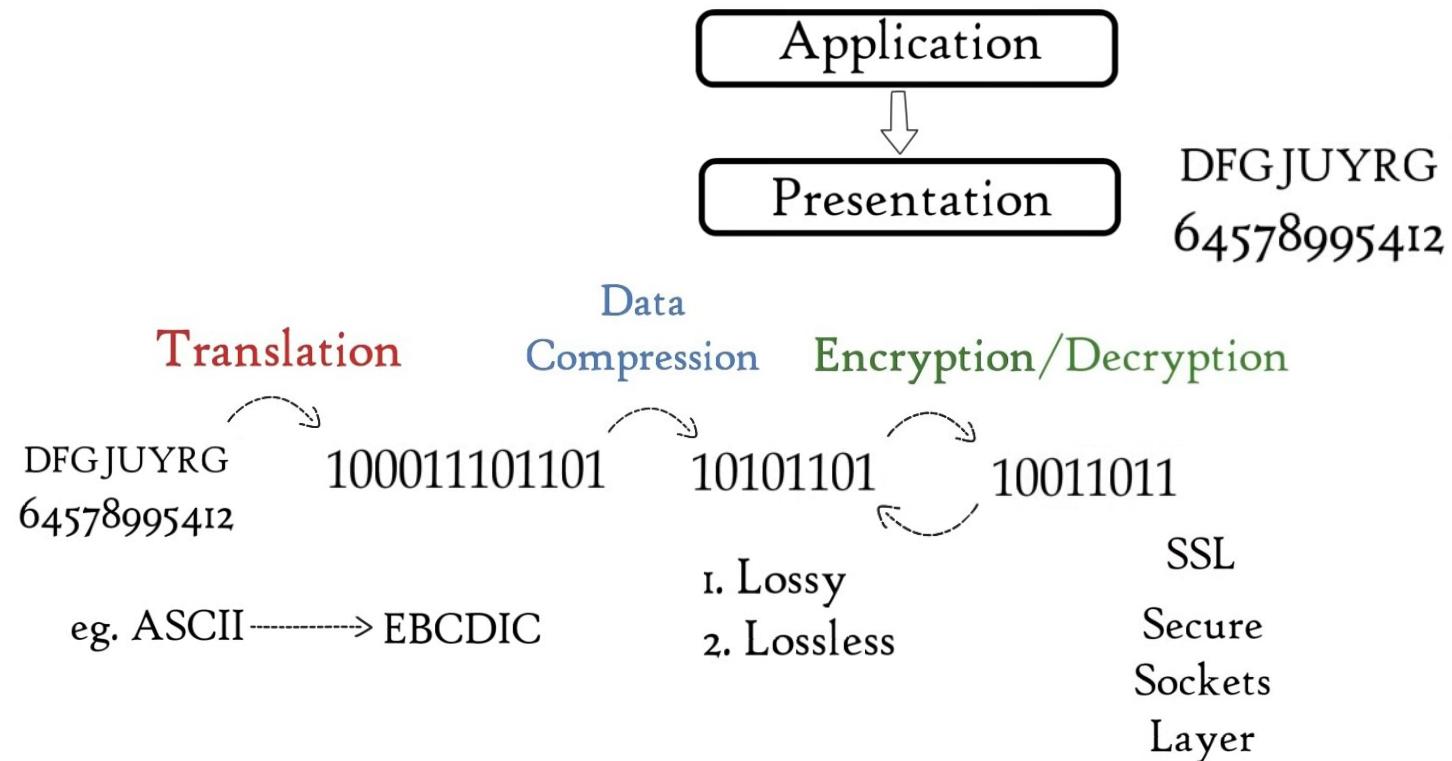
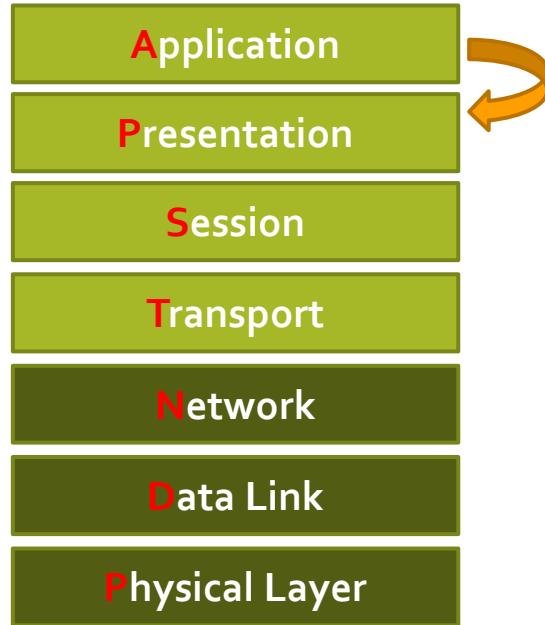
- *Non-tech term:* is about user's application
- *Tech Term:* Application layer **protocols:**



All People Should Try
New Data Path

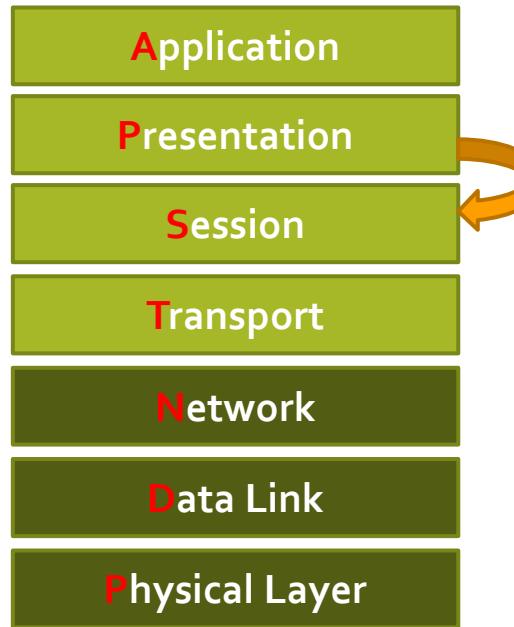
OSI Model Layers

- **Presentation Layer:** The presentation layer provides a variety of coding and conversion functions on application data. These functions ensure that information sent from the application layer of the client would be understood by the application layer of the server.



This layer tries to **translate** application data into a certain format that every different system **could understand**.

OSI Model Layers



• Session Layer:

- *Main Function:*

- To establish
- Manage
- And terminate
- Connections between the sender and the receiver

The session layer can also set checkpoints during a data transfer—if the session is interrupted, devices can resume data transfer from the last checkpoint.



