

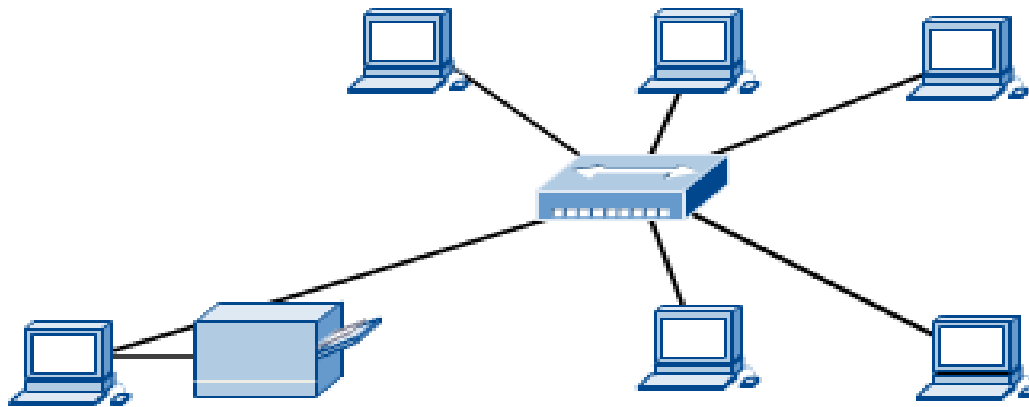


Data Communication (CSX-208) Dr Samayveer Singh

Overview of Network Models

Networks

- A network is a set of devices (often referred to as nodes) connected by communication links.

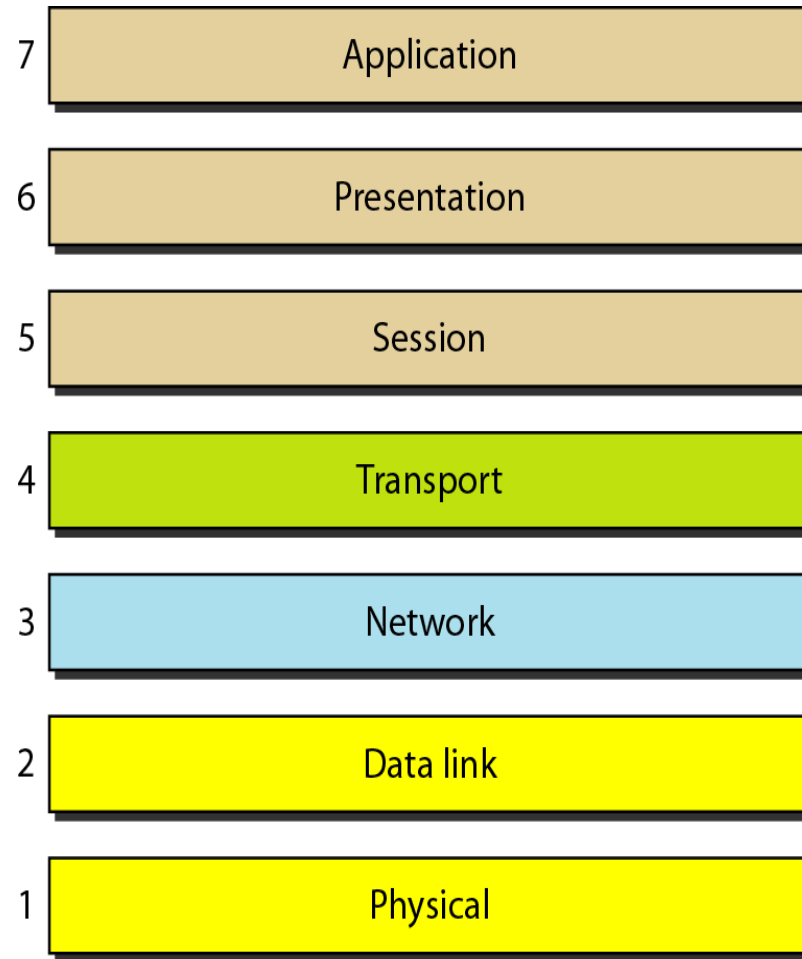


- A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.
- A link can be a cable, air, optical fiber, or any medium which can transport a signal carrying information.

