# OSI MODEL

# Communication Architecture

- Strategy for connecting host computers and other communicating equipment.
- Defines necessary elements for data communication between devices.
- A communication architecture, therefore, defines a standard for the communicating hosts.
- A programmer formats data in a manner defined by the communication architecture and passes it on to the communication software.
- Separating communication functions adds flexibility, for example, we do not need to modify the entire host software to include more communication devices.

# Layer Architecture

- Layer architecture simplifies the network design.
- It is easy to debug network applications in a layered architecture network.
- The network management is easier due to the layered architecture.
- Network layers follow a set of rules, called protocol.
- The protocol defines the format of the data being exchanged, and the control and timing for the handshake between layers.

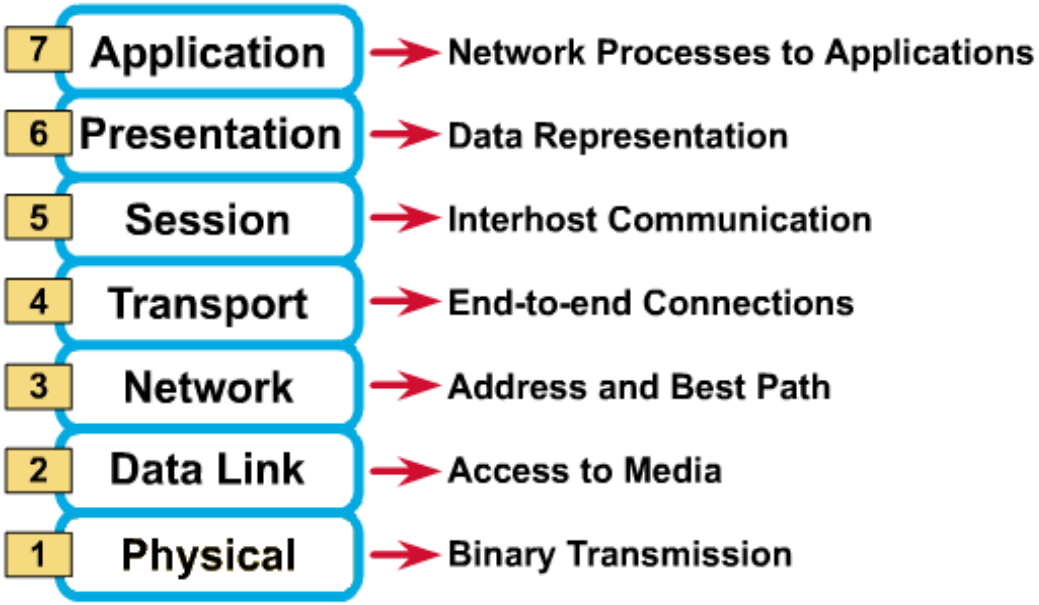
# Open Systems Interconnection (OSI) Model

- International standard organization (ISO) established a committee in 1977 to develop an architecture for computer communication.
- Open Systems Interconnection (OSI) reference model is the result of this effort.
- In 1984, the Open Systems Interconnection (OSI) reference model was approved as an international standard for communications architecture.
- Term "open" denotes the ability to connect any two systems which conform to the reference model and associated standards.

# OSI Reference Model

- The OSI model is now considered the primary Architectural model for inter-computer communications.
- The OSI model describes how information or data makes its way from application programmes (such as spreadsheets) through a network medium (such as wire) to another application programme located on another network.
- The OSI reference model divides the problem of moving information between computers over a network medium into SEVEN smaller and more manageable problems .
- This separation into smaller more manageable functions is known as layering.

