INTRODUCTION

- A collection of autonomous computers
- interconnected by a single technology. Interconnected means they are able to exchange information.
- Copper wire, fiber optics, microwaves, infrared and communication satellites can be used for connection.

Distributed system Vs Computer Networks

Computer Networks:

- A computer network is an interconnected collection of autonomous computers able to exchange information.
- A computer network usually require users to explicitly login onto one machine, explicitly submit jobs remotely, explicitly move files/data around the network.

Distributed system Vs Computer Networks

Distributed System

- In distributed system a collection of independent computers appears to its user as a single coherent system where a layer of software on top of the operating system.
- The existence of multiple autonomous computers in a computer network is transparent to the user.
- The operating system automatically allocates jobs to processors, moves files among various computers without explicit user intervention.

Distributed system Vs Computer Networks

- Thus, the distinction between a network and a distributed system lies with software rather than hardware.

Types of Transmission

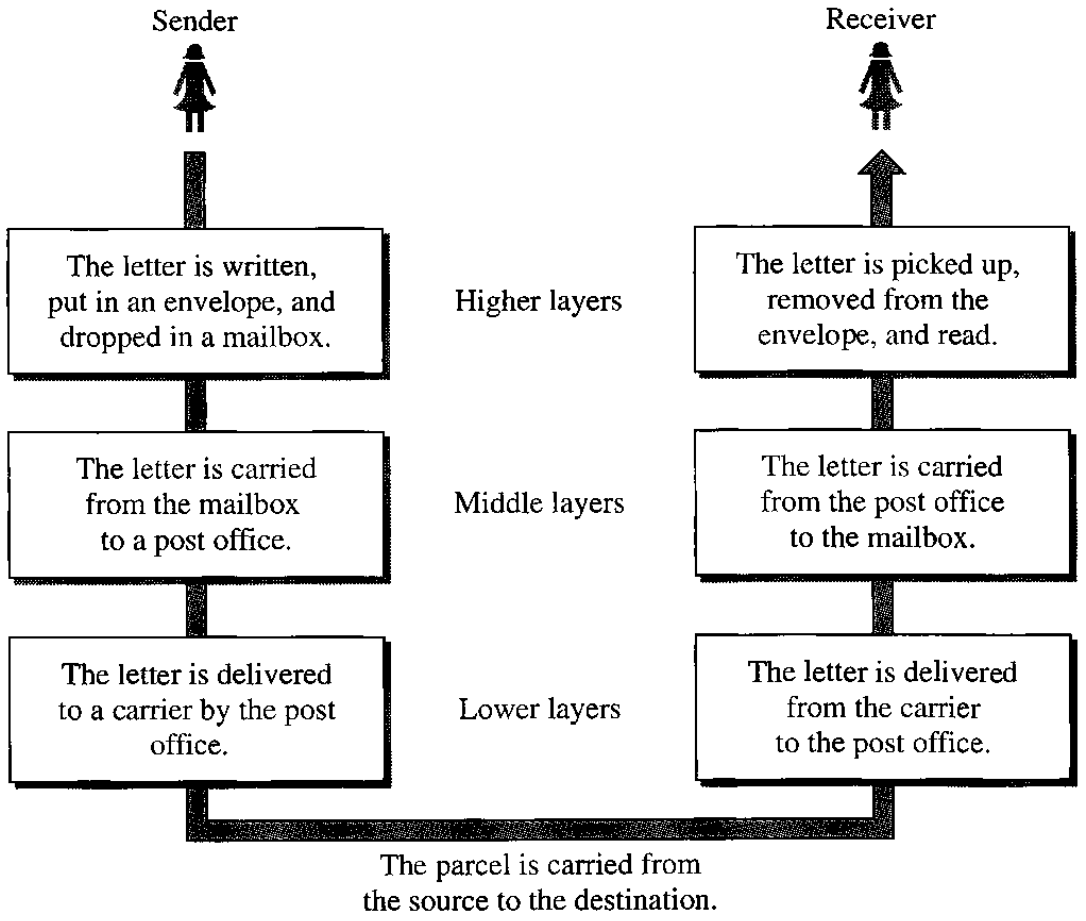
- Broadly speaking, there are two types of transmission technology:

1. Broadcast link
2. Point-to-point links

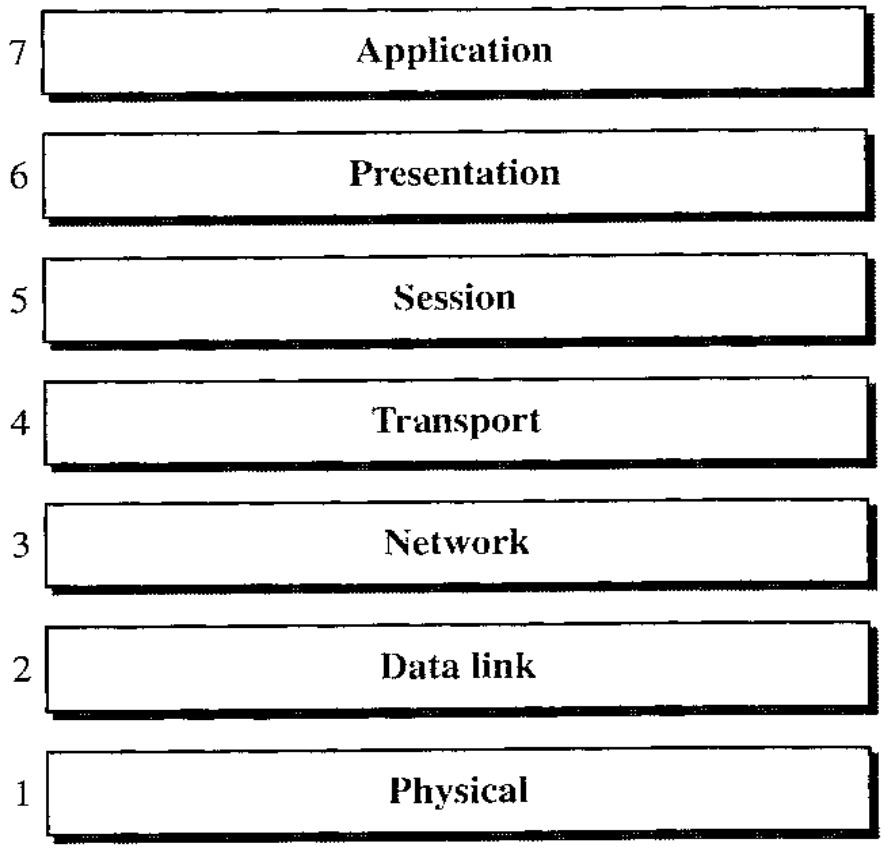
Alternate classification of network on their scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Layer interface and network hierarchy



