Chapter 2

Network Models

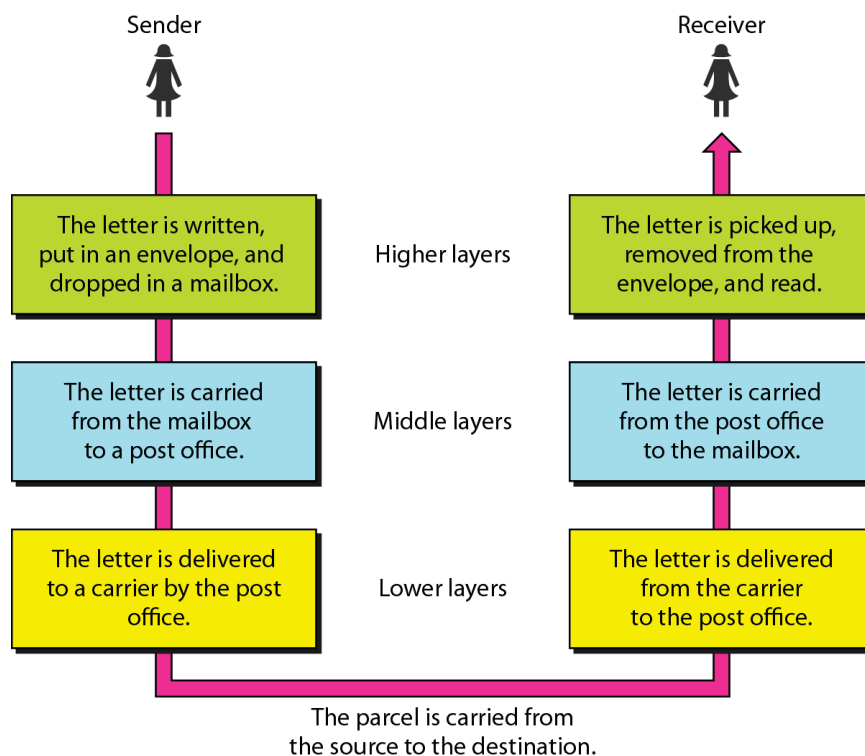**2.1**

2-1   LAYERED TASKS

We use the concept of layers in our daily life. As an example, let us consider two friends who communicate through postal mail. The process of sending a letter to a friend would be complex if there were no services available from the post office.

Figure 2.1 Tasks involved in sending a letter

Sender

Receiver

The letter is written, put in an envelope, and dropped in a mailbox.	The letter is picked up, removed from the envelope, and read.

Higher layers

The letter is carried from the mailbox to a post office.	The letter is carried from the post office to the mailbox.

Middle layers

The letter is delivered to a carrier by the post office.	The letter is delivered from the carrier to the post office.

Lower layers

The parcel is carried from the source to the destination.

2.3

2-2   THE OSI MODEL

The International Standards Organization **(ISO)** is a multinational body dedicated to worldwide agreement. **An ISO standard that coven international standards all aspects of network communications is the Open Systems Interconnection (OSI) model.** It was first introduced in the late 1970s.

> **ISO is the organization.**
> **OSI is the model.**

Why do we need the OSI Model?

To address the problem of networks increasing in size and in number, the International Organization for Standardization (ISO) researched many network schemes and recognized that there was a need to create a network model

This would help network builders implement networks that could communicate and work together

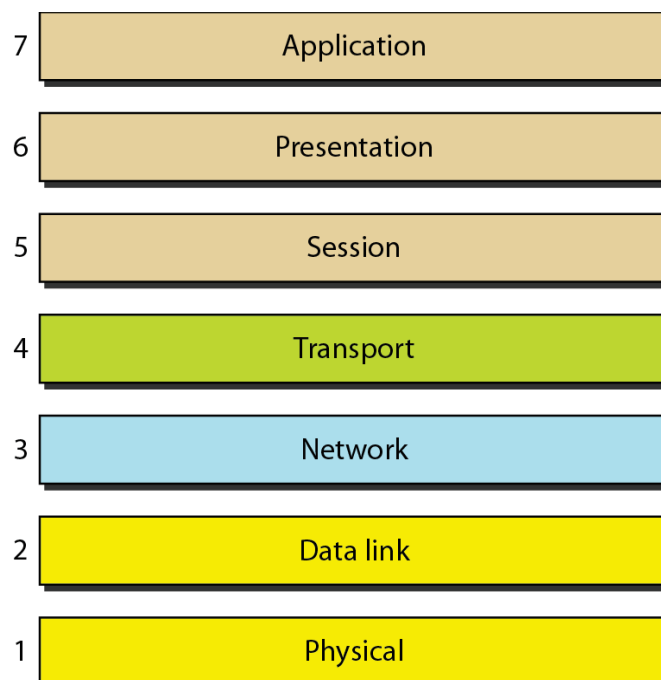**Figure 2.2** *Seven layers of the OSI model*