• Transport Layer

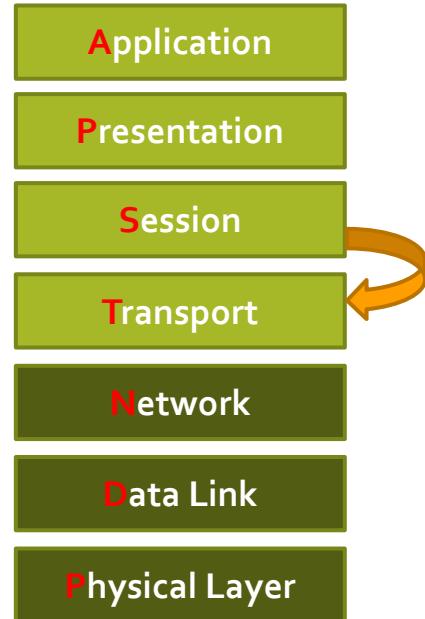
- The transport layer takes data transferred in the session layer and breaks it into “**segments**” on the transmitting end.
- This layer can be termed as an end-to-end layer as it provides a **point-to-point** connection between source and destination to deliver **the data reliably**.
- Controls the **reliability** of communication through **segmentation, Flow control and Error control**.

OSI Model Layers

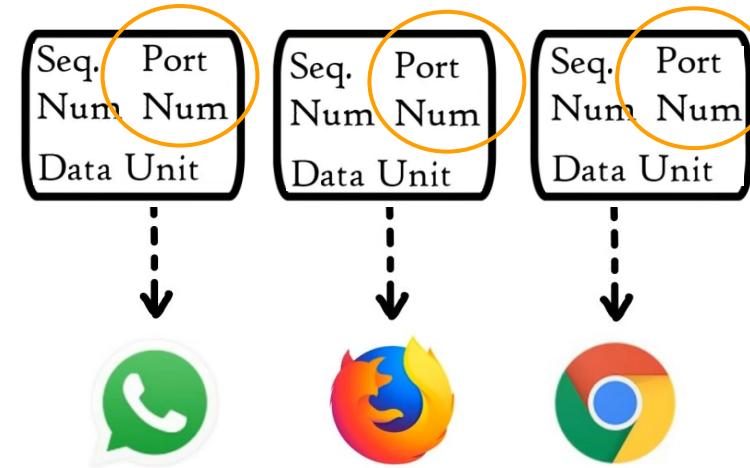
- **Transport Layer**

- Controls the reliability of communication through **segmentation**, **Flow control**, and **Error control**.

- **Segmentation:**



Segments



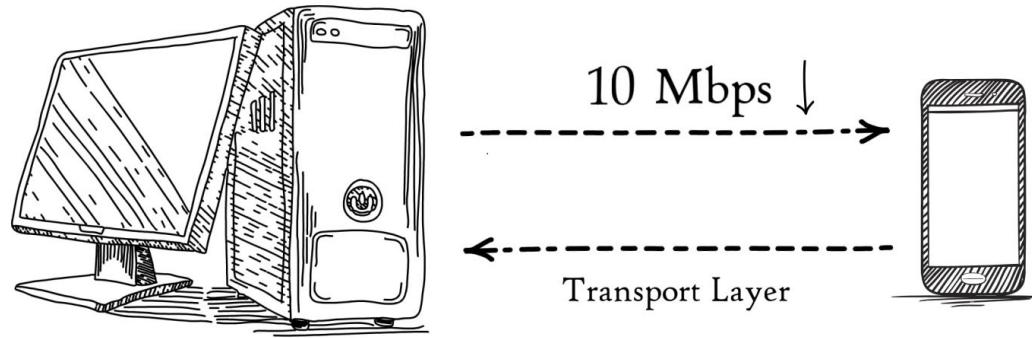
Port Number helps to direct each segment into the correct application.
Sequence Numbers help to reassemble segments into the correct sequence.

OSI Model Layers

- **Transport Layer**

- Controls the reliability of communication through **segmentation**, **Flow control**, and **Error control**.

- **Flow Control:**



Application

Presentation

Session

Transport

Network

Data Link

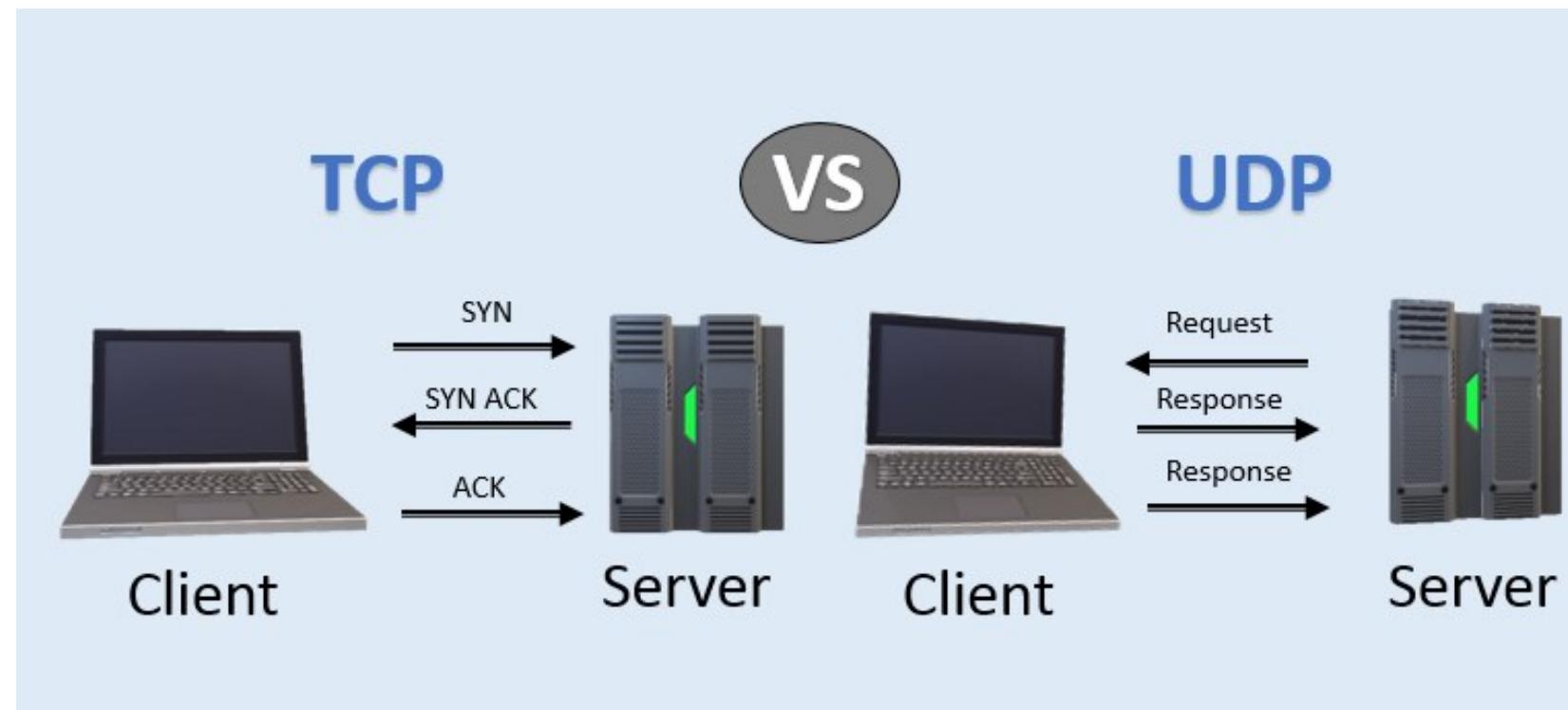
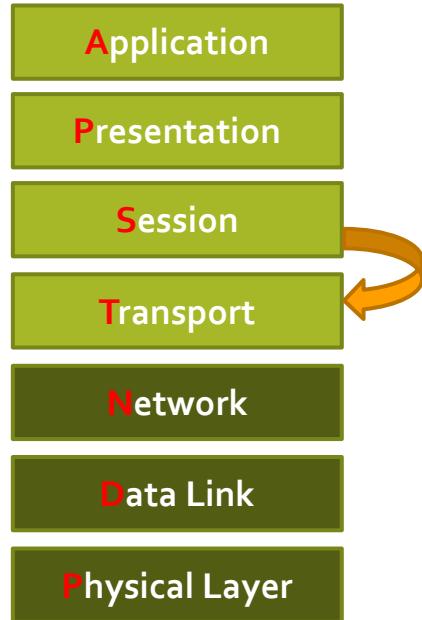
Physical Layer

