

Computer Networks(CS30006)

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Network Stack

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Network

- ❑ Network, in computer science, a group of computers and associated devices that are connected by communications facilities.
- ❑ Network is an inter connected collection of autonomous computers.
- ❑ When two or more computers are joined together so that they are capable of exchanging information, they form a network.



Need for Networking:

- ❑ **Resource sharing** - Through a network, data, software and hardware resources can be shared irrespective of the physical location of the resources and the user.
- ❑ **Reliability** – A file can have its copies on two or more computers of the network.
- ❑ **Reduced Cost** – Sharing resources reduces the cost.
- ❑ **Fast Communication** – Information can be exchanged at a very fast speed.



Internet

- ❑ Internet is worldwide network of computer networks.
- ❑ **How does it work?**
 - Most computers are not connected directly to the internet.
 - They are connected to smaller networks.
 - Which are connected through gateways to the internet backbone.



Network Model:

- ❑ A method of describing and analyzing data communication networks by breaking the entire set of communication process into a number of layers.
- ❑ Each layer has a specific function.



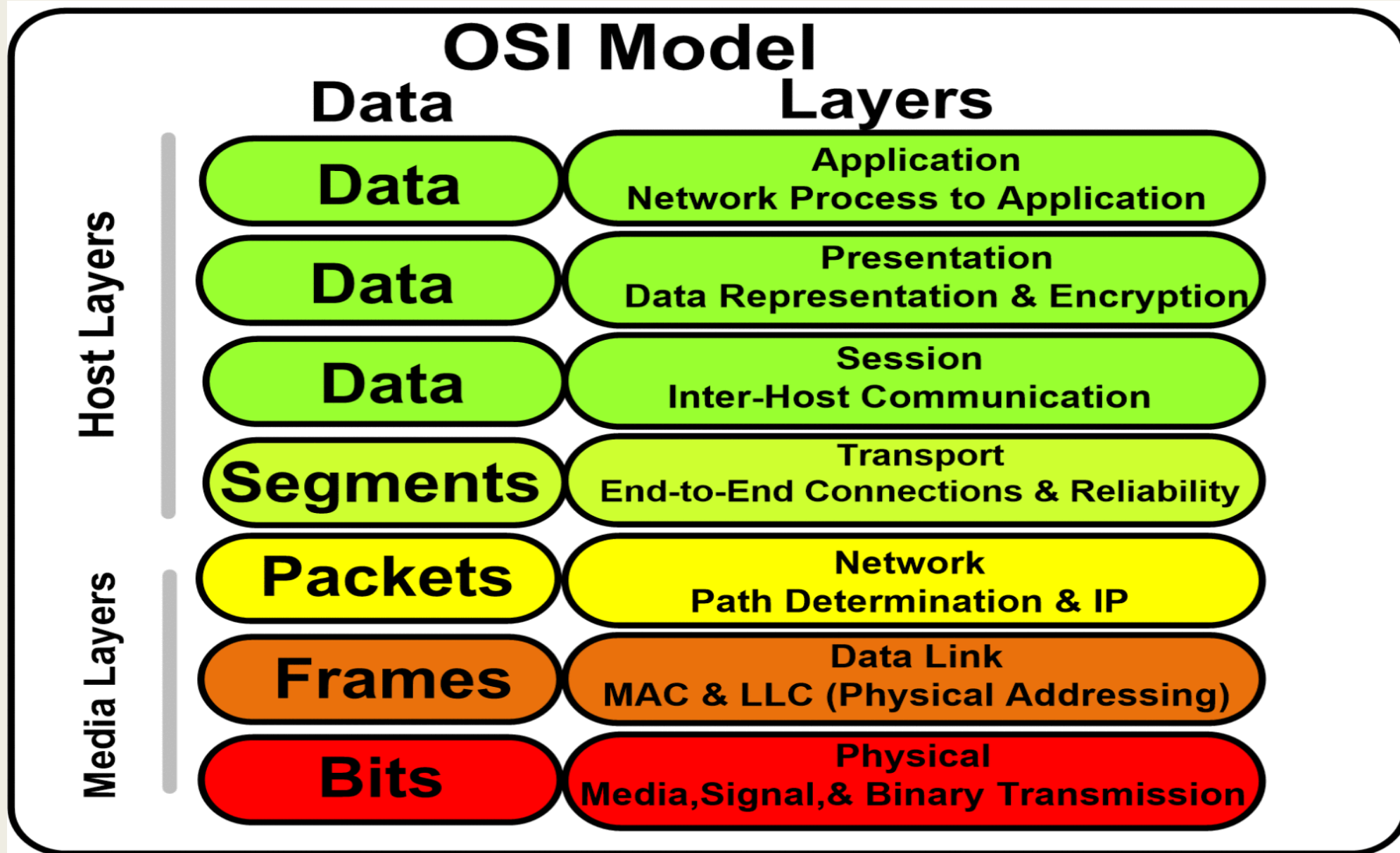
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- ❑ International standard organization (ISO) established a committee in 1977 to develop an architecture for systems communication.
- ❑ Open System Interconnection (OSI) reference model is the result of this effort.
- ❑ This model allows any two different systems to communicate regardless of their underlying architecture.



Cont...

- ❑ The OSI model describes how data flows from one computer, through a network to another computer.
- ❑ The OSI model is not a protocol; it is a model for understanding and designing a network architecture that is flexible and robust.
- ❑ The OSI model consists of seven separate but related layers, each of which defines a part of the process of moving information across a network.