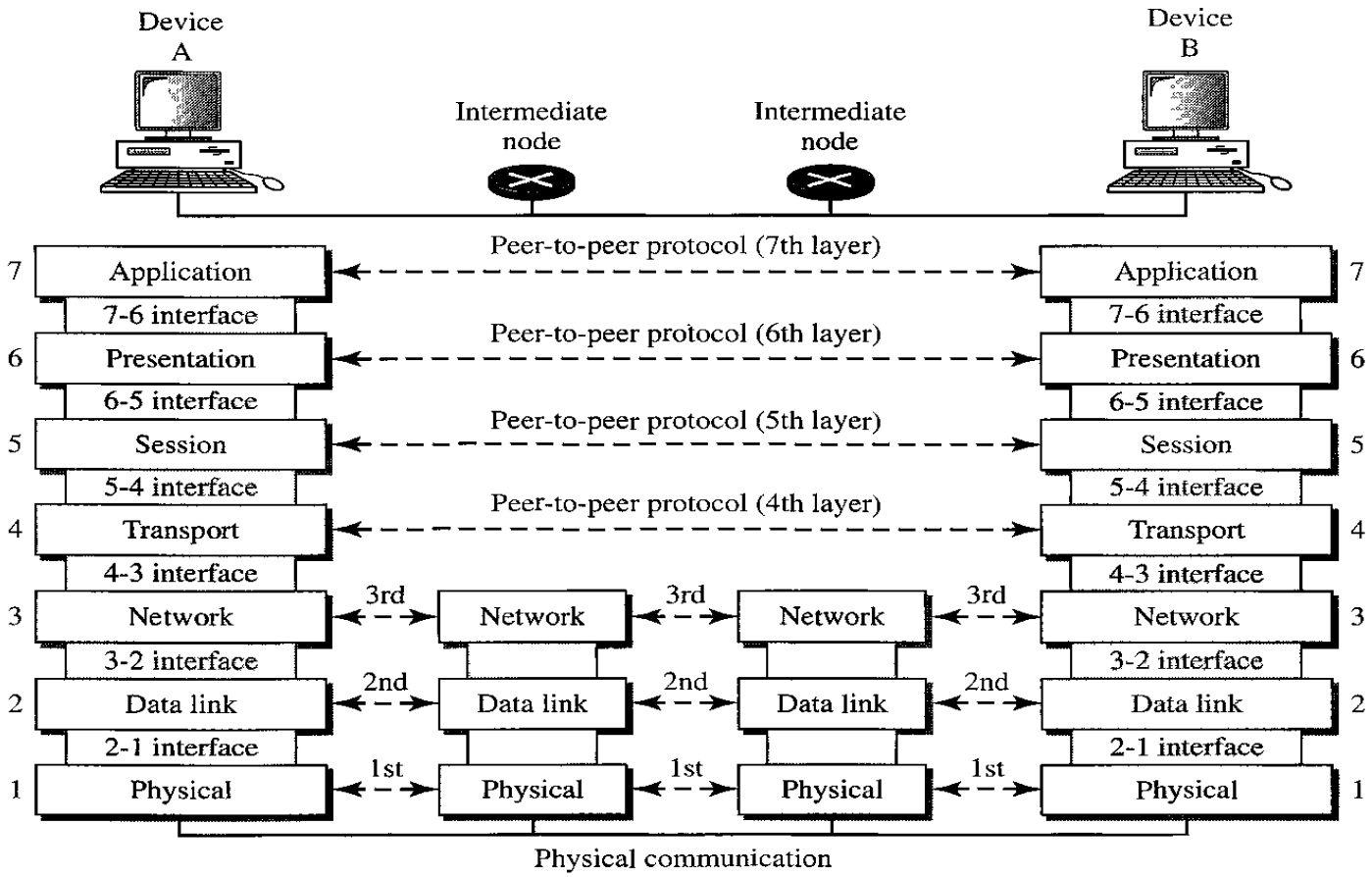
The OSI (Open system interconnection) model



Please Do Not Touch Steve's Pet Alligator

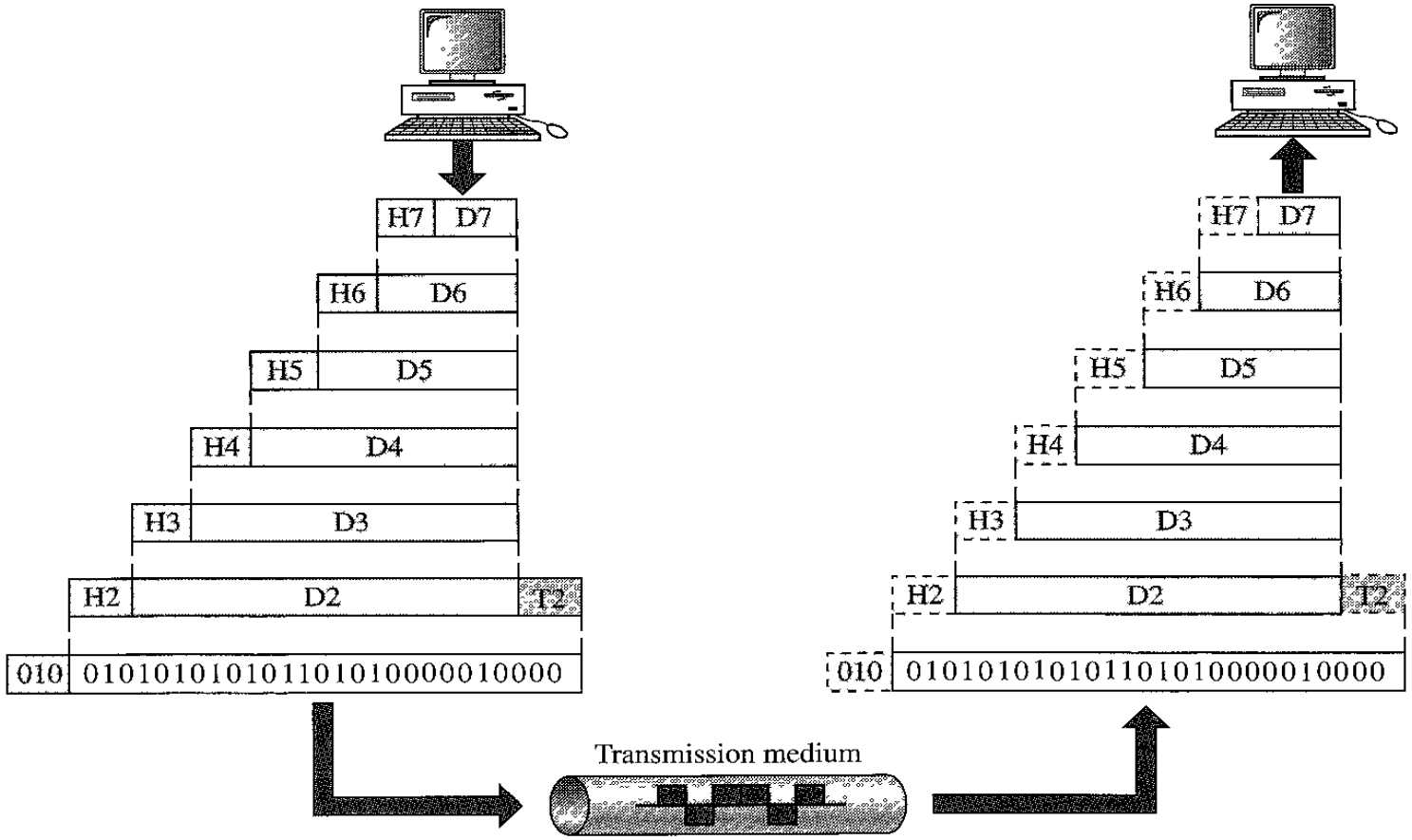
The OSI (Open system interconnection) model

