Computer Network

Lecture-5

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Network Models

OSI Model

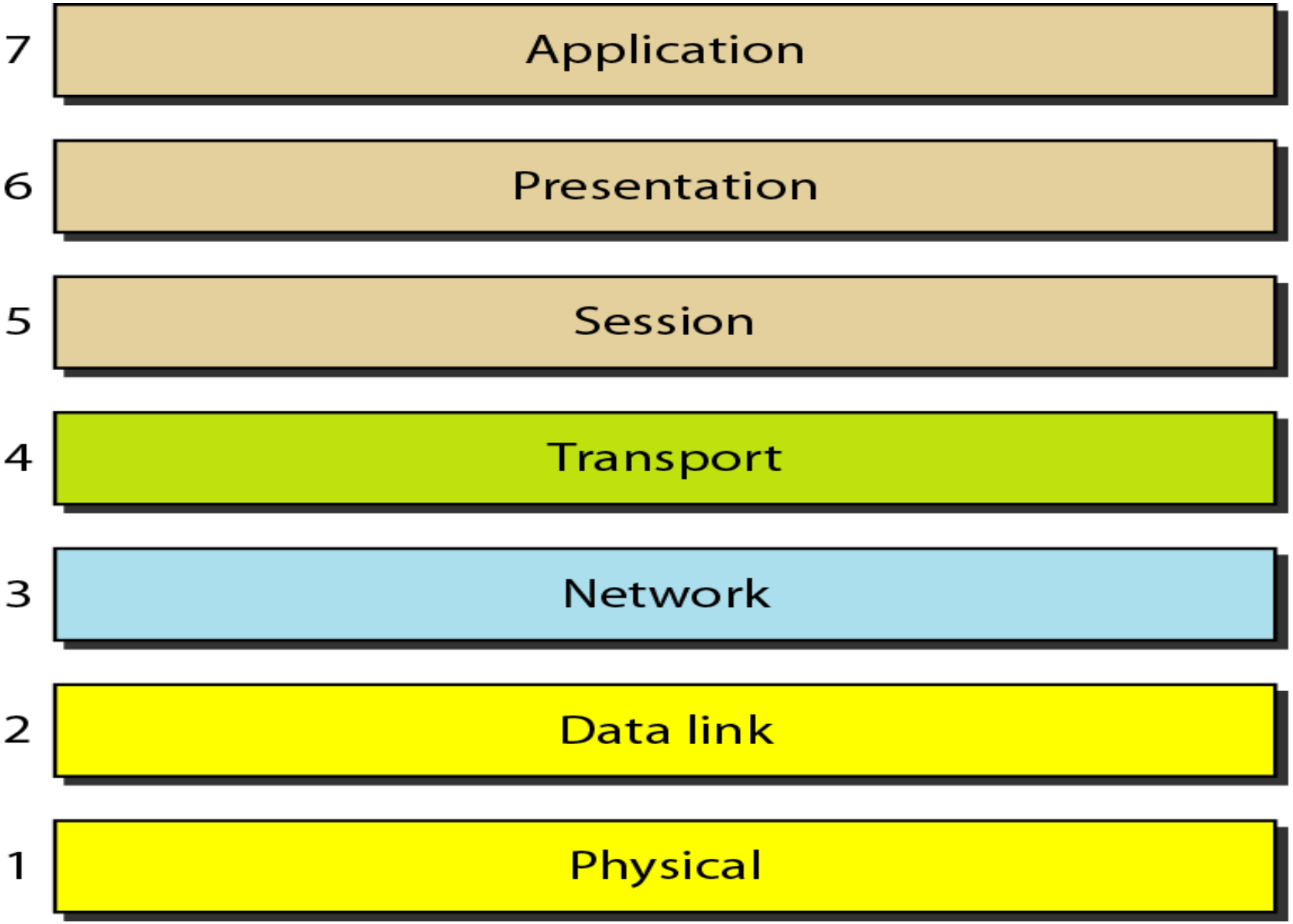
- Its full form is Open Systems Interconnection model.
- It was developed by International Standards Organization (ISO) organization in 1970.
- An open system is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture.
- The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.
- The OSI model is not a protocol; it is a model for understanding and designing a network architecture that is flexible, robust, and interoperable.