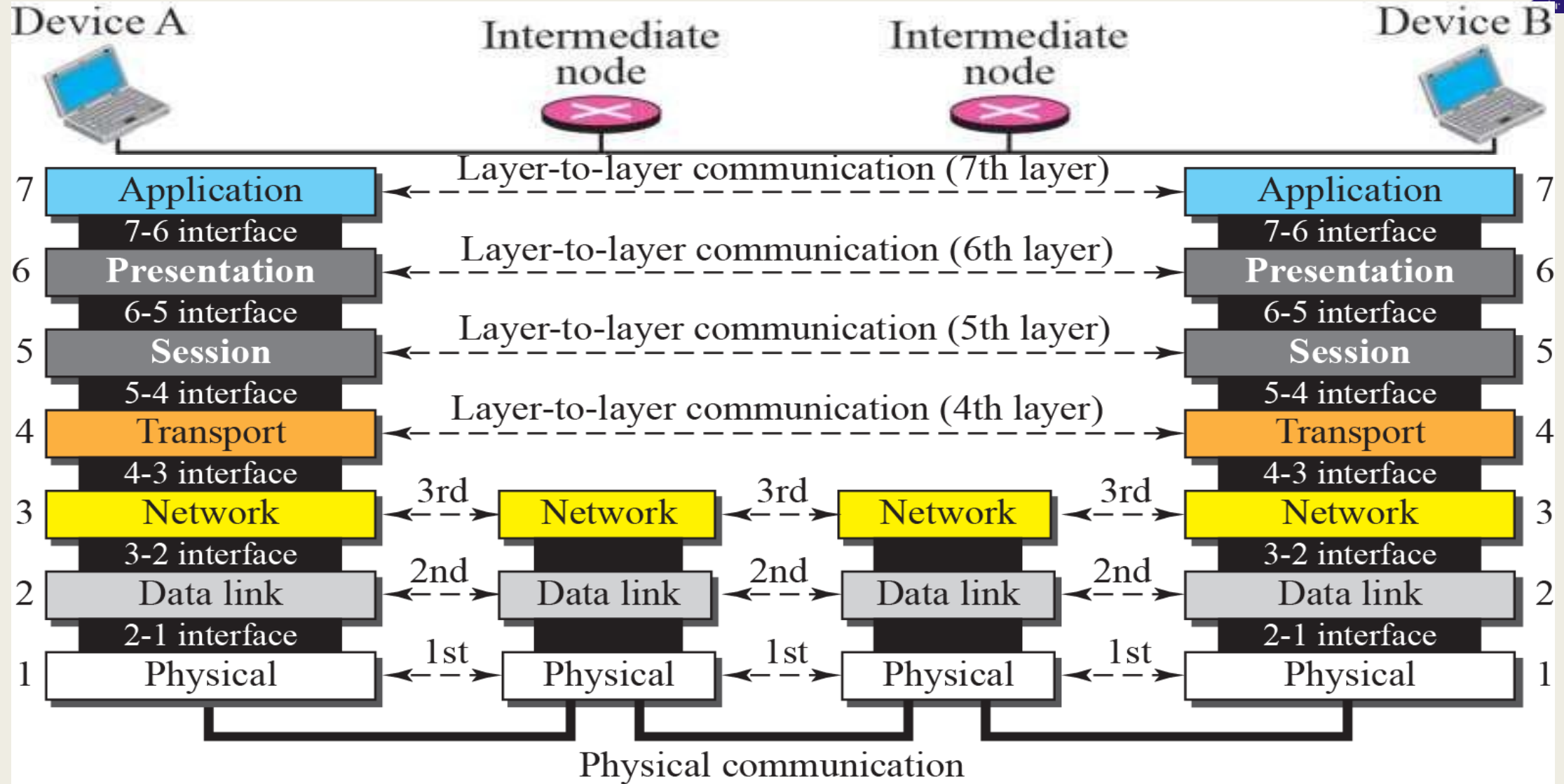




Why so many layers?

- ❑ To reduce the complexity, networks are organized as a stack of layers, one below the other.
- ❑ Each layer performs a specific task. It provides services to an adjacent layer.

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Source: Studyregular, "OSI Models", [Online], Available:

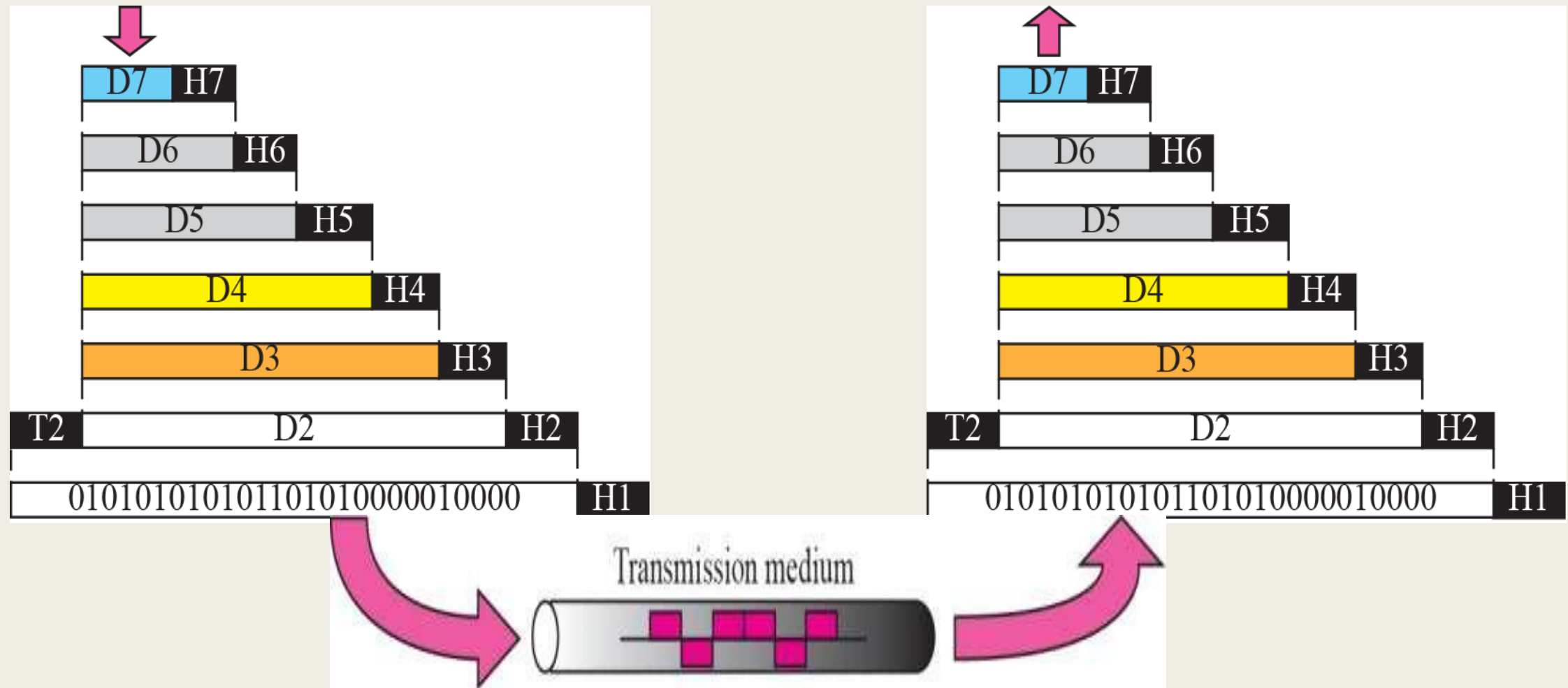
<https://studyregular.blogspot.com/2016/10/computer-networks-topic-osi-model.html>¹⁰



Cont...

- ❑ Layers 1, 2, 3- physical, data link and network are network support layers.
- ❑ Layer 4, the transport layer, links the two subgroups.
- ❑ Layers 5, 6, 7- session, presentation, and application are user support layers.