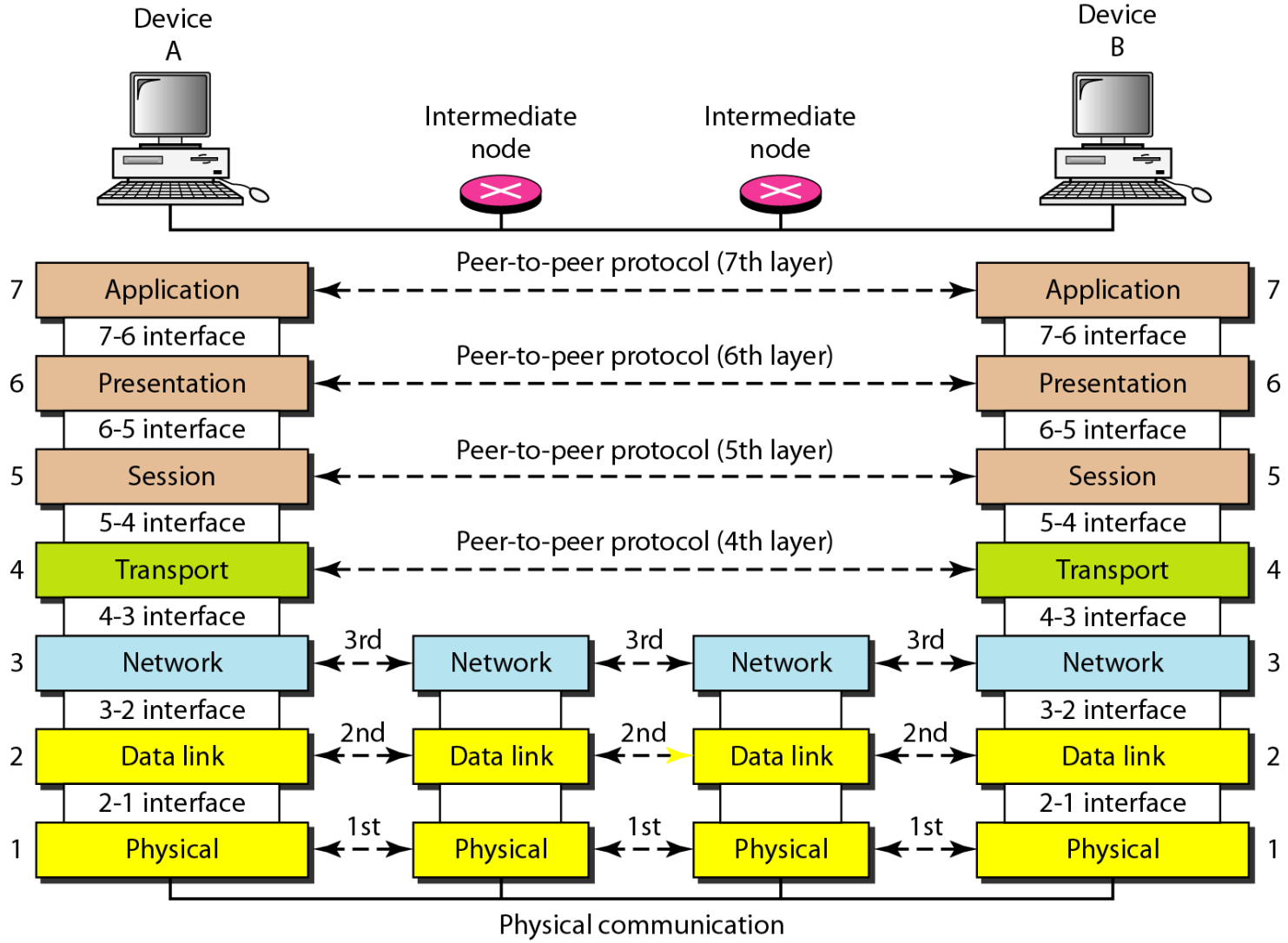
# OSI Reference Model: 7 Layers



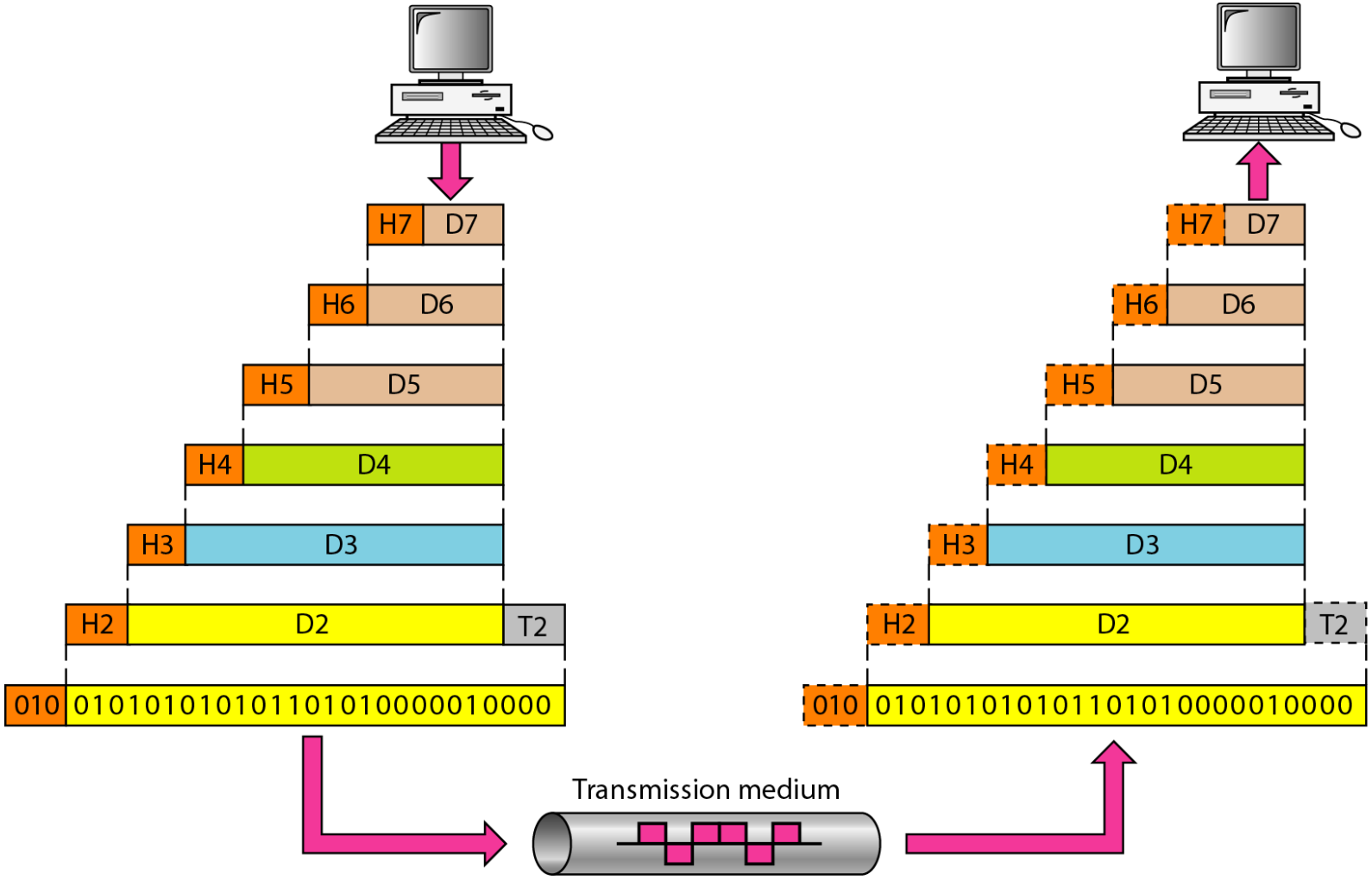
# OSI: A Layered Network Model

- The process of breaking up the functions or tasks of networking into layers reduces complexity.
- Each layer provides a service to the layer above it in the protocol specification.
- Each layer communicates with the same layer's software or hardware on other computers.
- The lower 4 layers (transport, network, data link and physical — Layers 4, 3, 2, and 1) are concerned with the flow of data from end to end through the network.
- The upper four layers of the OSI model (application, presentation and session—Layers 7, 6 and 5) are orientated more toward services to the applications.
- Data is Encapsulated with the necessary protocol information as it moves down the layers before network transit.

# *The interaction between layers in the OSI model*



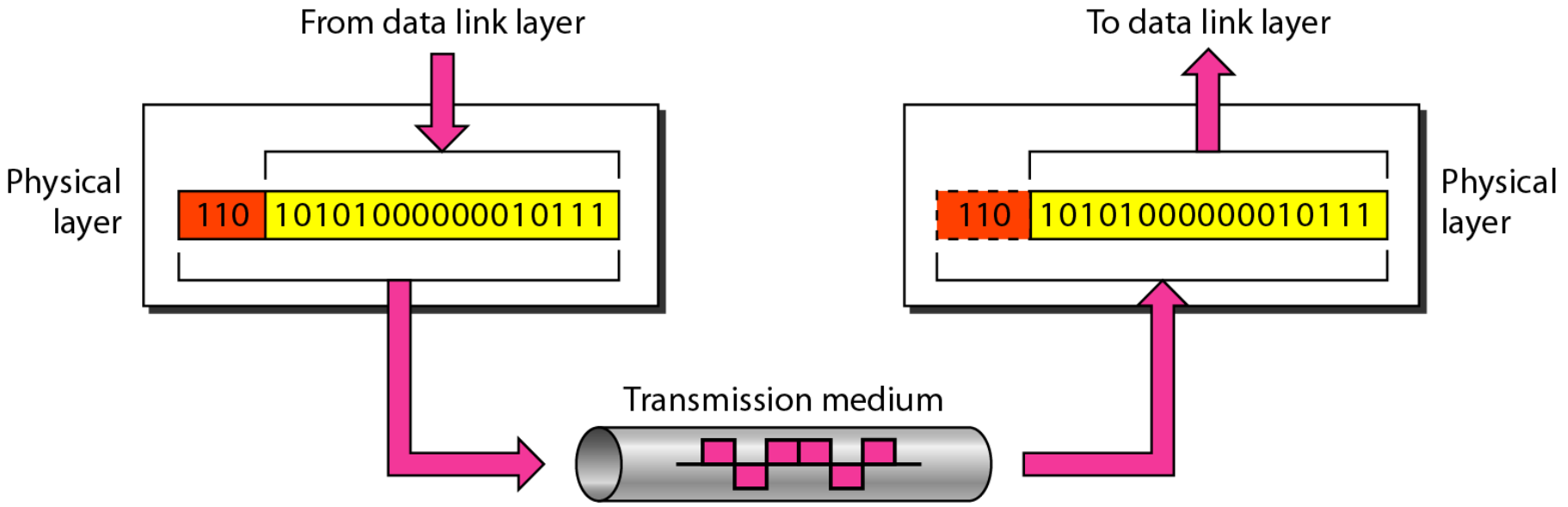
# Figure 2.4 *An exchange using the OSI model*



# Physical Layer

- Provides physical interface for transmission of information.
- Defines rules by which bits are passed from one system to another on a physical communication medium.
- Covers all - mechanical, electrical, functional and procedural - aspects for physical communication.
- Such characteristics as voltage levels, timing of voltage changes, physical data rates, maximum transmission distances, physical connectors, and other similar attributes are defined by physical layer specifications.