OSI Model

- The OSI model is a layered framework for the design of network systems that allows communication between all types of computer systems.

- It consists of seven separate but related layers, each of which defines a part of the process of moving information across a network.

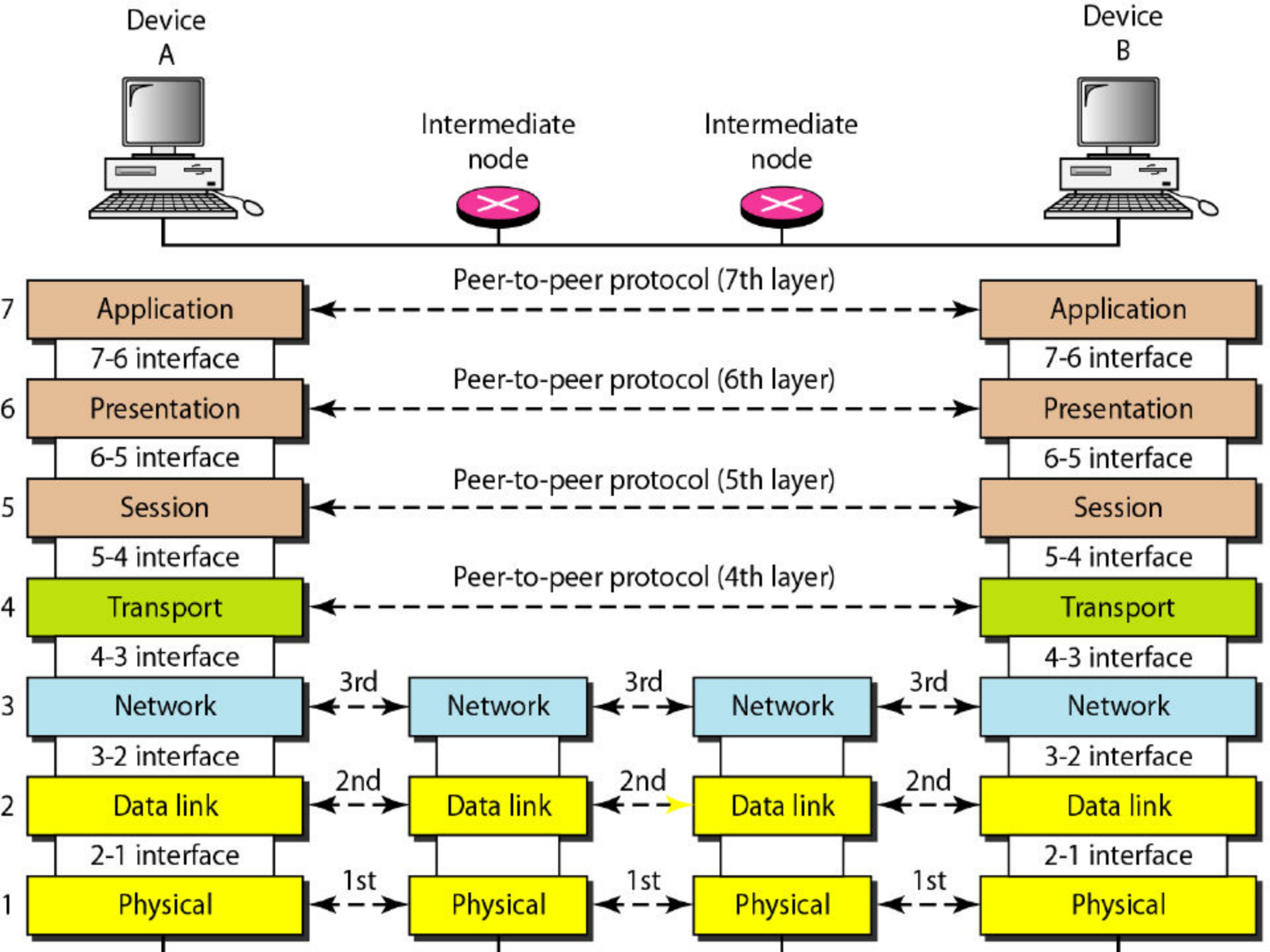
OSI Model