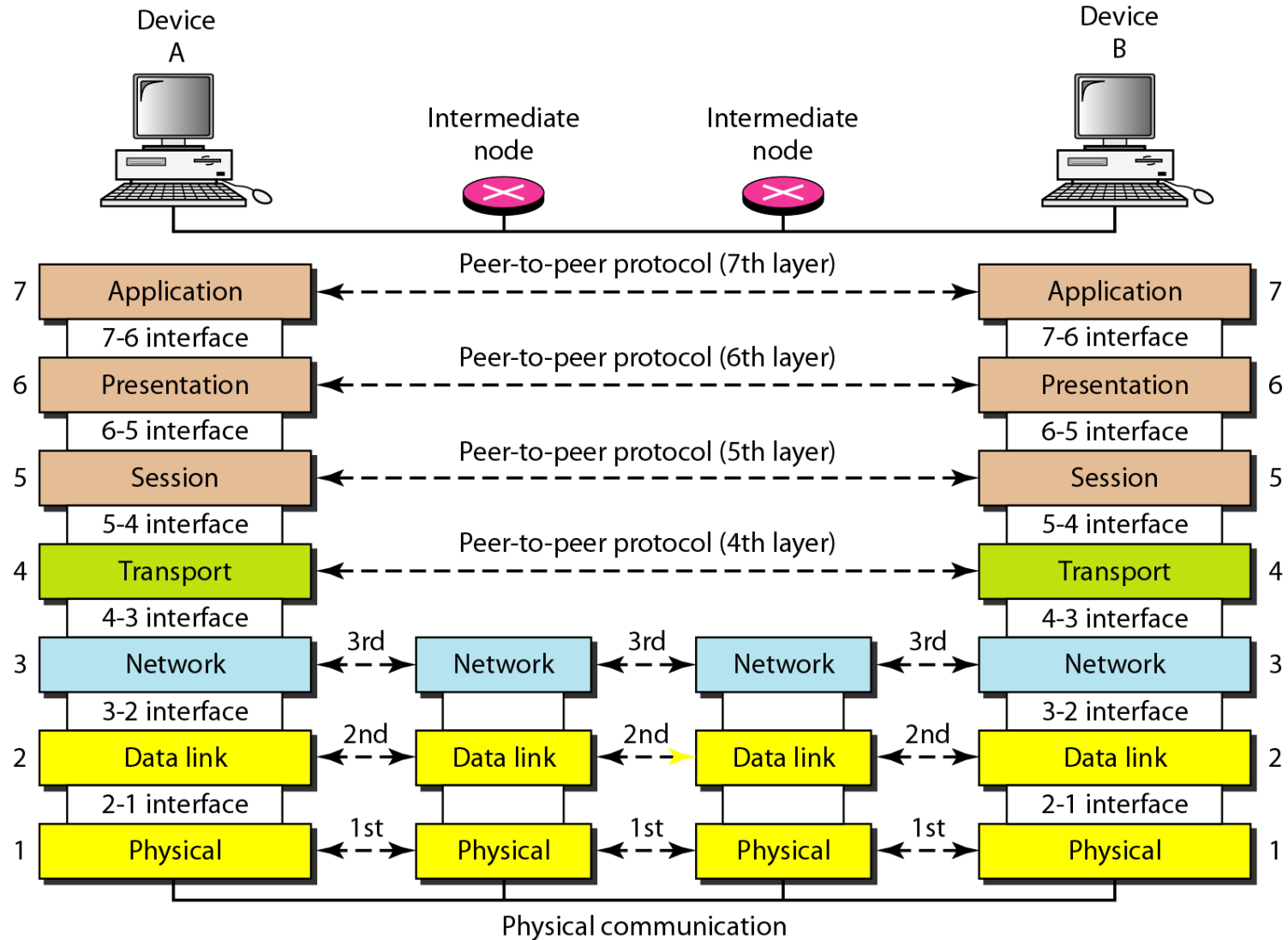
Computer Network Frameworks

- There are some well defined frameworks (i.e., OSI and TCP/IP) to design computer networks so that communication between various devices (of any type) can be done.
- OSI Model: It is a layered framework which is composed of seven ordered layers.
- *Each layer is part of a process, which moves information across a network from one system to another.*