# Figure 2.5 *Physical layer*



Note

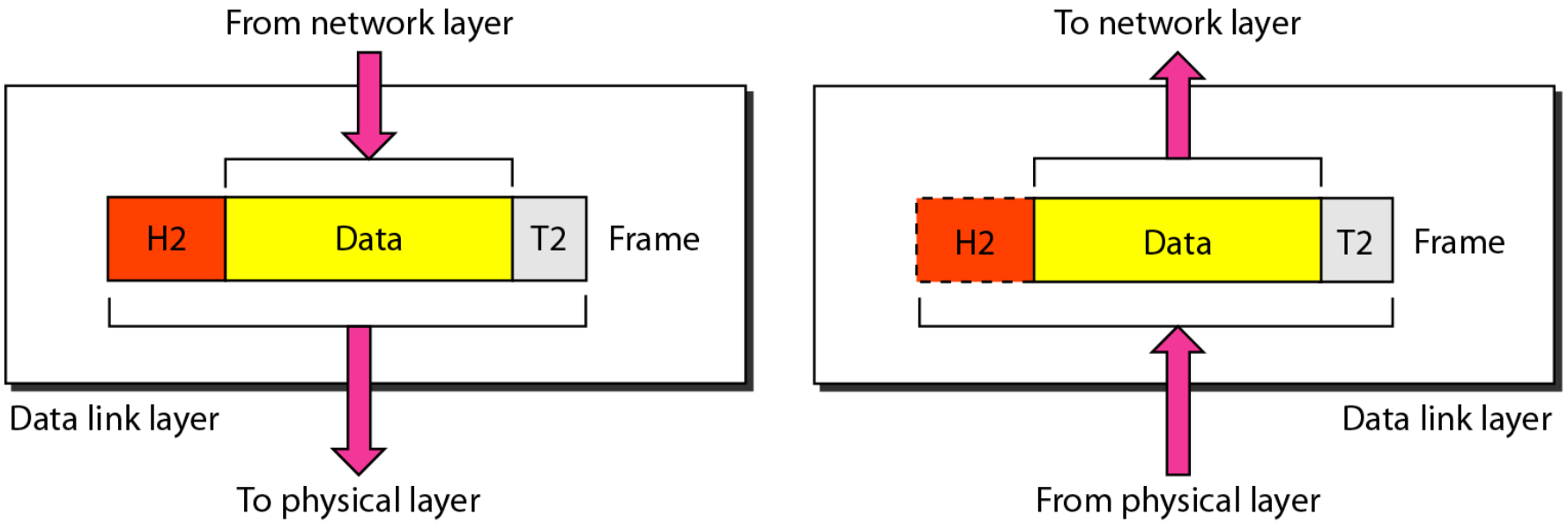
The physical layer is responsible for movements of individual bits from one hop (node) to the next.

# Data Link Layer

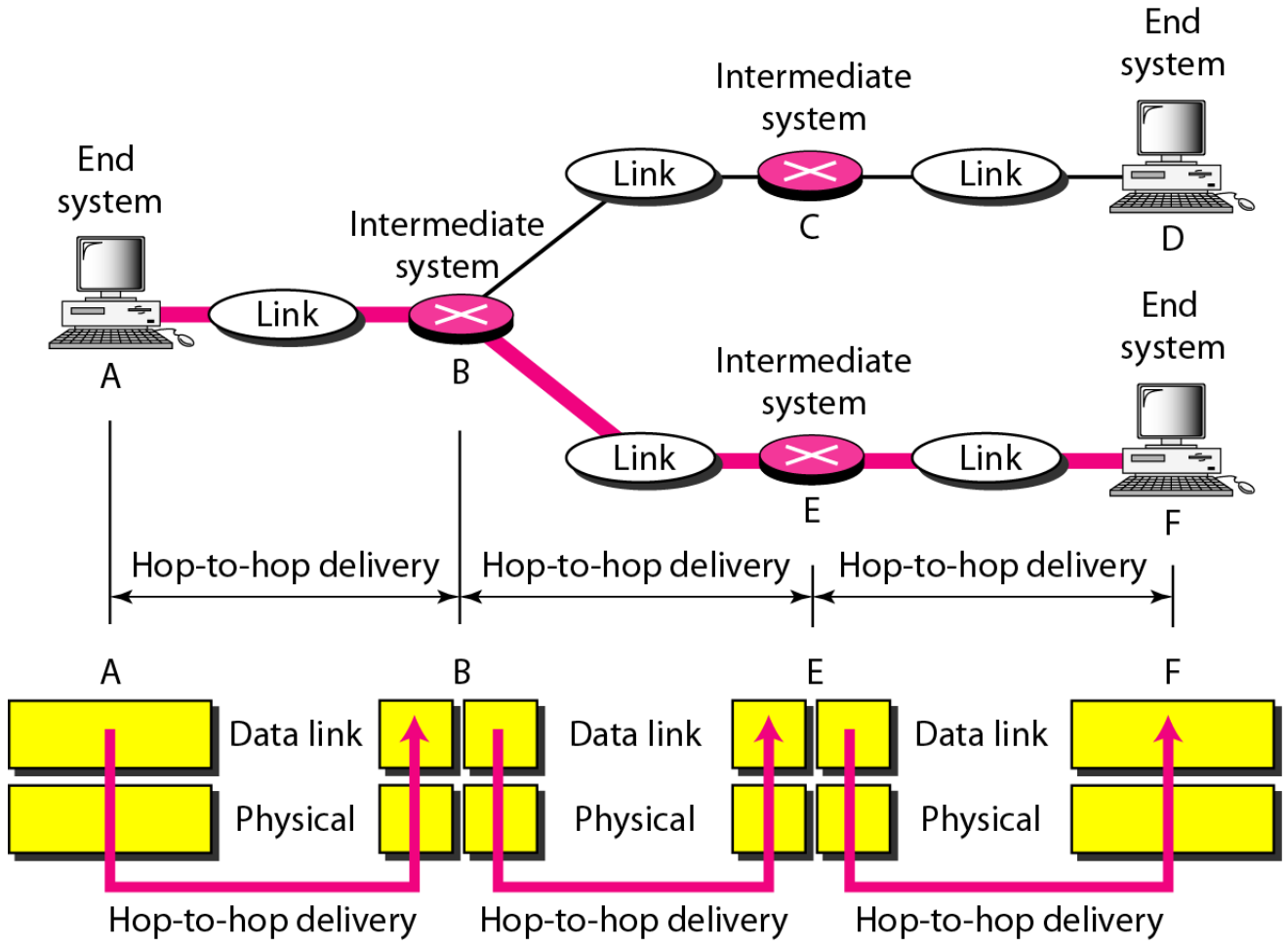
- Data link layer attempts to provide reliable communication over the physical layer interface.

- Breaks the outgoing data into frames and reassemble the received frames.
- Create and detect frame boundaries.
- Handle errors by implementing an acknowledgement and retransmission scheme.(error control)
- Implement flow control.
- Supports points-to-point as well as broadcast communication.
- Supports simplex, half-duplex or full-duplex communication.