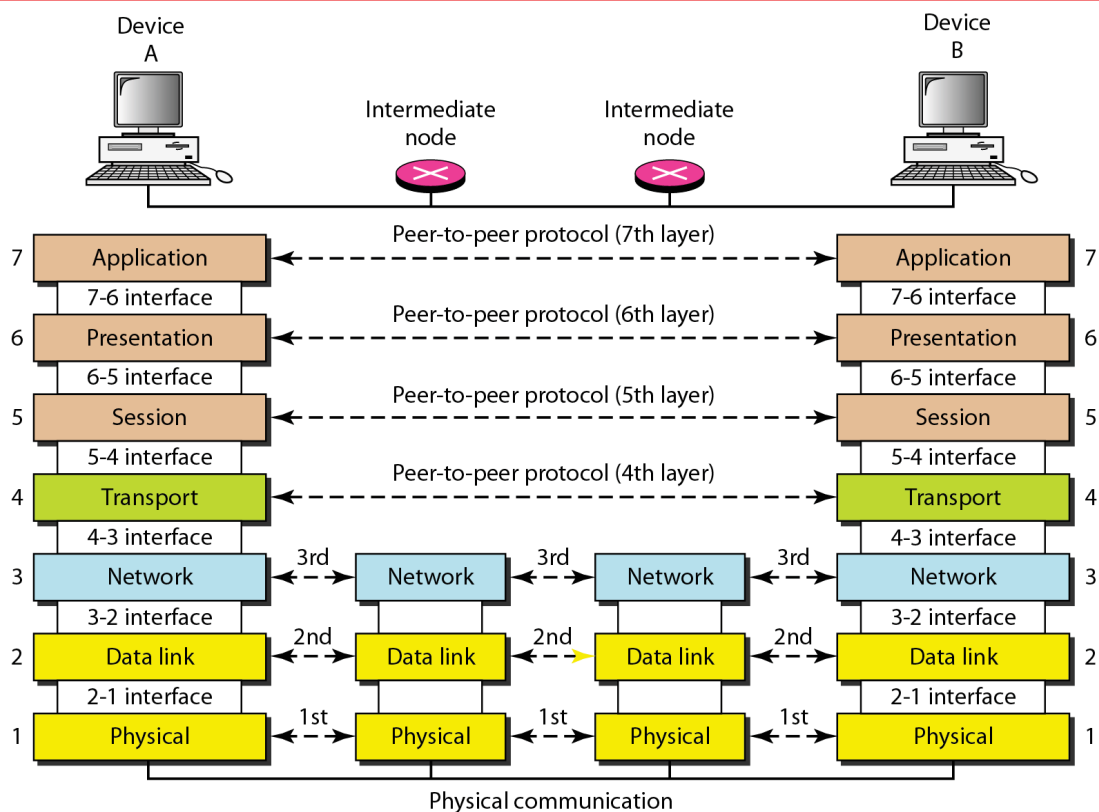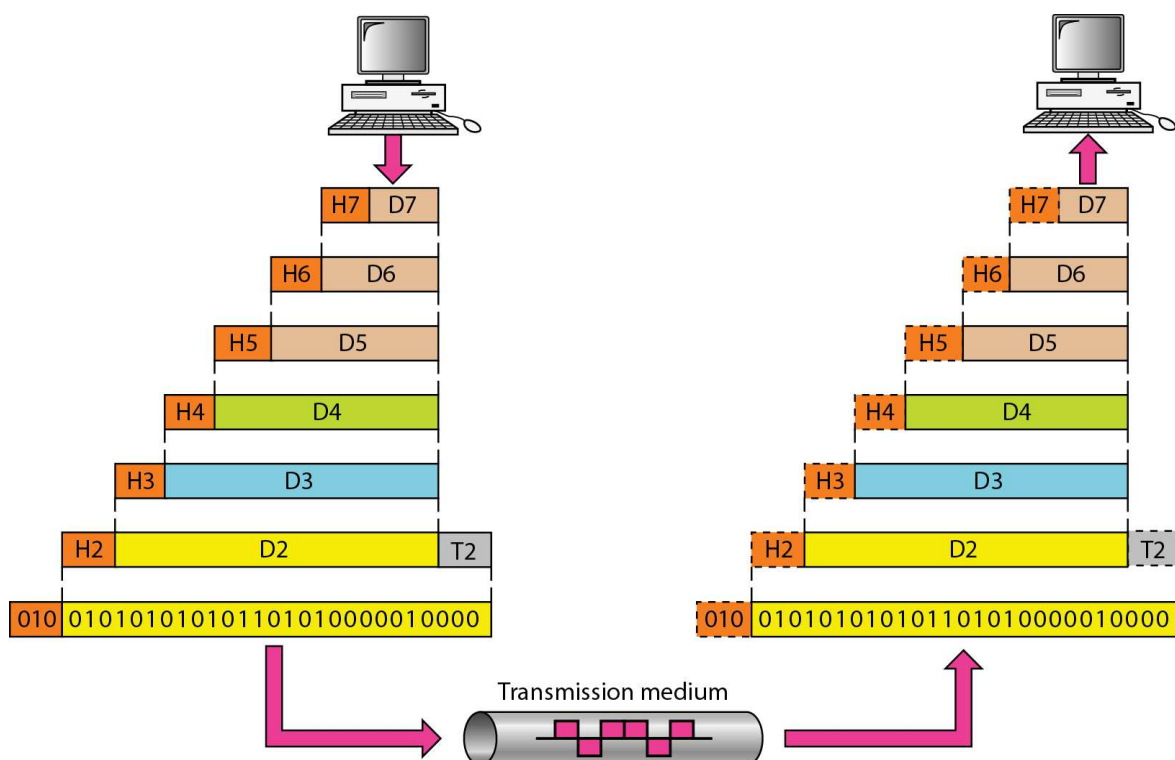|	
7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data link
1	Physical

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

Device A

Intermediate node

Intermediate node

Device B

7	Application	Peer-to-peer protocol (7th layer)	Application	7
	7-6 interface		7-6 interface	
6	Presentation	Peer-to-peer protocol (6th layer)	Presentation	6
	6-5 interface		6-5 interface	
5	Session	Peer-to-peer protocol (5th layer)	Session	5
	5-4 interface		5-4 interface	
4	Transport	Peer-to-peer protocol (4th layer)	Transport	4
	4-3 interface		4-3 interface	

3 Network 3rd Network 3rd Network 3rd Network 3

3-2 interface

3-2 interface

2 Data link 2nd Data link 2nd Data link 2nd Data link 2

2-1 interface

2-1 interface

1 Physical 1st Physical 1st Physical 1st Physical 1

Physical communication

2.7

Figure 2.4 *An exchange using the OSI model*

H7 D7

H6 D6

H5 D5

H4 D4

H3 D3

H2 D2 T2

010 010101010101101010000010000

H7 D7

H6 D6

H5 D5

H4 D4

H3 D3

H2 D2 T2

010 010101010101101010000010000

Transmission medium

2.8

Peer-to-Peer Processes

- At the higher layers, communication must move down through the layers on device A, over to device B.

- Each layer in the sending device adds its own information to the message it receives from the layer just above it and passes the whole package to the layer just below it.

- At the receiving machine, the message is unwrapped layer by layer, with each process receiving and removing the data meant for it.

- For example, layer 2 removes the data meant for it, then passes the rest to layer 3. Layer 3 then removes the data meant for it and passes the rest to layer 4, and so on

-Each interface defines the information and services a layer must provide for the layer above it.
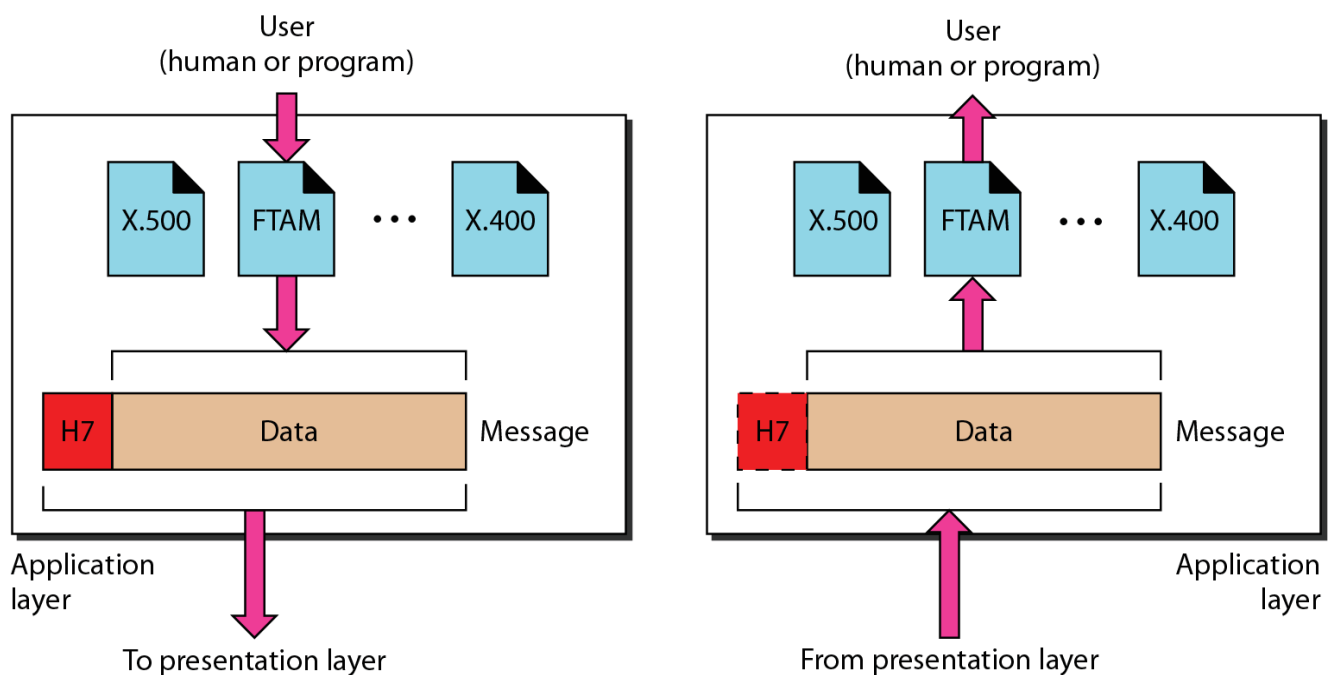
2.9

2-3   LAYERS IN THE OSI MODEL

In this section we briefly describe the functions of each layer in the OSI model.

OSI Layers:

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer

2.10

Figure 2.14 *Application layer*

2.11

Note

The application layer is responsible for providing services to the user.
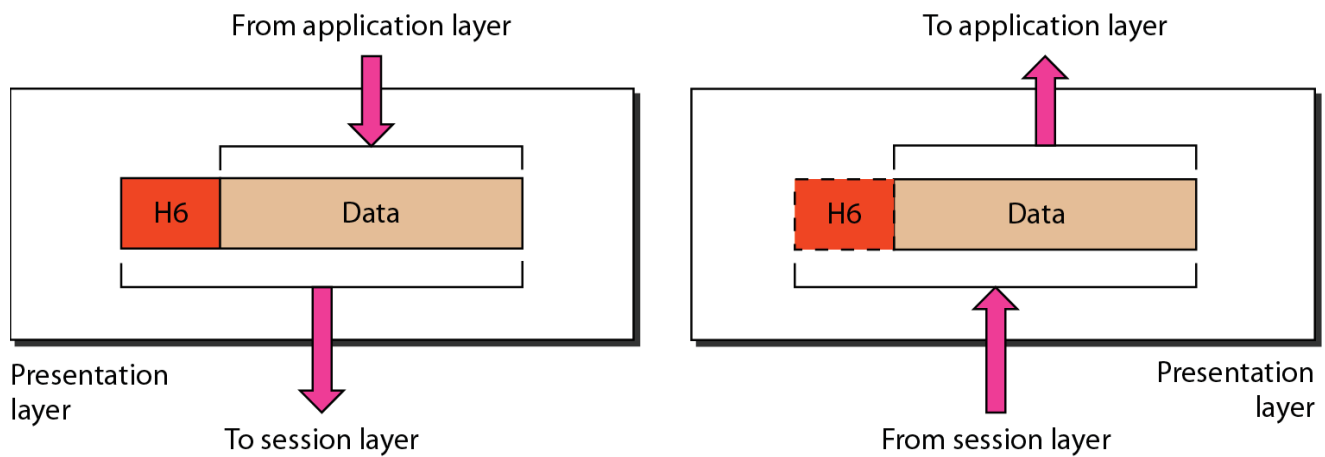
Examples:
- Email
- Web browsers
- Protocol Data Unit (**PDU**) - User Data

The application layer is also concerned with the following

1) Network virtual terminal.

2) File transfer.

3) Mail services.

4) Directory services.

2.12

Figure 2.13 *Presentation layer*

From application layer

H6 | Data

Presentation
layer

To session layer

To application layer

H6 | Data
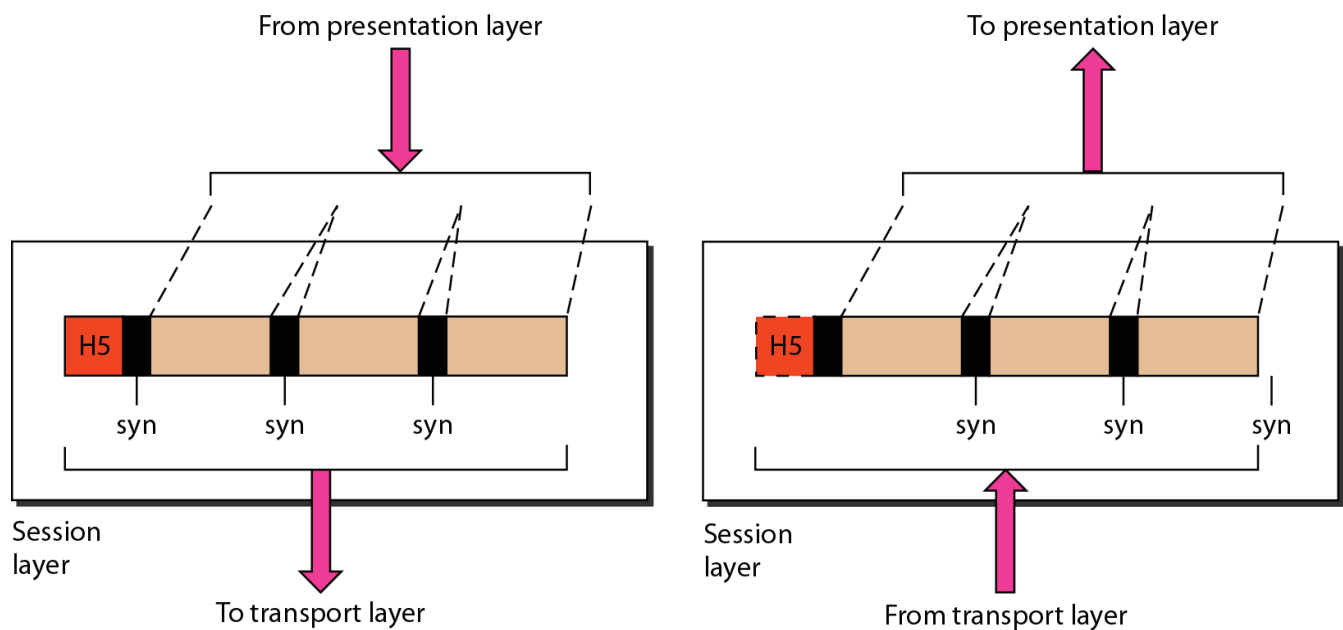
Presentation
layer

From session layer

2.13

Note

-The presentation layer is responsible for translation, compression, Code Formatting and encryption.
-PDU - Formatted Data

The Presentation layer is also concerned with the following

1) Translation.

2) Encryption.

3) Compression.

2.14

Figure 2.12 *Session layer*

From presentation layer

To presentation layer

| H5 | | | |
| syn | syn | syn |

Session
layer

To transport layer

| H5 | | | |
| syn | syn | syn |

Session
layer

From transport layer

2.15

Note

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

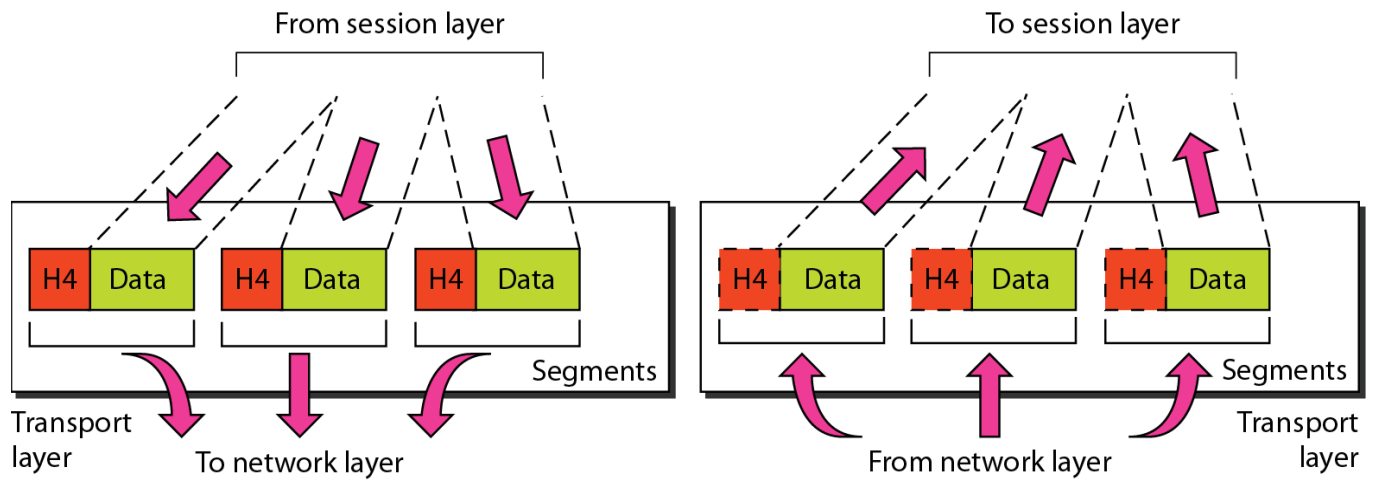**The Session layer is also concerned with the following**

1) Dialog control.

2) Synchronization.

2.16

Figure 2.10   *Transport layer*

Note

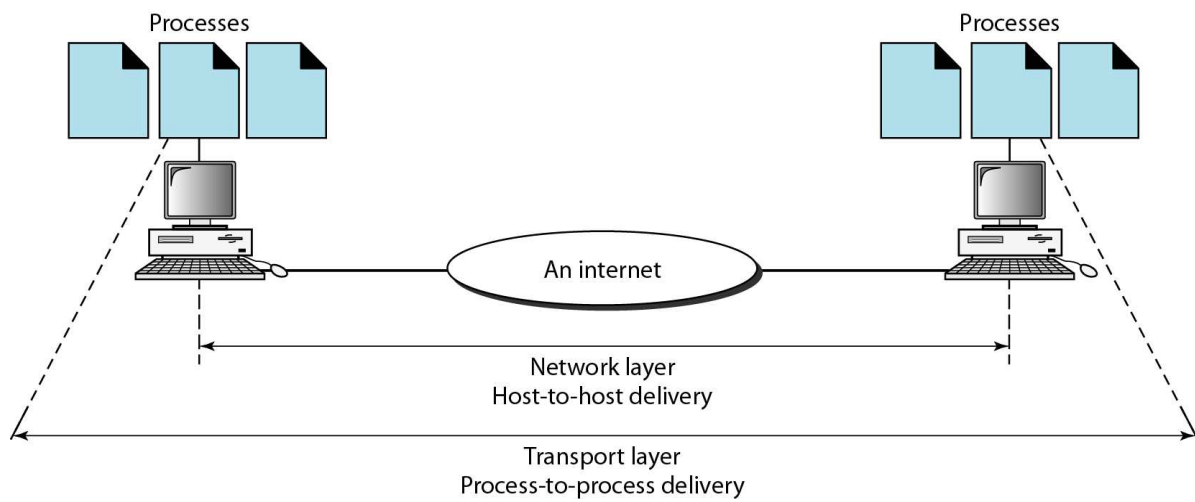-The transport layer is responsible for the delivery of a message from one process to another.
-PDU - Segments

The Transport layer is also concerned with the following

1) Service-point addressing.

2) Segmentation and reassembly.

3) Connection control.

4) Flow control.

5) Error control.

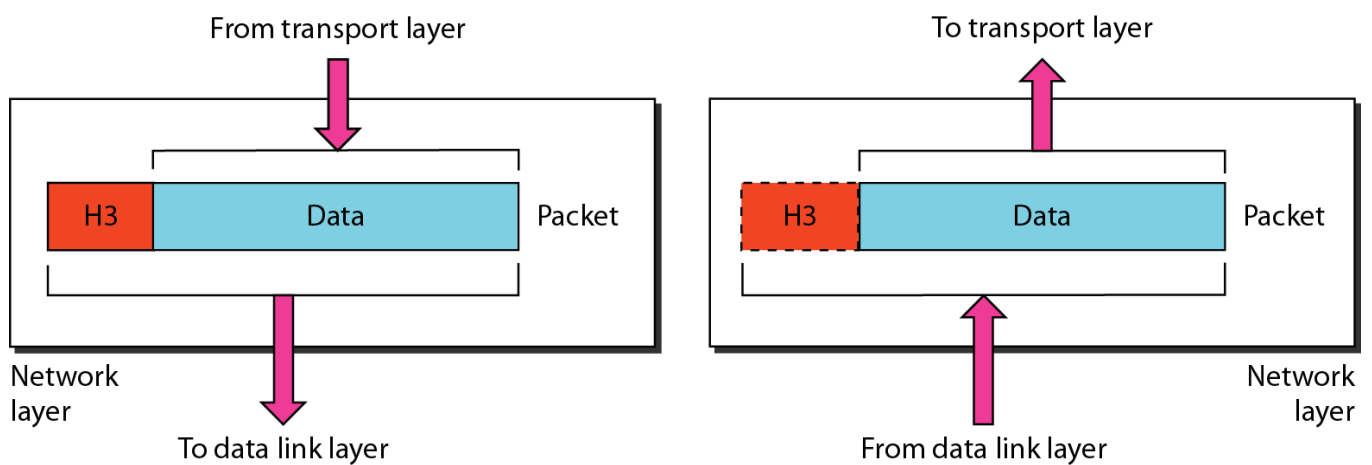## Figure 2.11 *Reliable process-to-process delivery of a message*

Processes

Processes

An internet

Network layer
Host-to-host delivery

Transport layer
Process-to-process delivery

2.19

Figure 2.8 *Network layer*

From transport layer

To transport layer

| H3 | Data | Packet

Network
layer

To data link layer

| H3 | Data | Packet

Network
layer

From data link layer

2.20

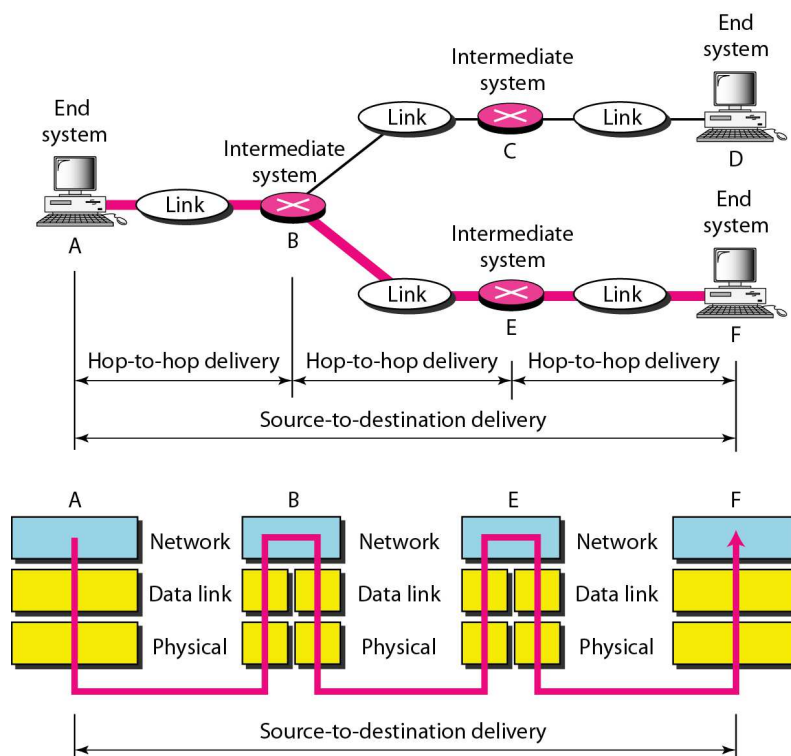-The network layer is responsible for the delivery of individual packets from the source host to the destination host.

-**PDU – Packets**

The Network layer is also concerned with the following

1) **Logical addressing.**

2) **Routing.**

2.21

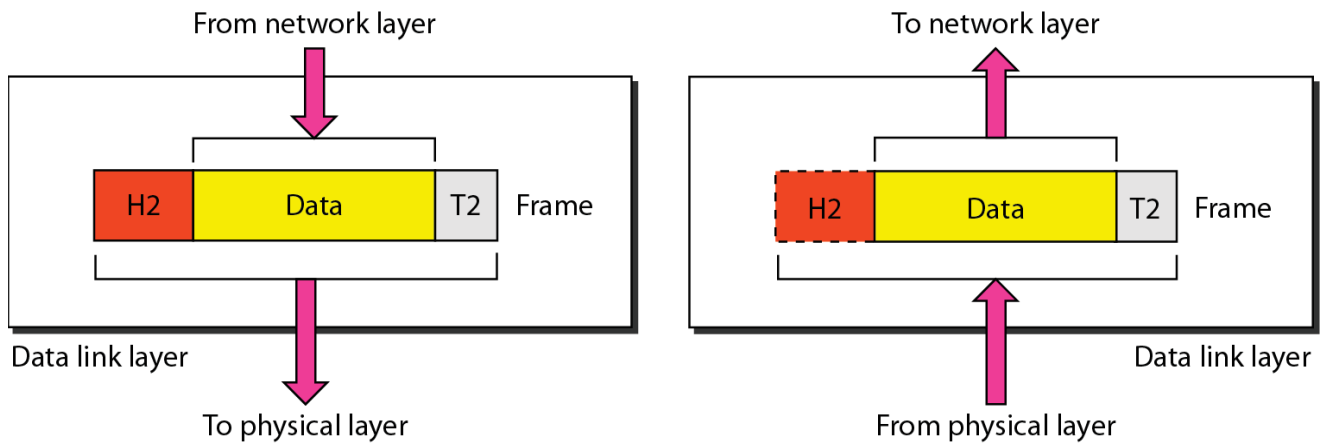**Figure 2.9** *Source-to-destination delivery*

Figure 2.6 *Data link layer*

From network layer

| H2 | Data | T2 | Frame

To physical layer

Data link layer

To network layer

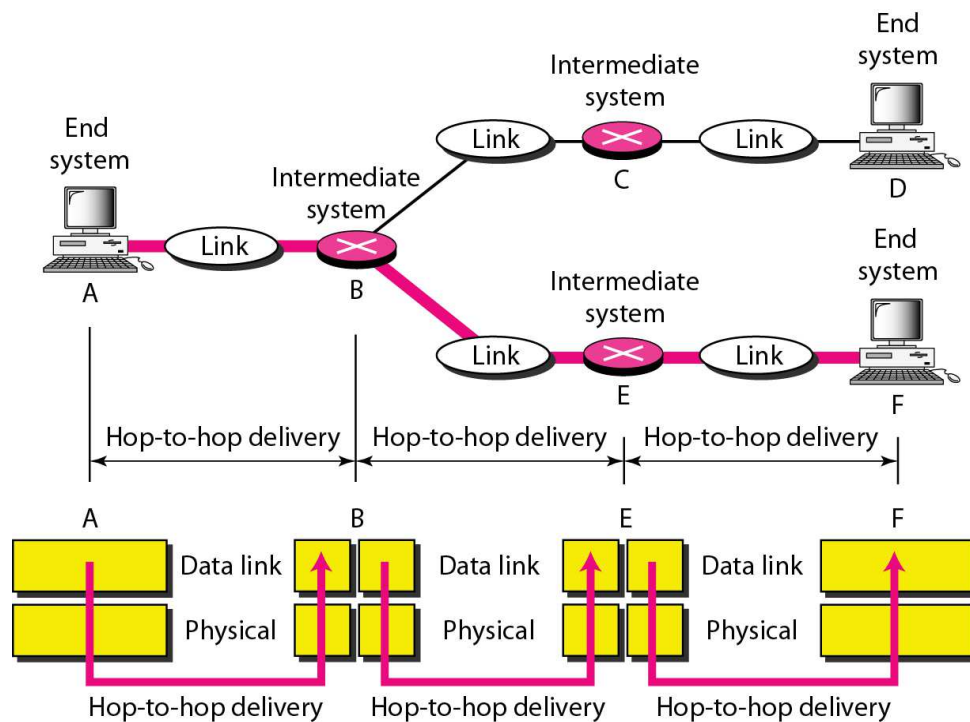| H2 | Data | T2 | Frame

From physical layer

Data link layer

2.23

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

The data link layer is also concerned with the following

1) Framing.