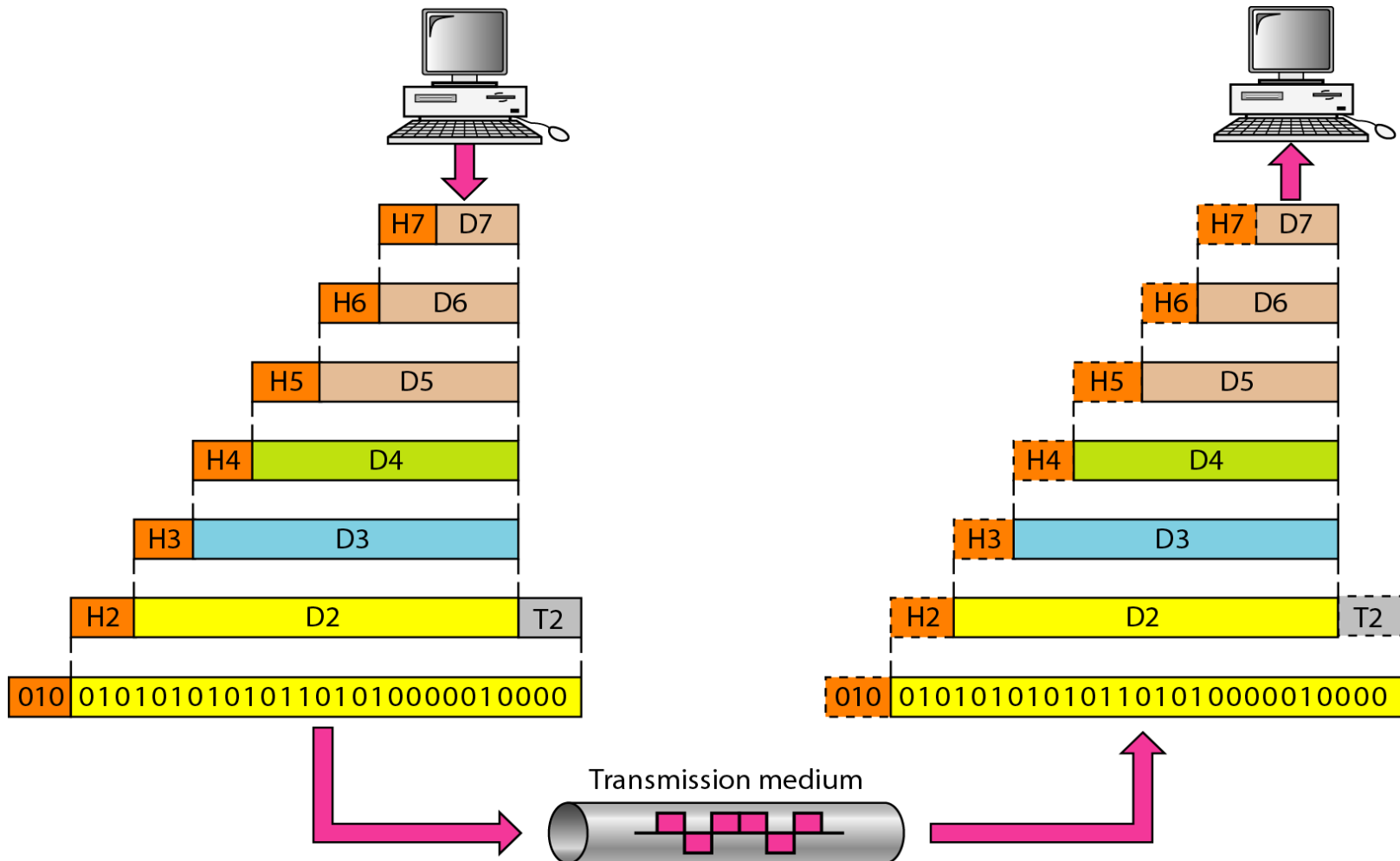
Seven layers of the OSI model



Interaction between layers in OSI model

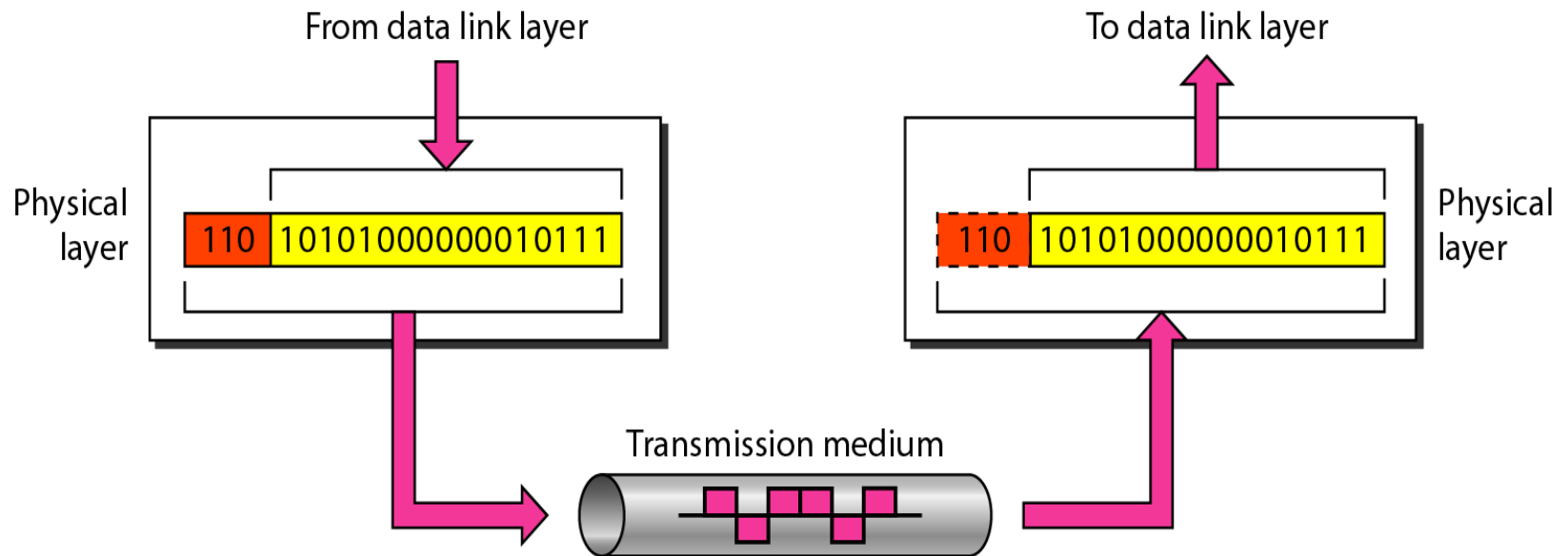


An exchange using OSI model



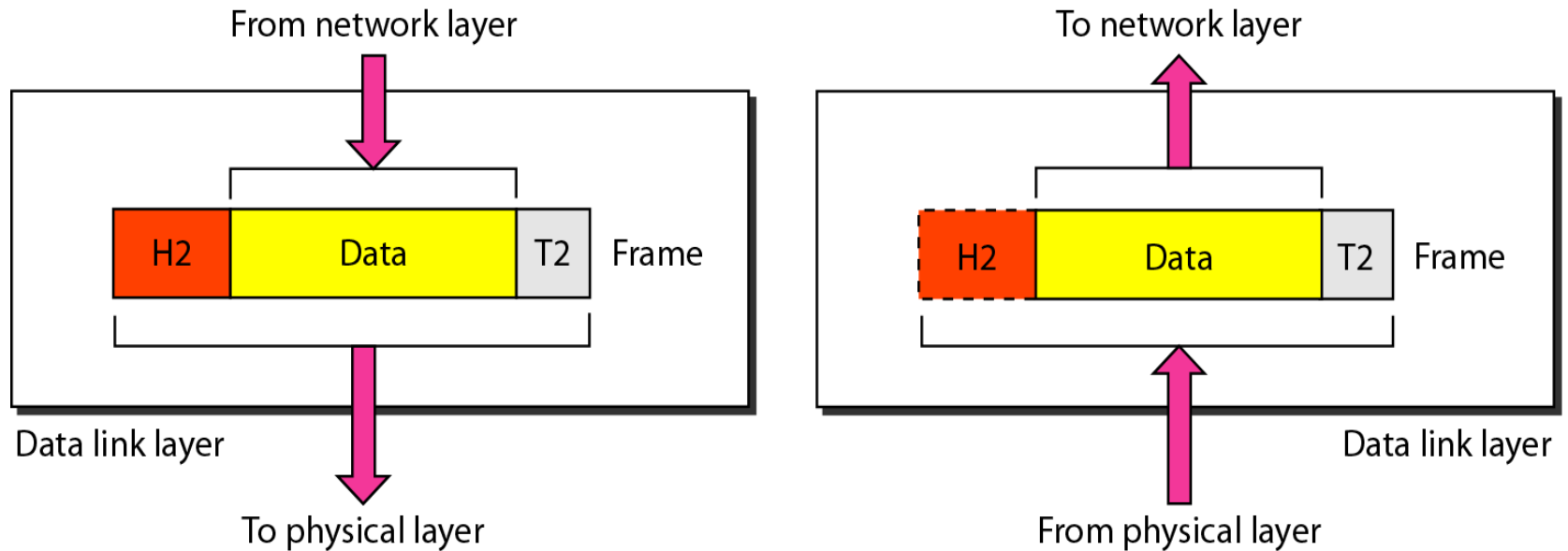
Physical layer

- It is responsible for movement of individual bits from one node to the next node.