Figure 2.3 *The interaction between layers in the OSI model*

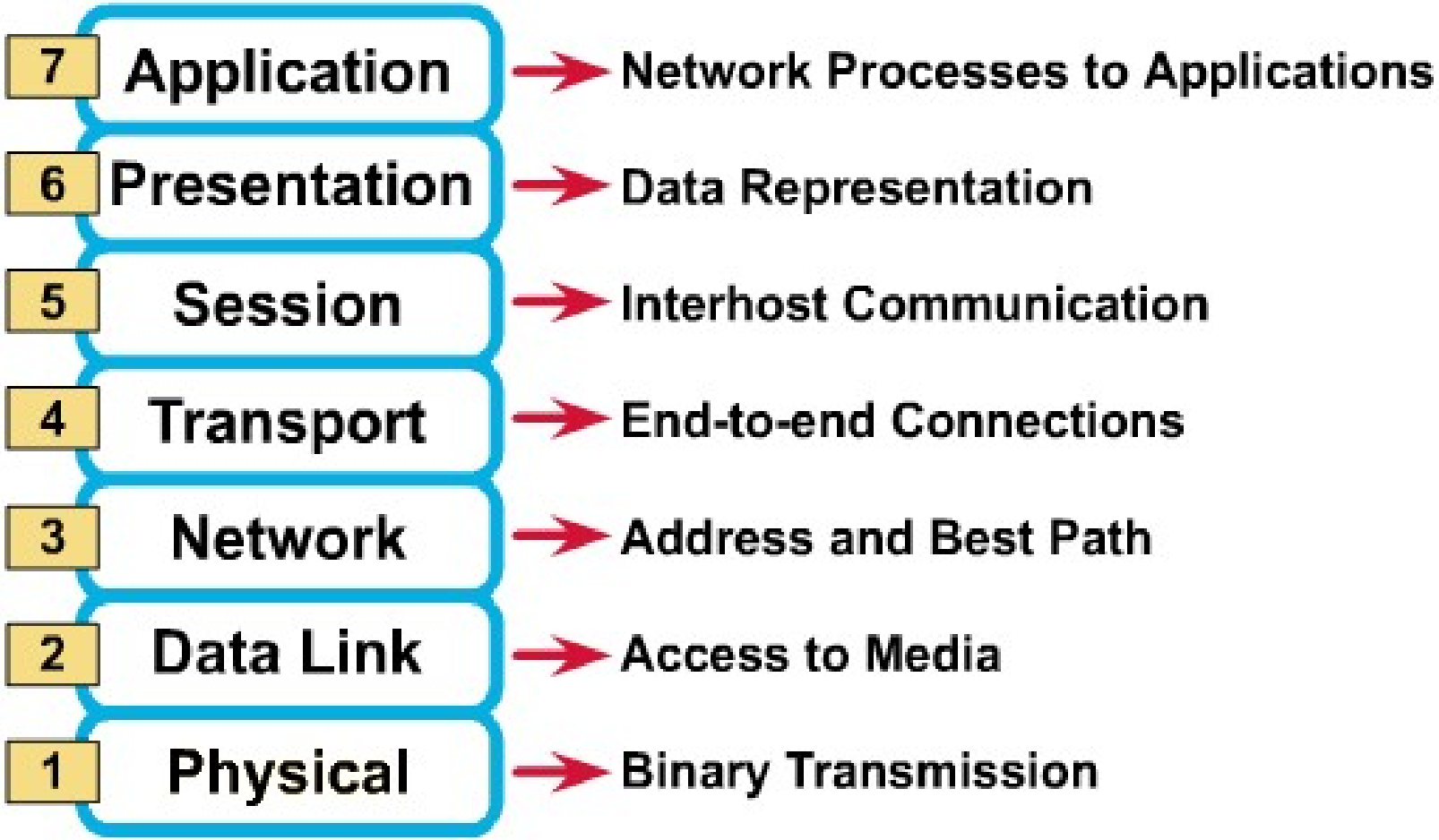


The OSI (Open system interconnection) model

Figure 2.4 *An exchange using the OSI model*



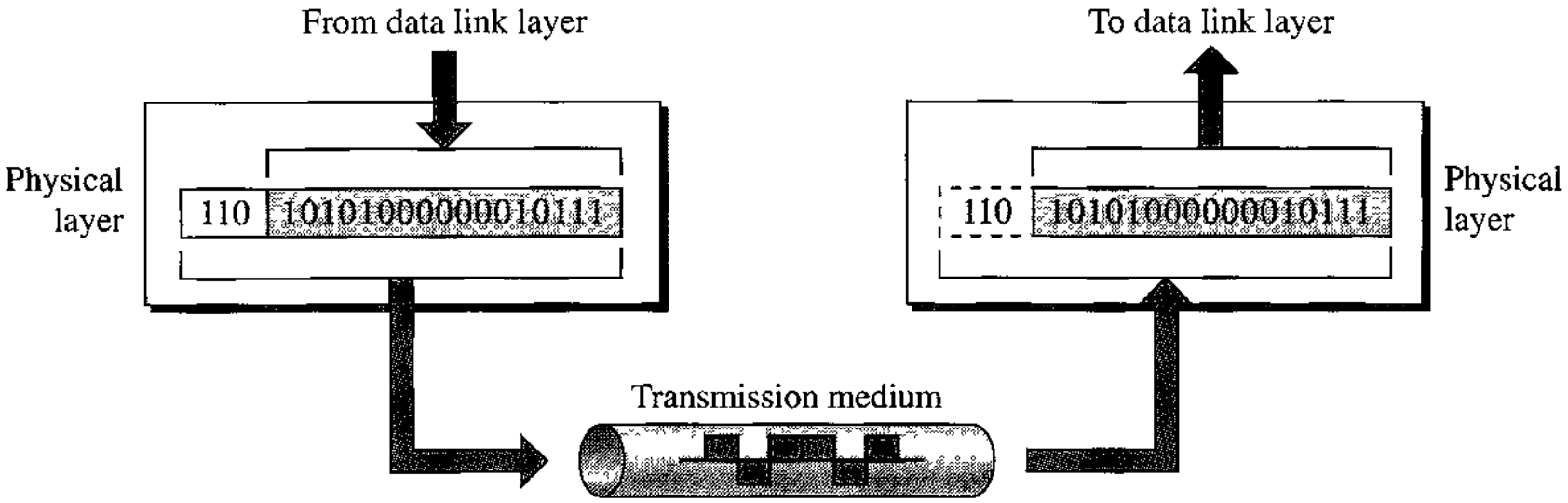
The seven OSI reference model layers



Layer1: PHYSICAL

- The physical layer deals with the physical characteristics of them transmission medium.
- It defines the electrical, mechanical, procedural, and functional specifications for activating, maintaining, and deactivating the physical link between end systems.
- 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.
- Examples :- EIA/TIA-232, RJ45, NRZ.