# Figure 2.6 *Data link layer*



# Figure 2.7 *Hop-to-hop delivery*



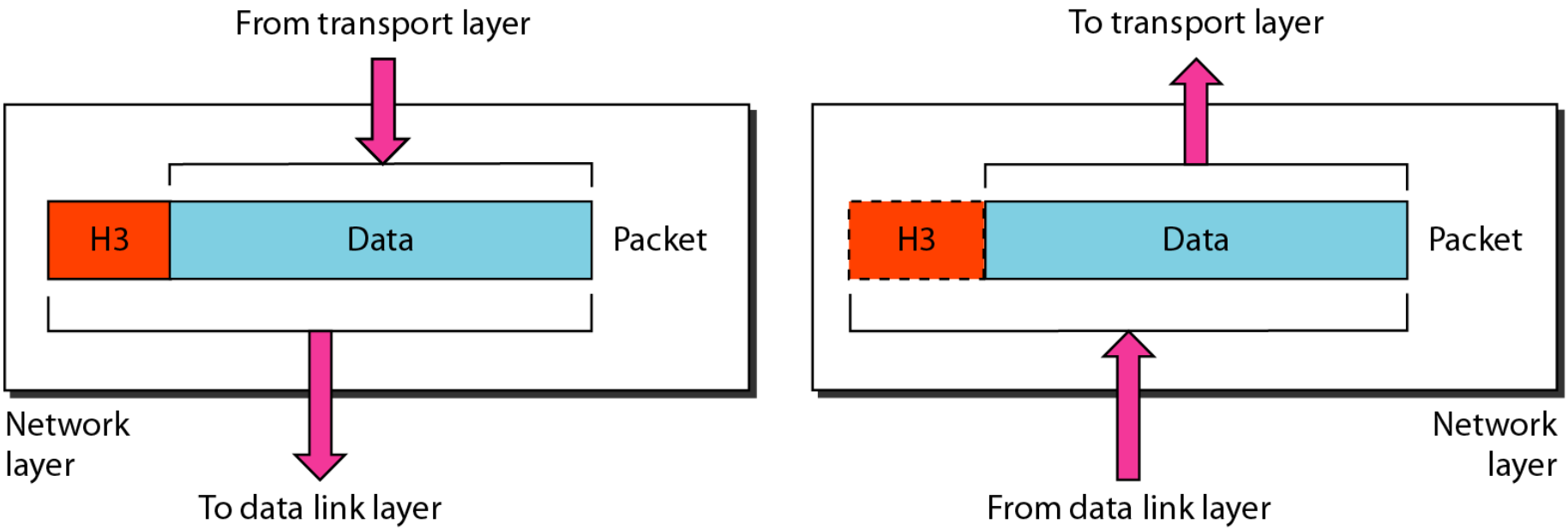
Note

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

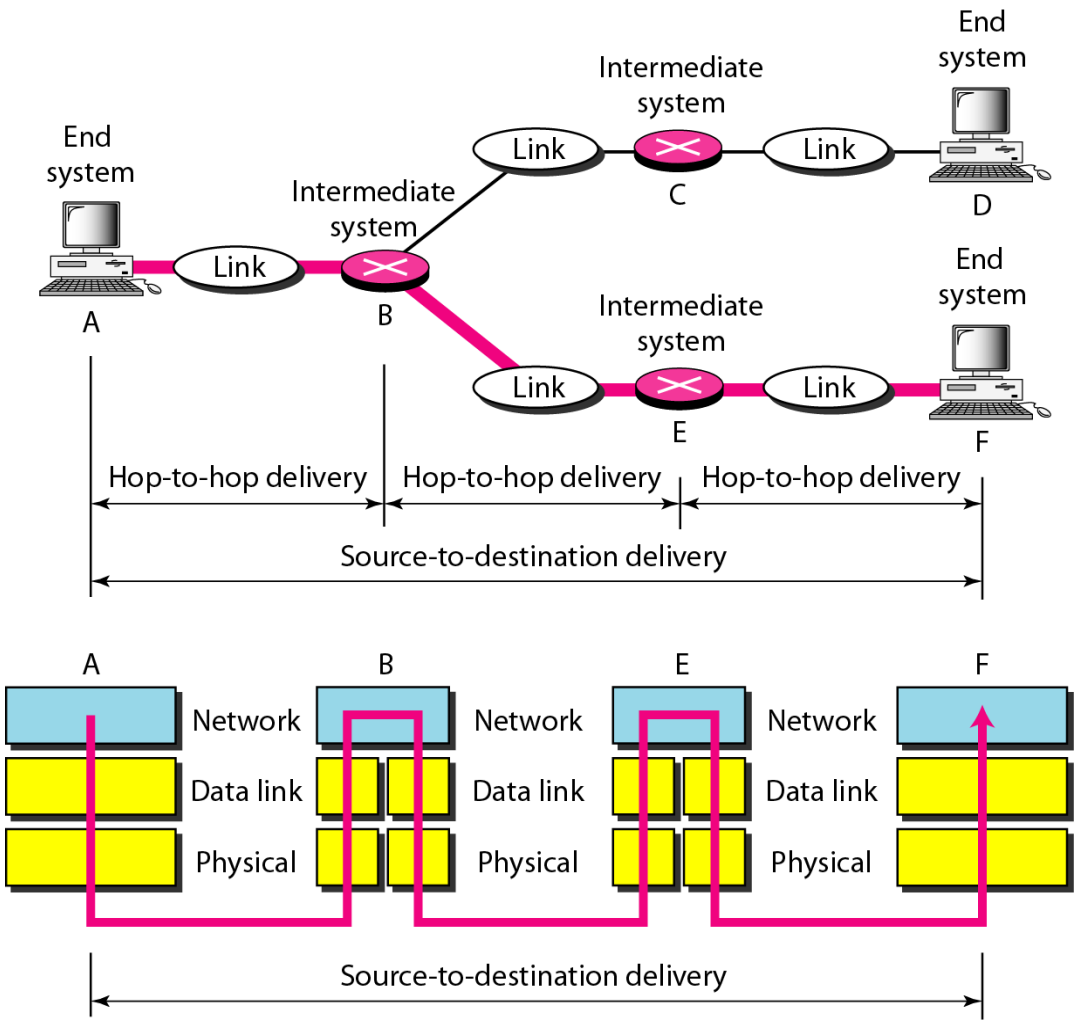
# Network Layer

- Implements routing of frames (packets) through the network.
- Defines the most optimum path the packet should take from the source to the destination
- Defines logical addressing so that any endpoint can be identified.
- Handles congestion in the network.
- Facilitates interconnection between heterogeneous networks (Internetworking).
- The network layer also defines how to fragment a packet into smaller packets to accommodate different media.