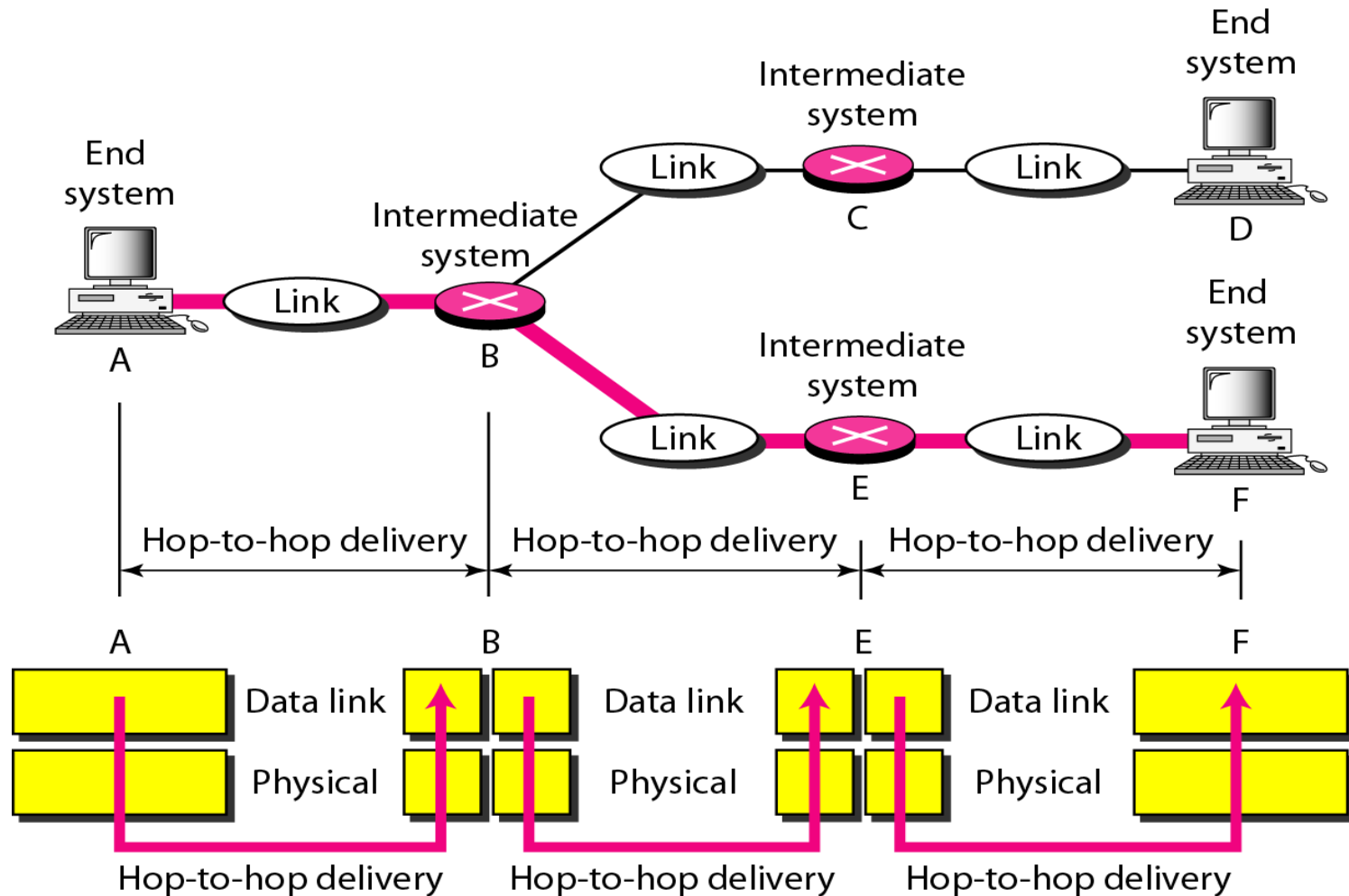


Data Link layer

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

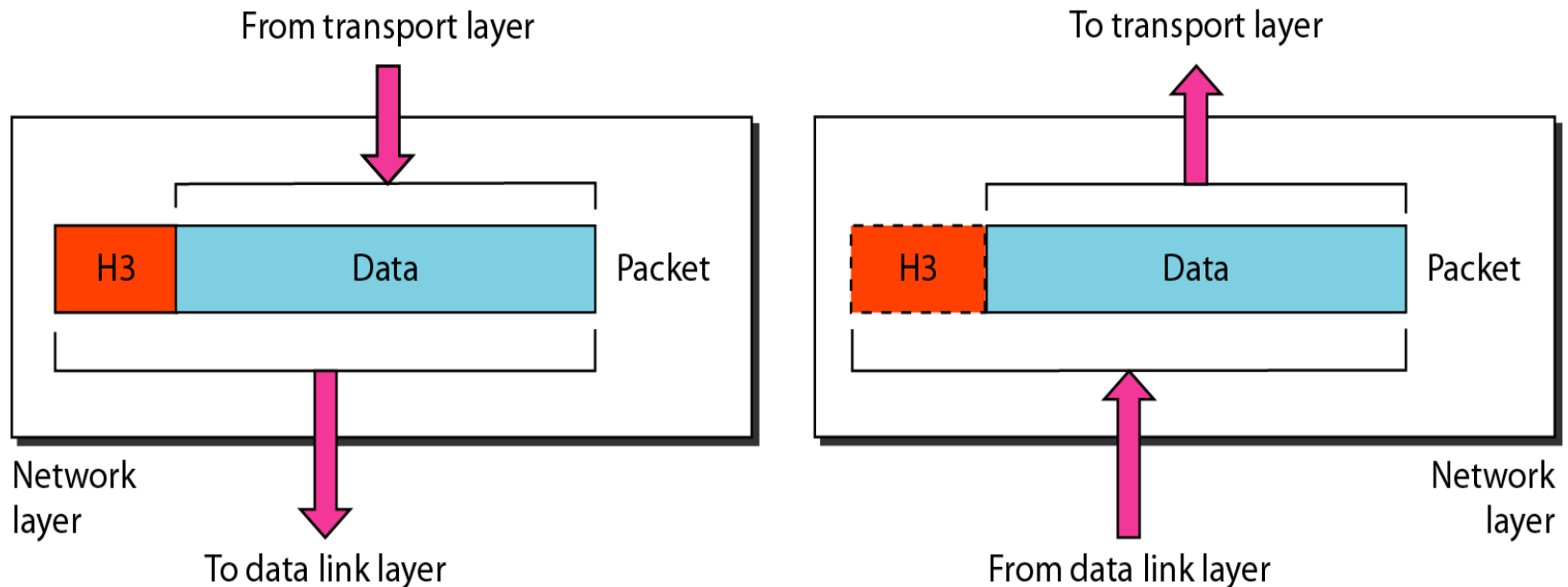


Hop-to-hop delivery

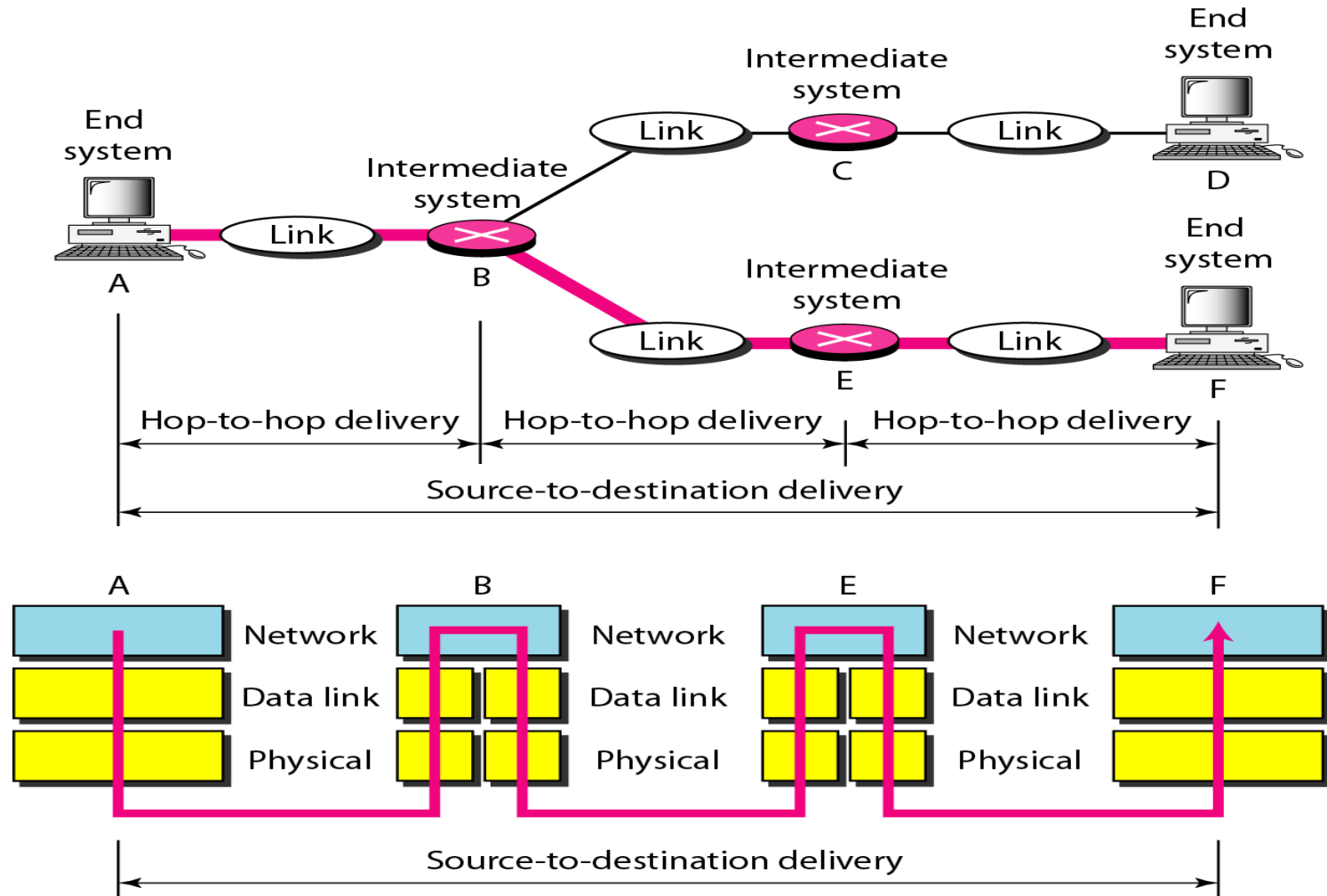


Network layer

- The network layer is responsible for the delivery of individual packets from the source host to the destination host.