- **Error Control:**

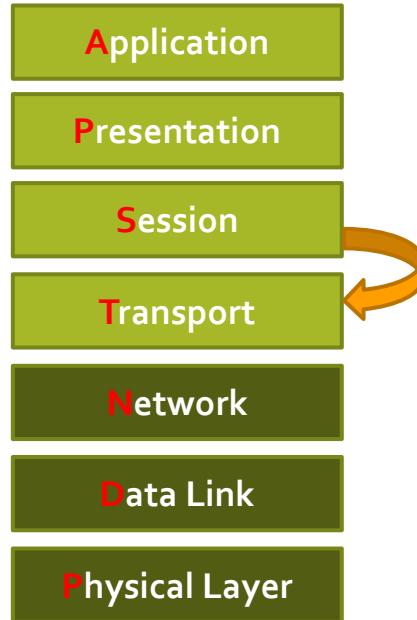


OSI Model Layers

- Transport Layer
- The two protocols used in this layer are:
 - Transmission Control Protocol (TCP)
 - User Datagram Protocol (UDP)

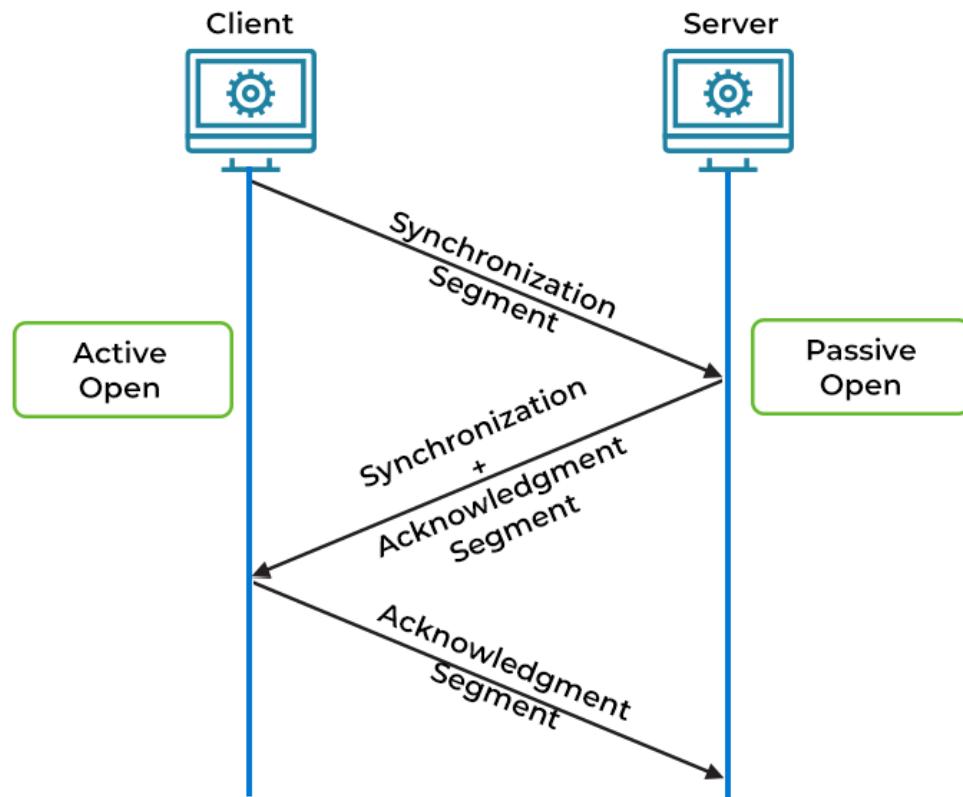


OSI Model Layers

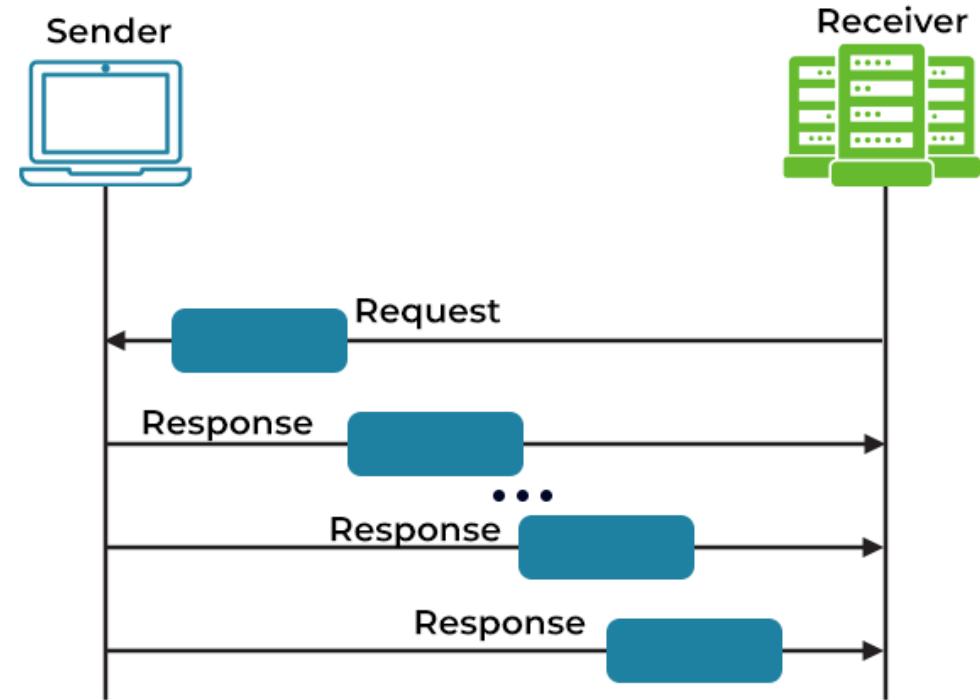


- **Transport Layer**
- **The two protocols used in this layer are:**
- **Transmission Control Protocol (TCP)**
 - It is a standard protocol that allows the systems to communicate over the internet.
 - It establishes and **maintains a connection** between hosts.
 - When data is sent over the TCP connection, then the TCP protocol divides the data into smaller units known as segments. Each segment travels over the internet using multiple routes, and they arrive in different orders at the destination.
 - The transmission control protocol **reorders** the packets in the correct order at the receiving end.
- **User Datagram Protocol (UDP)**
 - User Datagram Protocol is a transport layer protocol.
 - It is an **unreliable** transport protocol as in this case receiver does not send any acknowledgment when the packet is received, **the sender does not wait for any acknowledgment**. Therefore, this makes a protocol unreliable.