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

OSI Model

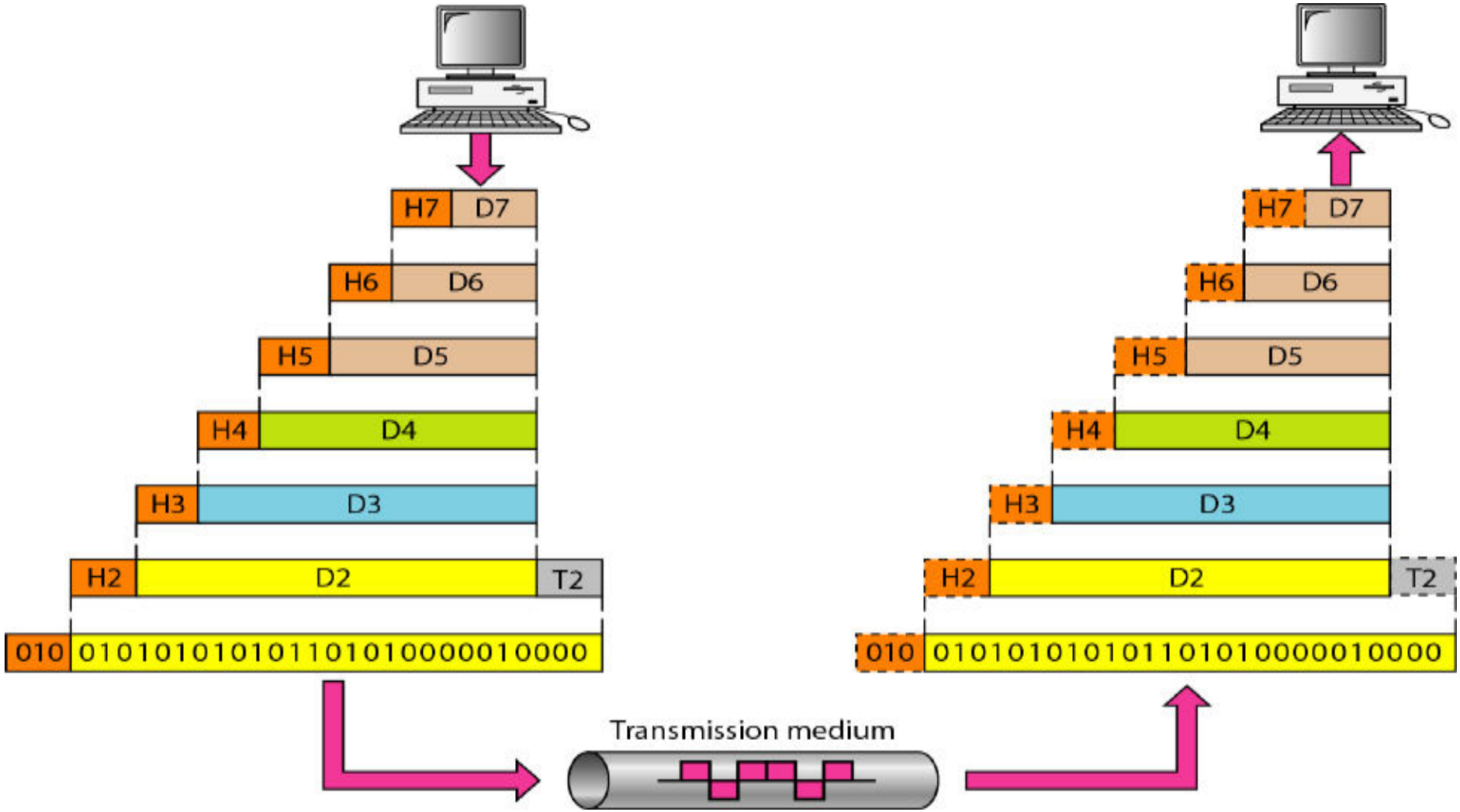
Layered Architecture

Following figure shows the layers involved when a message is sent from device A to device B. As the message travels from A to B, it may pass through many intermediate nodes. These intermediate nodes usually involve only the first three layers of the OSI model.


Device A
Device B
Intermediate node
Intermediate node
Peer-to-peer protocol (7th layer)
Peer-to-peer protocol (6th layer)
Peer-to-peer protocol (5th layer)
Peer-to-peer protocol (4th layer)
7
Application
7-6 interface
6
Presentation
6-5 interface
5
Session
5-4 interface
4
Transport
4-3 interface
3
Network
3rd
3-2 interface
2
Data link
2nd
2-1 interface
1
Physical
1st

OSI Model

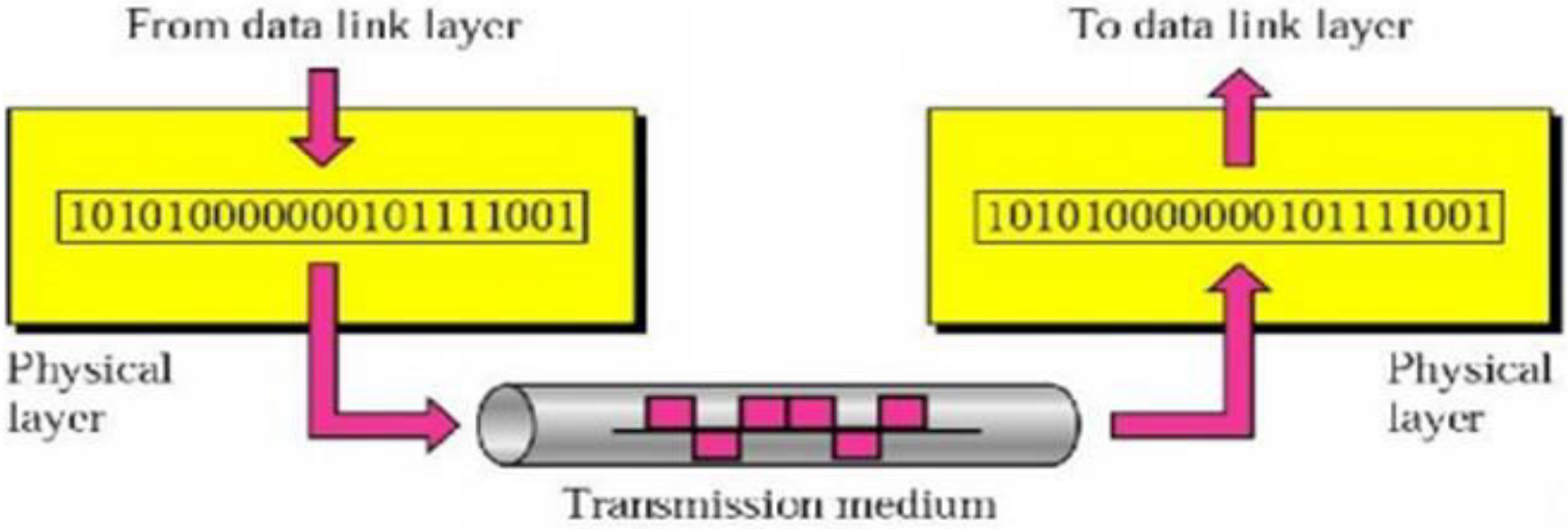
An exchange of messages using OSI model is shown in the following figure:-



Functions of Physical Layer

The physical layer coordinates the functions required to carry a bit stream over a physical medium. It deals with the mechanical and electrical specifications of the interface and transmission medium.

Note: The physical layer is responsible for movements of individual bits from one hop (node) to the next.



Functions of Physical Layer

The physical layer is also concerned with the following:

- Physical characteristics of interfaces and medium: The physical layer defines the characteristics of the interface between the devices and the transmission medium. It also defines the type of transmission medium.
- Representation of bits: The physical layer data consists of a stream of bits (sequence of 0s or 1s) with no interpretation. To be transmitted, bits must be encoded into signals--electrical or optical. The physical layer defines the type of encoding (how 0s and 1s are changed to signals).

Functions of Physical Layer

- Data rate: The transmission rate-the number of bits sent each second-is also defined by the physical layer.
- Synchronization of bits: The sender and receiver not only must use the same bit rate but also must be synchronized at the bit level.
- Line configuration: The physical layer is concerned with the connection of devices to the media; it may be point-to-point configuration or multi-point.

Functions of Physical Layer

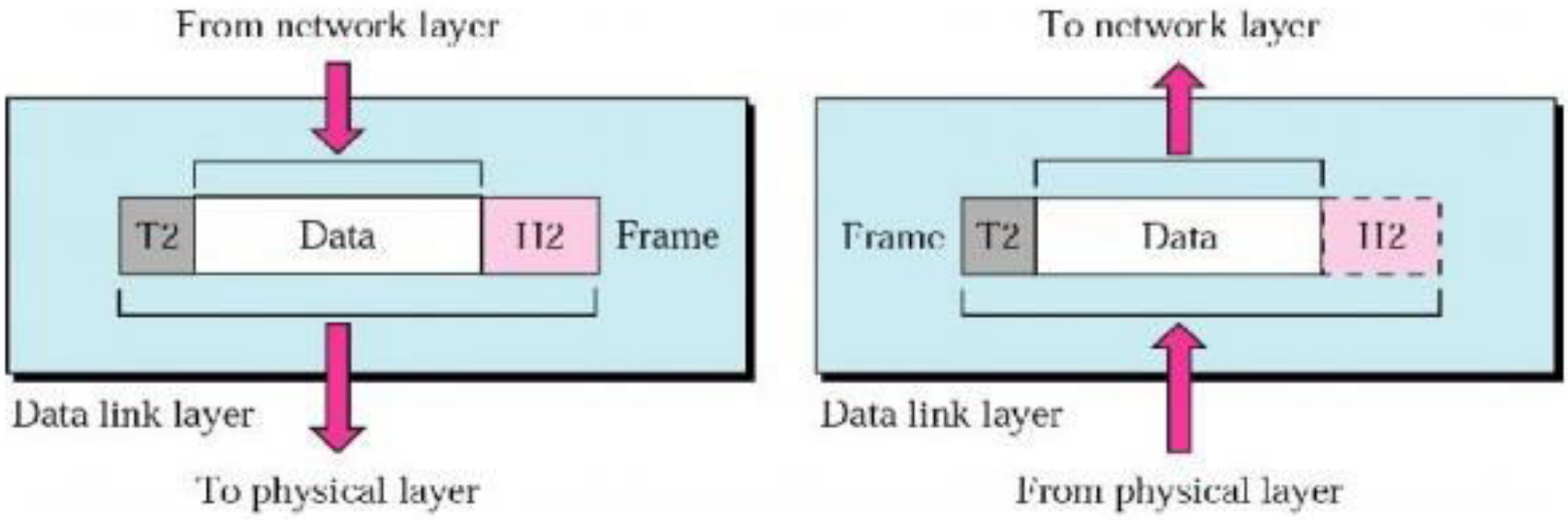
- Physical topology: The physical topology defines how devices are connected to make a network. Ex. Mesh, Star, Ring, Bus, or a hybrid topology.

- Transmission mode: The physical layer also defines the direction of transmission between two devices: simplex, half-duplex, or full-duplex.