Physical Layer: The Physical layer is responsible for movement of individual bits from one hop (node) to the next



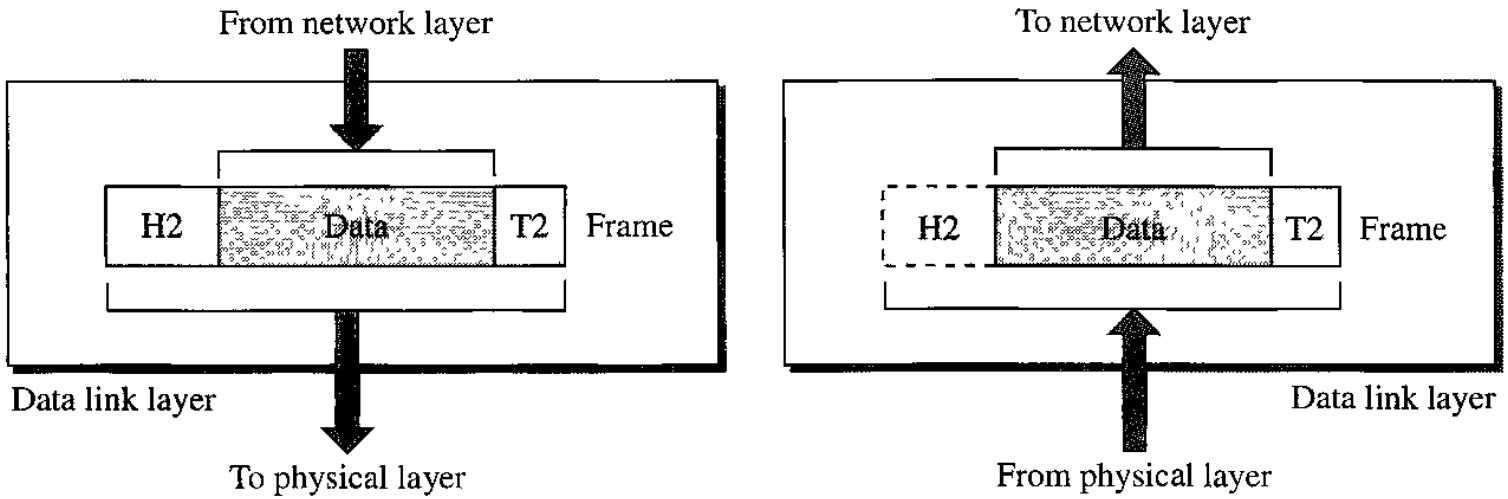
- Physical characteristics of interface and media
- Representation of bits
- Data rate
- Synchronization of bits
- Line configuration
- Physical topology
- Transmission mode

Layer2: DATALINK

- The data link layer provides access to the networking media and physical transmission across the media and this enables the data to locate its intended destination on a network.
- The data link layer provides reliable transit of data across a physical link by using the Media Access Control (MAC) addresses.
- The data link layer uses the MAC address to define a hardware or data link address in order for multiple stations to share the same medium and still uniquely identify each other.
- Concerned with network topology, network access, error notification, ordered delivery of frames, and flow control.
- Examples :- Ethernet, Frame Relay, FDDI.

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

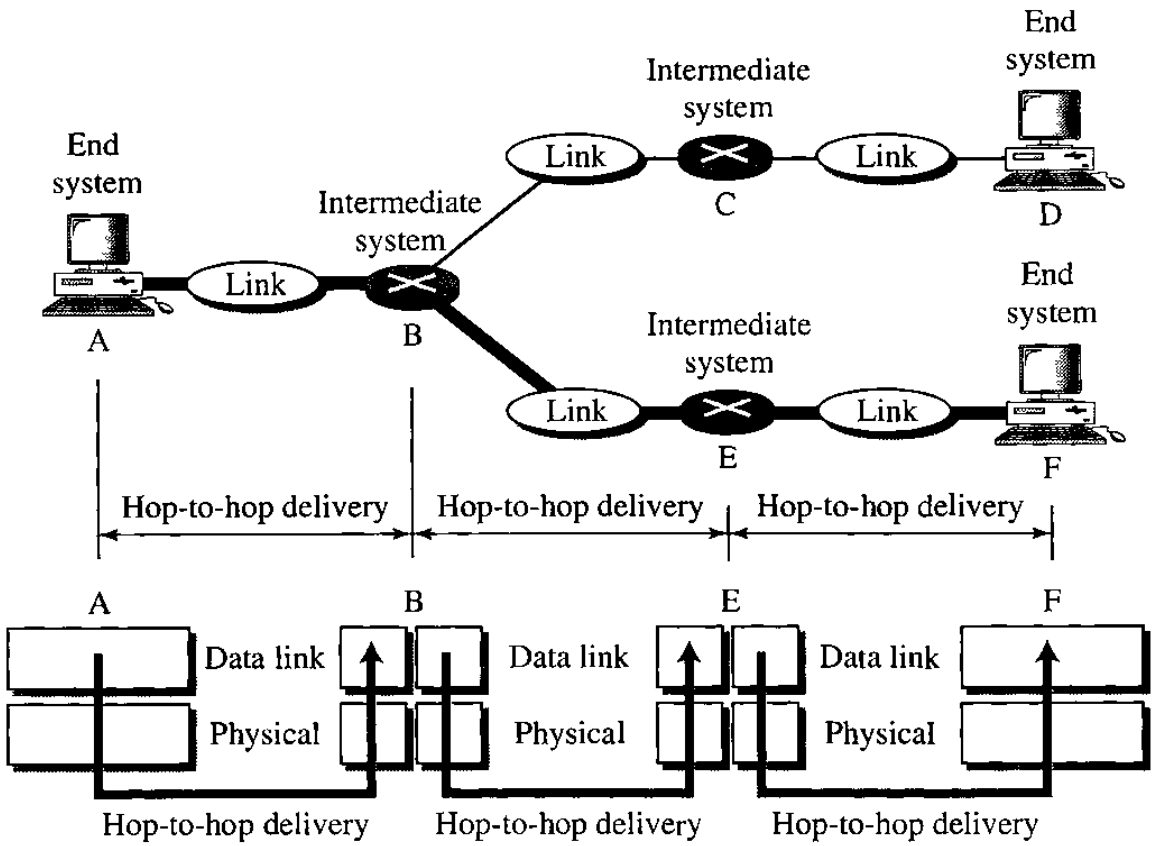
Figure 2.6 *Data link layer*



- Framing
- Physical addressing
- Flow control
- Error control
- Access control

Figure 2.7 illustrates **hop-to-hop (node-to-node) delivery** by the data link layer.