FUNCTIONING OF TRANSMISSION CONTROL PROTOCOL (TCP)



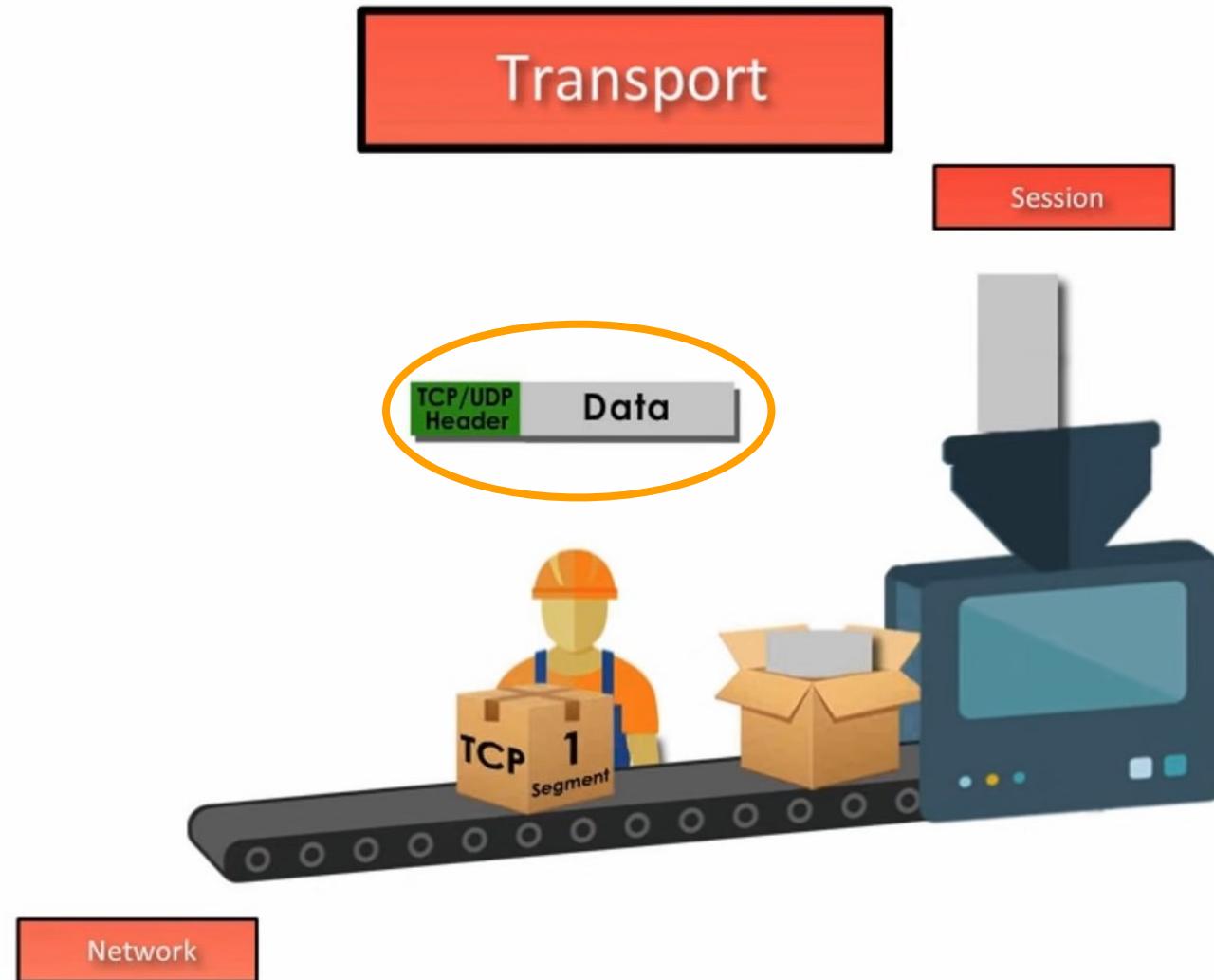
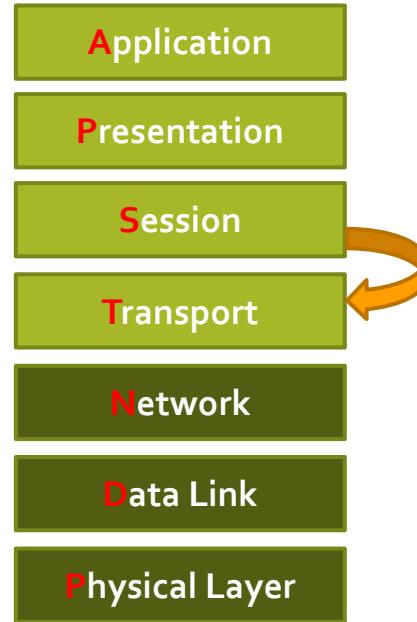
FUNCTIONING OF USER DATAGRAM PROTOCOL (UDP)



TCP relies on a three-way handshake (synchronization, synchronization acknowledgment, and final acknowledgment)