An exchange using the OSI model:

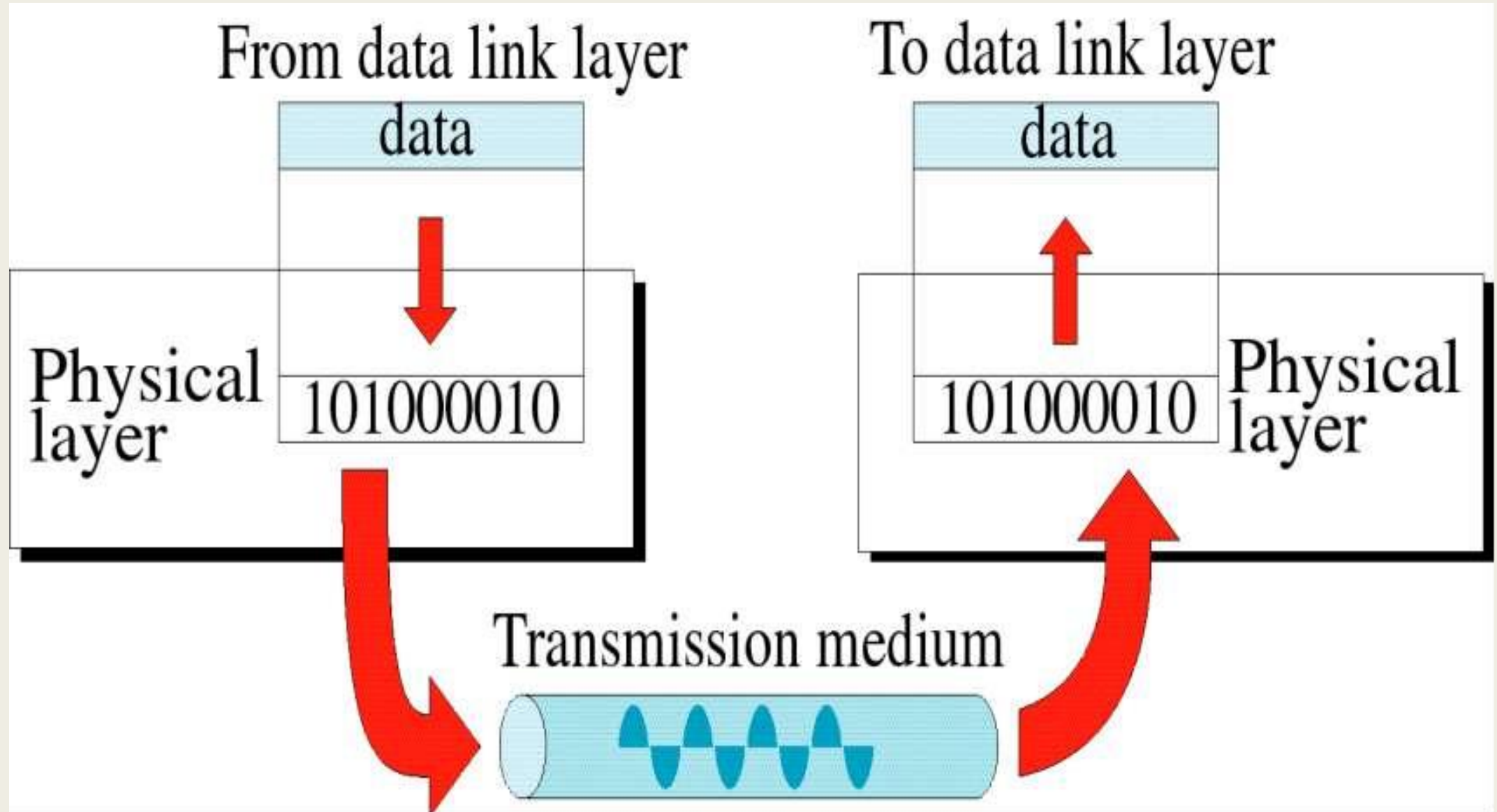




Physical Layer:

- ❑ Physical layer is the bottom(layer 1) of OSI model.
- ❑ It is responsible for the actual physical connection between the devices.
- ❑ The physical layer is responsible for movements of individual bits from one node to next.

Physical Layer:



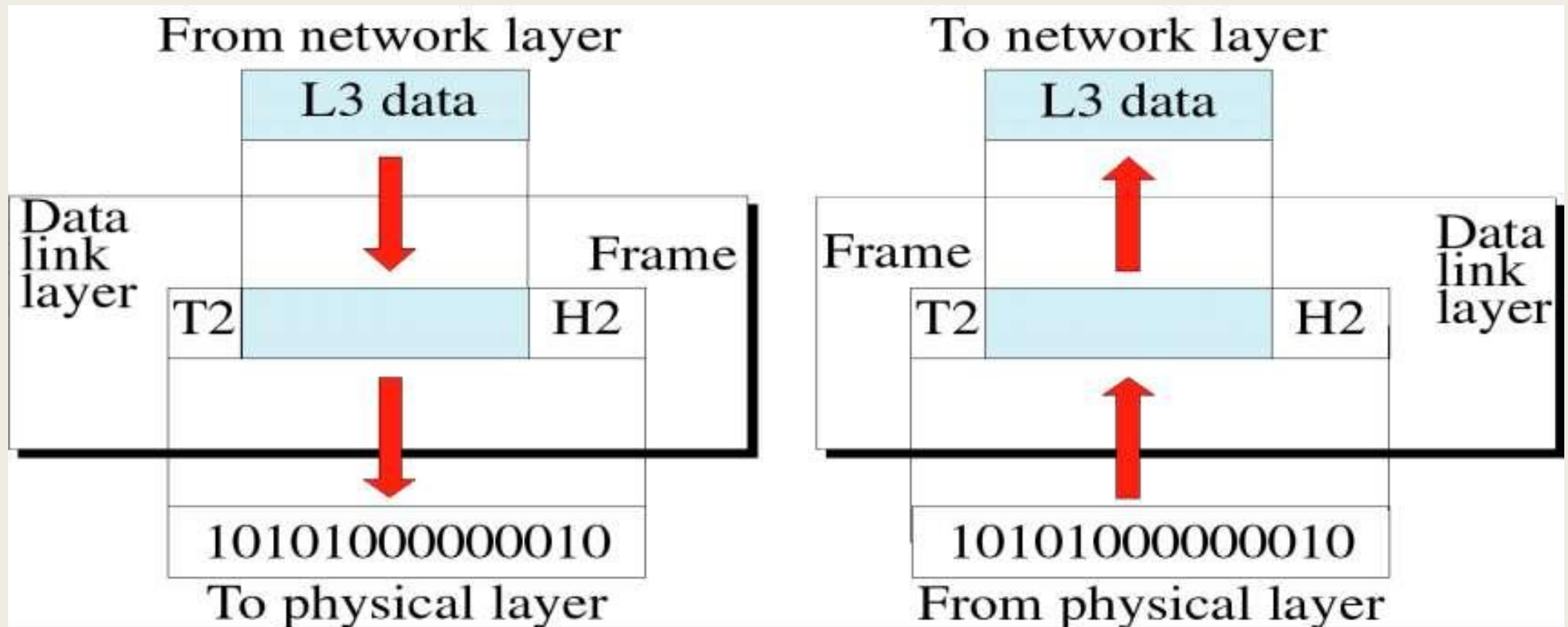


Functions of Physical Layer:

- ☐ Convert bits to signals
- ☐ Bit synchronization
- ☐ Manage physical connection
- ☐ Bit rate control
- ☐ Line configuration
- ☐ Physical topology
- ☐ Transmission mode
- ☐ Multiplexing
- ☐ Switching

Data Link Layer:

- ❑ The data link layer is responsible for moving frames from one node to the next.



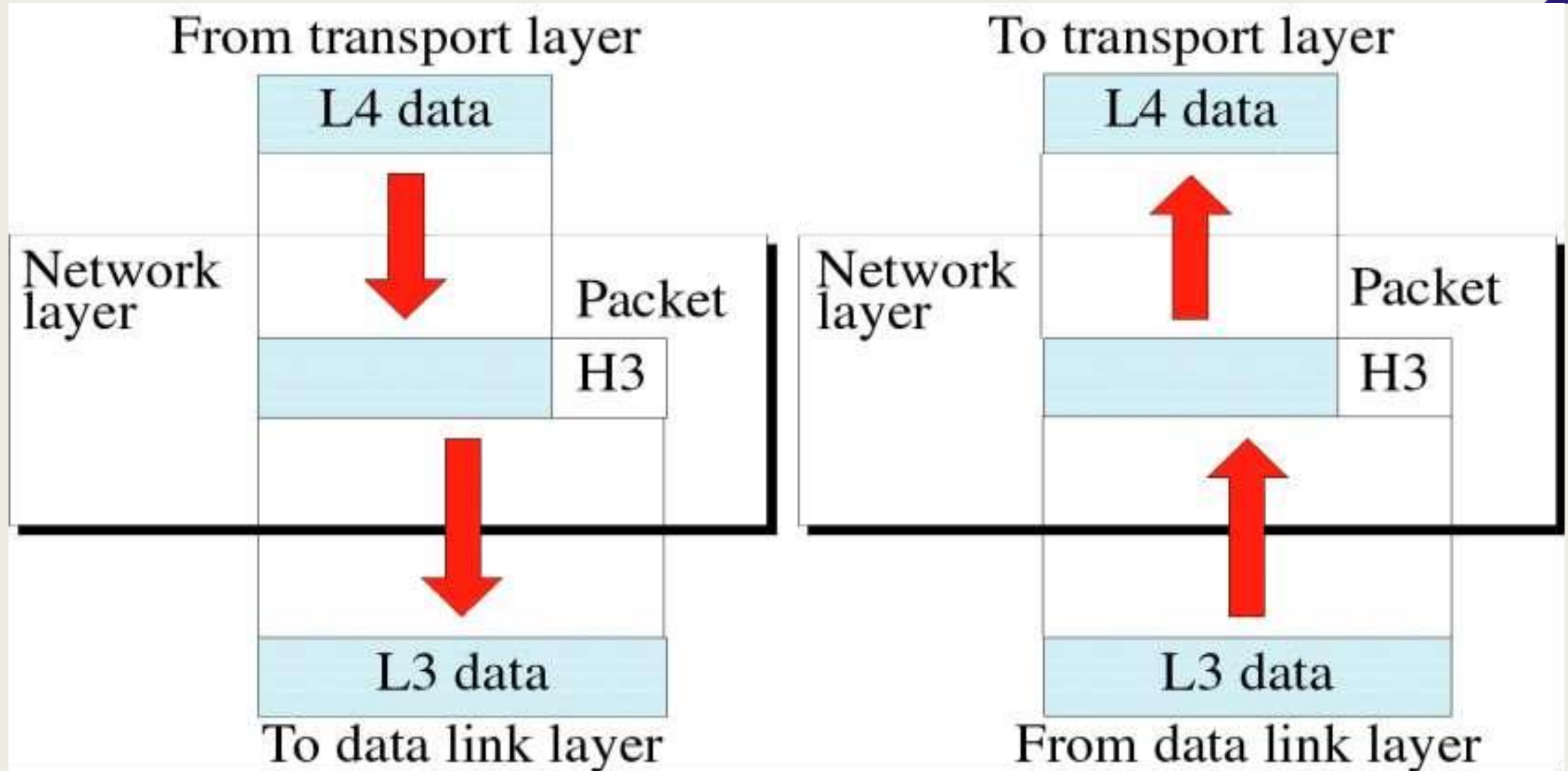
Source: Kataria, "OSI Models", [Online], Available:
<https://codes.pratikkataria.com/osi-models-explanation/>



Functions of Data Link Layer:

- ❑ Framing:- divides the data from N/W layer into frames.
- ❑ Physical Addressing:- Add a header to the frame to define the physical address of the source and the destination machines.
- ❑ Flow Control:- It is the traffic regulatory mechanism implemented by Data Link layer that prevents the fast sender from drowning the slow receiver.
- ❑ Error Control:- It provides the mechanism of error control in which it detects and retransmits damaged or lost frames.
- ❑ Feedback:- after transmitting the frames, the system waits for the feedback.

Network Layer:



Source: Kataria, "OSI Models", [Online], Available:
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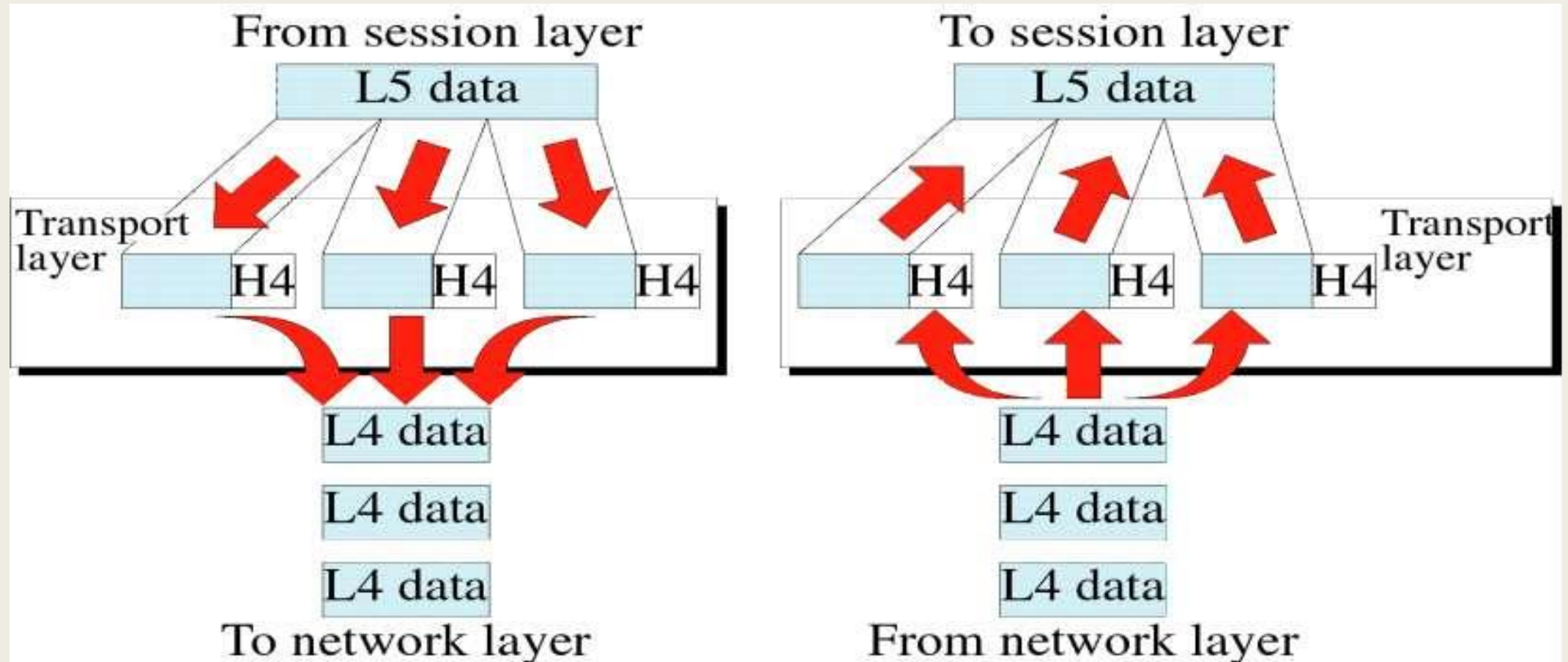


Functions of Network layer:

- ❑ It is responsible for the source to destination delivery of a packets across multiple networks.
- ❑ Routing:- Provide mechanism to transmit data over independent networks that are linked together.
- ❑ Logical addressing:- Adds Logical addresses of sender and Receiver.

Transport Layer:

It is responsible for source process to destination process delivery of entire message.





Transport Layer:

Transport layer provides two types of services:

- 1) **Connection Oriented Transmission:** In this type of transmission the receiving device sends an acknowledgment back to the source after a packet or group of packet is received.
- 2) **Connectionless Transmission:** In this type of transmission the receiver does not acknowledge receipt of a packet.

Functions of Transport Layer:

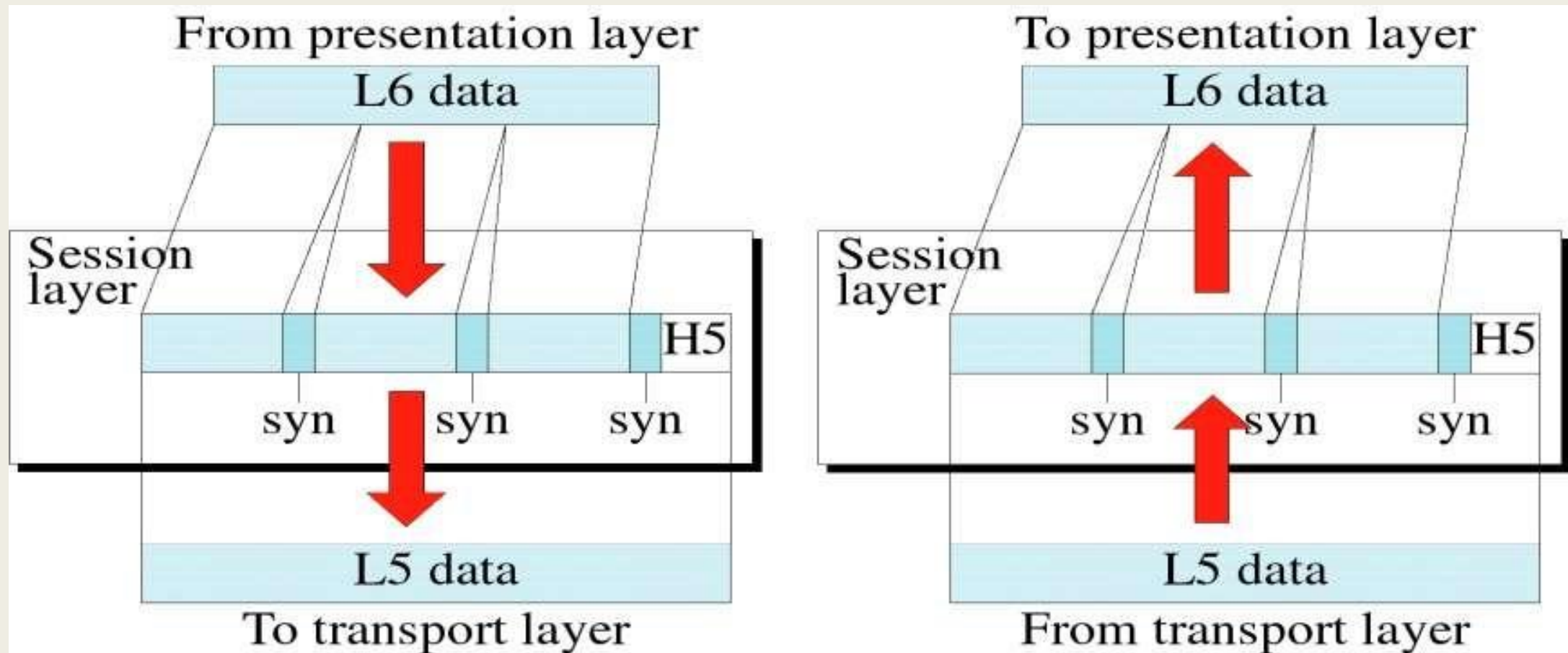


- ❑ Segmentation and Reassembly: Divide the message received from Session layer into Segments and number them to make a sequence for reassembly at the receiving side.
- ❑ Service point addressing: Transport layer makes sure that the message is delivered to the correct process on destination machine.
- ❑ Error Control: Make sure that the entire message arrives without errors else retransmit.
- ❑ Flow Control: Transport layer makes sure that the sender and the receiver communicate at a rate they both can handle.