Figure 2.7 *Hop-to-hop delivery*

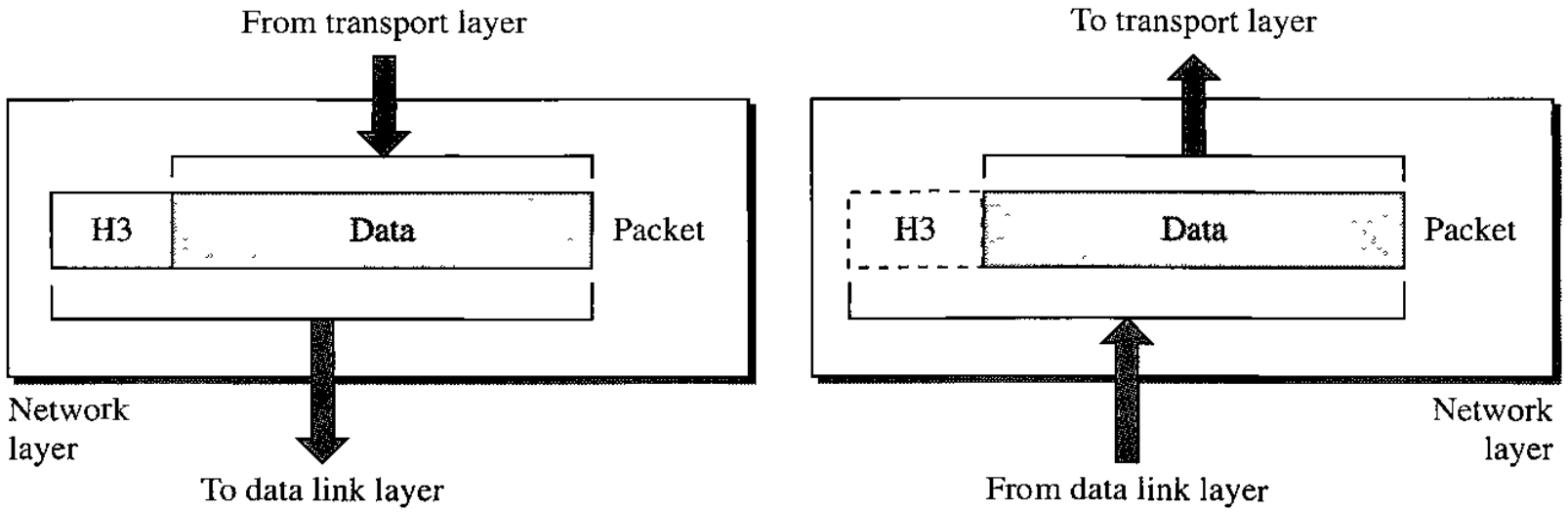


Layer3: NETWORK

- Defines end-to-end delivery of packets.
- Defines logical addressing so that any endpoint can be identified.
- Defines how routing works and how routes are learned so that the packets can be delivered.
- The network layer also defines how to fragment a packet into smaller packets to accommodate different media.
- Routers operate at Layer 3.
- Examples :- IP, IPX, AppleTalk.

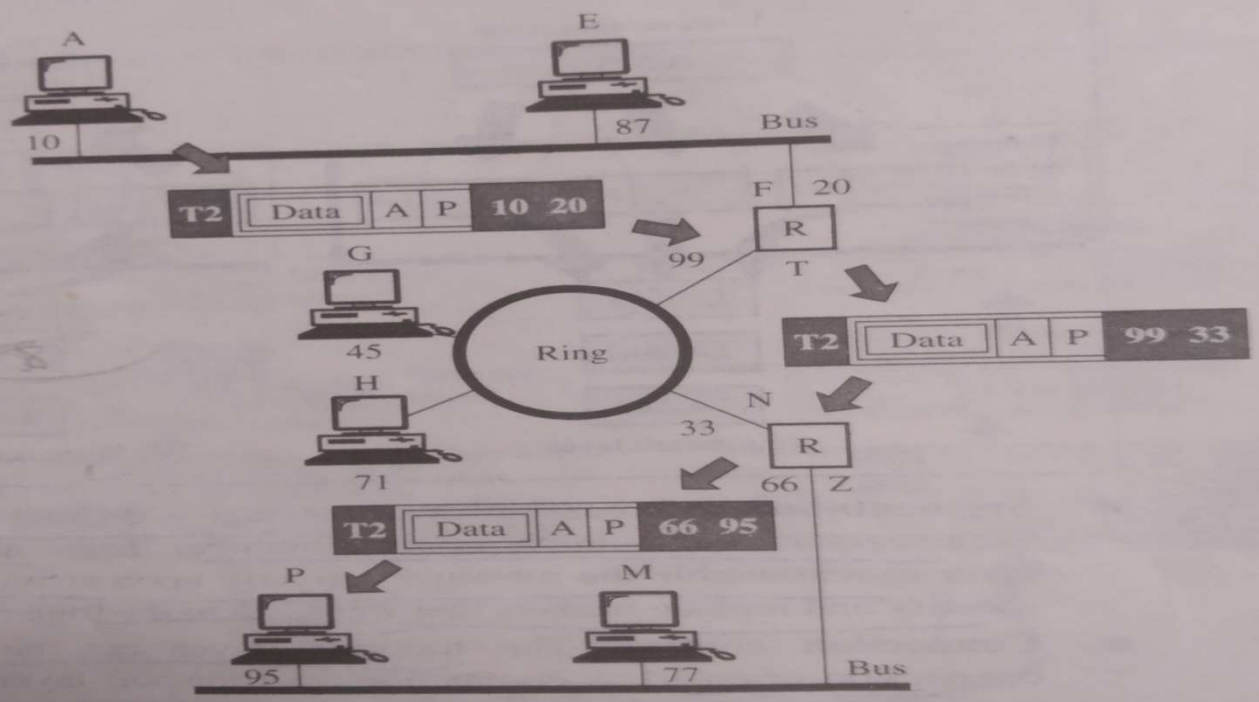
Network Layer: The network layer is responsible for the delivery of individual packets from the source host to the destination host.