# Figure 2.8 *Network layer*



# Figure 2.9 *Source-to-destination delivery*

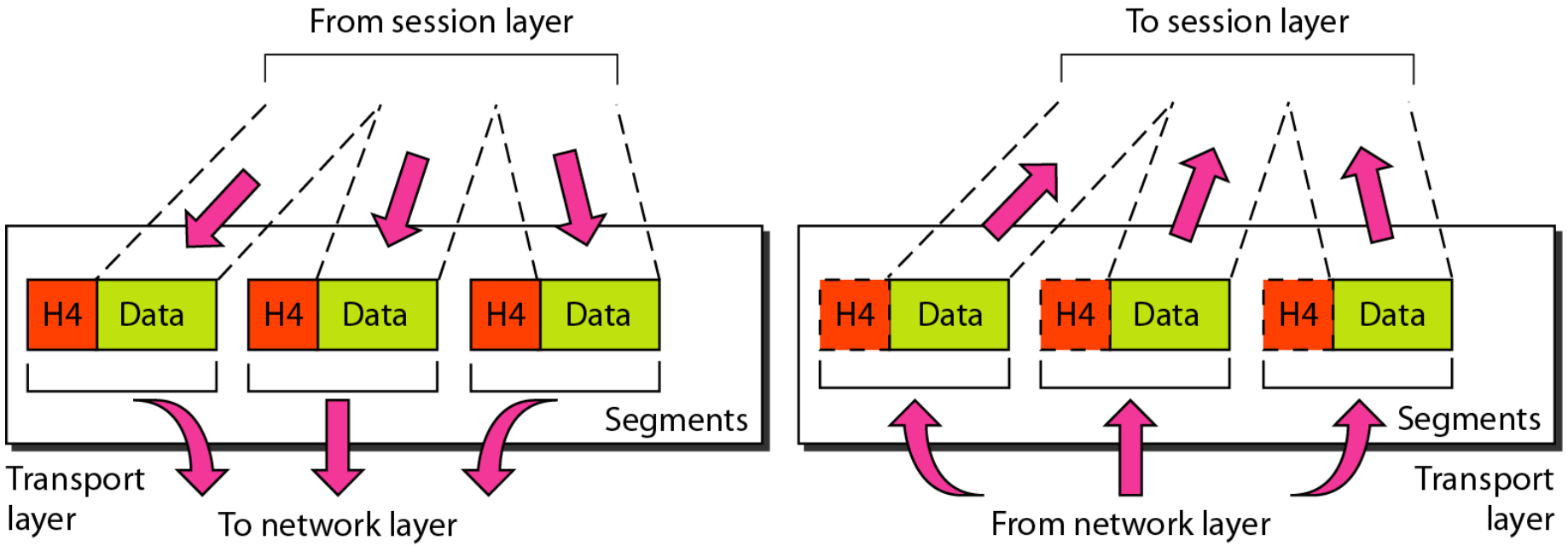


# Transport Layer

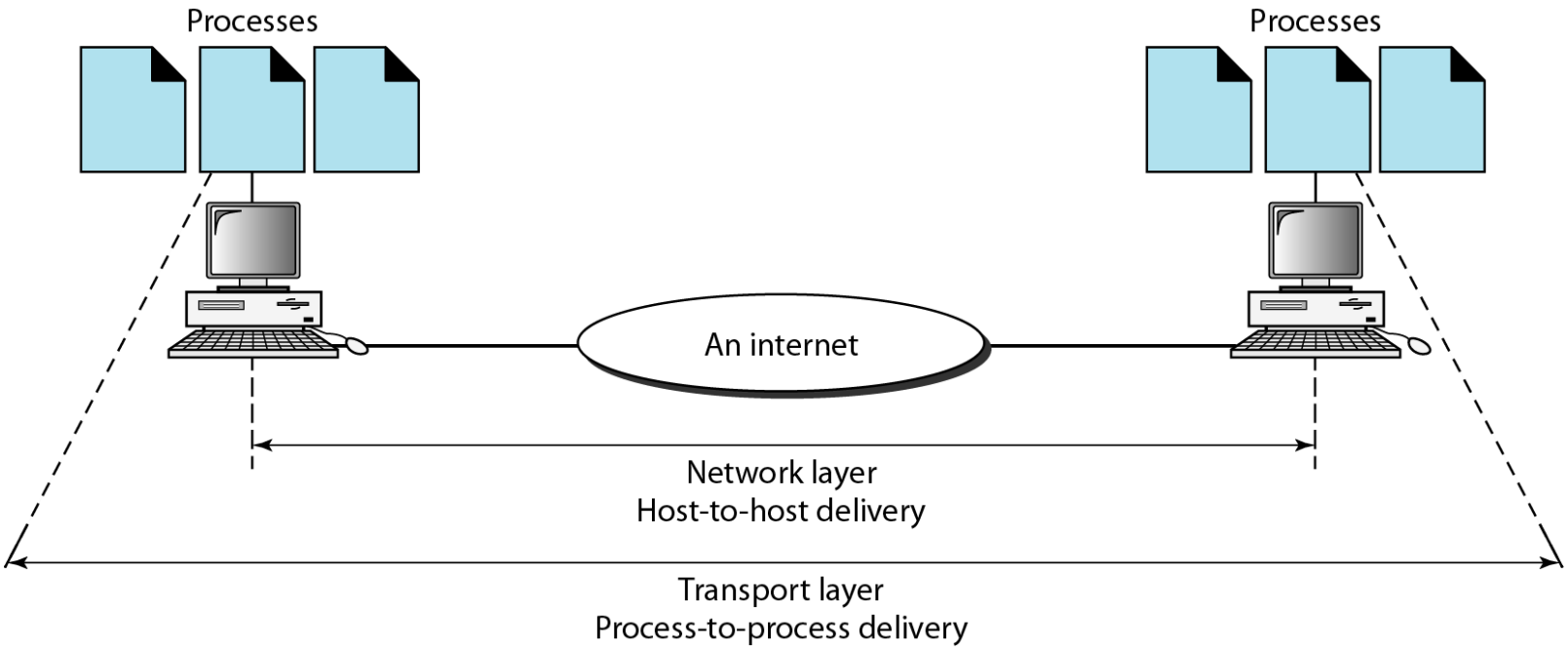
- Purpose of this layer is to provide a reliable mechanism for the exchange of data between two processes in different computers.

- Ensures that the data units are delivered error free.
- Ensures that data units are delivered in sequence.
- Ensures that there is no loss or duplication of data units.
- Provides connectionless or connection oriented service.
- Provides for the connection management.
- Multiplex  multiple connection over a single channel.

# Figure 2.10 *Transport layer*



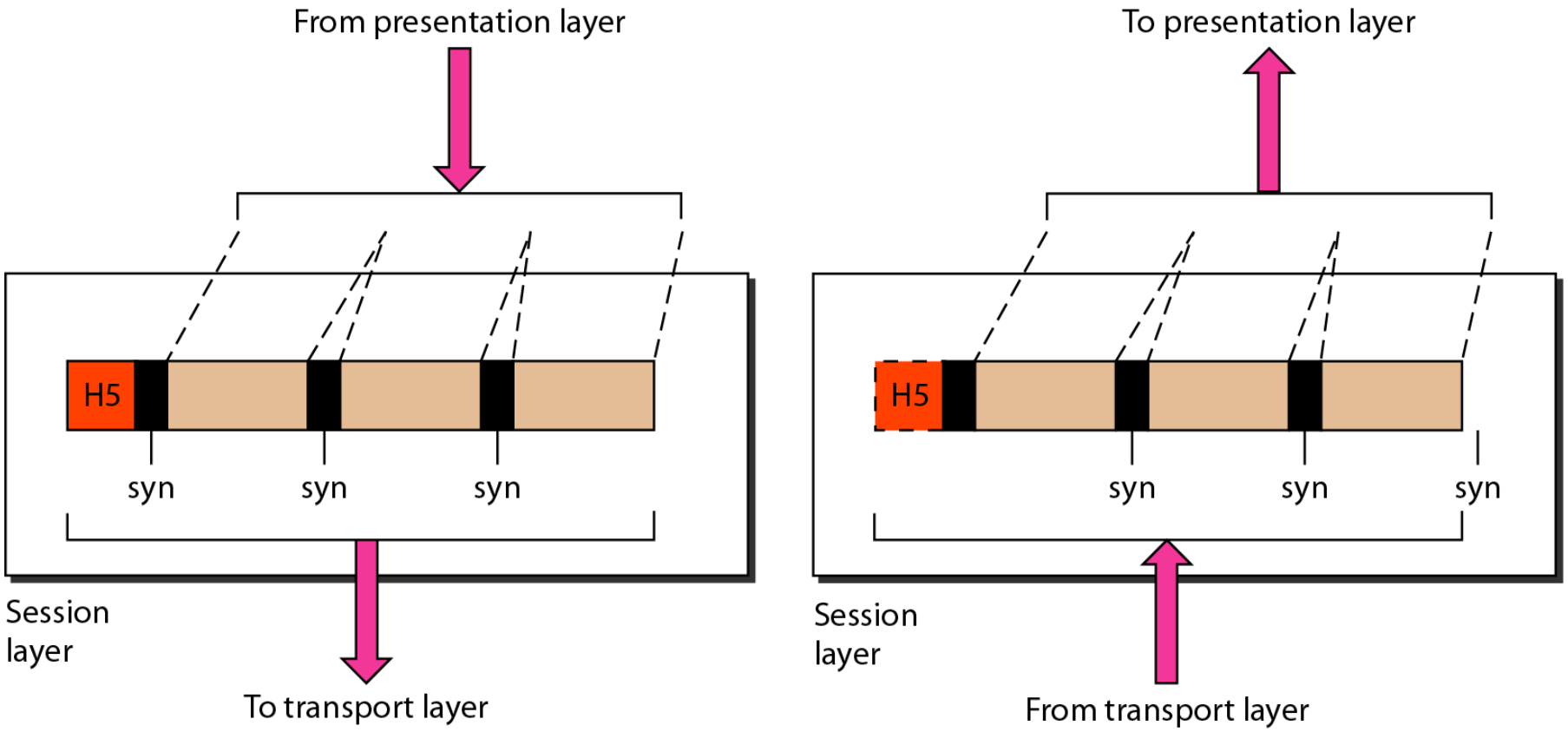
# Figure 2.11 *Reliable process-to-process delivery of a message*