2) Physical addressing.
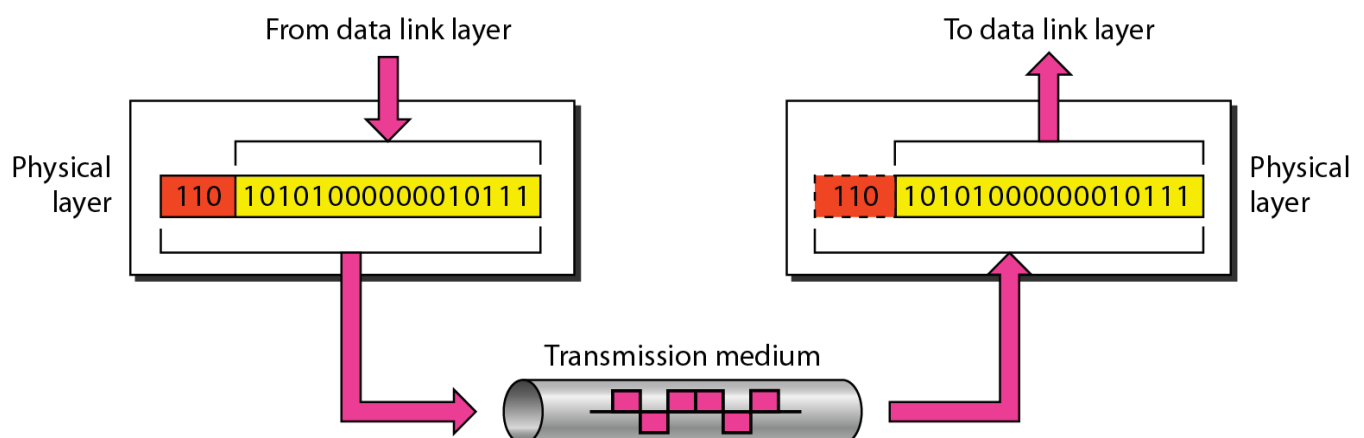
3) Flow control.

4) Error control.

5) Access control.

2.24

Figure 2.7 Hop-to-hop delivery

2.25

Figure 2.5 Physical layer

2.26

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

-**PDU - Bits**
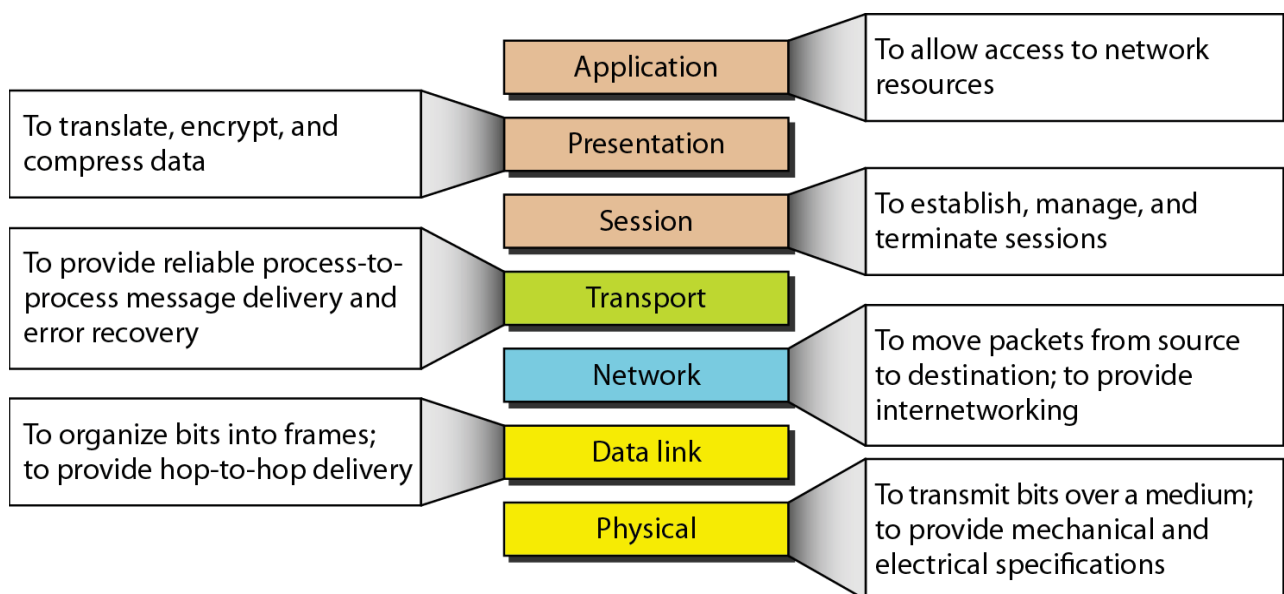
The physical layer is also concerned with the following

1) Physical characteristics of interfaces and medium.

2) Representation of bits.

3) Data rate.

4) Synchronization of bits.

5) Line configuration.

6) Physical topology.

7)Transmission mode.

2.27

Figure 2.15 *Summary of layers*

	Application	To allow access to network resources
To translate, encrypt, and compress data	Presentation	
	Session	To establish, manage, and terminate sessions
To provide reliable process-to-process message delivery and error recovery	Transport	
	Network	To move packets from source to destination; to provide internetworking
To organize bits into frames; to provide hop-to-hop delivery	Data link	
	Physical	To transmit bits over a medium; to provide mechanical and electrical specifications

2.28