Figure 2.8 *Network layer*



- Logical addressing
- Routing

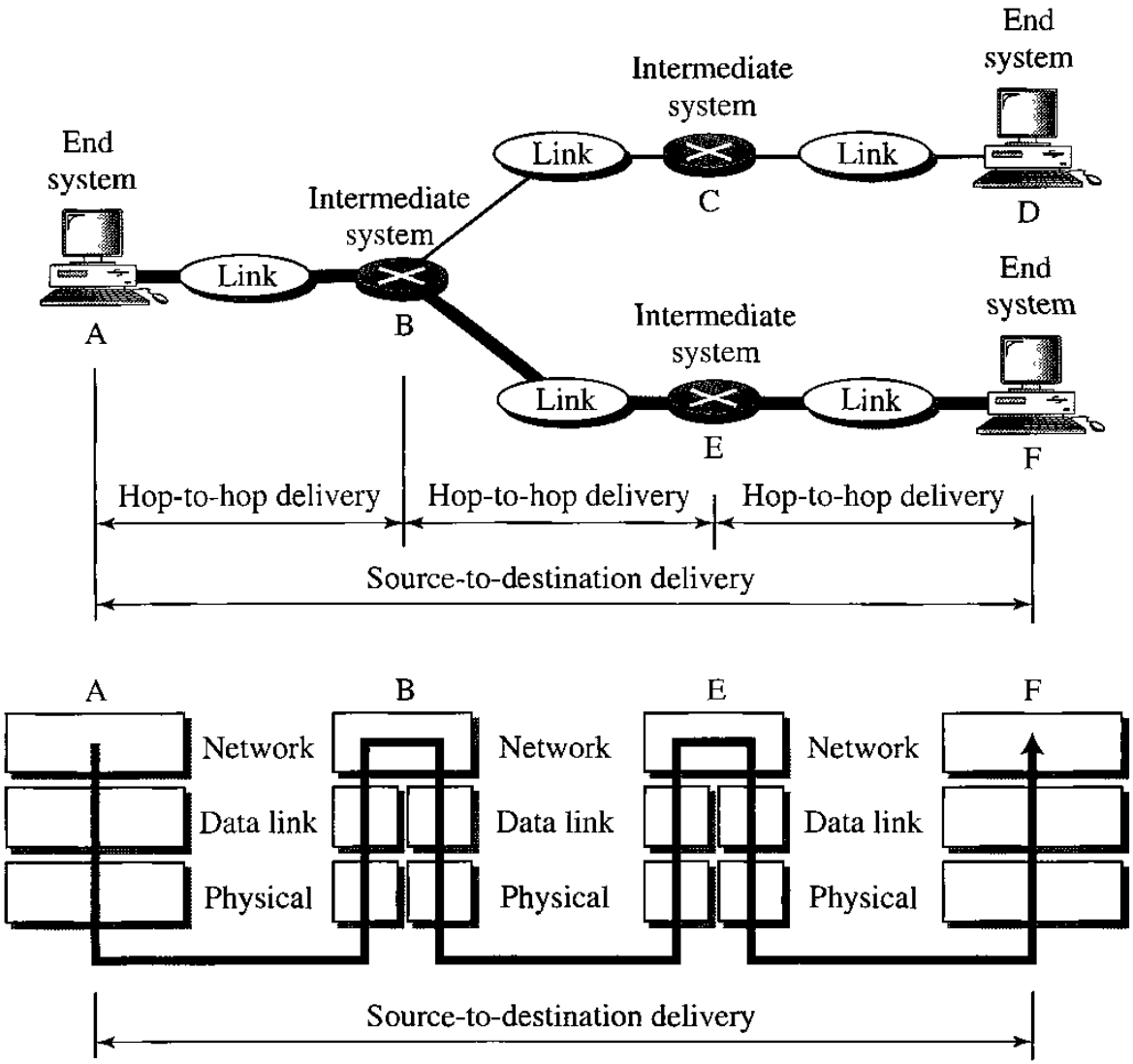
Figure 3.8 *Network layer (Example 3.2)*



ual packets, it does not recognize any relationship between those packets. It treats e
one independently, as though each piece belonged to a separate message, whethe
not it does. The transport layer, on the other hand, ensures that the whole mess
arrives intact and in order, overseeing both error control and flow control at the sou
to-destination level. Figure 3.9 shows the relationship of the transport layer to the
work and session layers.

For added security, the transport l

Figure 2.9 *Source-to-destination delivery*

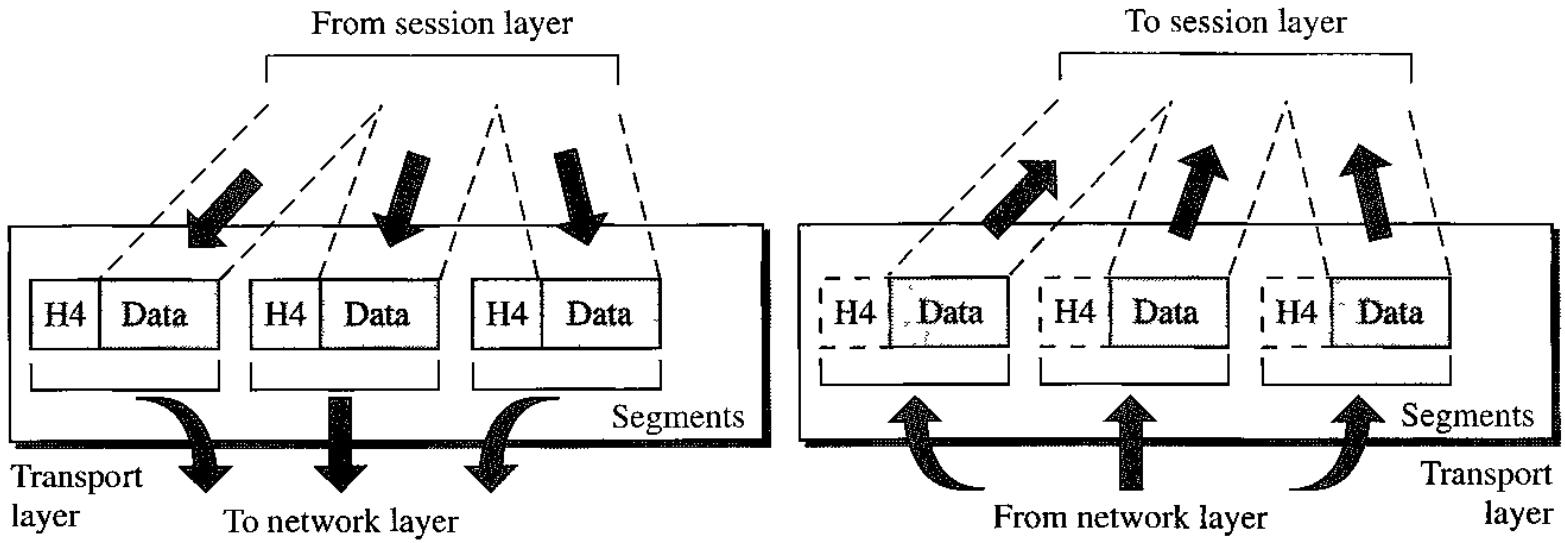


Layer4: TRANSPORT

- The transport layer regulates information flow to ensure end-to-end connectivity between host applications reliably and accurately.
- The transport layer segments data from the sending host's system and reassembles the data into a data stream on the receiving host's system.
- The boundary between the transport layer and the session layer can be thought of as the boundary between application protocols and data-flow protocols. Whereas the application, presentation, and session layers are concerned with application issues, the lower four layers are concerned with data transport issues.
- Layer 4 protocols include TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).