# Session Layer

- Session layer provides mechanism for controlling the dialogue between the two end systems. It defines how to start, control and end conversations (called sessions) between applications.
- This layer requests for a logical connection to be established on an end-user's request.
- Any necessary log-on or password validation is also handled by this layer.
- Session layer is also responsible for terminating the connection.
- This layer provides services like dialogue discipline which can be full duplex or half duplex.
- Session layer can also provide check-pointing mechanism such that if a failure of some sort occurs between checkpoints, all data can be retransmitted from the last checkpoint.

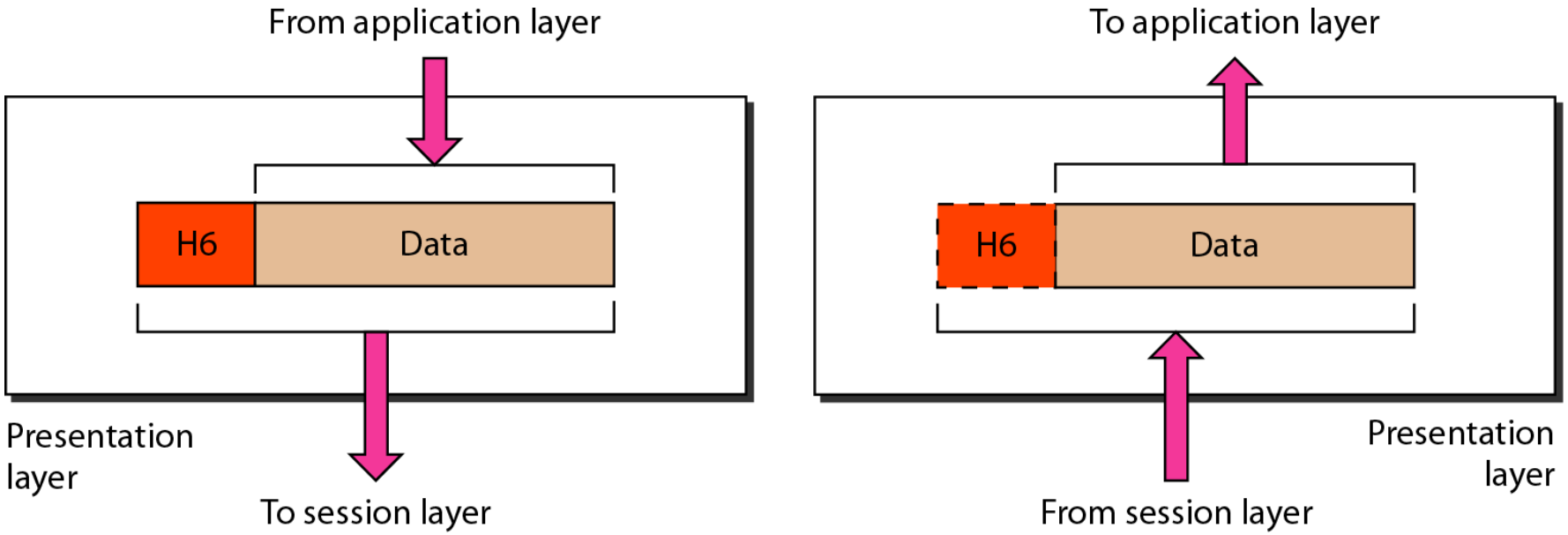
# Figure 2.12 *Session layer*



# Presentation Layer

- Presentation layer defines the format in which the data is to be exchanged between the two communicating entities.
- Also handles data compression and data encryption (cryptography).