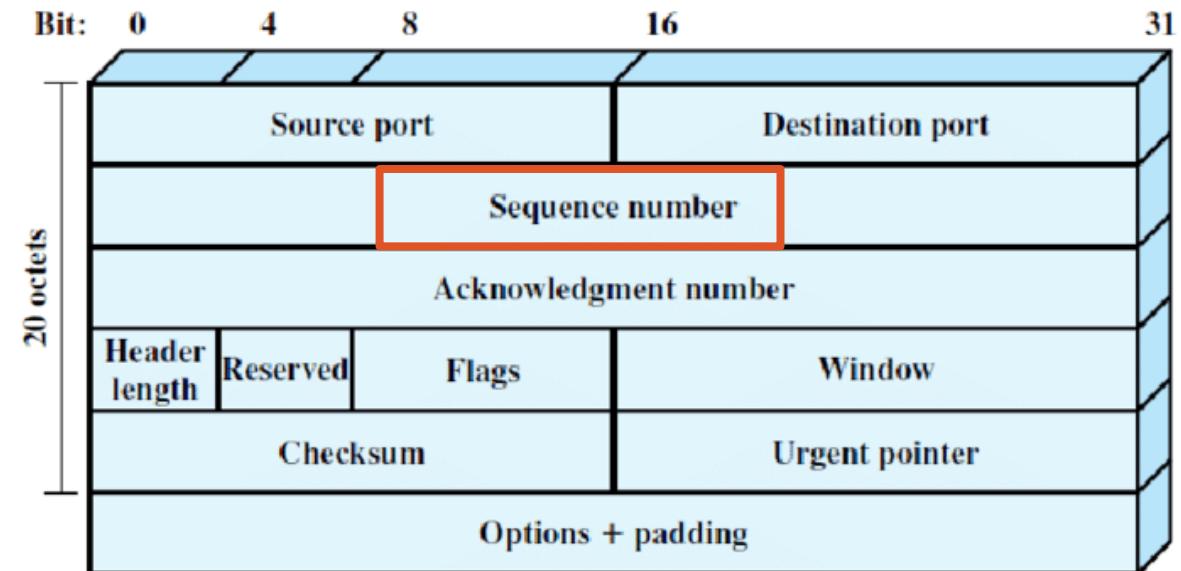
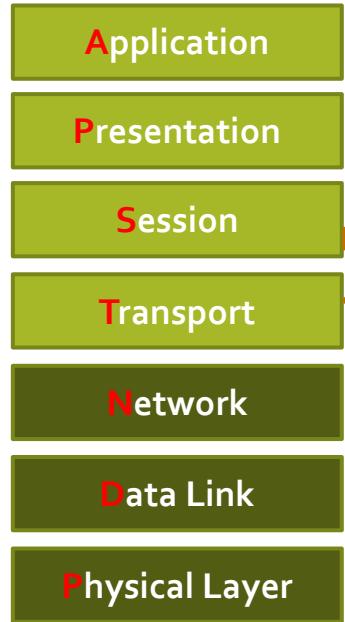
OSI Model Layers

- Transport Layer

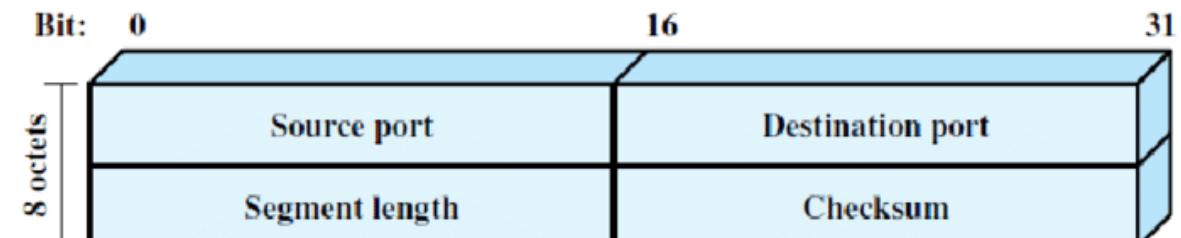


OSI Model Layers

- Transport Layer



(a) TCP header



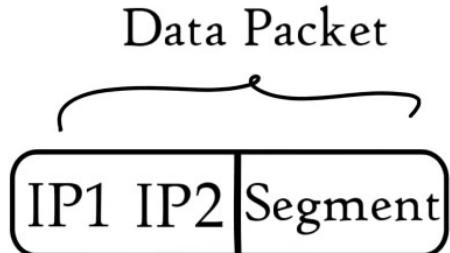
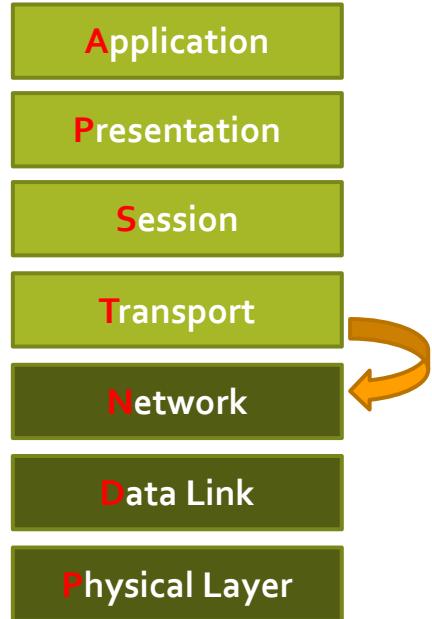
(b) UDP header

- In Datagram, Data packets include a 16-bit value in the header, known as the checksum field.
- TCP includes a checksum field for every data segment, which it evaluates for integrity during transmission.

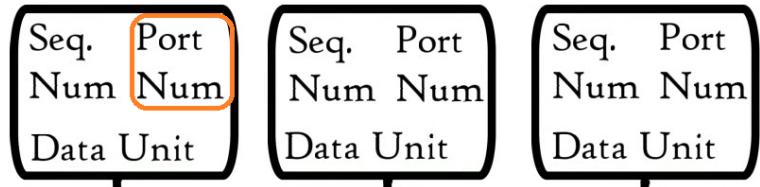
	Transmission Control Protocol (TCP)	User Datagram Protocol (UDP)
Nature of connectivity	TCP is connection-oriented.	UDP is a message-oriented and connectionless protocol.
Order of data transmission	TCP data packets have a sequencing number in the header to maintain the order of transmission.	UDP data packets arrive in no fixed order, and incorrect sequencing cannot be detected or corrected.
Speed	Slower	Faster
Multicast and broadcast	It is ideal for point-to-point transmission only, with confirmation of receipt.	It is suitable for broadcasting data packets to an entire group of endpoints, regardless of whether they listen.
Flow control	It utilizes flow control information to calibrate the pace of data transmission, to avoid overwhelming the recipient .	It does not use flow control and sends data at a rate suitable for the originating server .
Congestion control	It implements congestion avoidance algorithms to prevent data packets from getting lost in a congested network.	It cannot control network congestion and drops packets if too much traffic is on the pathway.
Reliability	TCP's most significant advantage is that it is highly reliable.	Its architecture is designed in a manner that makes it inherently unreliable.
Application	It is suitable for use cases where data integrity , including images, web pages, data files, etc. matters more than transmission speed.	It is ideal for live data transmission (e.g., media), where transmission is so fast that a few dropped packets do not matter.

OSI Model Layers

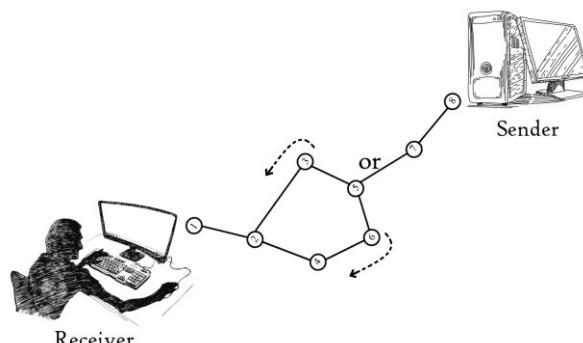
- **Network Layer:** The network layer has two main functions.
 - The segments received from the Transport layer are further processed to form the Packets.



Segments



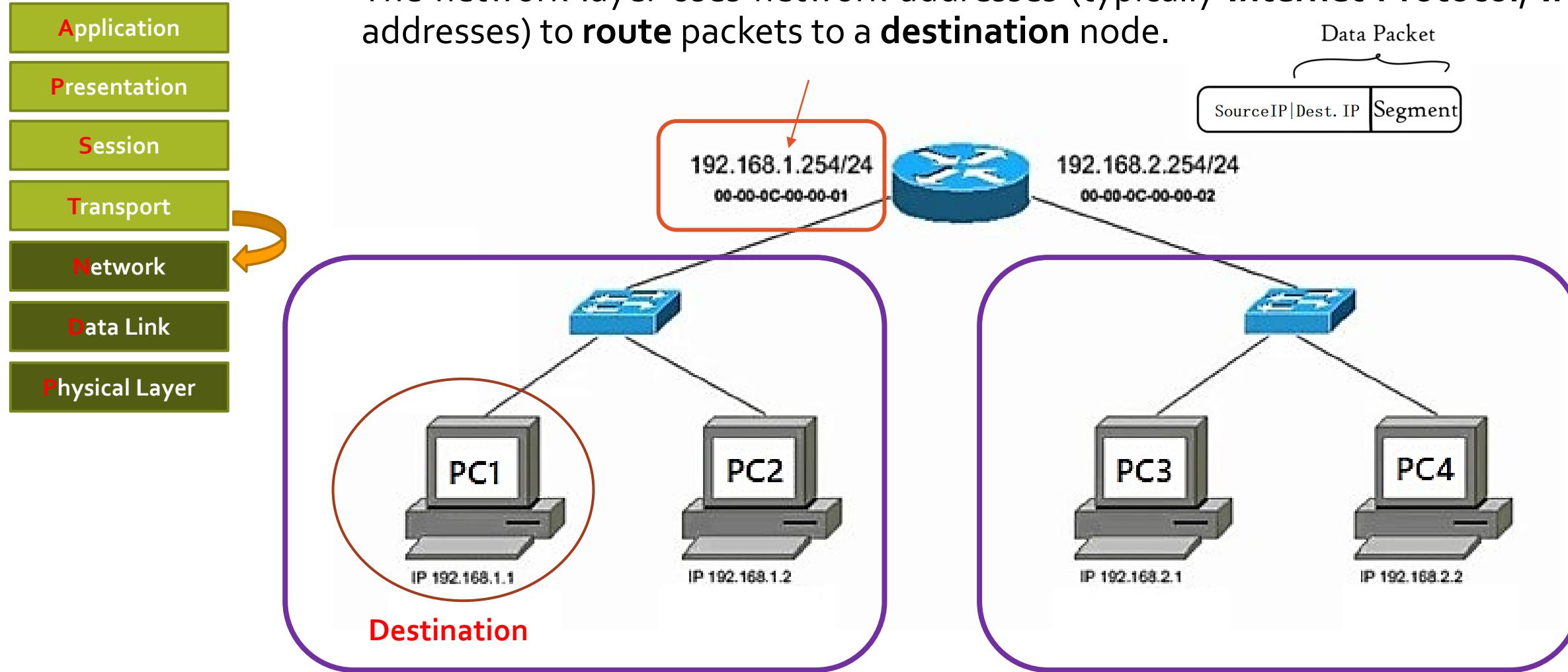
- The other is routing packets by discovering the best path across a physical network. The network layer uses network addresses (typically **Internet Protocol**, IP addresses) to **route** packets to a destination node.



OSI Model Layers

- **Network Layer:**

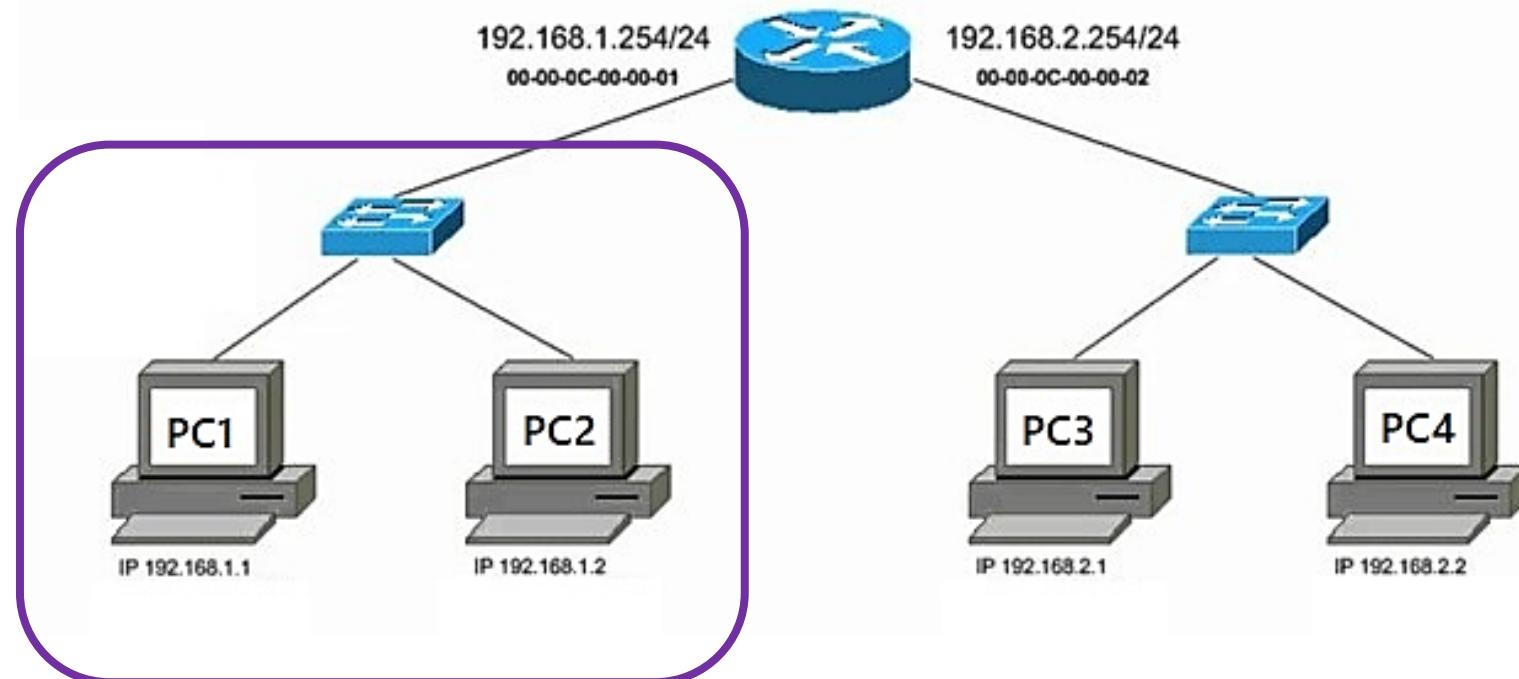
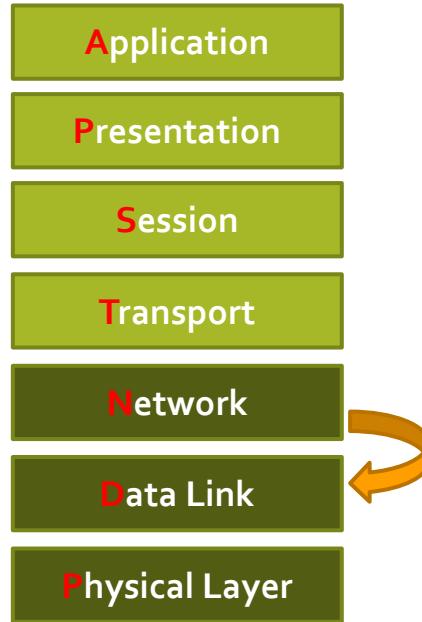
- The network layer uses network addresses (typically **Internet Protocol**, IP addresses) to **route** packets to a **destination** node.



OSI Model Layers

- **Data Link Layer:**

- The data link layer is very similar to the network layer, except the data link layer facilitates data transfer between **two devices on the SAME network**.

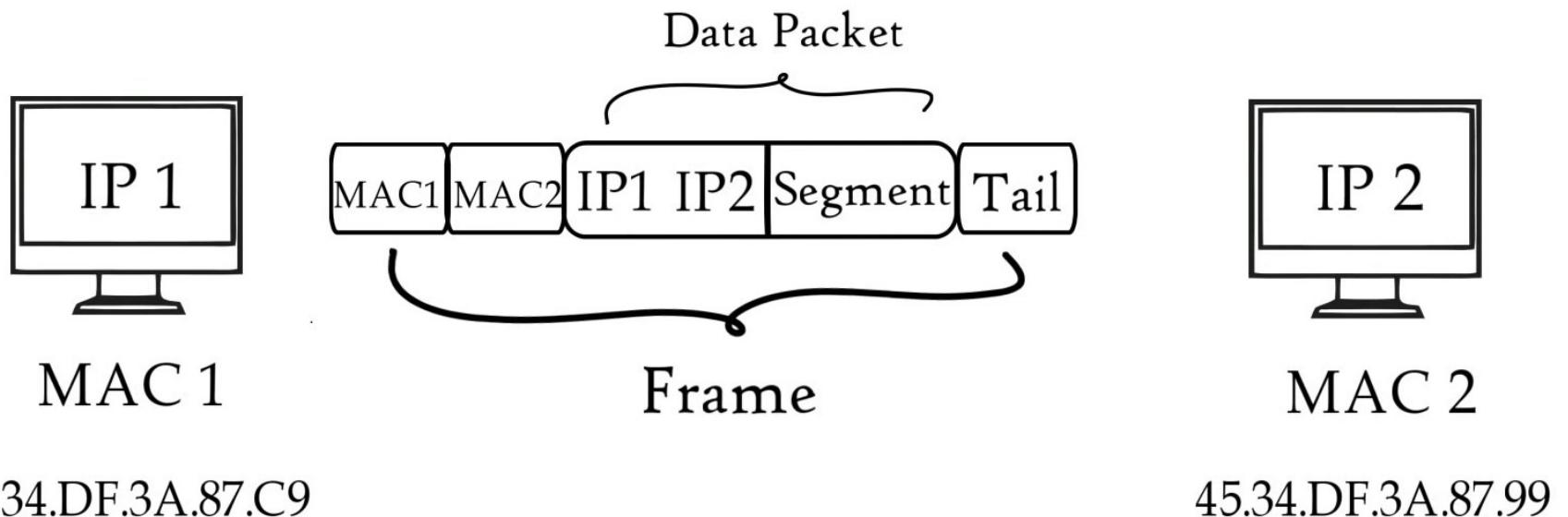


OSI Model Layers

- **Data Link Layer:**



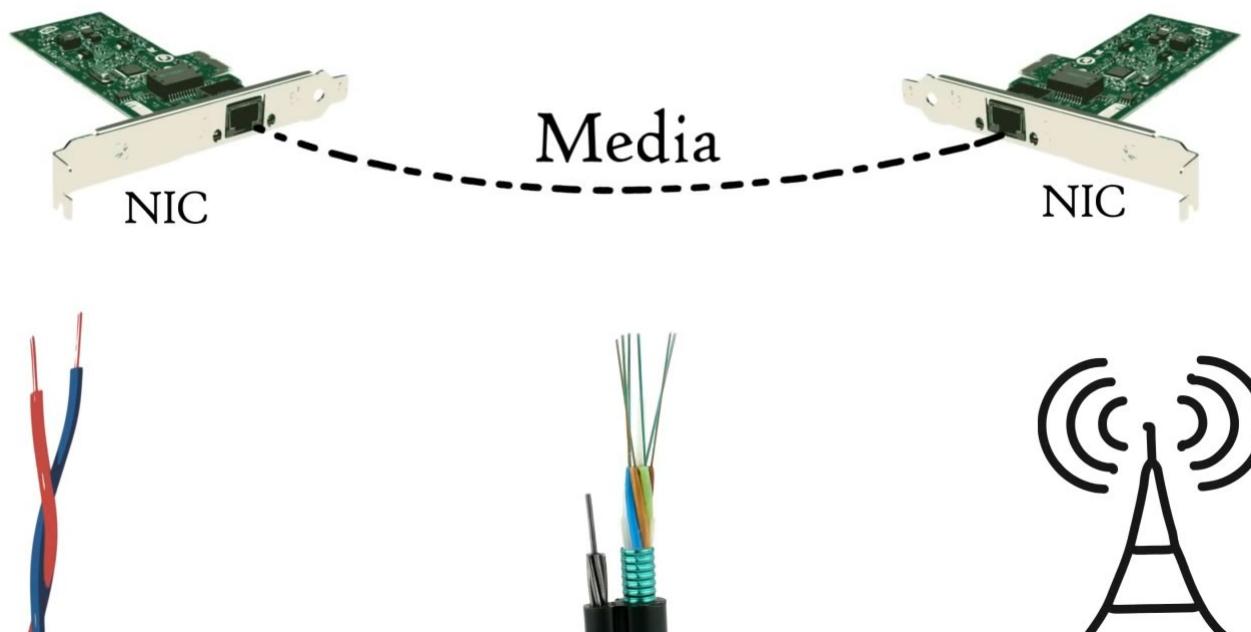
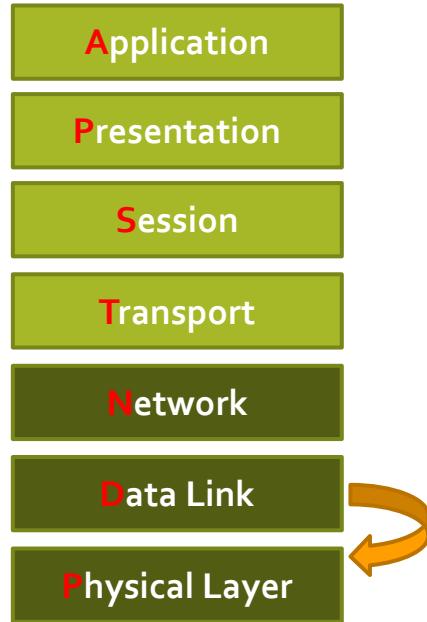
- The data link layer takes packets from the network layer and breaks them into smaller pieces called **frames**. The data link layer is also responsible for flow control and error control in **intra-network communication** (*The transport layer only does flow control and error control for inter-network communications*).



OSI Model Layers

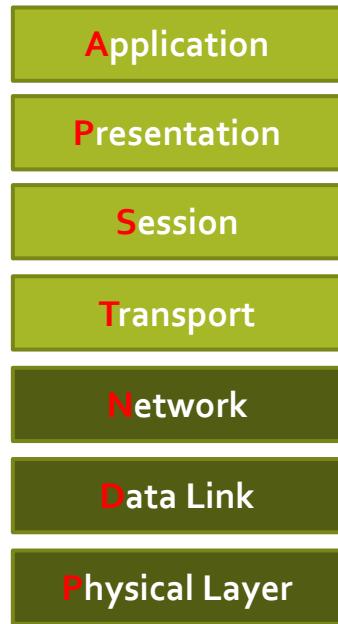
- **Physical Layer:**

- This level establishes the relationship between a device and a **physical transmission medium**.
- It defines the connector, the electrical cable, or wireless technology connecting the devices, and is responsible for the transmission of the raw data, which is simply a series of 0s and 1s while taking care of bit rate control.



OSI Model Layers

- **Physical Layer:**



- It defines the connector, the electrical cable, or wireless technology connecting the devices, and is responsible for the transmission of the raw data, which is simply a series of 0s and 1s while taking care of bit rate control.

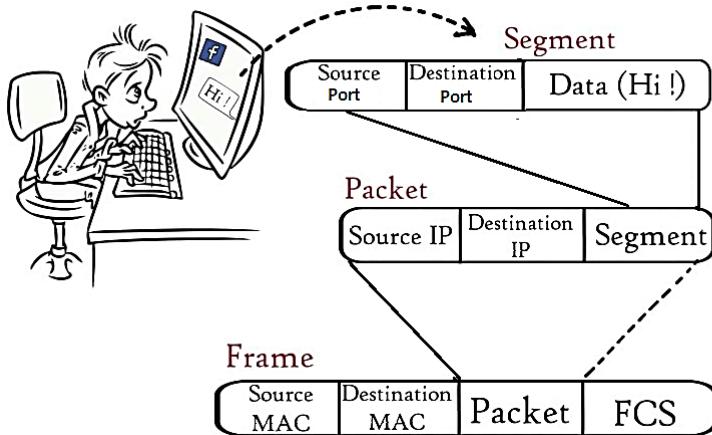


1001011101101100101110110111011 BITs



- Application**
- Presentation**
- Session**
- Transport**
- Network**
- Data Link**
- Physical Layer**

APPLICATION, PRESENTATION, SESSION



TRANSPORT LAYER

NETWORK LAYER

DATA LINK LAYER

BITs

SIGNALS

MEDIA



APPLICATION LAYER



TRANSPORT LAYER

NETWORK LAYER

DATA LINK LAYER

BITs

SIGNALS

MEDIA

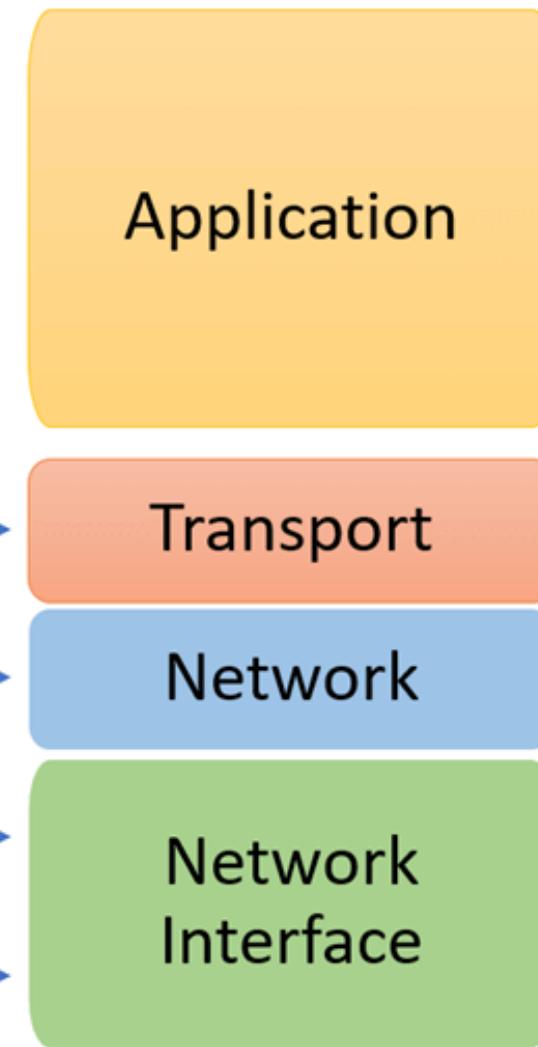


- The **modern Internet** is not based on OSI, but on the simpler **TCP/IP model**.
- However, the **OSI 7-layer model** is still widely used, as it **helps visualize** and communicate how networks operate and helps isolate and troubleshoot networking problems.

OSI Reference Model



TCP/IP Conceptual Layers



OSI Model	TCP/IP Model
It is developed by ISO (International Standard Organization)	It is developed by ARPANET (Advanced Research Project Agency Network).
OSI model provides a clear distinction between interfaces, services, and protocols.	TCP/IP doesn't have any clear distinguishing points between services, interfaces, and protocols.
OSI refers to Open Systems Interconnection.	TCP refers to Transmission Control Protocol.
OSI uses the network layer to define routing standards and protocols.	TCP/IP uses only the Internet layer.
OSI layers have seven layers.	TCP/IP has four layers.
In the OSI model, the transport layer is only connection-oriented.	A layer of the TCP/IP model is both connection-oriented and connectionless.
In the OSI model, the data link layer and physical are separate layers.	In TCP, physical and data link are both combined as a single host-to-network layer.
Session and presentation layers are a part of the OSI model.	There is no session and presentation layer in the TCP model.
It is defined after the advent of the Internet.	It is defined before the advent of the internet.

- **TCP/IP model.**

Application	HTTP FTP DNS	Application message
Transport	TCP UDP	TCP Segment/ UDP data frame
Network	IP ICM ARP	IP Packets
Data Link	Ethernet	Ethernet Frame
Physical	Ethernet	