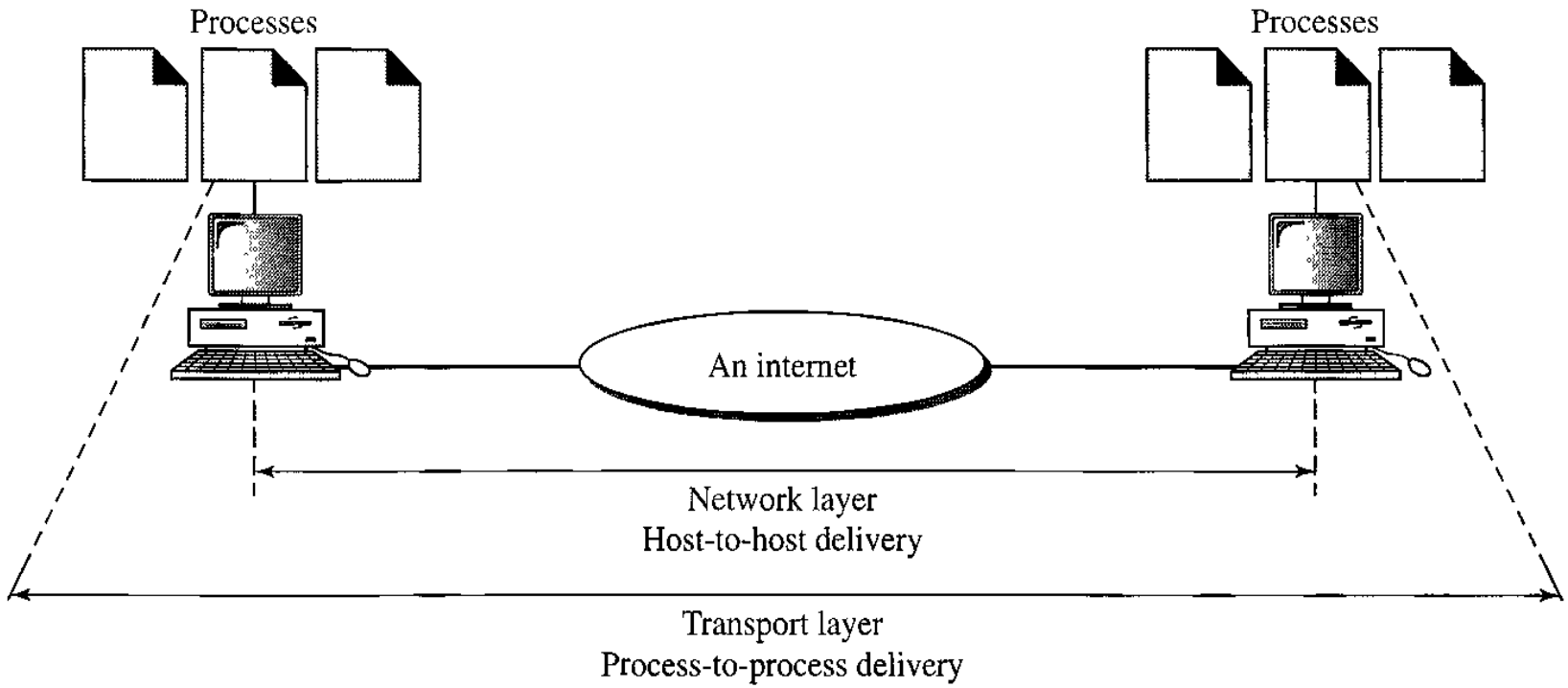
Transport Layer: The transport layer is responsible for the delivery of a message from one process to another.

Figure 2.10 *Transport layer*



- Service point addressing
- Segmentation and reassembly
- Connection control
- Flow control
- Error control

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

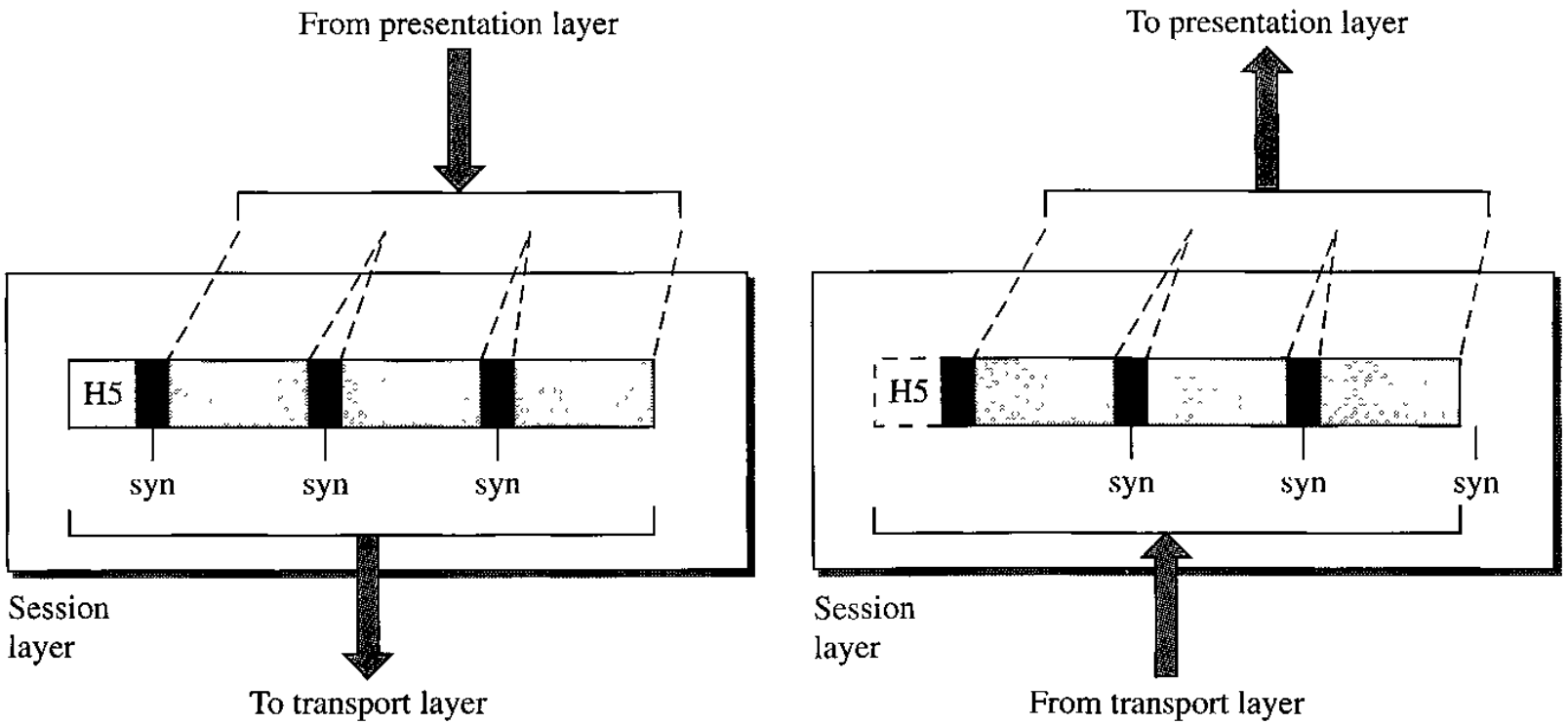


Layer5: SESSION

- The session layer defines how to start, control and end conversations (called sessions) between applications.
- This includes the control and management of multiple bi-directional messages using dialogue control.
- It also synchronizes dialogue between two hosts' presentation layers and manages their data exchange.
- The session layer offers provisions for efficient data transfer.
- Examples :- SQL, ASP(AppleTalk Session Protocol).

Session Layer: The session layer is responsible for dialog control and synchronization.