Session Layer:



- It is responsible for beginning, maintaining & ending the communication between two devices, which is called session.



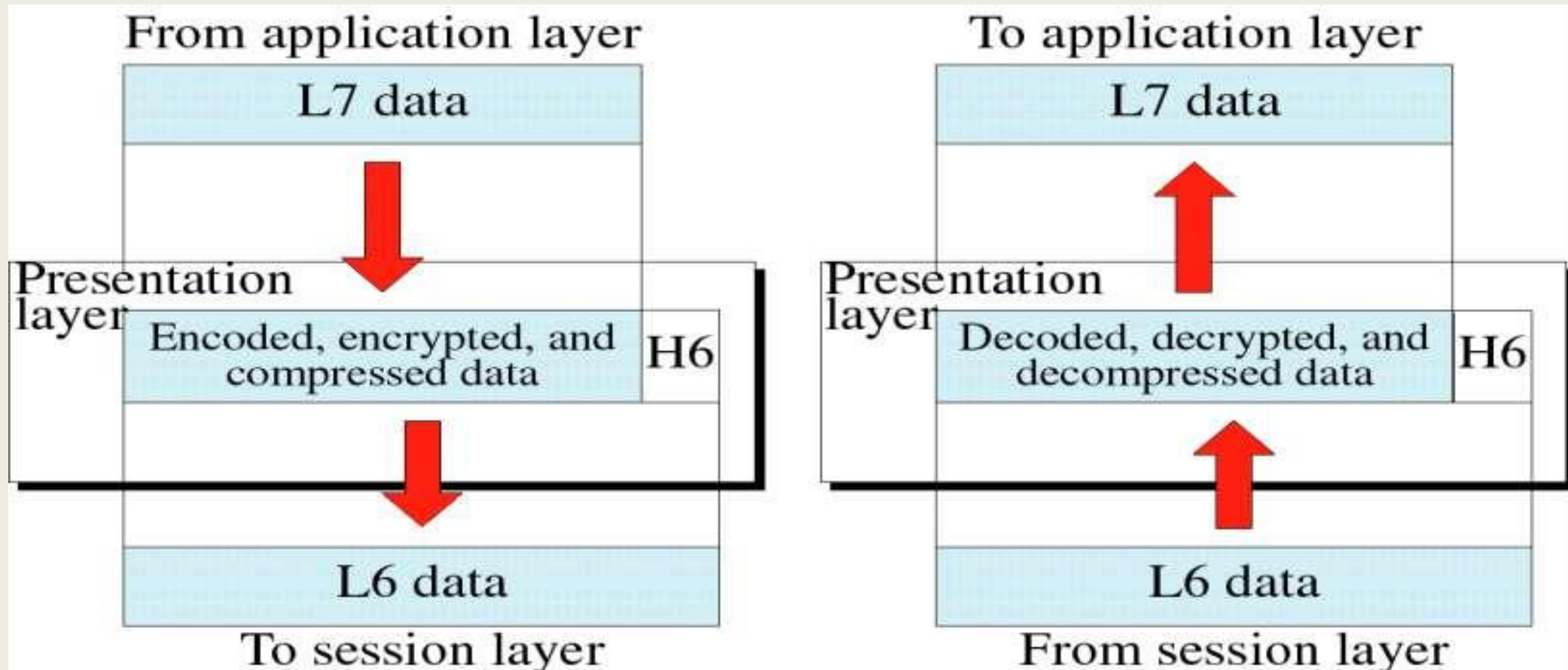
Functions of Session Layer:



- ❑ Establishment, maintaining and ending a session:
 - ❑ Sends SYN packet – establish request
 - ❑ Receives ACK & SYN- established
 - ❑ To end – Sender sends ACK
- ❑ Dialog Control: The session layer allows two systems to enter into a dialog.
- ❑ Synchronization: Allows a process to add checkpoints to a stream of data.

Presentation Layer:

- ❑ This layer is concerned with the syntax and semantics of the information exchanged between two systems.



Source: Kataria, "OSI Models", [Online], Available:
<https://codes.pratikkataria.com/osi-models-explanation/>

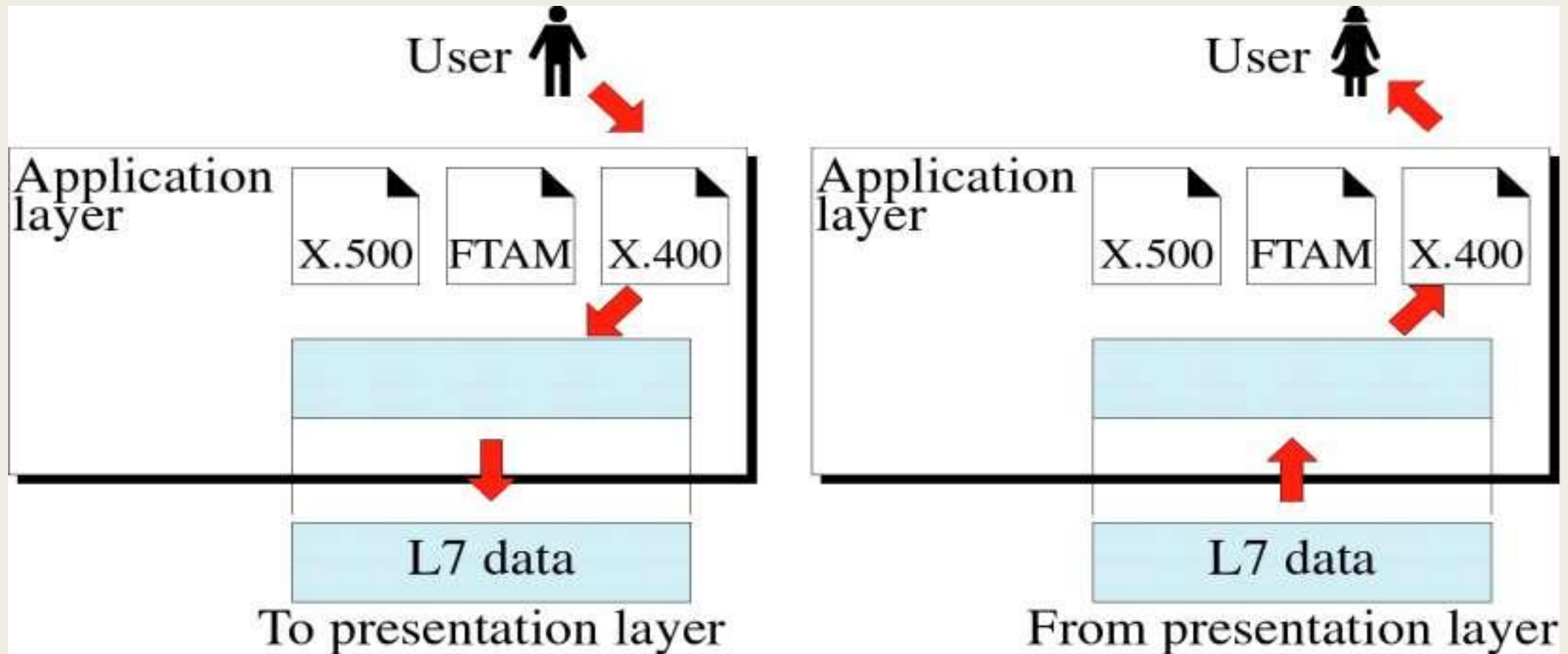
Functions of Presentation Layer:



- ❑ Data Translation: Encoding and Decoding Sender to Common format on Sending side Common to Receiving format on Receiver side
- ❑ Data Encryption: For security and privacy purpose.
- ❑ Data Compression: Data compression reduces the number of bits contained in the information.

Application Layer:

- ❑ Provides User interfaces and support for Services, like e-mail, file transfer.



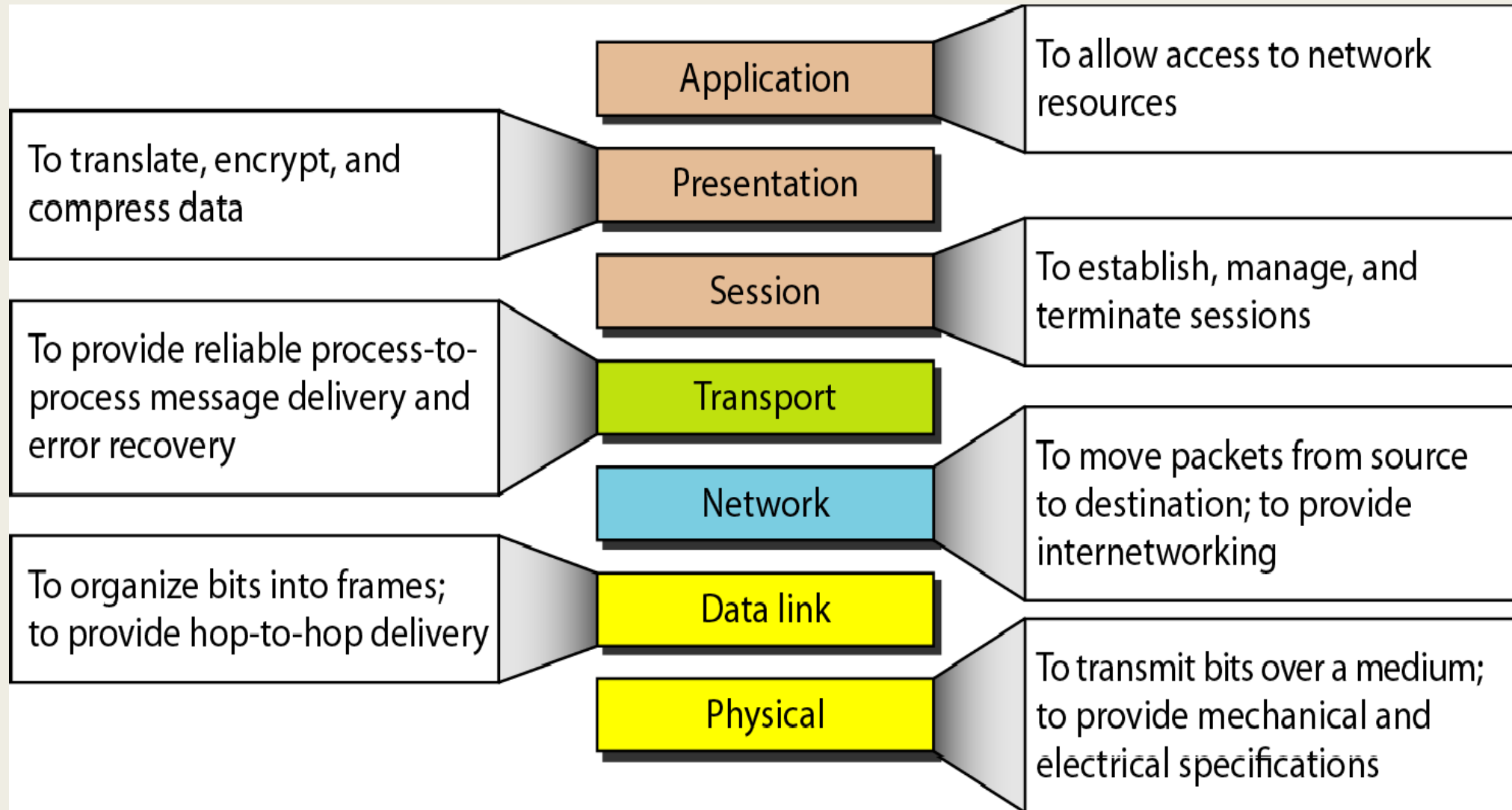
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Functions of Application Layer:



- ❑ Network Virtual terminal: It allows a user to log on to a remote host.
- ❑ File Transfer Access, and Management: This application allows a user to access files in a remote host.
- ❑ Mail Services: This application provides various e-mail services.
- ❑ Directory Services: This application provides the distributed database sources and access for global information about various objects and services.