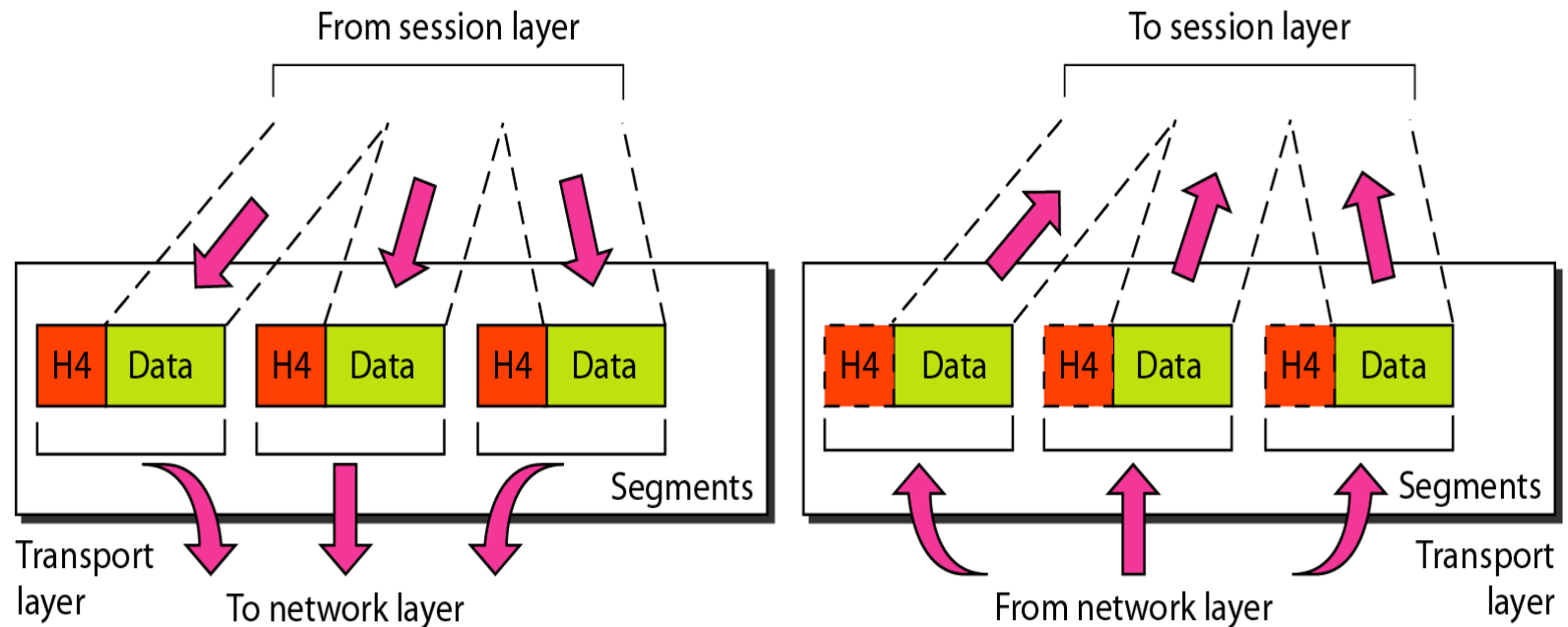


Source-to-destination delivery

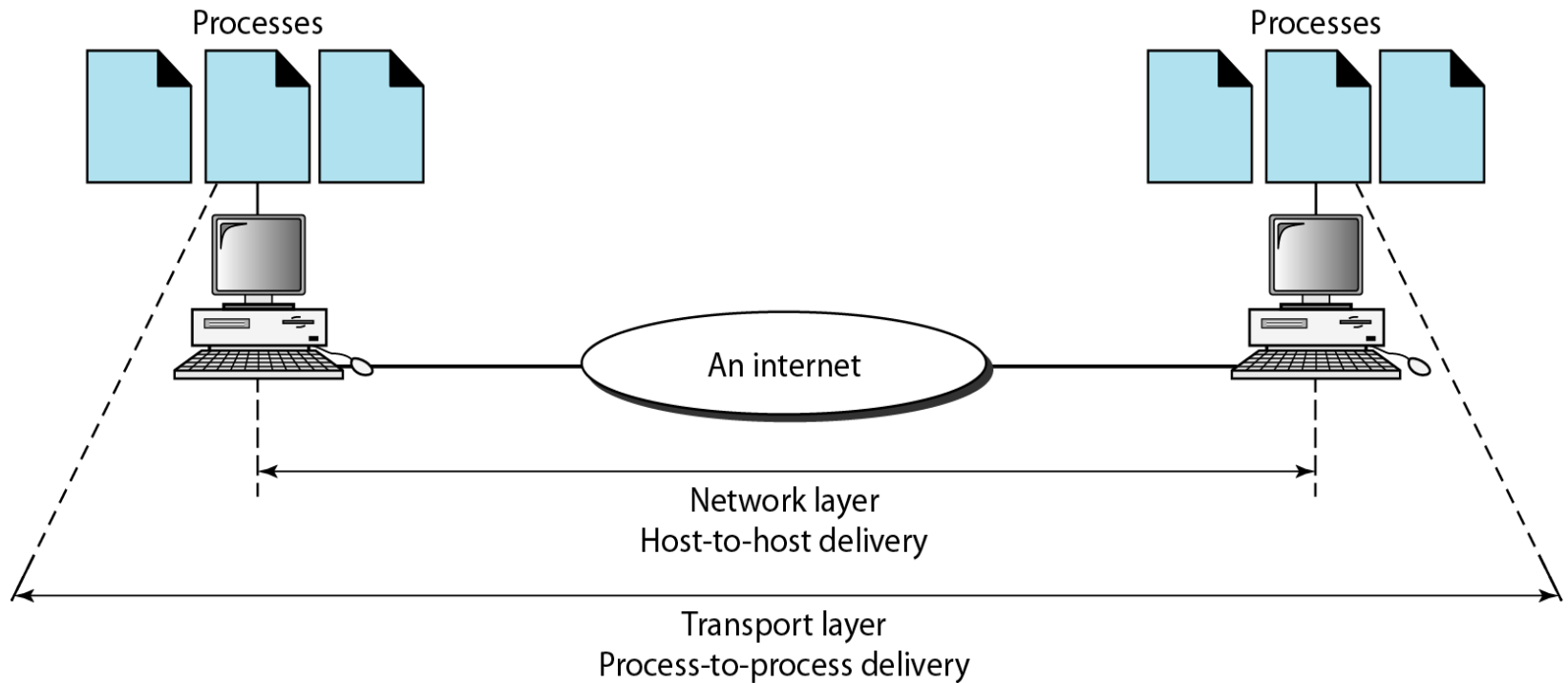


Transport layer

- The transport layer is responsible for the delivery of a message from one process to another.

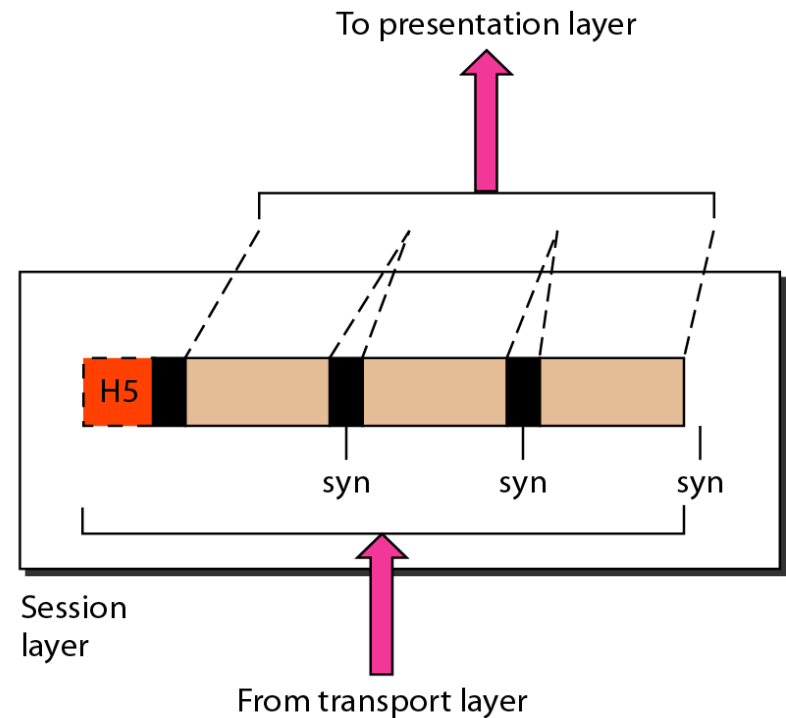
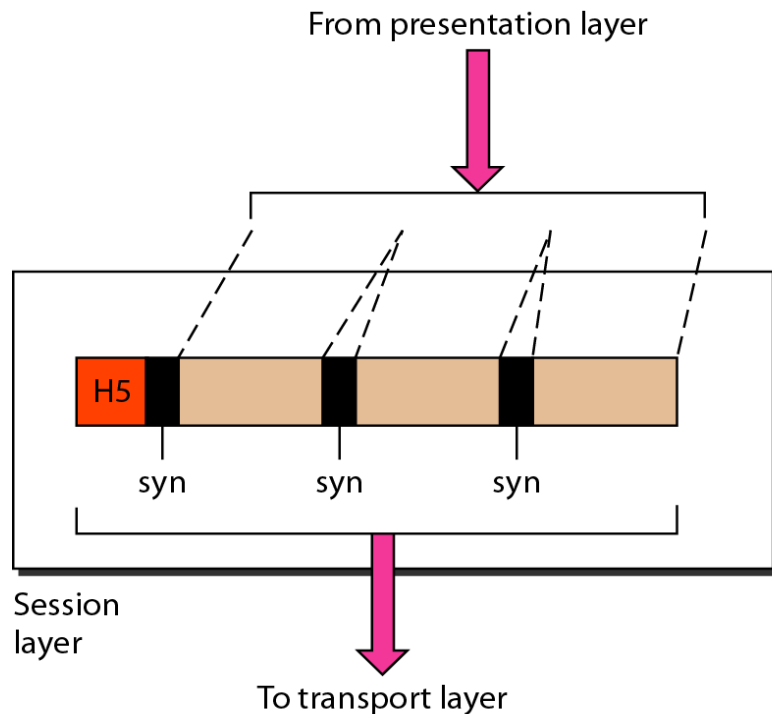


Reliable process-to-process delivery of a message



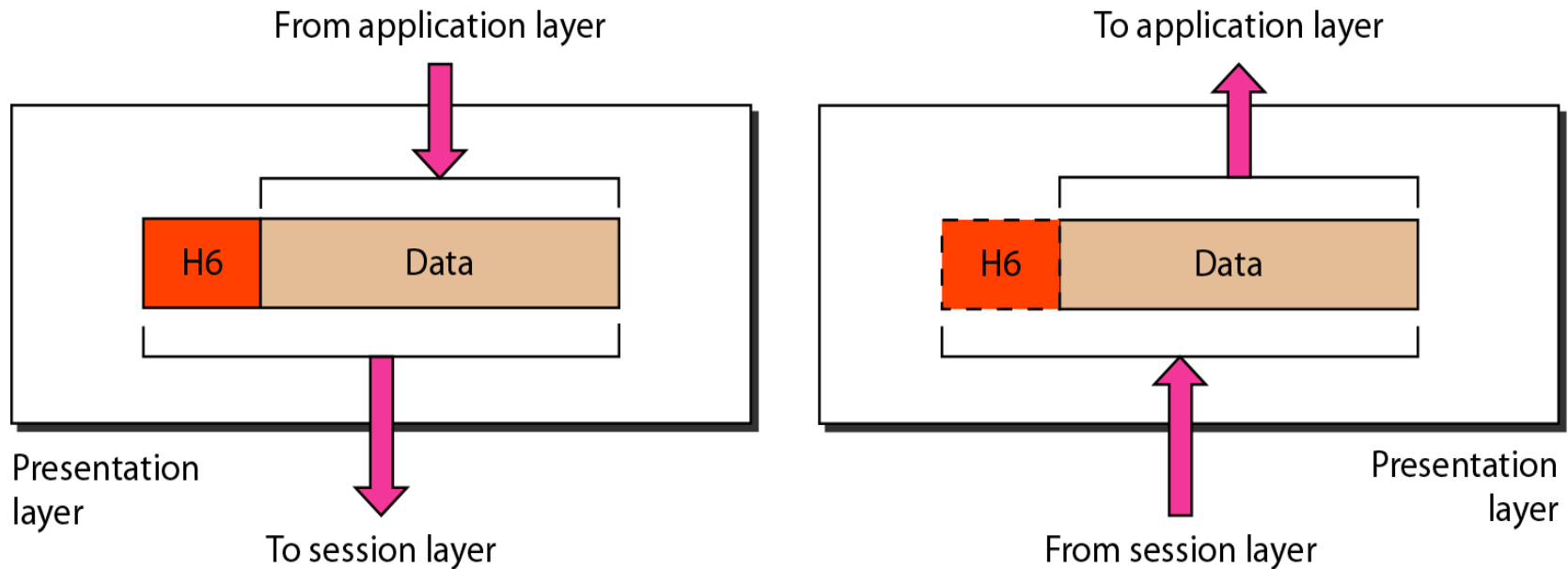
Session layer

- The session layer is responsible for dialog control and synchronization.



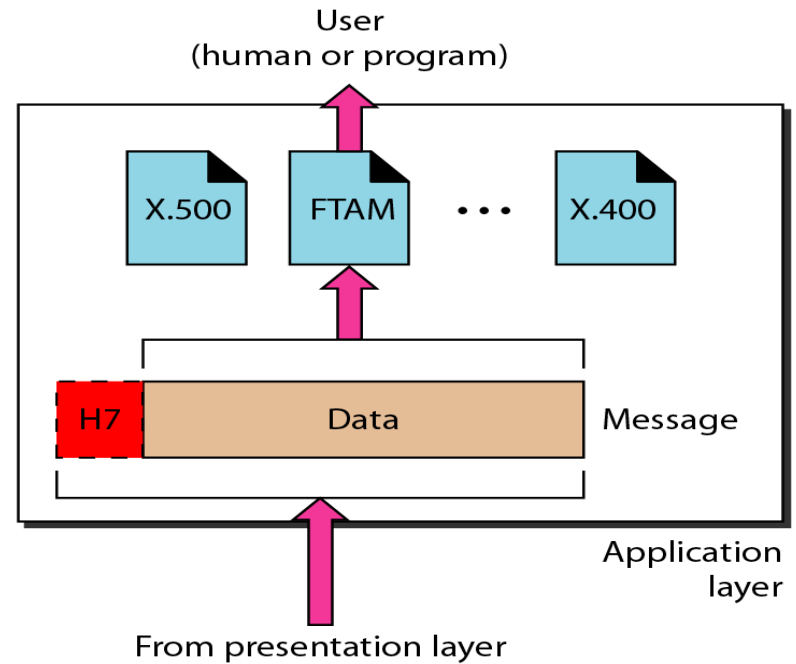
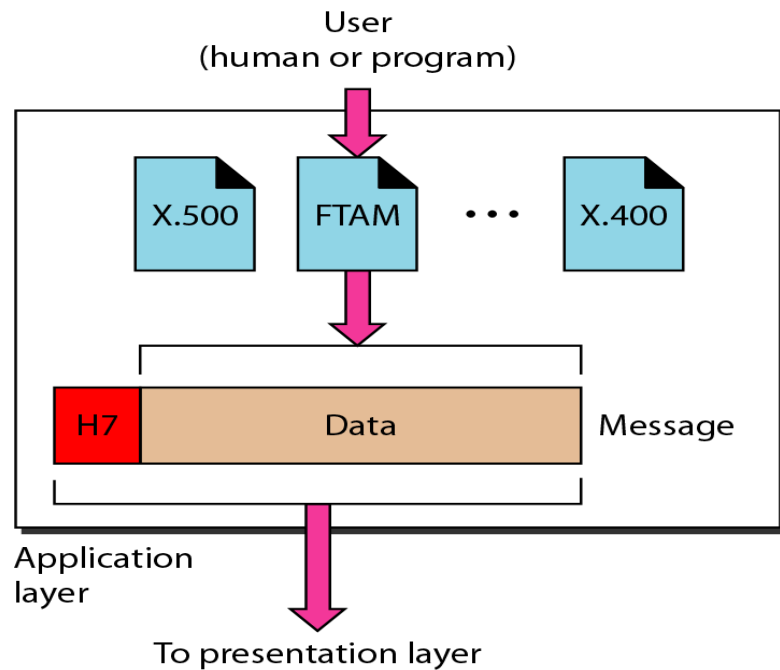
Presentation layer

- The presentation layer is responsible for translation, compression, and encryption.

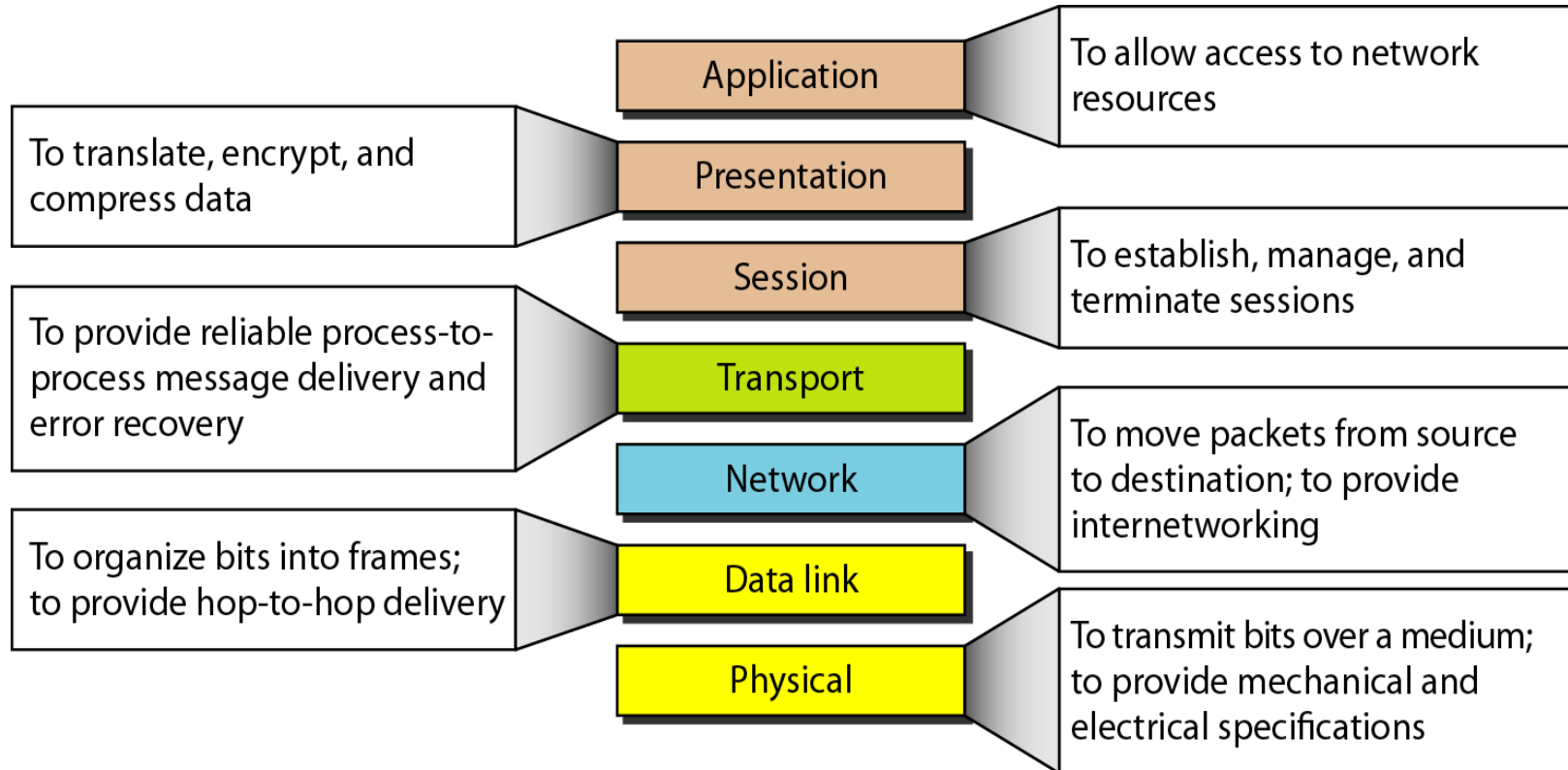


Application layer

- It is responsible for providing services to the user.



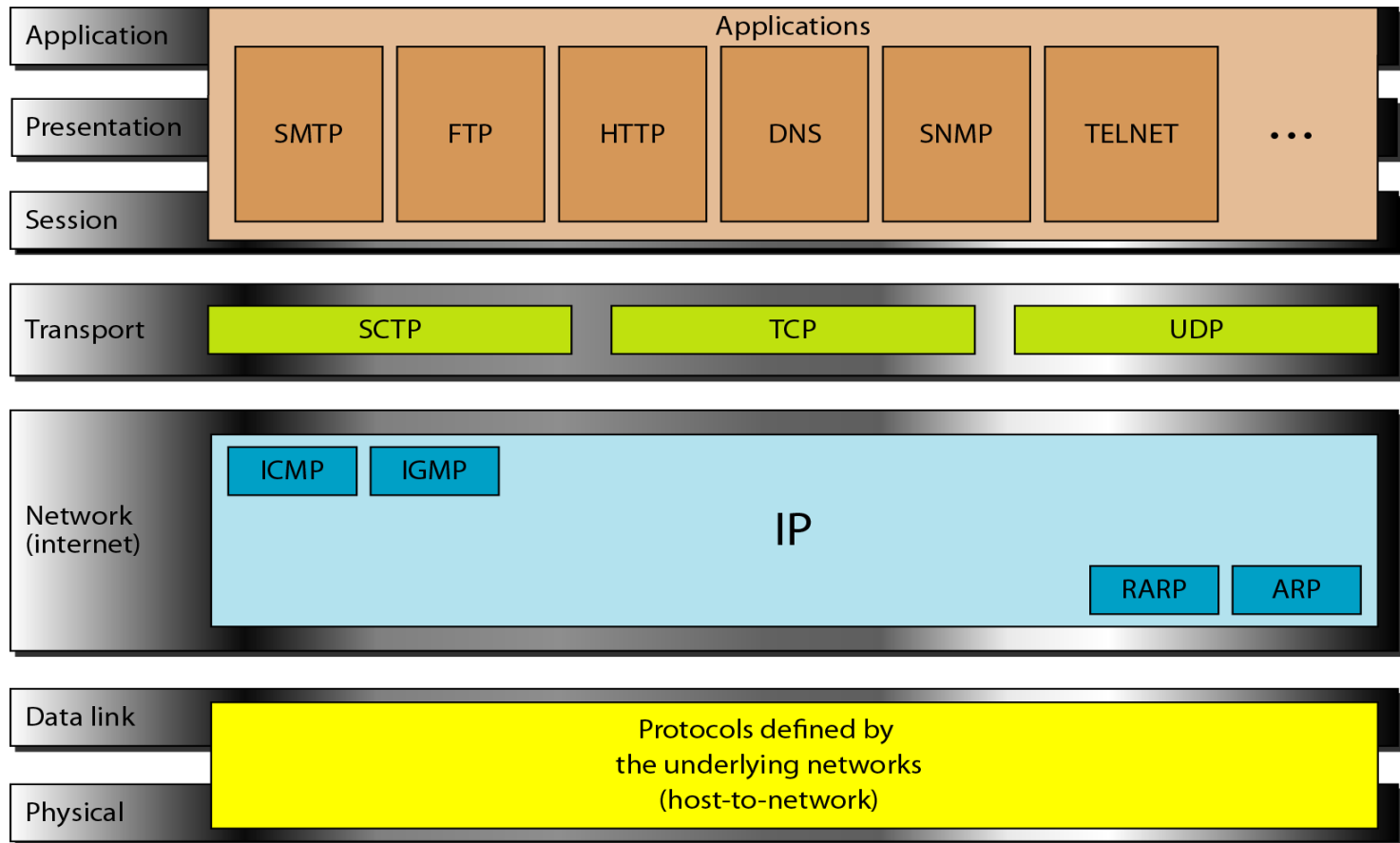
Summary of layers



TCP/IP Protocol Suite

- It was developed prior to the OSI model and consists only five layers.
- The layers in the TCP/IP protocol suite do not exactly match those in the OSI model.
- The original TCP/IP protocol suite was defined as having four layers: host-to-network, internet, transport, and application.
- However, when TCP/IP is compared to OSI, we can say that the TCP/IP protocol suite is made of five layers: physical, data link, network, transport, and application.

TCP/IP and OSI model



Physical and Data Link Layers



- At this layer, TCP/IP does not define any specific protocol. It supports all the standard protocols.
- A network in a TCP/IP internetwork can be a LAN or WAN.

Network Layer

- Network layer is responsible for creating a connection between the source computer and destination computer.
- NL is responsible for host-to-host connection and also responsible to control routers for choosing best routing strategy.
- NL in the Internet includes a main protocol called Internet Protocol (IP) which defines format of packet (called datagram).
- IP also perform the routing by passing each datagram through routers unless it reaches the destination.
- NL also includes unicast and multi-cast routing protocols
 - A routing protocol does not take part in routing (That is the responsibility of IP)
 - It simply creates forwarding tables for routers to help them in routing

IP



- It is an unreliable and connectionless protocol.
 - No flow control
 - No error control
 - No congestion control
- If any of these services are required by Application, it should rely on transport layer protocol

Axillary Protocols which help IP at NL

➤ At Network layer, Some Auxiliary protocols help IP in its work:

- ICMP
- IGMP
- RARP
- ARP.

ICMP, IGMP and RARP

- Internet Control Message Protocol (ICMP)
 - A mechanism used by host and gateways to send notification of datagram problems back to the sender.
 - It sends query and error reporting messages.
- Internet Group Management Protocol (IGMP)
 - Used to facilitate the simultaneous transmission of a message to a group of recipients
 - It helps IP in multitasking
- Reverse Address Resolution Protocol (RARP)
 - Protocol allows a host to discover its internet address when it knows its physical address.
 - It is used when computer is connected to a network for first time.

ARP

- Used to associate the logical address with physical address (link-layer address to a host or a router when network layers address is given).
- Each device on the network is identified by physical or station address, usually imprinted on the network interface card (NIC).
- ARP is used to find the physical address of the node when its internet address is known.

Transport Layer



- Logical connection at Transport Layer is end-to-end
- It performs the following service:
 - To get a message from application program running on source host
 - Deliver it to corresponding application program at destination host

Transport Layer



- Responsible for delivery of message from a process to another process
 - TCP (Transmission control Protocol)
 - UDP (User Datagram Protocol)

TCP

- TCP is a connection oriented protocol
- It first establishes a connection is established between both the ends (source and destination host) before data transmission.
- At the sending end TCP divides a stream of data into smaller units called segments.
- Each segment includes a sequence number for reordering after receipt, together with acknowledgment no. for the segments received.
- At the receiving end, TCP collects each datagram as it comes in and reorder the transmission based on sequence no.
- TCP provides:
 - flow control
 - error control
 - congestion control

UDP

- UDP is a connection-less protocol
 - Transmits user datagram without first creating a logical connection
 - Each datagram from a user is an independent entity
- Does not provide:
 - flow control
 - error control
 - congestion control
- It is a simple protocol which is attractive to an application program which needs to send short messages and cannot afford the retransmission of packets involved in TCP if a packet is corrupted and lost.

SCTP



- Stream Control Transmission Protocol
 - provides support for newer applications such as voice over the internet.
 - It combines the best features of UDP & TCP protocol.

Application Layer

- An application is a program running on a computer (which is also termed as a process)
- Logical connection is end-to-end
 - Two applications exchange messages between each other via a virtual bridge between the two.
 - Physically, communication is performed via all the layers.
- To communicate, one process sends a request message to other process and gets a reply message
- A number of protocols are predefined but a user can also do the same provided they provide it at both ends.
- Some of the protocols are:
 - HTTP (Hyper Text Markup Language)
 - SMTP (Simple Mail Transfer Protocol)
 - FTP (File Transfer Protocol)
 - TELNET (TErminaLNETwork)
 - SSH (Secure SHell)
 - SNMP (Simple Network Managemnet Protocol)