Figure 2.12 *Session layer*

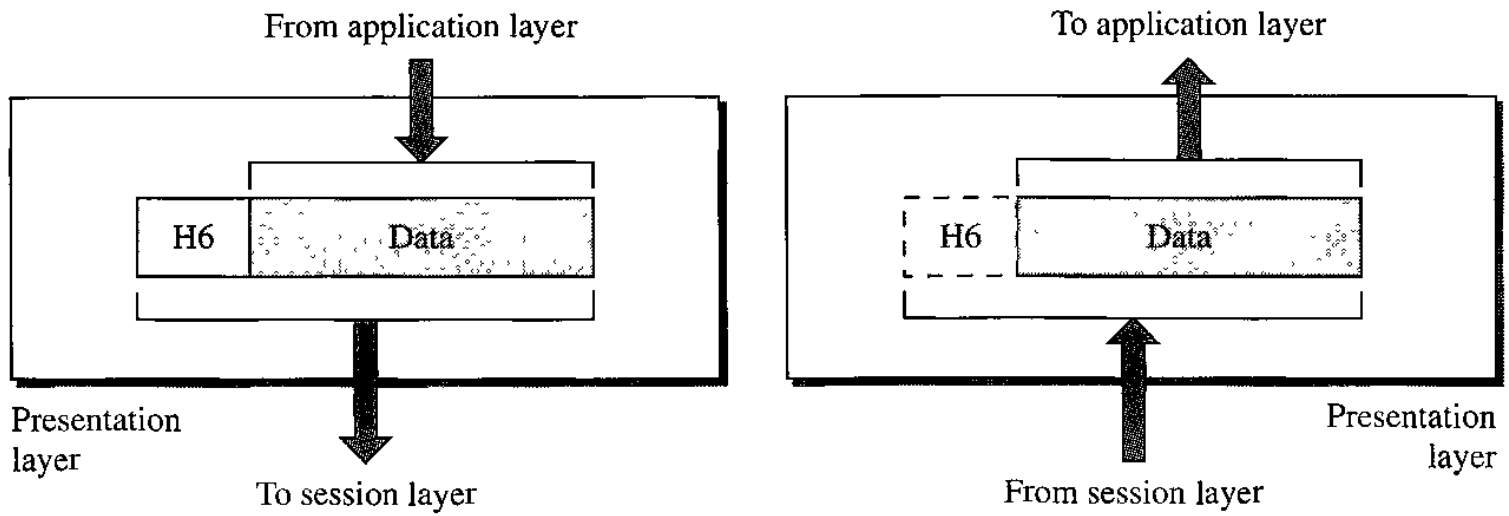


Layer 6: PRESENTATION

- The presentation layer ensures that the information that the application layer of one system sends out is readable by the application layer of another system.
- If necessary, the presentation layer translates between multiple data formats by using a common format.
- Provides encryption and compression of data.
- Examples :- JPEG, MPEG, ASCII, EBCDIC, HTML.

The Presentation Layer: The presentation layer is responsible for translation, compression, and encryption.

Figure 2.13 *Presentation layer*

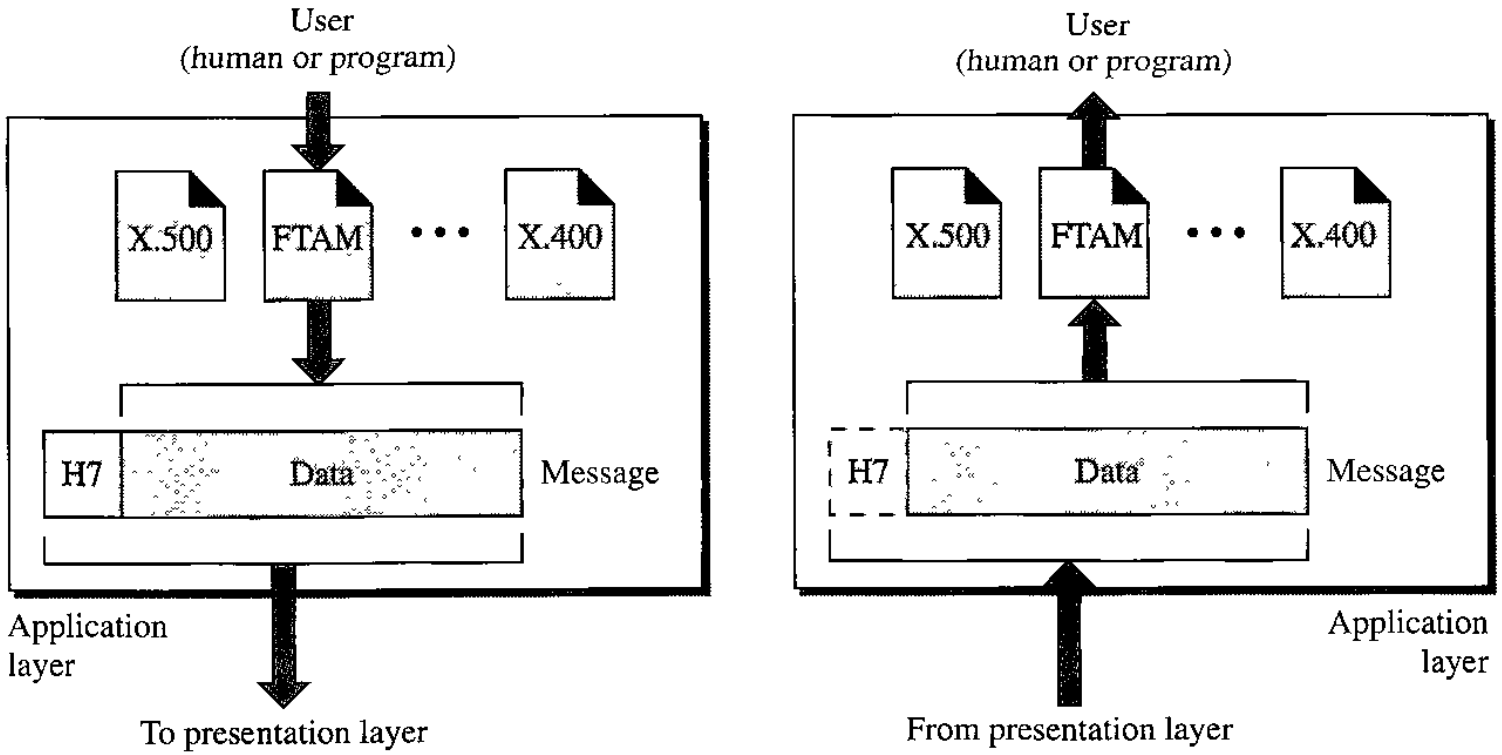


Layer 7: APPLICATION

- The application layer is the OSI layer that is closest to the user.
- It provides network services to the user's applications.
- It differs from the other layers in that it does not provide services to any other OSI layer, but rather, only to applications outside the OSI model.
- Examples of such applications are spreadsheet programs, word processing programs, and bank terminal programs.
- The application layer establishes the availability of intended communication partners, synchronizes and establishes agreement on procedures for error recovery and control of data integrity.

The application layer: The application layer is responsible for providing services to the users.

Figure 2.14 *Application layer*



SUMMARY OF LAYERS

Figure 2.15 *Summary of layers*