Summary

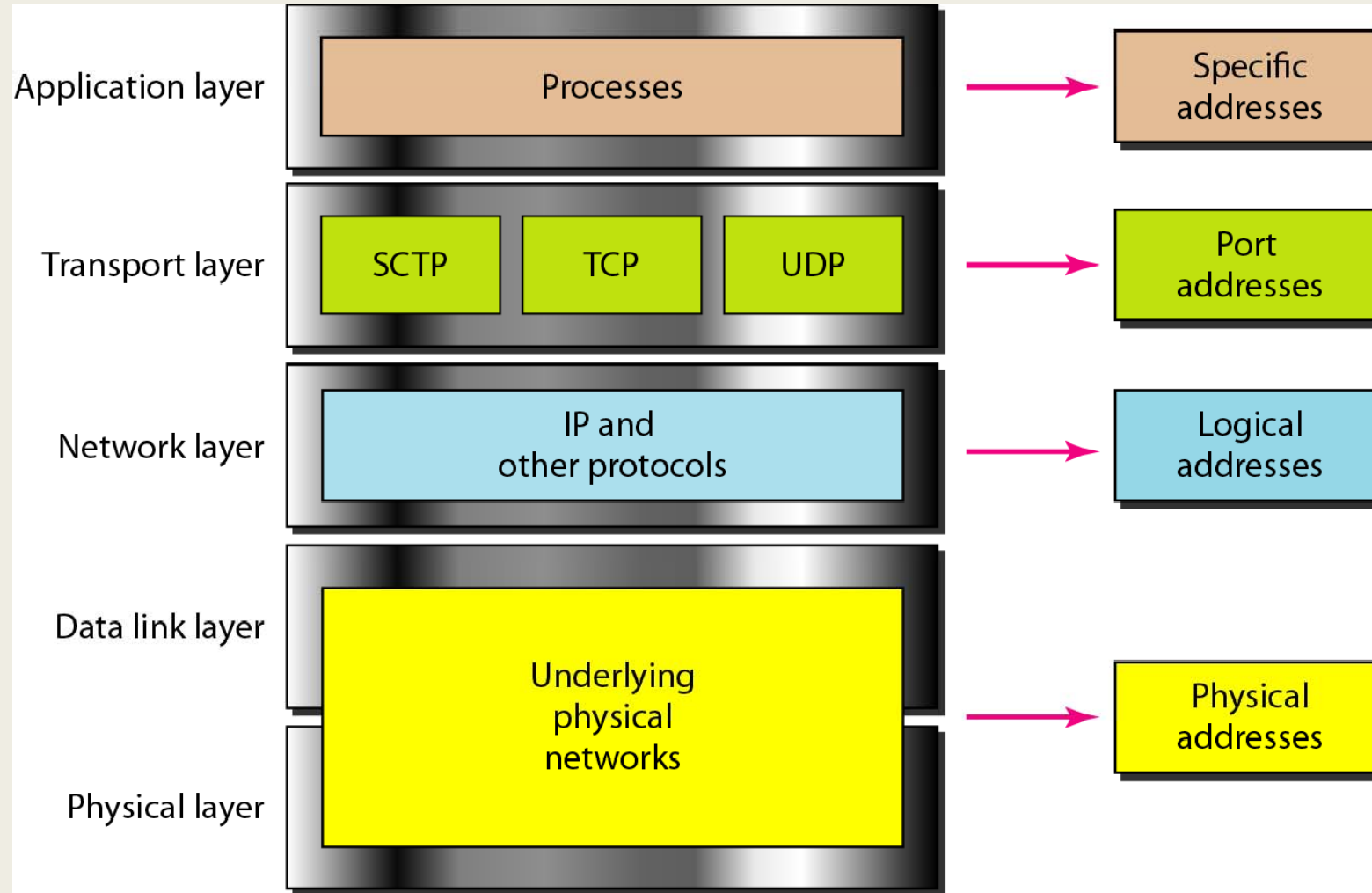


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TCP/IP Model:

- ❑ TCP/IP forms the base of present day internet.
- ❑ TCP and IP are two protocols of this model.
- ❑ This model was initially used by ARPANET.
- ❑ The TCP/IP protocol suite was defined as having four layers:
 - ❑ Host-to-network
 - ❑ Internet
 - ❑ Transport
 - ❑ Application

TCP/IP Model:

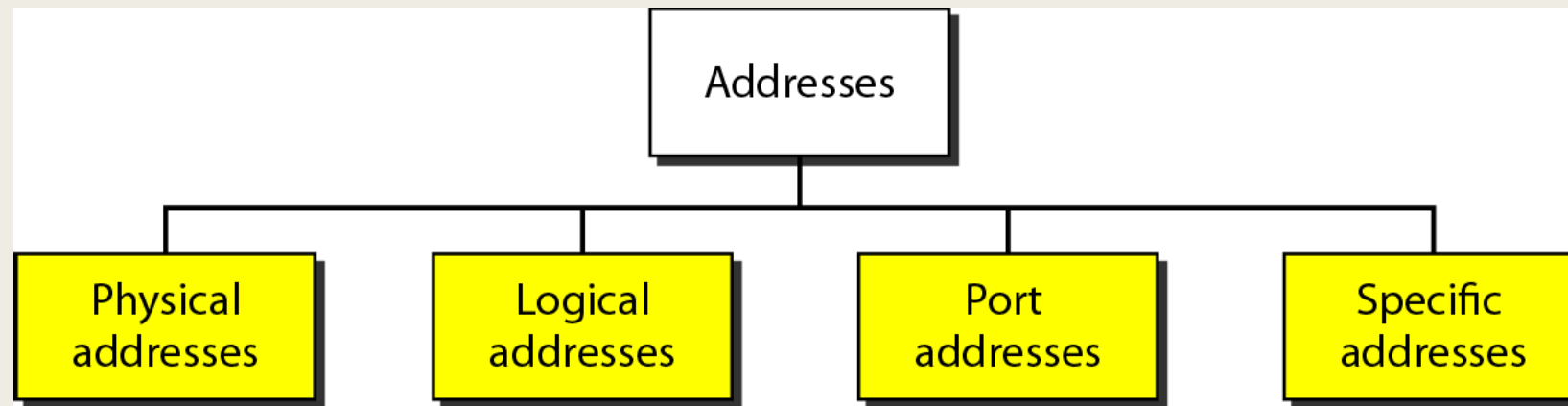


<https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxIZWJhaHJpYTV8Z3g6MjE2MzY2Mjc4MGU3MmQ4Nw>

Addressing

Four levels of addresses are used in an internet employing the *TCP/IP* protocols:

physical (link) addresses, logical (IP) addresses, port addresses, and specific addresses.





Physical Addresses

- The physical address, also known as the link address, is the address of a node as defined by its LAN or WAN.
- It is included in the frame used by the data link layer.
- It is the lowest-level address.
- The physical addresses have authority over the network (LAN or WAN).
- The size and format of these addresses vary depending on the network.
- For example, Ethernet uses a 6-byte (48-bit) physical address that is imprinted on the network interface card (NIC).



Logical Addresses

- Logical addresses are necessary for universal communications that are independent of underlying physical networks.
- A logical address in the Internet is currently a 32-bit address.
- Uniquely define a host connected to the Internet.
- No two publicly addressed and visible hosts on the Internet can have the same IP address.



Port Addresses

- A port number is the logical address of each application or process that uses a network or the Internet to communicate.
- A port number uniquely identifies a network-based application on a computer.
- Each application/program is allocated a 16-bit integer port number.
- This number is assigned automatically by the OS, manually by the user or is set as a default for some popular applications.



Specific Addresses

- Some applications have user-friendly addresses that are designed for that specific application.
- Examples include the e-mail address (for example, `forouzan@fhda.edu`) and the Universal Resource Locator (URL) (for example, `www.mhhe.com`).
- The first defines the recipient of an e-mail; the second is used to find a document on the World Wide Web.

Thank You!!!