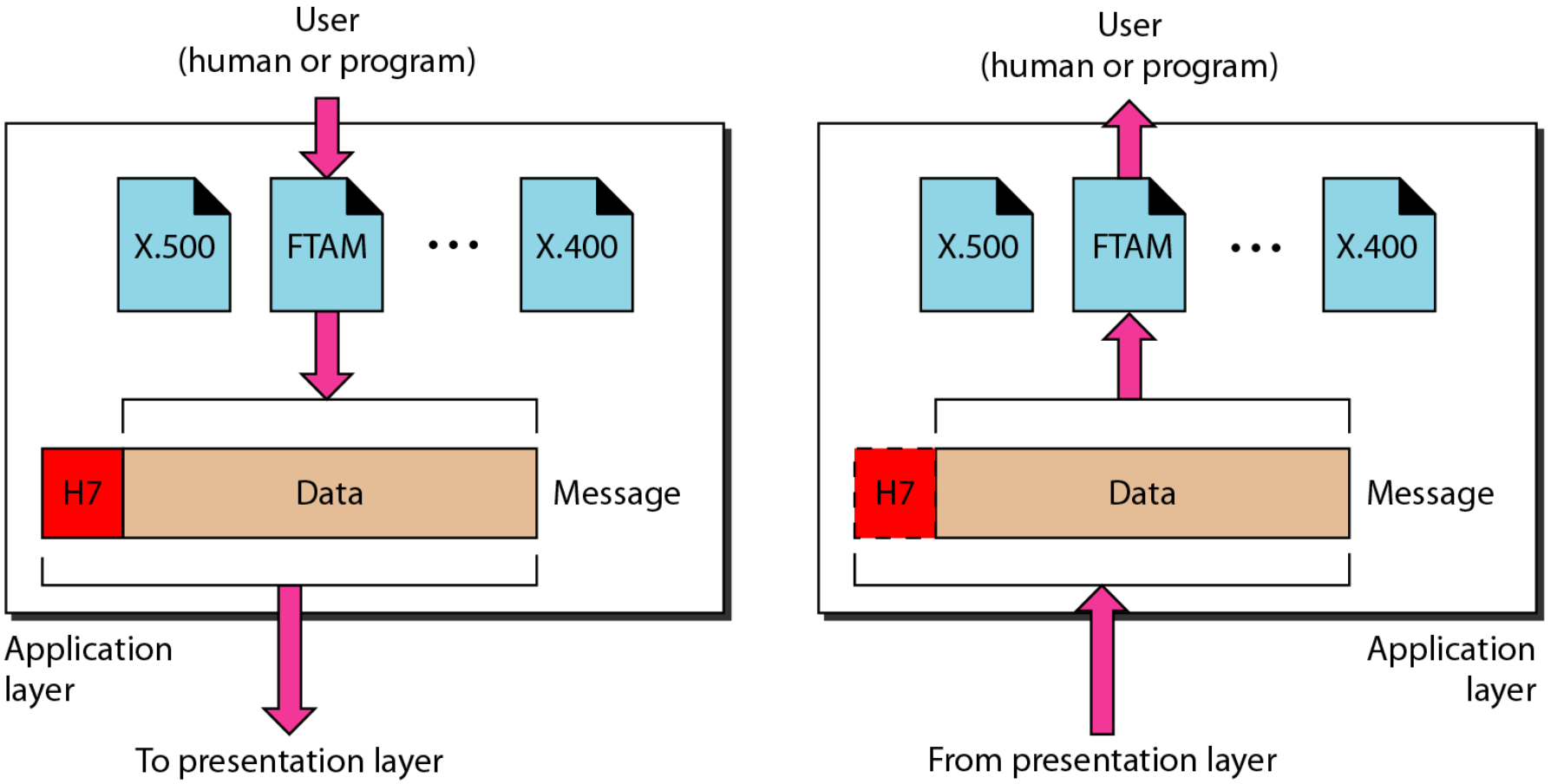
# Figure 2.13 *Presentation layer*



# Application Layer

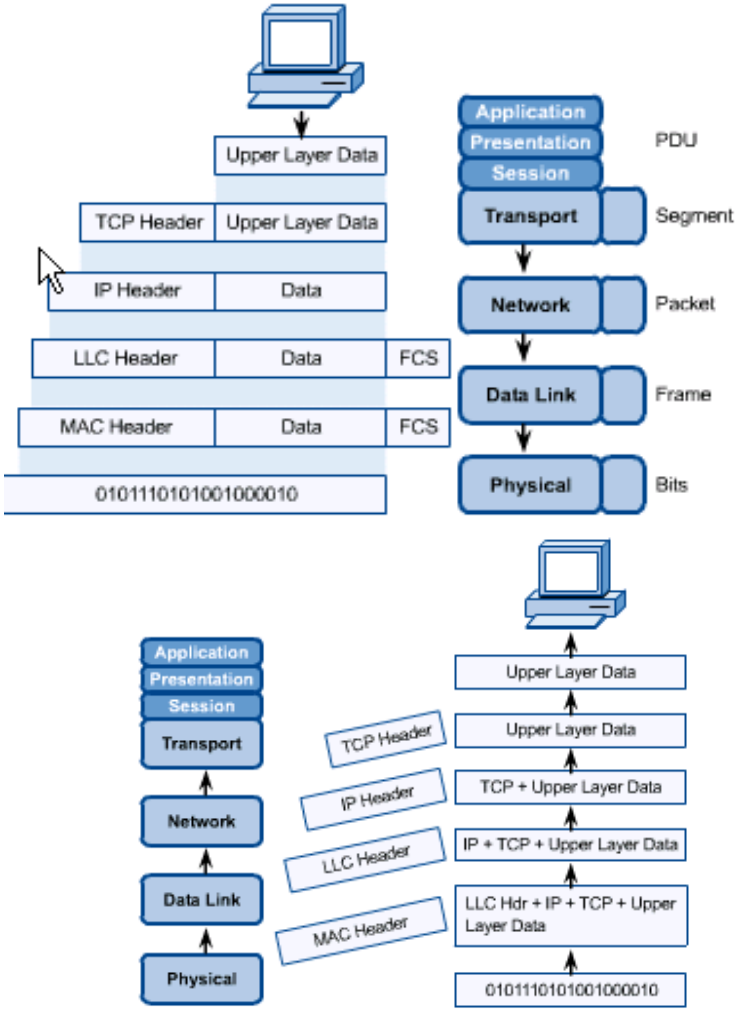
- Application layer interacts with application programs and is the highest level of OSI model.
- Application layer contains management functions to support distributed applications.
- Examples of application layer are applications such as file transfer, electronic mail, remote login etc.

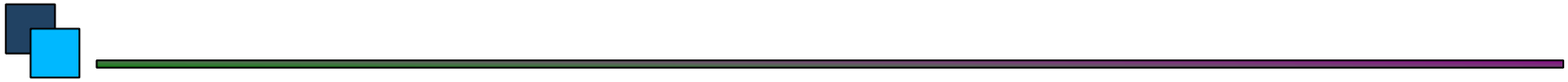
# Figure 2.14 *Application layer*



# OSI in Action

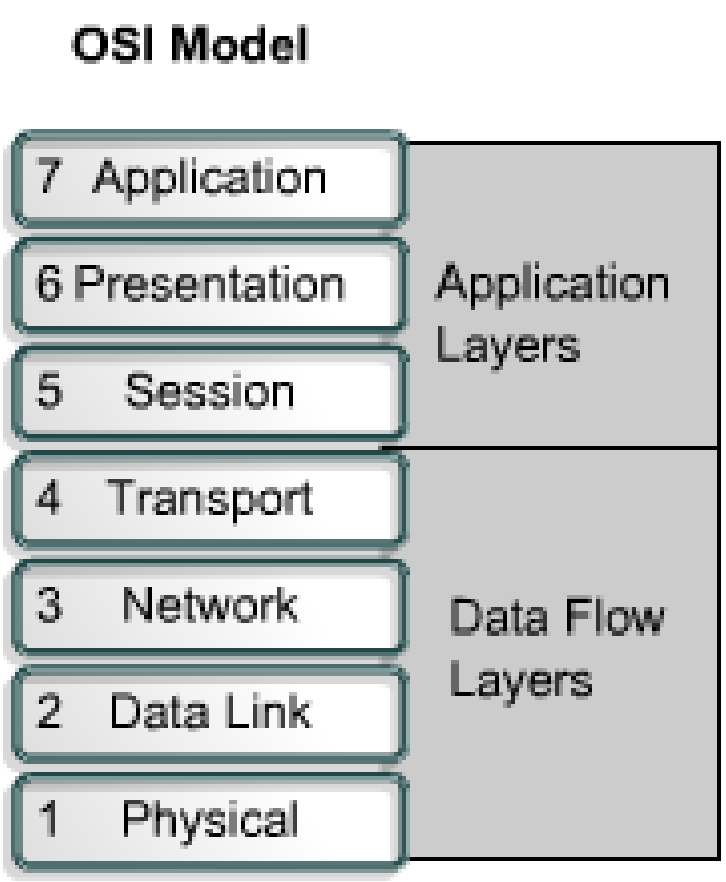
- A message begins at the top application layer and moves down the OSI layers to the bottom physical layer.
- As the message descends, each successive OSI model layer adds a header to it.
- A header is layer-specific information that basically explains what functions the layer carried out.
- Conversely, at the receiving end, headers are striped from the message as it travels up the corresponding layers.