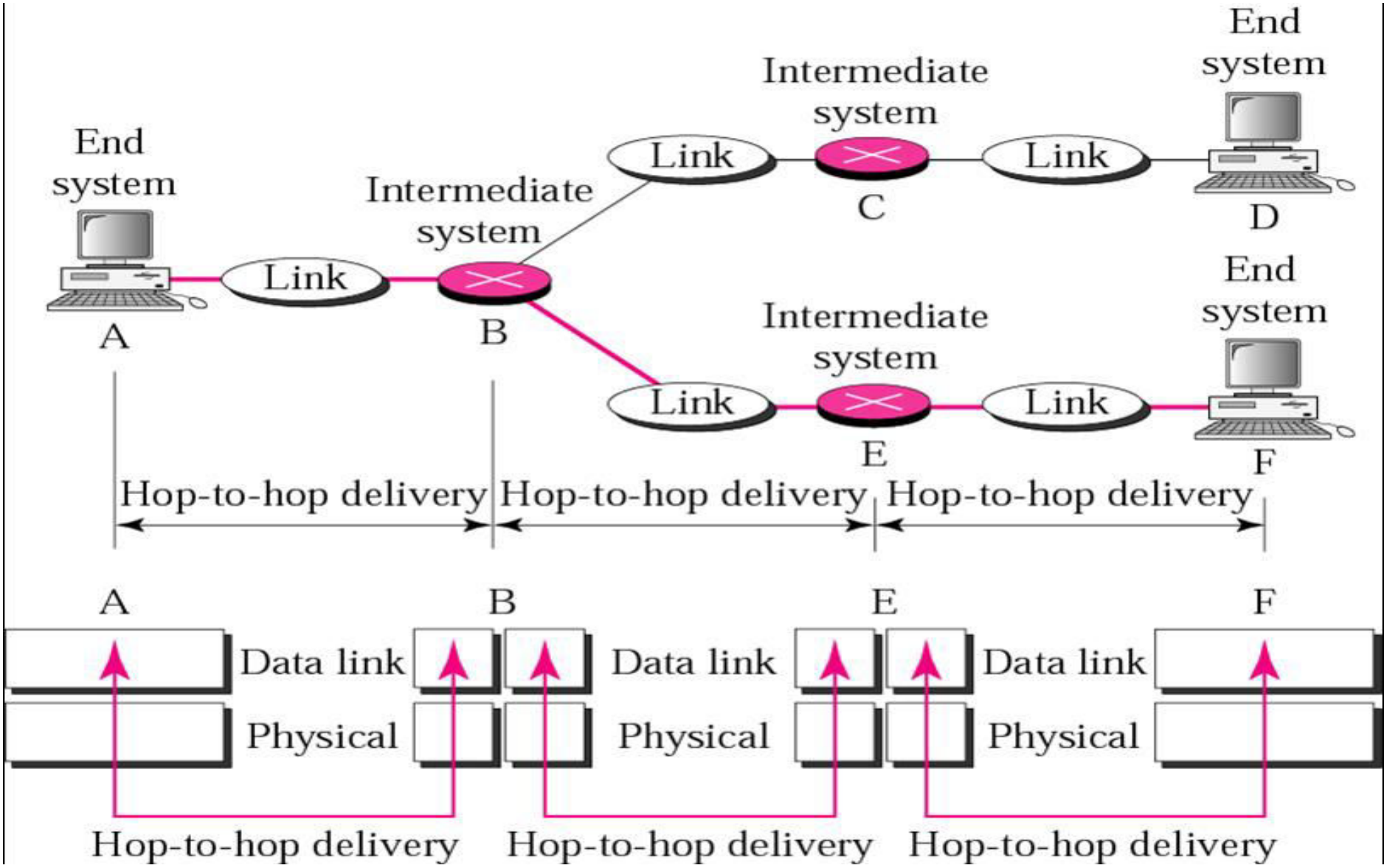
Functions of Data Link Layer

The data link layer transforms the physical layer, a raw transmission facility, to a reliable link. It makes the physical layer appear error-free to the upper layer (network layer).

Note: The data link layer is responsible for moving frames from one hop (node) to the next.



Functions of Data Link Layer



Functions of Data Link Layer

Other responsibilities of the data link layer include the following:

1. Framing: The data link layer divides the stream of bits received from the network layer into manageable data units called frames.

2. Physical addressing: If frames are to be distributed to different systems on the network , the data link layer adds a header to the frame to define the sender and/or receiver of the frame.

3. Flow control: If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver.

Functions of Data Link Layer

4. Error control: The data link layer adds reliability to the physical layer by adding mechanisms to detect and retransmit damaged or lost frames.

5. Access control: When two or more devices are connected to the same link, data link layer protocols are necessary to determine which device has control over the link at any given time.