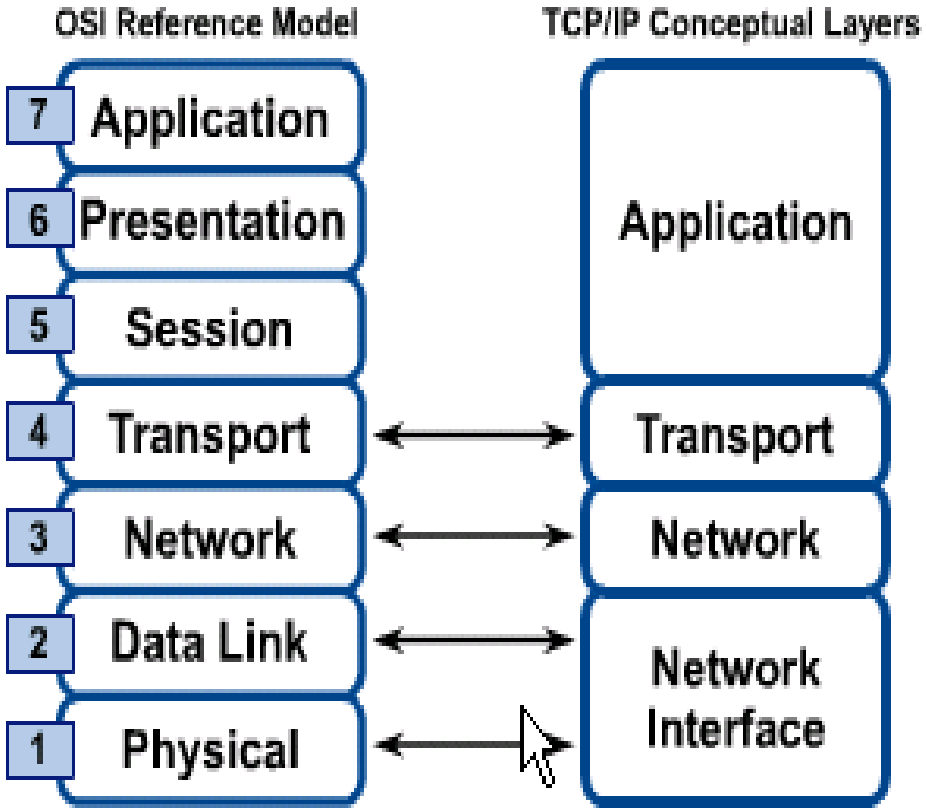




# TCP/IP MODEL

# OSI & TCP/IP Models



# TCP/IP Model

**Application Layer**
Application programs using the network

**Transport Layer (TCP/UDP)**
Management of end-to-end message transmission, error detection and error correction

**Network Layer (IP)**
Handling of datagrams : routing and congestion

**Data Link Layer**
Management of cost effective and reliable data delivery, access to physical networks

**Physical Layer**
Physical Media

# TCP/IP PROTOCOL SUIT

- TCP/IP, or the Transmission Control Protocol/Internet Protocol, is a suite of communication protocols used to interconnect network devices on the internet.
- TCP/IP can also be used as a communications protocol in a private network (an intranet or an extranet)
- TCP/IP specifies how data is exchanged over the internet by providing end-to-end communications that identify how it should be broken into packets, addressed, transmitted, routed and received at the destination.
- TCP/IP requires little central management, and it is designed to make networks reliable, with the ability to recover automatically from the failure of any device on the network.

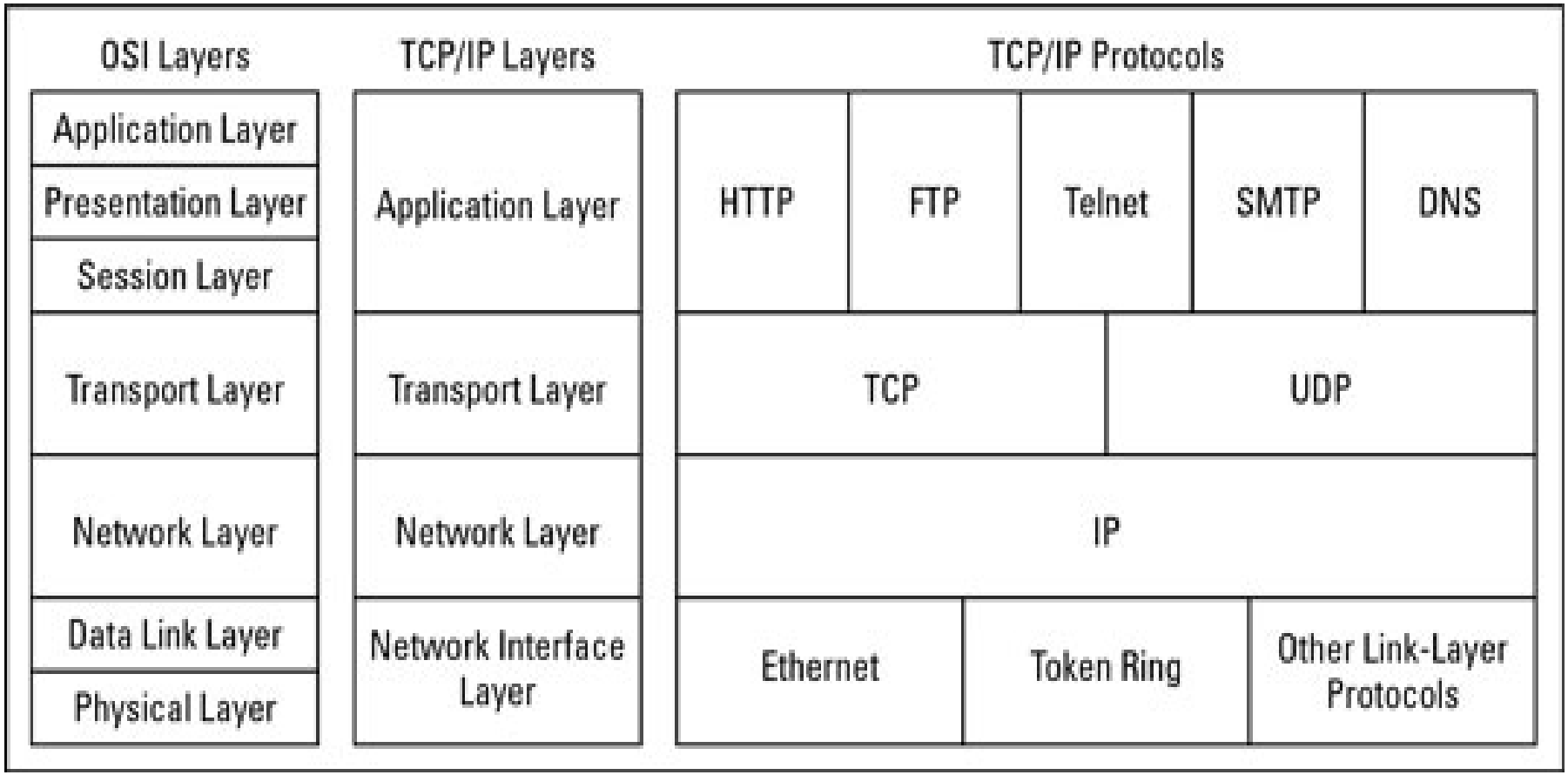
# TCP

- TCP defines how applications can create channels of communication across a network.
- It also manages how a message is assembled into smaller packets before they are then transmitted over the internet and reassembled in the right order at the destination address.

# IP

- IP defines how to address and route each packet to make sure it reaches the right destination.
- Each gateway computer on the network checks this IP address to determine where to forward the message.

# TCP/IP (Transmission Control Protocol/Internet Protocol)



# Types of addressing: