Introduction To Wireless Communications and Networks

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OUTLINE

- **BACKGROUND**
- **Location based services : aim**
- **Predictive Spatial Queries: Definition**
- **Predictive Spatial Queries: Common types**
- **Predictive Queries: Applications**
- **Predictive Spatio-Temporal Query**
- **Spatio-temporal Data Management : Open Research Areas**
- **Challenges**
- **Conclusions**

BACKGROUND

- **Wireless Communications**
  - **Responsibility**: Communication engineers
  - Physical layer
  - Data link layer
- **Networks**
  - **Responsibility**: Software Engineers
  - Application layer
  - Network Layer
  - Transport Layer

BACKGROUND

- **What is the role of each layer:**
  - Application layer
  - Network Layer
  - Transport Layer
  - Data link layer
  - Physical layer

Wireless Comes of Age

- **Guglielmo Marconi invented the wireless telegraph in 1896**
  - Communications by encoding alphanumeric characters in analog signals
  - Sent telegraphic signals across Atlantic ocean
- **Communications satellites launched in 1960s**
- **Advances in wireless technology**
  - Radio,television,mobiletelephone,communication satellites
- **More Recently**
  - Satellite communications, wireless networking, cellular technology

Broadband Wireless Technology

- **Higher data rates obtainable with broadband wireless technology**
  - Graphics, video, audio
- **Share same advantages of all wireless services: convenience and reduced cost**
  - Service can be deployed faster
  - No cost of cable
  - Service is mobile, deployed almost anywhere.

Three Faces of Networking

- Fundamental concepts of networking
  - How data moves from one computer to another over a network
  - Theories of how network operate
- Technologies in use today
  - How theories are implemented, specific products
  - How do they work, their use, applications
- Management of networking technologies
  - Security
  - Network Design
  - Managing the network

Topics Coverage

- **Data Communications**
- **TCP/IP**

DEFNTION

- **Data communications (DC)** is the process of using communication technologies to transfer data from one place to another, and vice versa.
- It enables the movement of electronic or digital data between two or more nodes, regardless of geographical location, technological medium or data contents.
- **Common example of data communications** is a computer connected to the Internet via a Wi-Fi connection, which uses a wireless medium to send and receive data from one or more remote servers.

DEFNTION

- 

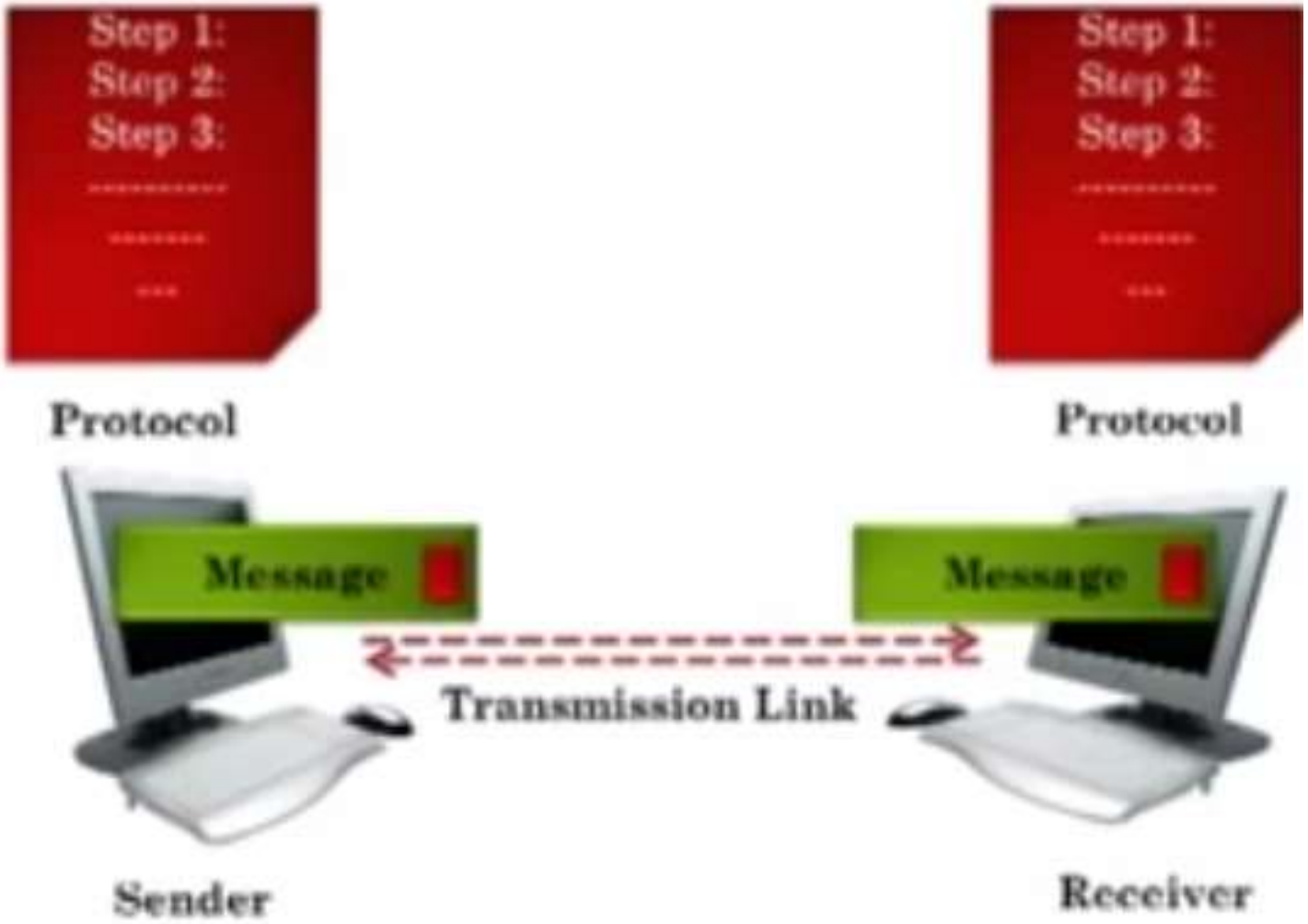
Effectiveness of data Communication

- The Effectiveness of data communication depends on three fundamental characteristics

Communications Tasks

Transmission system utilization	Addressing
Interfacing	Routing
Signal generation	Recovery
Synchronization	Message formatting
Exchange management	Security
Error detection and correction	Network management
Flow control	

Components of Data Communication

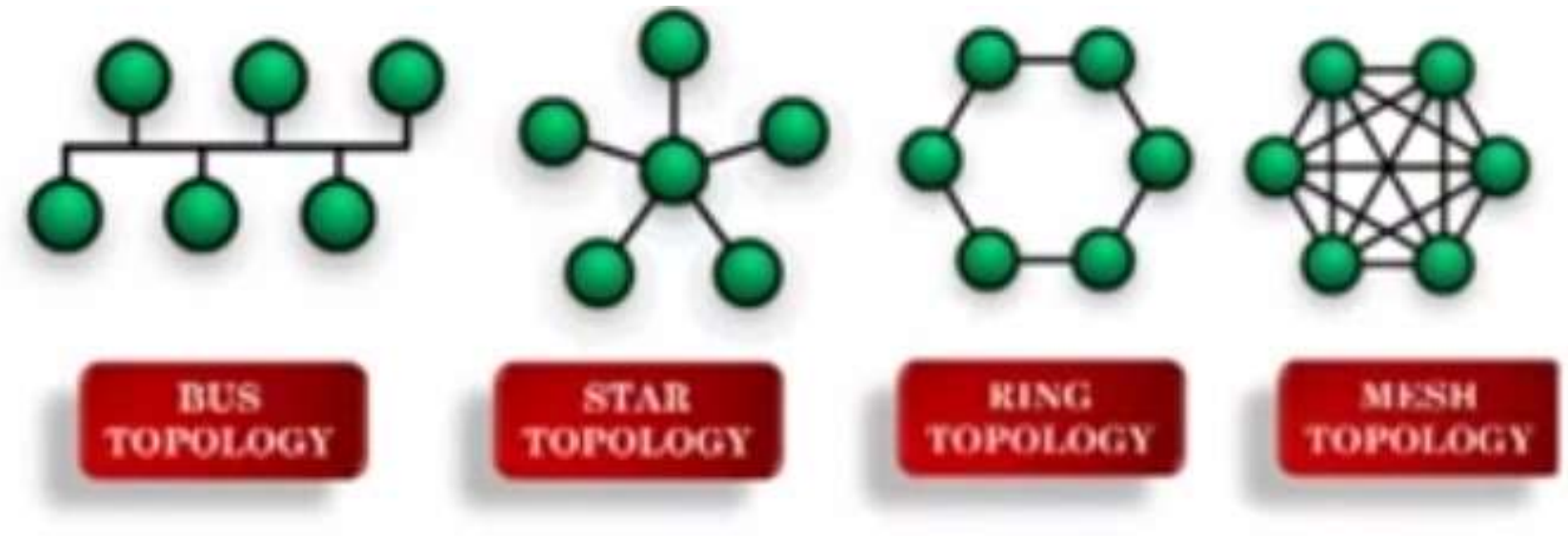


Topology

- How To connect 2 or More devices ? **Topology**
- Two or more devices connect to a link and two or more links form topology.

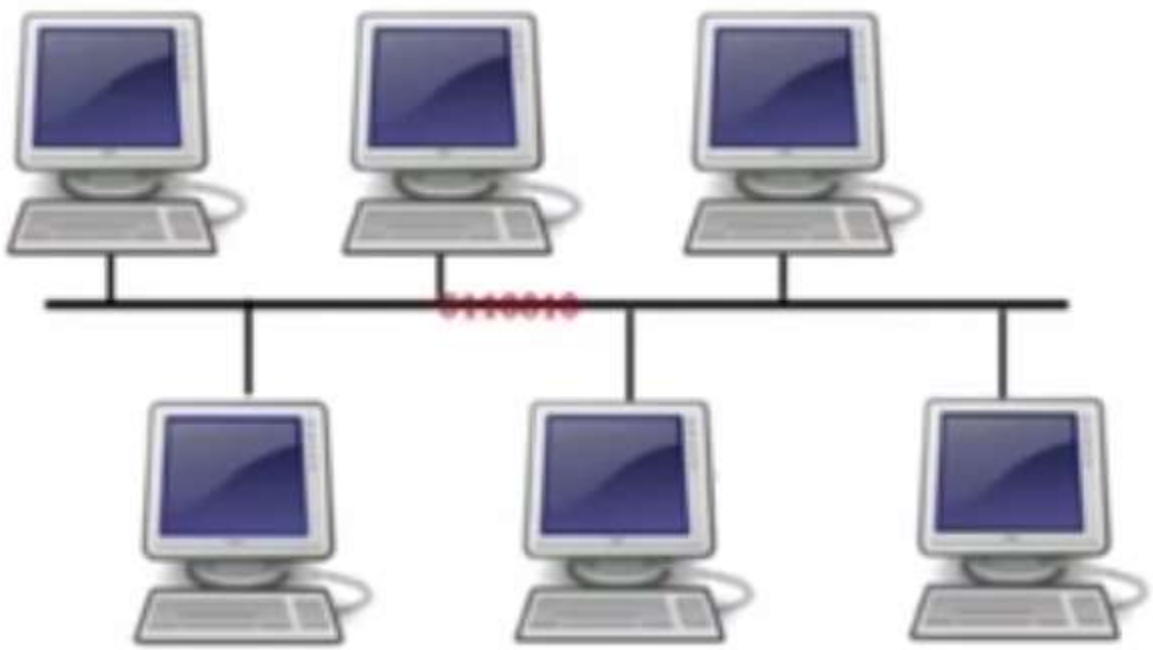
Types of Topology

- Bus Topology
- Star Topology
- Ring Topology
- Mesh Topology



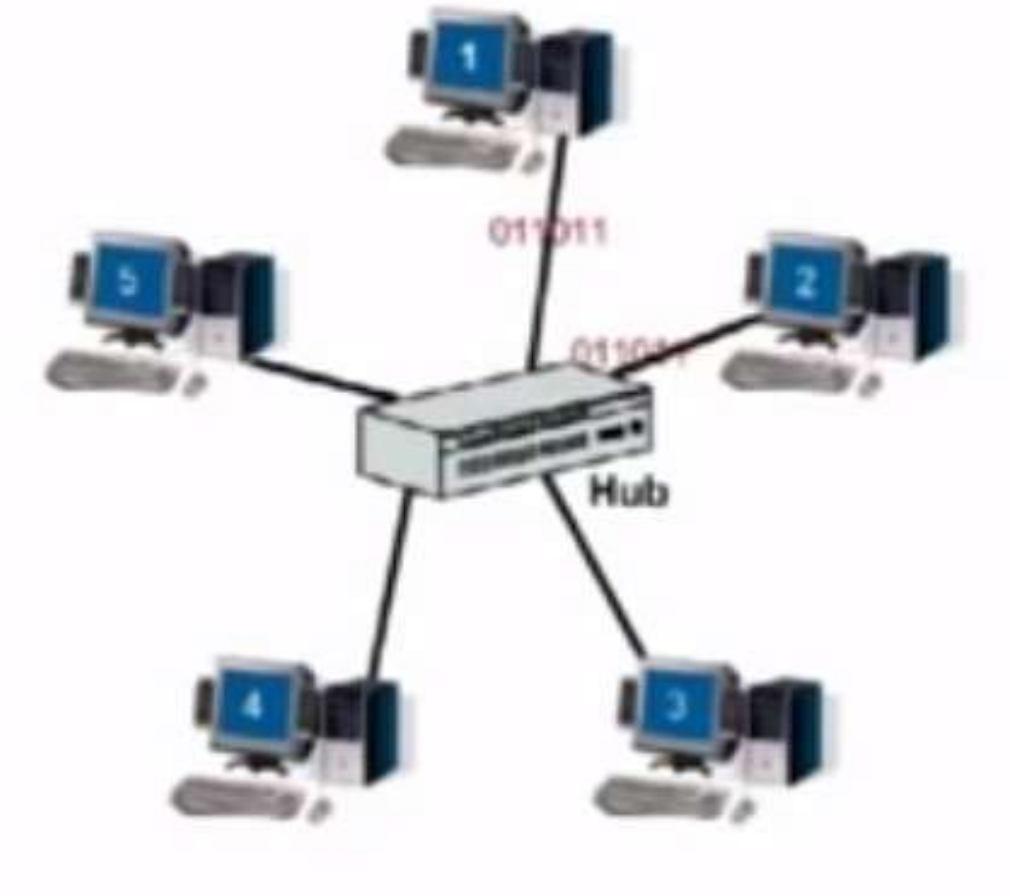
Bus Topology

- Bus topology is a specific kind of network topology in which all of the various devices in the network are connected to a single cable or line.



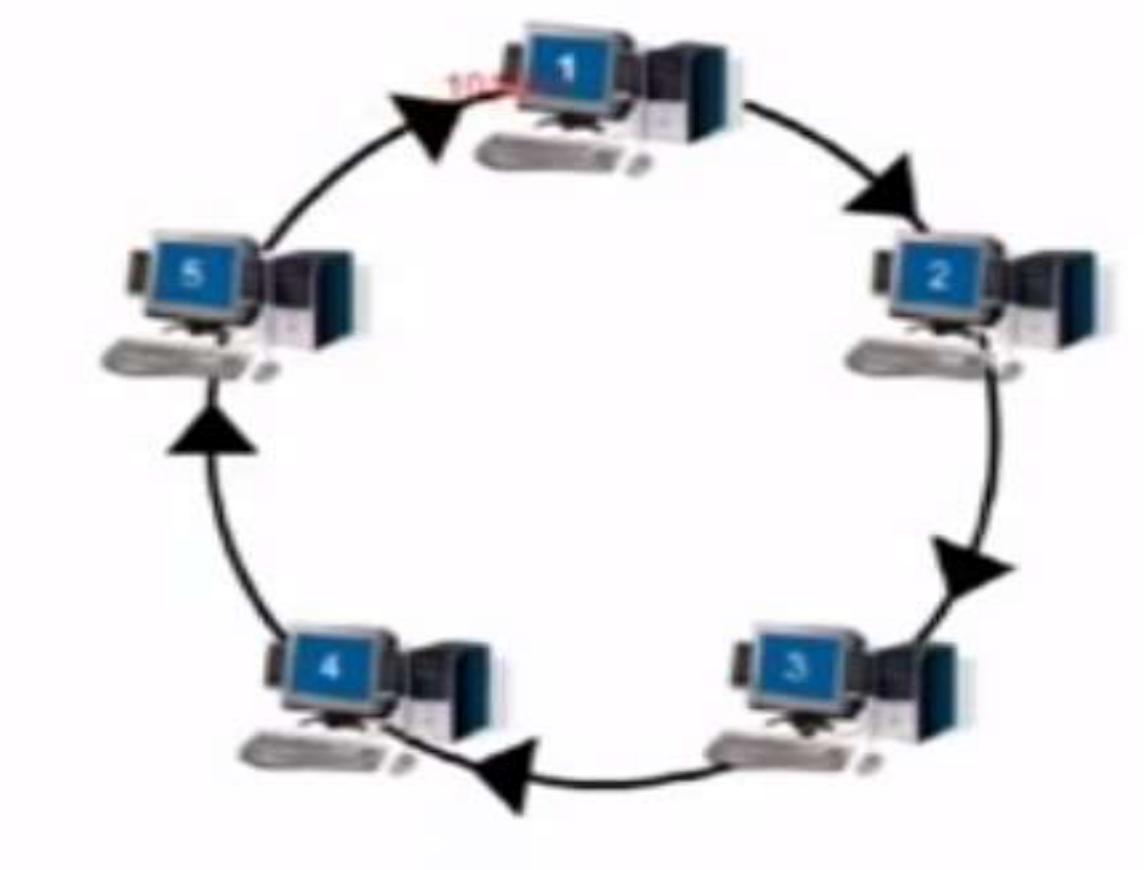
Star Topology

- Set or more devices connected to central Hub
- The **major disadvantage** is if the central hub fail all devices will be disconnected.



Ring Topology

- computer network configuration which each device connect to each other forming circle.
- Each packet is go to around until it reaches final destination.



Mesh Topology

- Each computer and network device is interconnected with one another, allowing for most transmissions to be distributed, even if one of the connections go down.

A Communications Model

- Source
  - generates data to be transmitted
- Transmitter
  - Converts data into transmittable signals
- Transmission System
  - Carries data
- Receiver
  - Converts received signal into data
- Destination
  - Takes incoming data

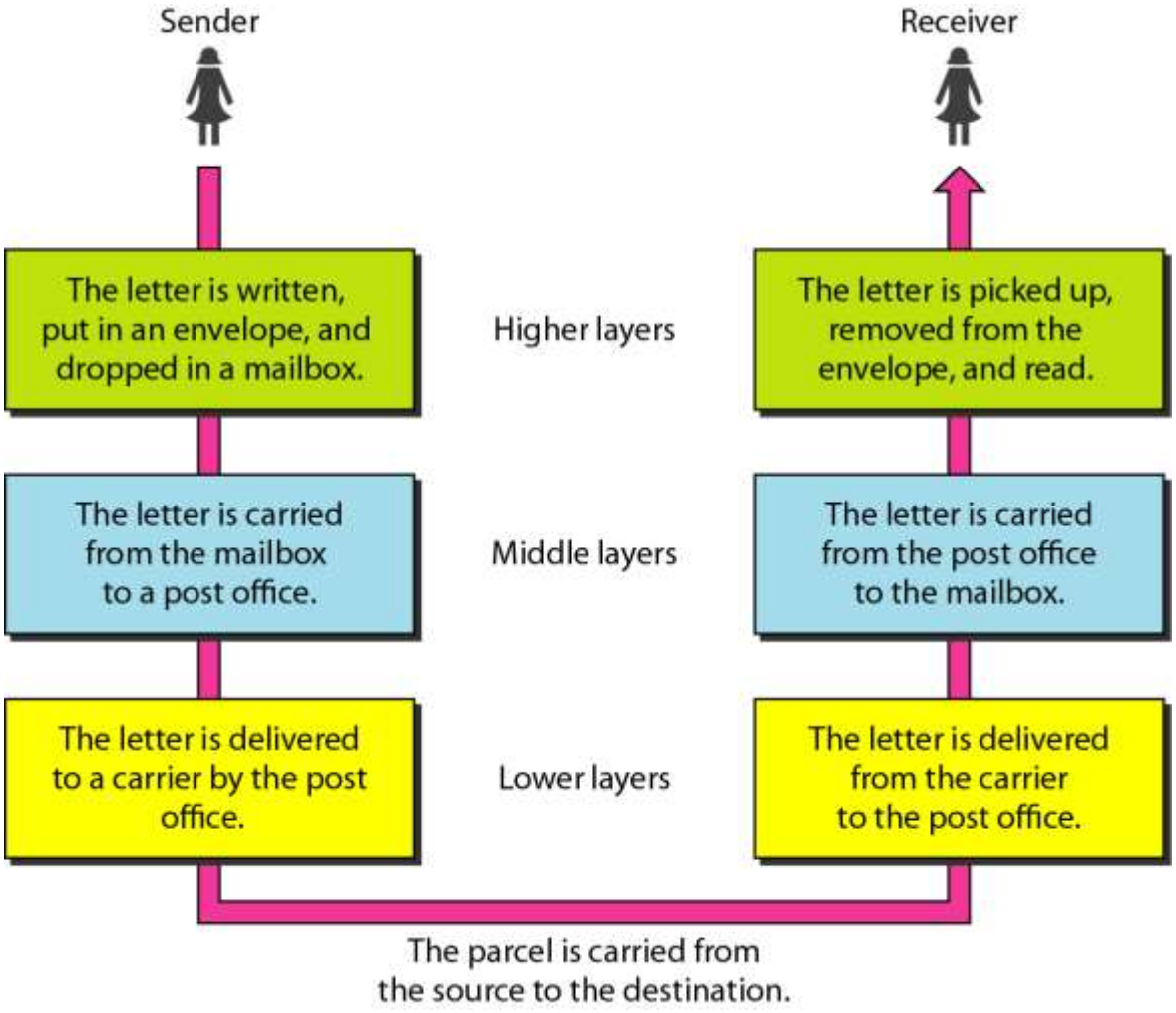
Communications Tasks

Transmission system utilization	Addressing
Interfacing	Routing
Signal generation	Recovery
Synchronization	Message formatting
Exchange management	Security
Error detection and correction	Network management
Flow control	

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.

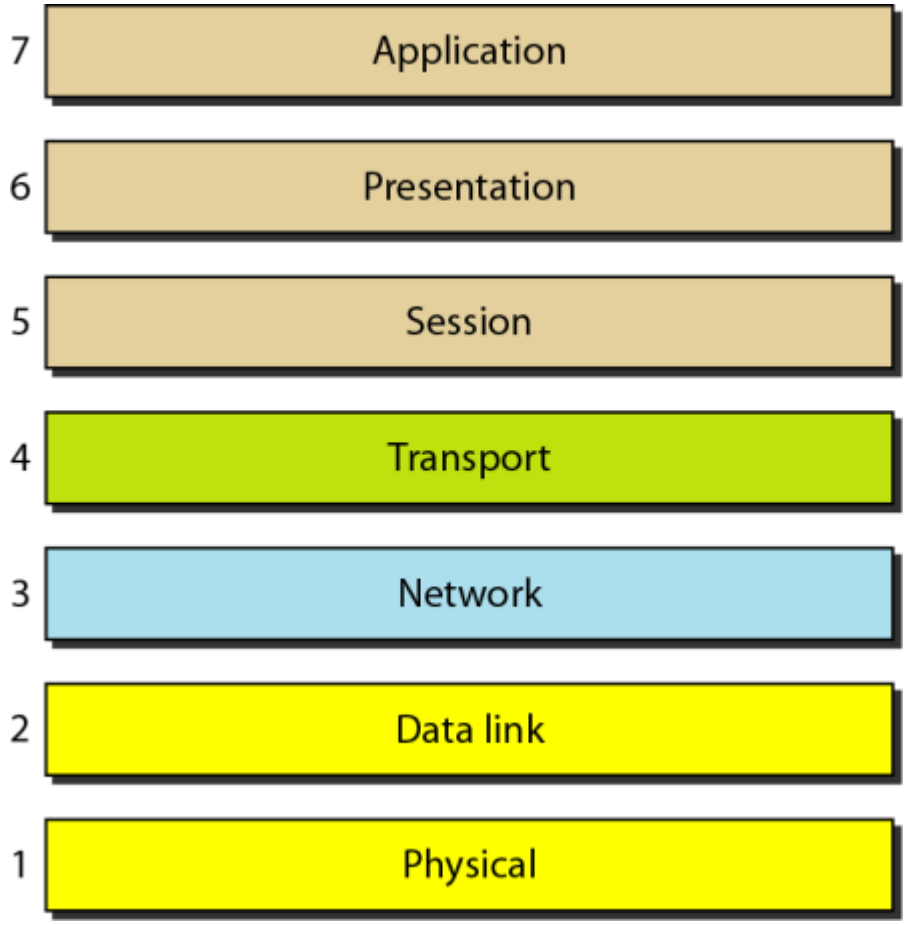
Figure Tasks involved in sending a letter



The OSI Model

– Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO standard that covers all aspects of network communications is the Open Systems Interconnection (OSI) model. It was first introduced in the late 1970s.

Figure *Seven layers of the OSI model*



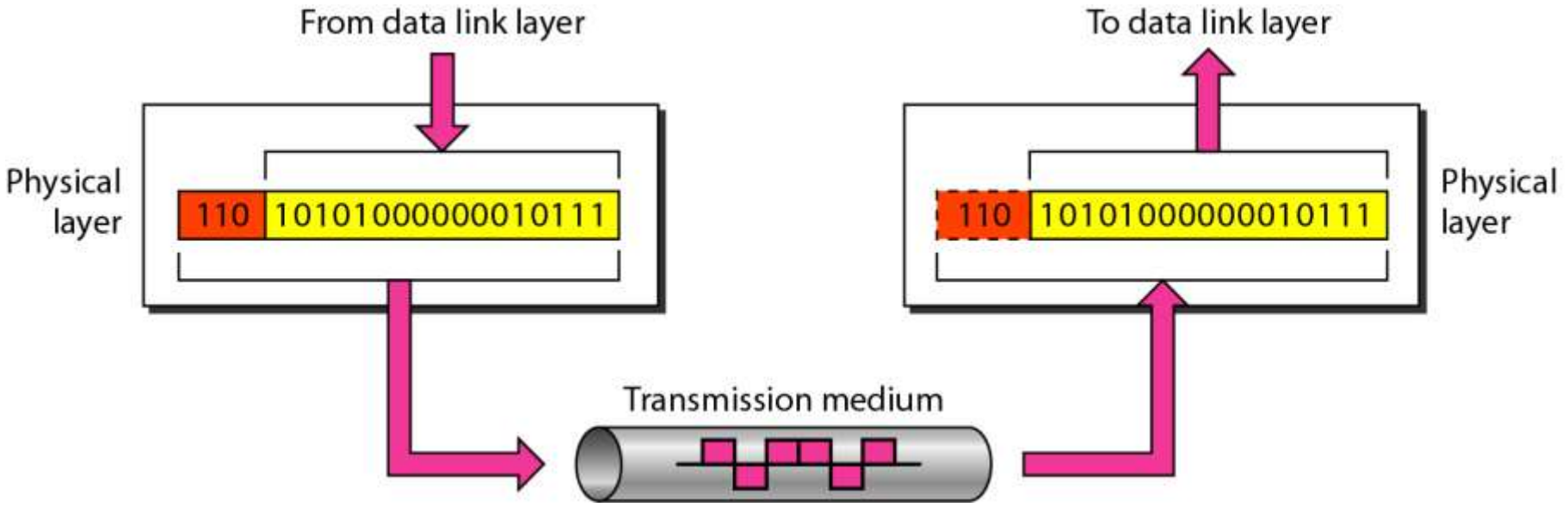
2-3 LAYERS IN THE OSI MODEL

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

Topics discussed :

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

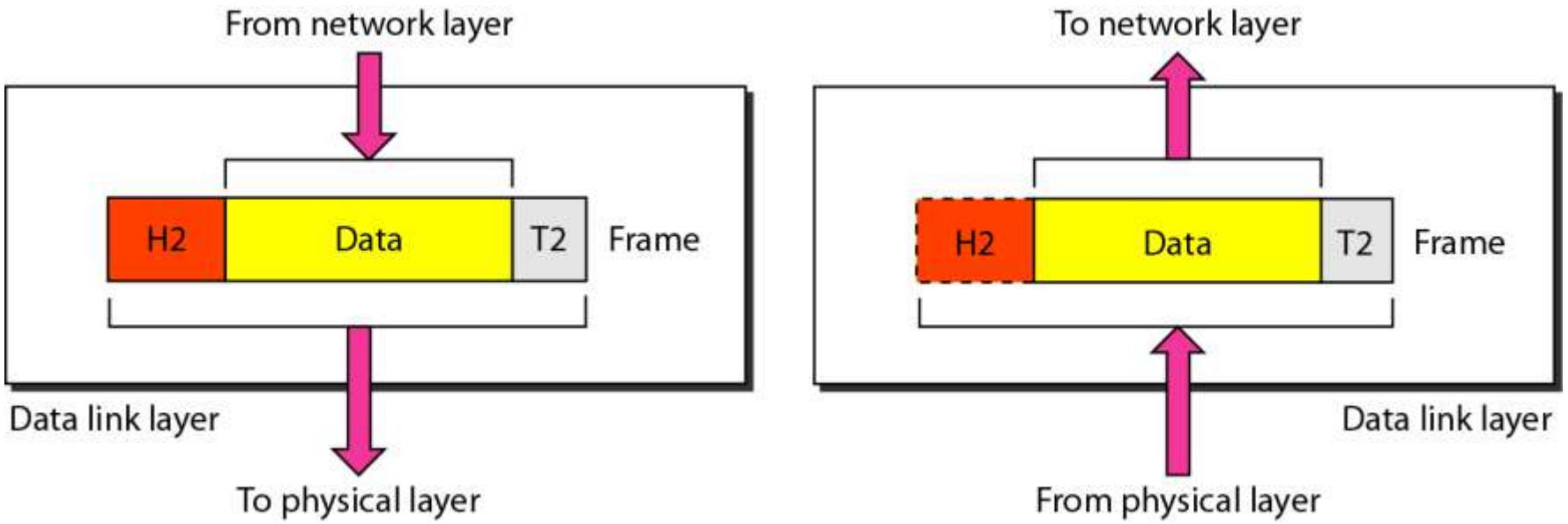
Figure 2.5 *Physical layer*



Note

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

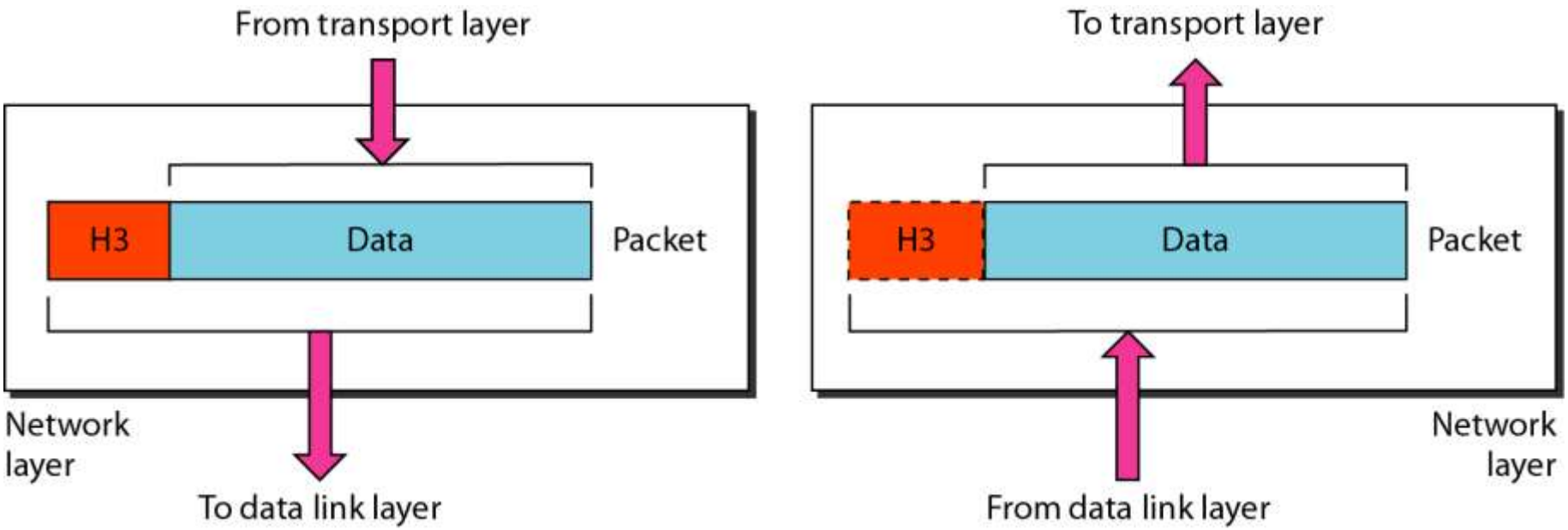
Figure *Data link layer*



Note

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

Figure 2.8 *Network layer*



Note

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

Note

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

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

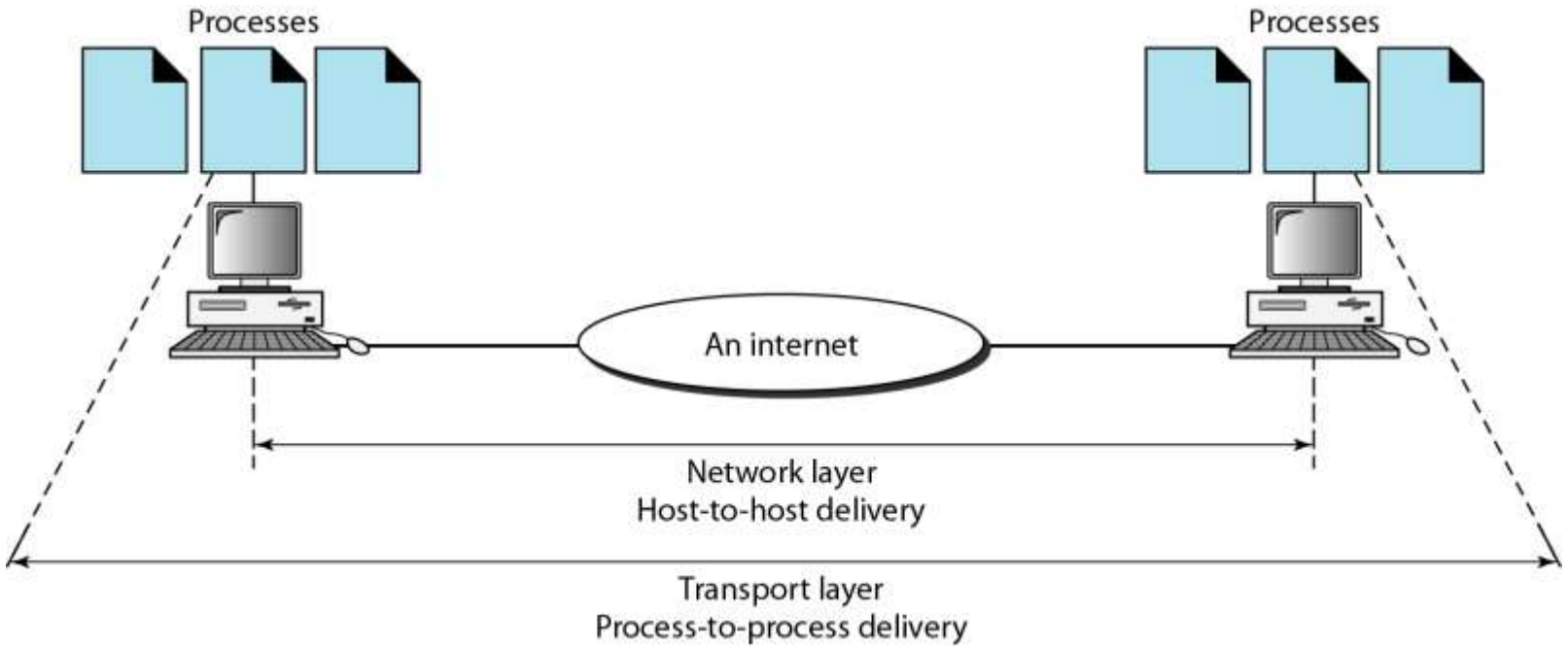
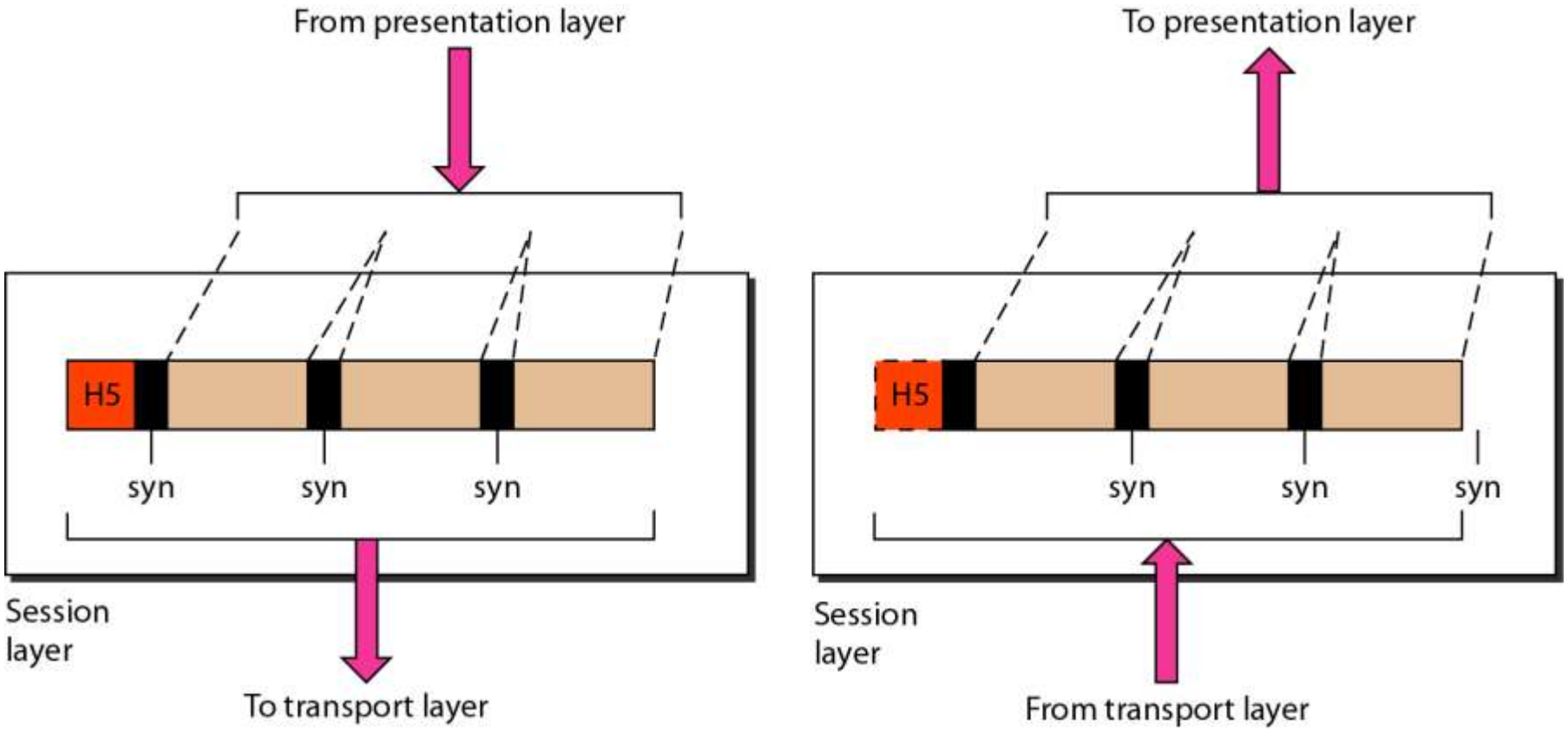


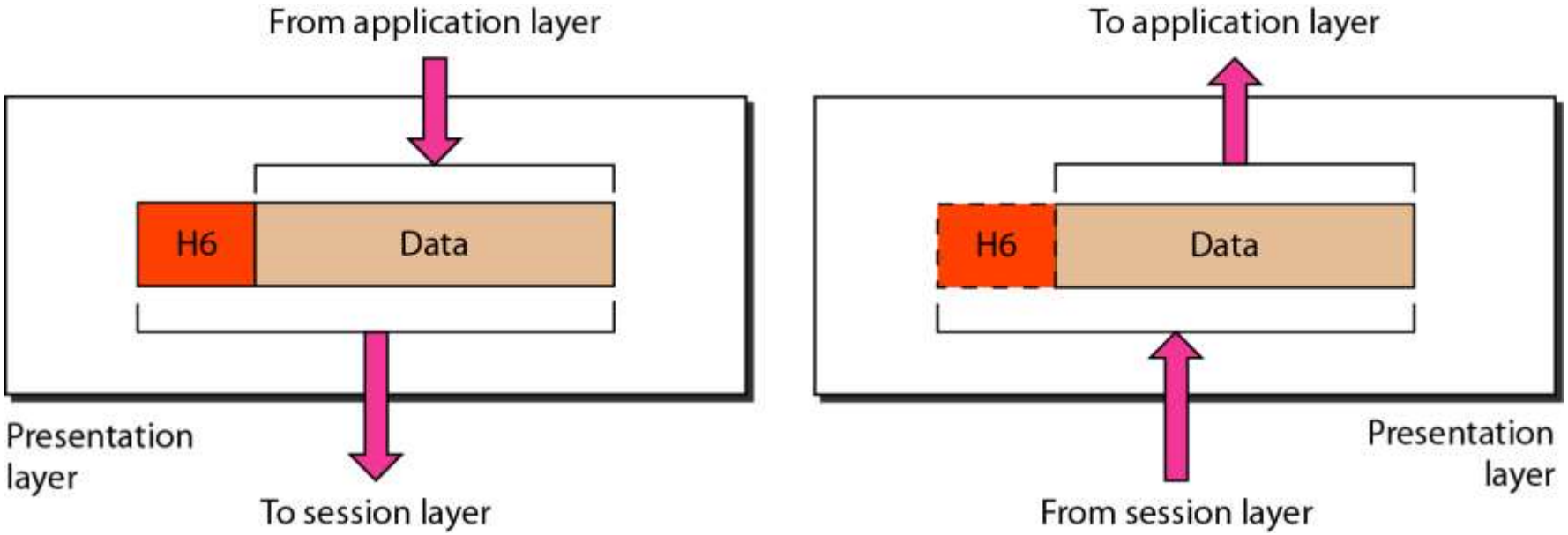
Figure 2.12 *Session layer*



Note

The session layer is responsible for dialog control and synchronization.

Figure 2.13 *Presentation layer*



Note

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

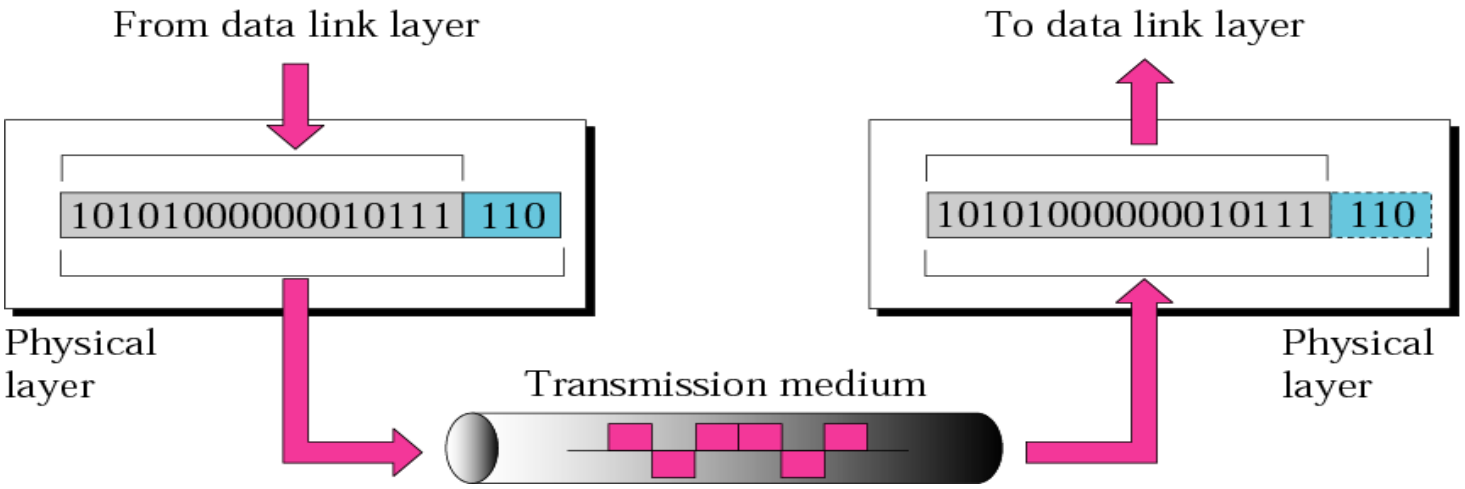
Note

The application layer is responsible for providing services to the user.

Layer 1: Physical Layer

- Responsible of:
  - Transmitting individual bits from one to the next.
  - Physical characteristics of interface and media.
  - Representation of bits: a stream of bit(0s,1s),
  - Data rate.
  - Synchronize of bits
  - Line configuration
  - Physical topology
  - Transmission mode

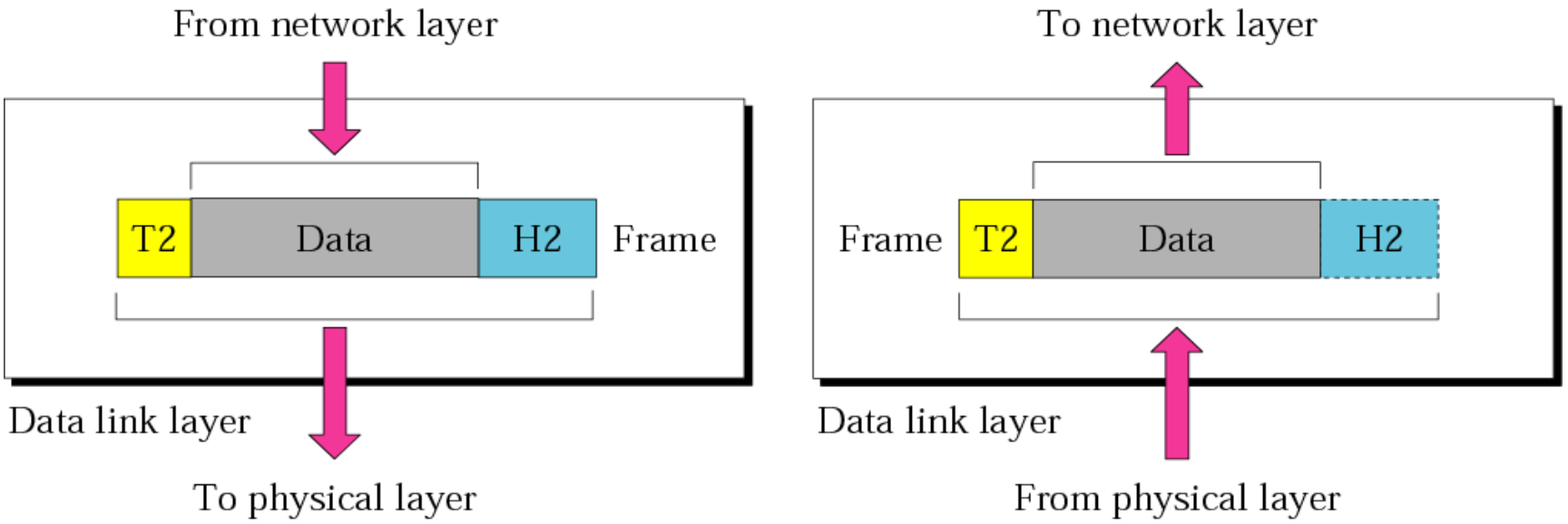
Physical Layer cont.

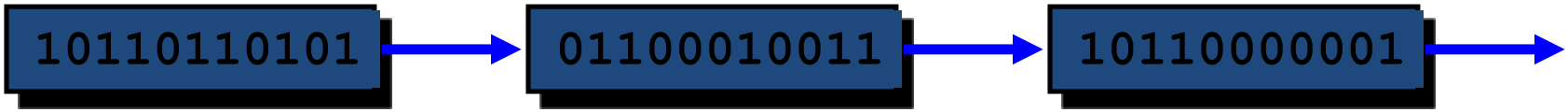


Layer 2: Data Link layer

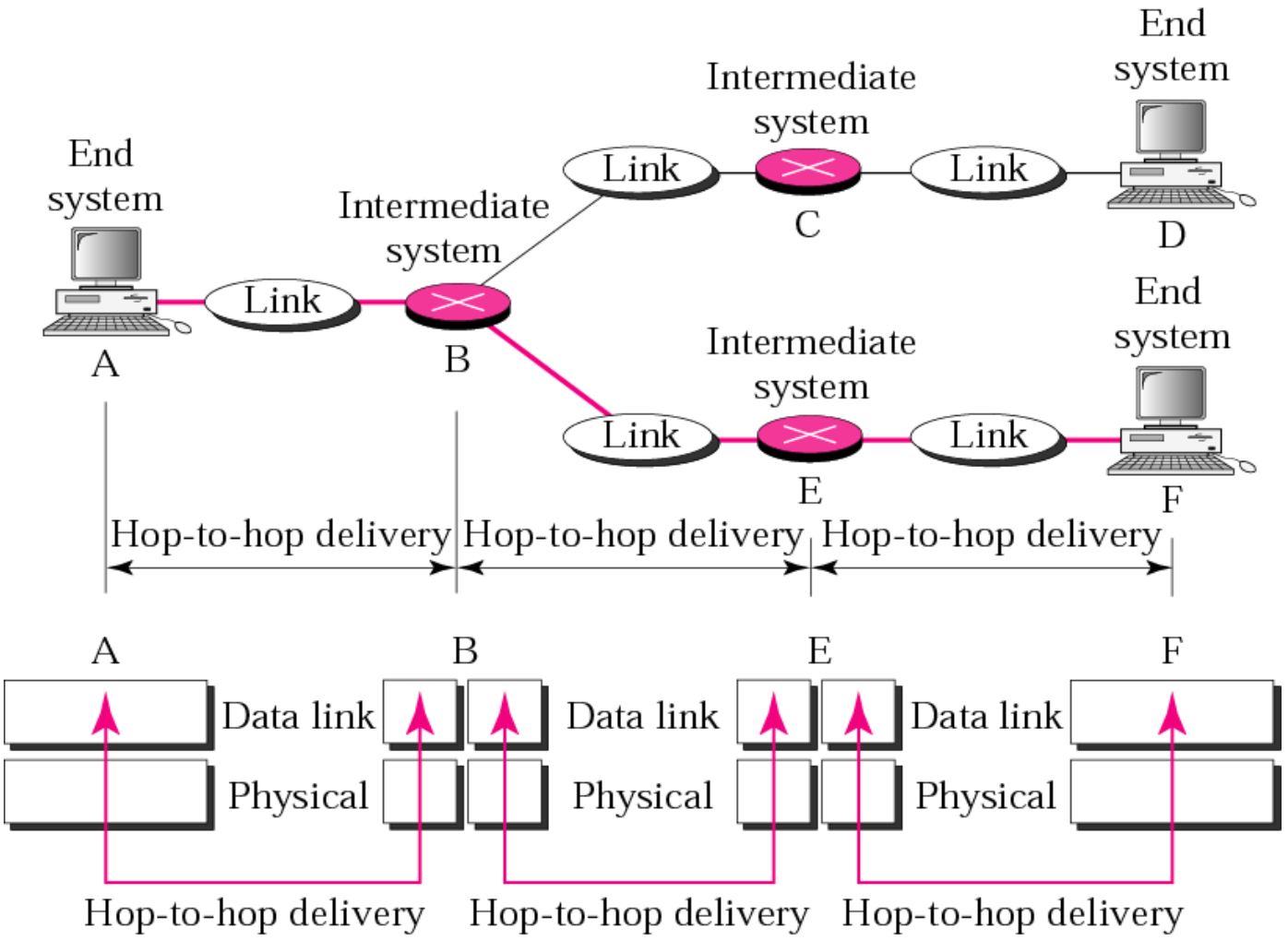
- Responsible of:
  - Moving frames from one hop (node) to the next.
  - Framing: divided the stream of bits received from the network layer manageable data units called frames.
  - Physical address (MAC address).
  - Flow control.
  - Error control: added trailer to the end of frame.
  - Access control.
  - Hop to hop delivery

Data Link layer cont.





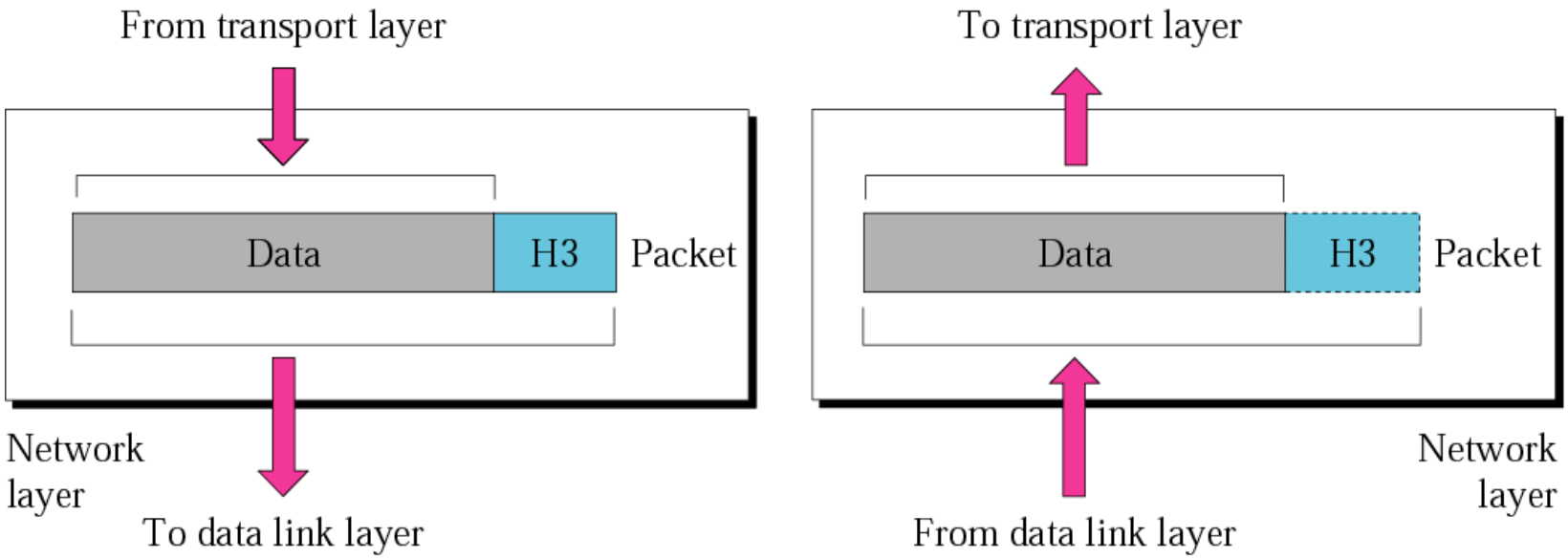
Hop-to-Hop delivery



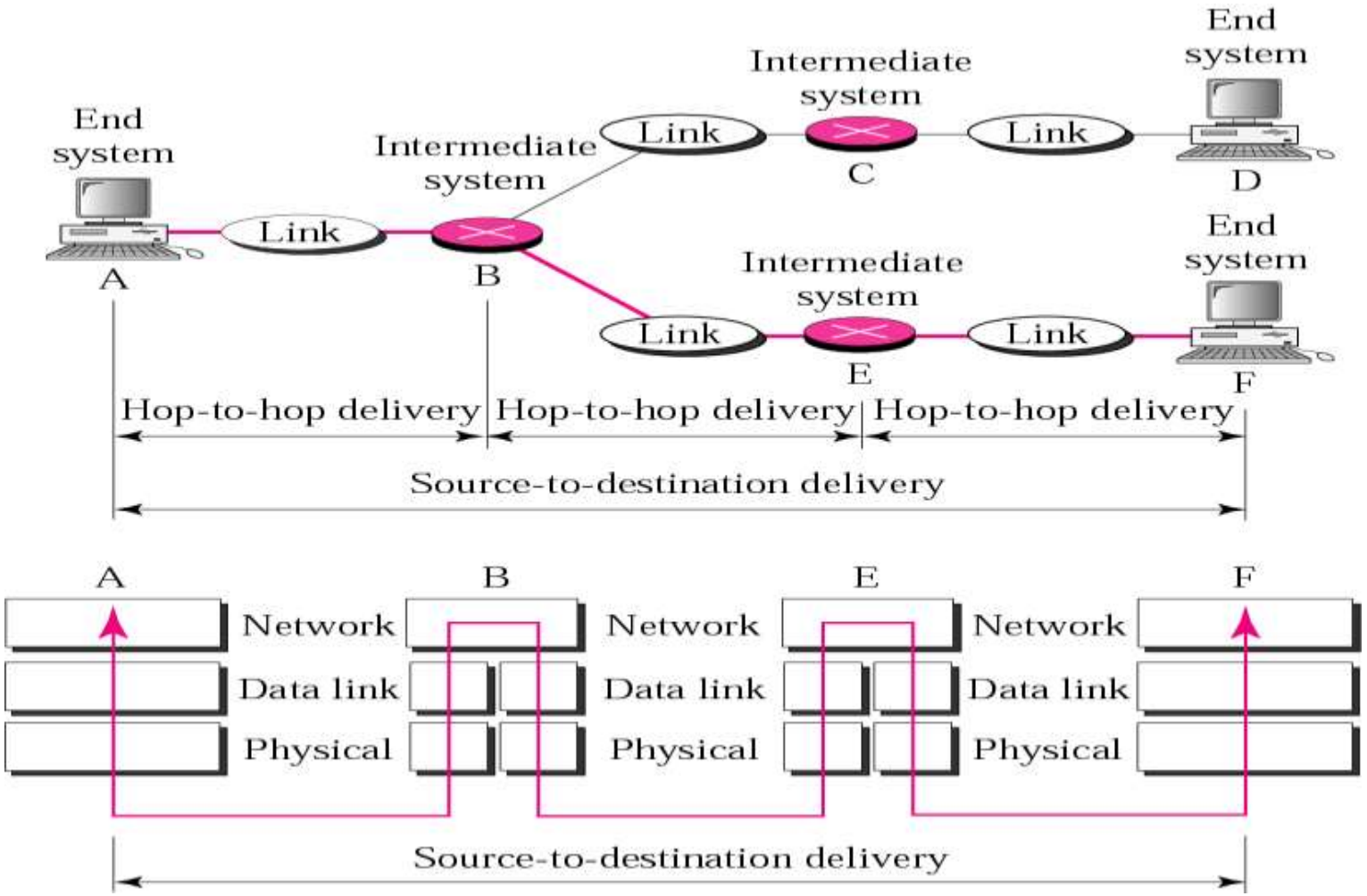
Layer 3: Network Layer

- The network layer is responsible:
  - The delivery of individual packets from the original source to the final destination .
  - Logical addressing: if the packet passes the network boundary we need another addressing system to help (source to destination) connection.
  - Routing : route or switch the packet to final destination.
  - Source-to-destination delivery (End-to-End).

Network Layer cont.



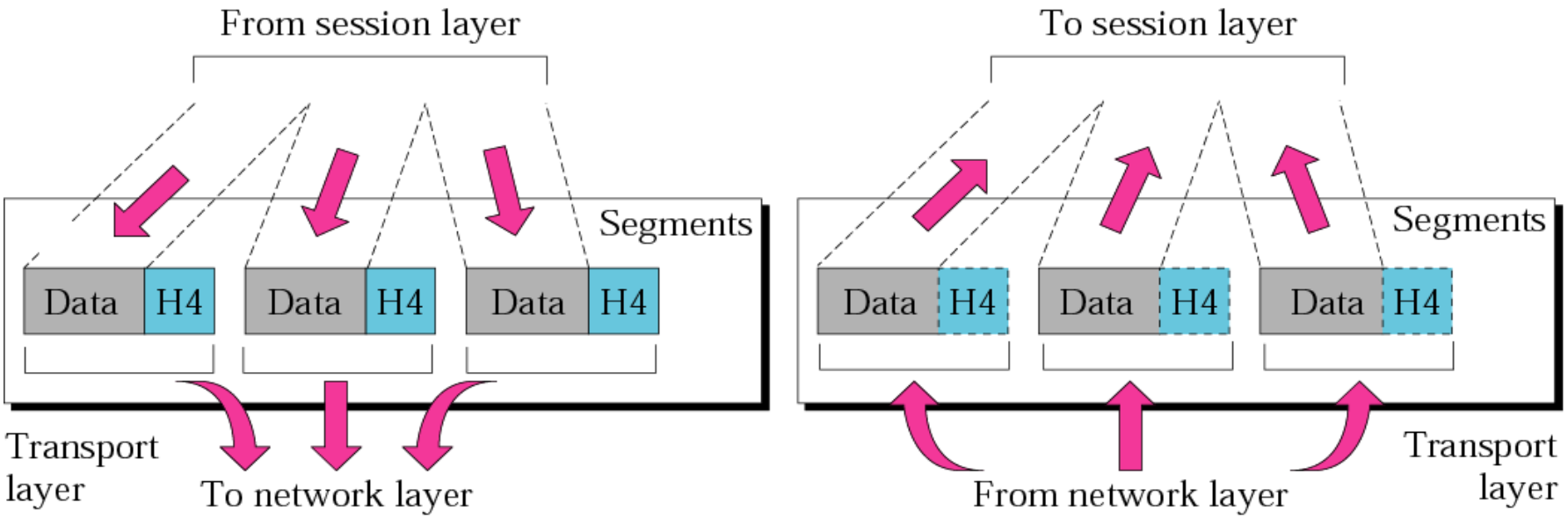
Source-to-Destination delivery



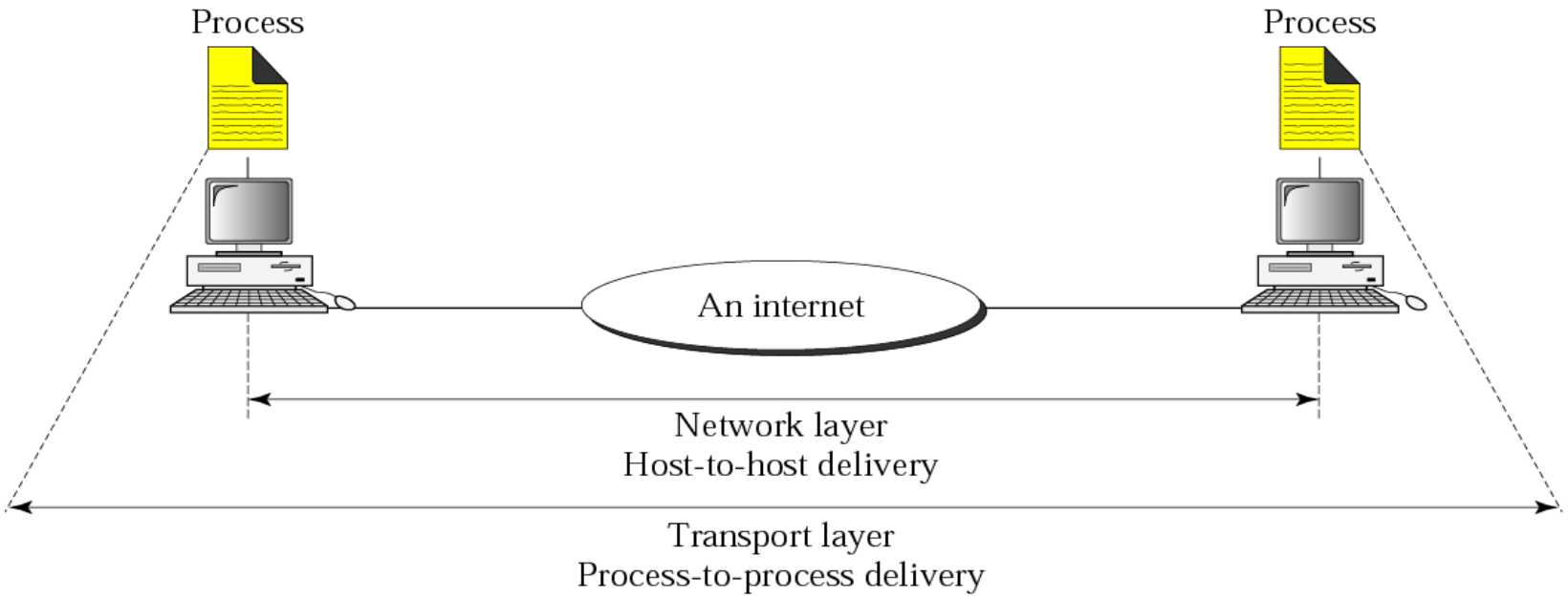
Layer 4: Transport Layer

- The transport layer is responsible for:
  - **Service point or Port addressing**
  - **Segmentation and reassembly** : a message is divided into transmittable segments each segment containing a sequence no.
  - **Connection Control**: connection oriented or connectionless.
  - **Flow control**
  - **Error control**

Transport Layer cont.



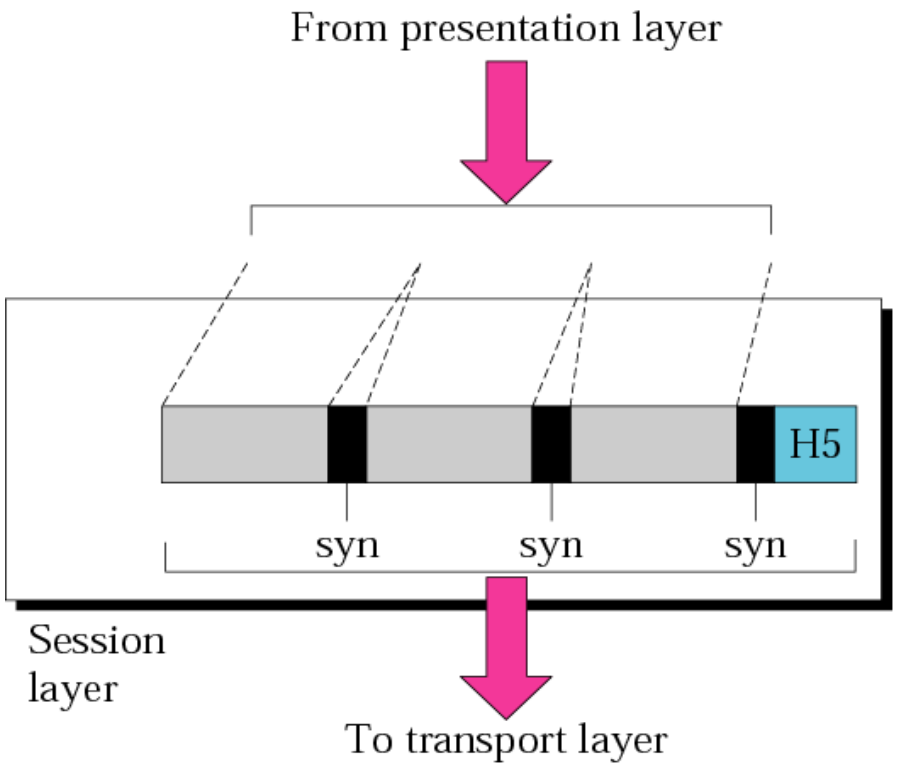
Reliable process-to-process delivery of a message

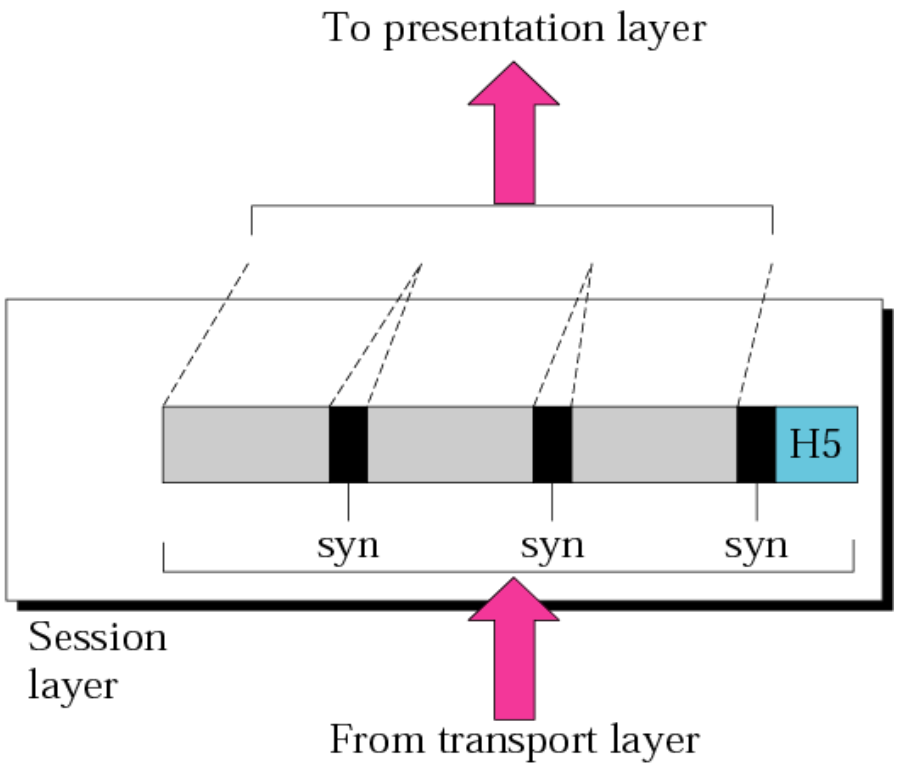


Layer 5: Session Layer

- Dialog control: design to establish, maintain, and synchronize the interaction between communicating systems.
- Synchronization: it allows a process to add checkpoints or synchronization points to a data stream.

Session Layer cont.

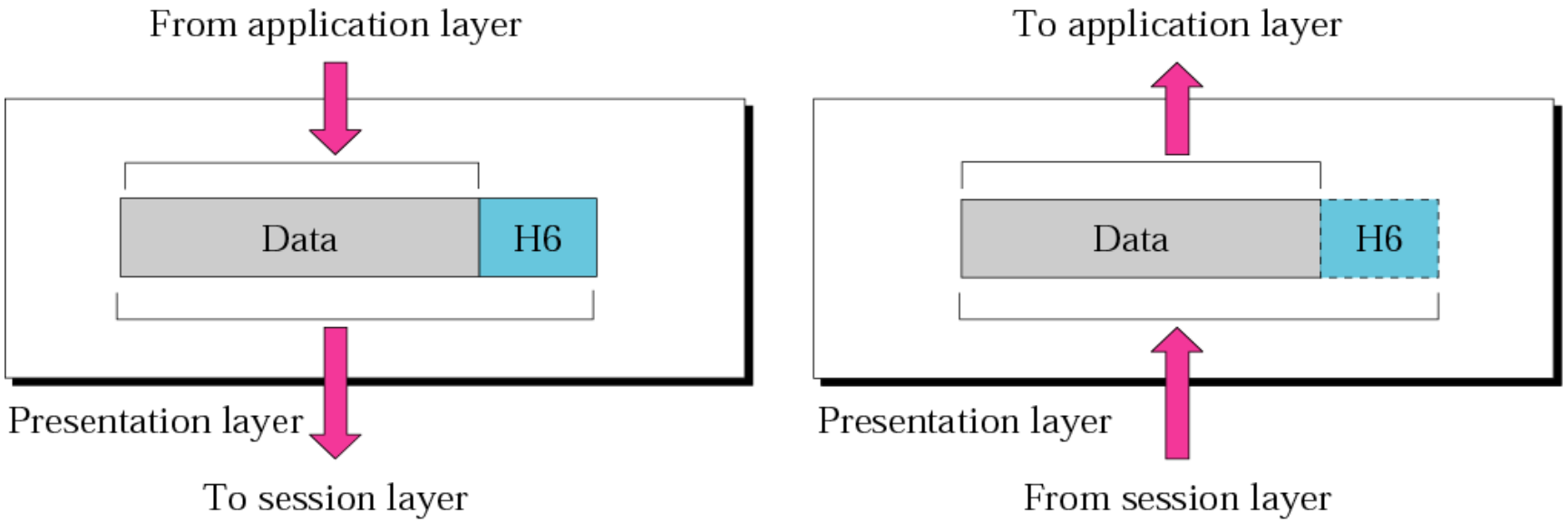




Layer 6 :Presentation Layer

- Design to the handle the syntax and semantic of the information exchanged between 2 systems.
- And design for data translation, encryption, decryption, and compression.

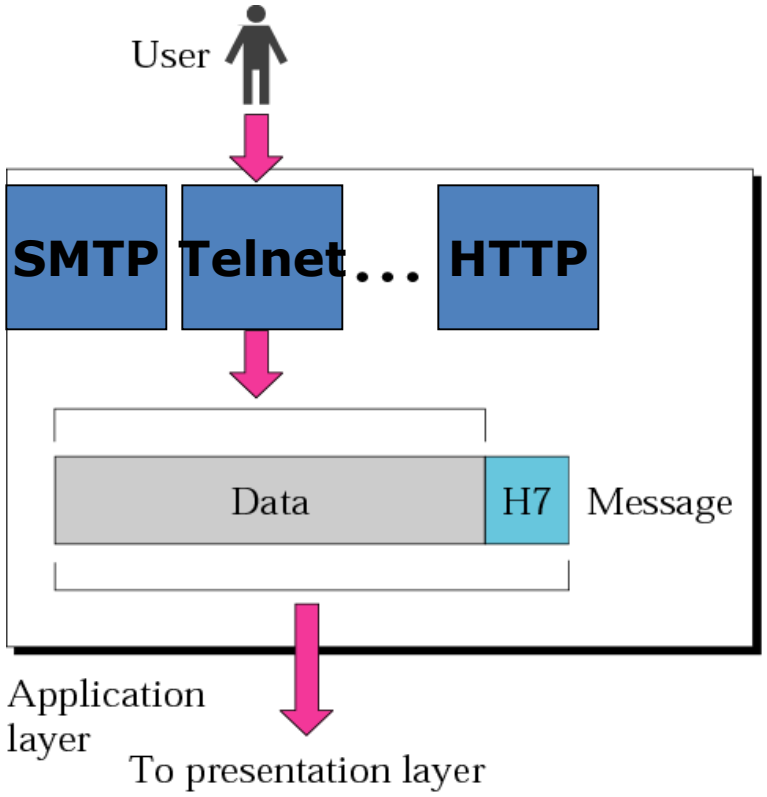
Presentation Layer cont.

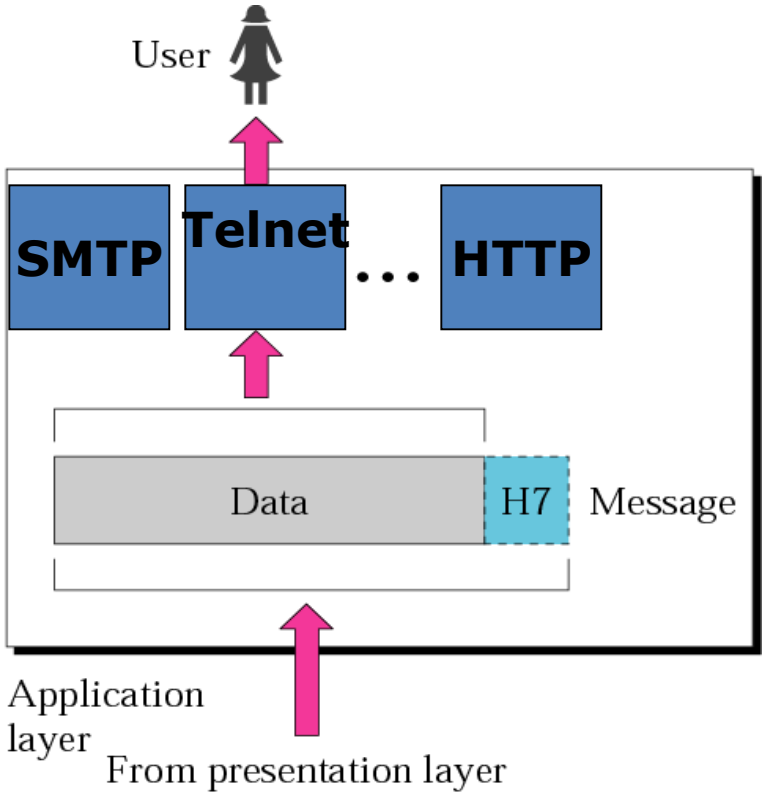


Layer 7: Application Layer

- The application layer is responsible for providing services to the user.
- Mail services
- File transfer, access and management
- Remote log-in or network virtual terminal
- Accessing the World Wide Web
- Directory service

Application Layer cont.





Summary

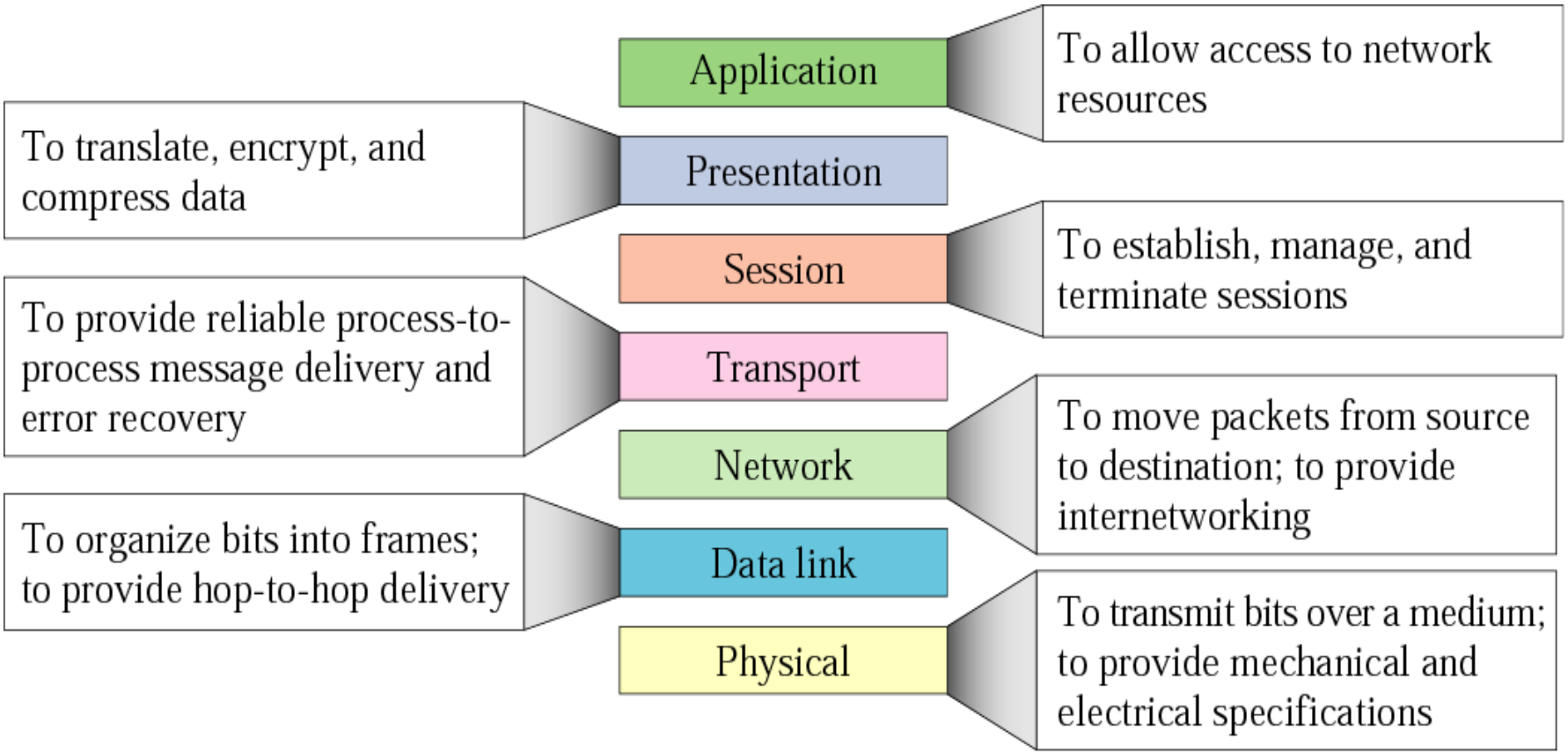
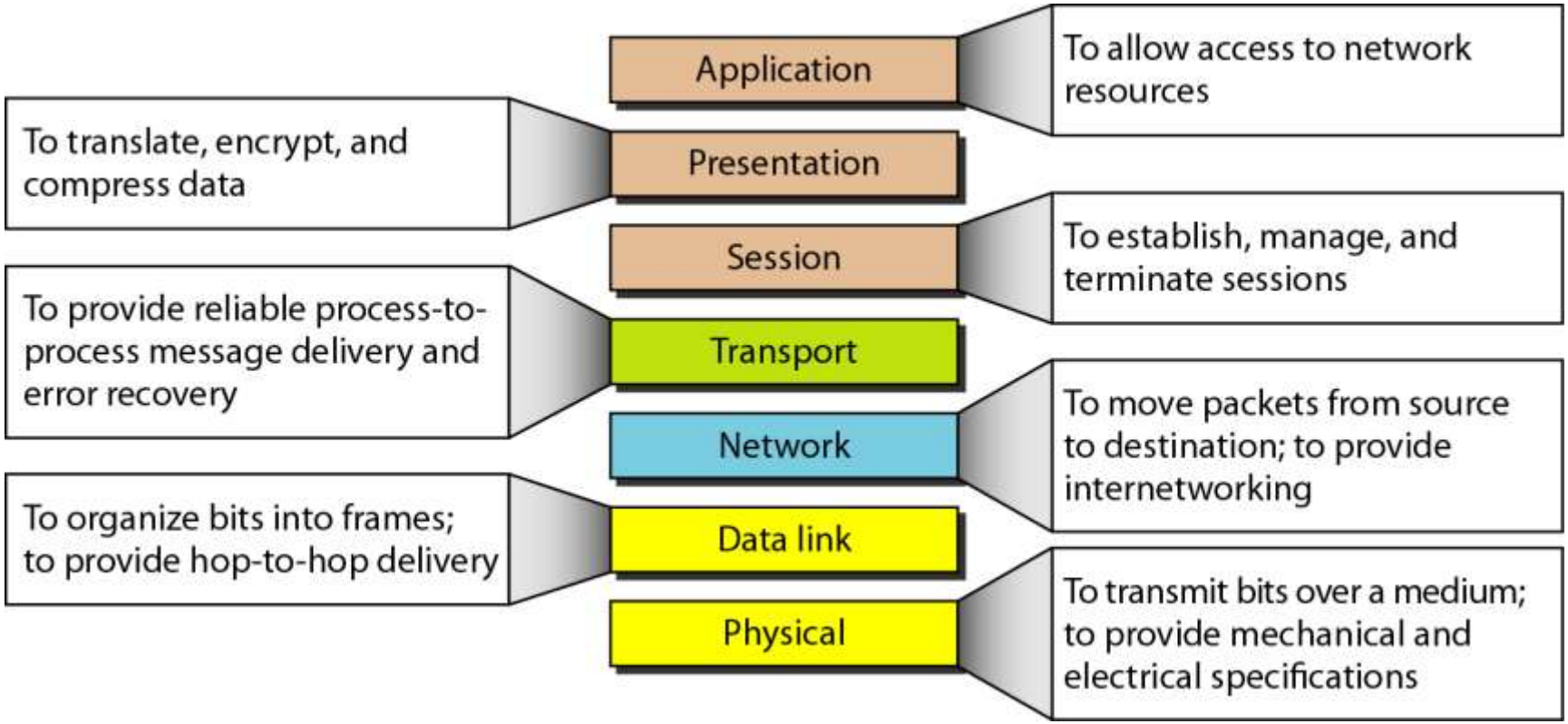

Application
To allow access to network resources
Presentation
To translate, encrypt, and compress data
Session
To establish, manage, and terminate sessions
Transport
To provide reliable process-to-process message delivery and error recovery
Network
To move packets from source to destination; to provide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

Figure 2.15 *Summary of layers*



2-5 ADDRESSING

Four levels of addresses are used in an internet employing the TCP/IP protocols: physical, logical, port, and specific.

Topics discussed in this section:

Physical Addresses
Logical Addresses
Port Addresses
Specific Addresses

Figure 2.17 *Addresses in TCP/IP*

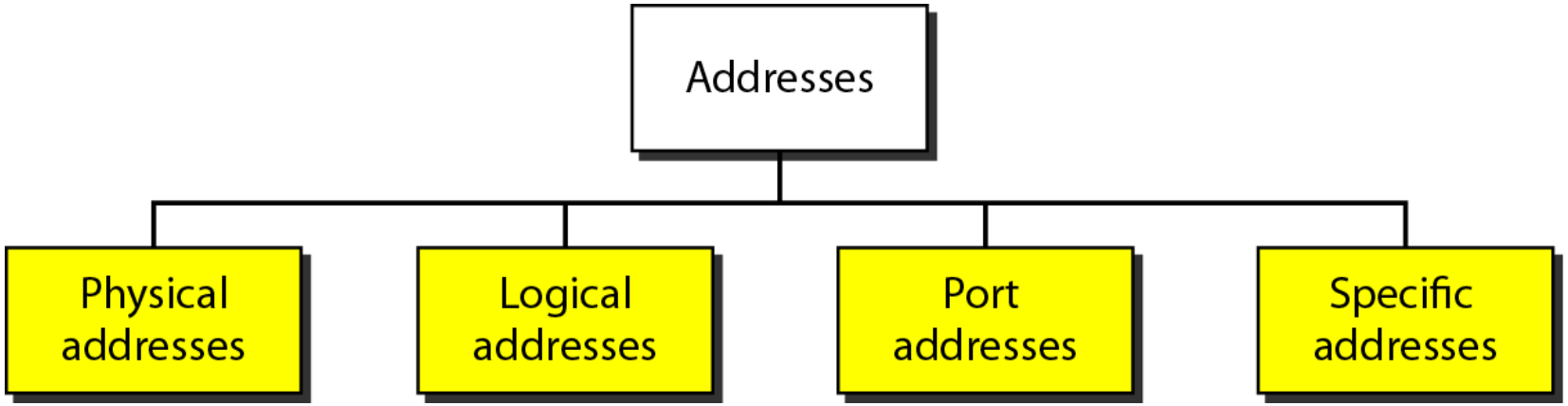
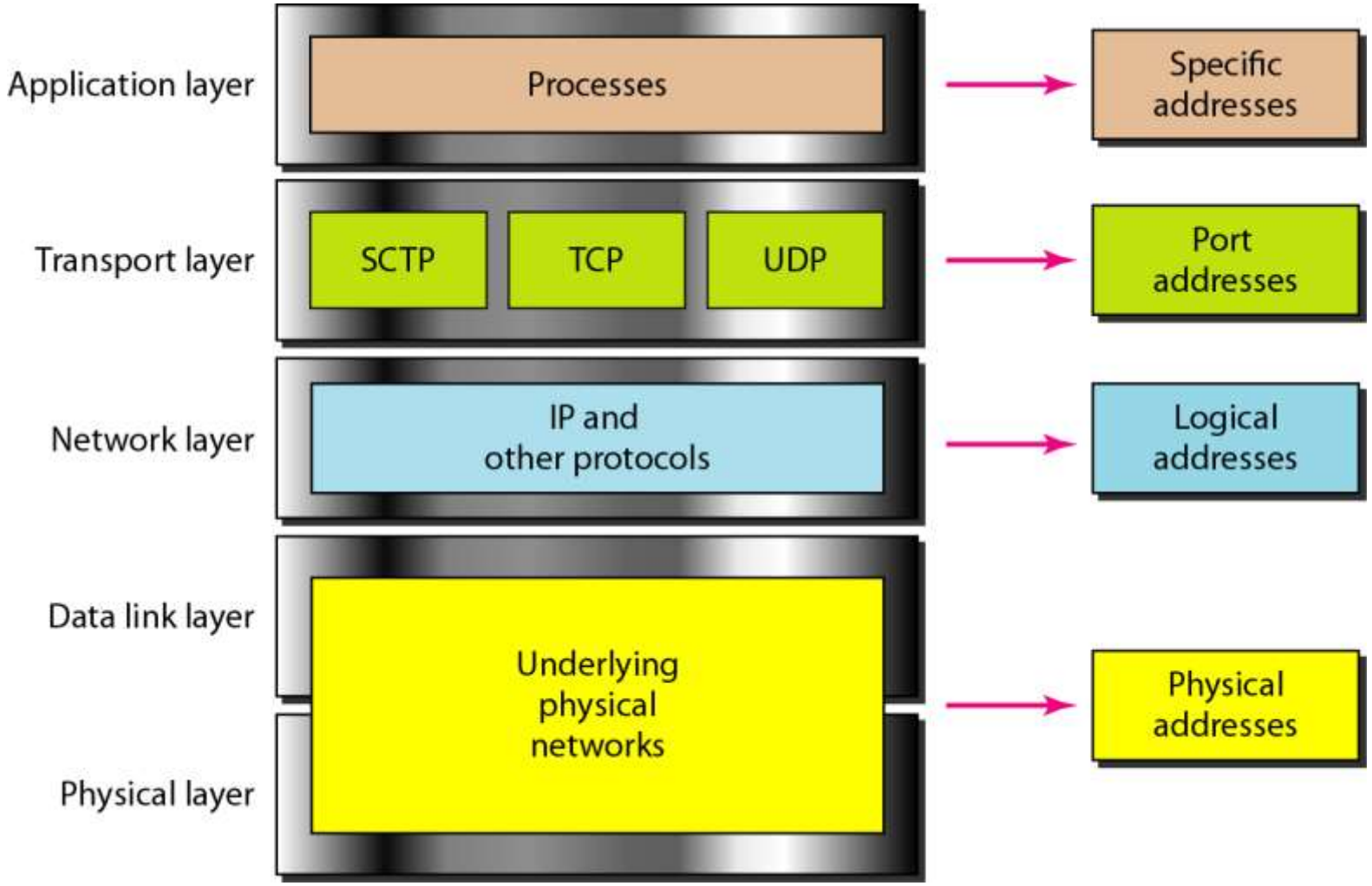


Figure 2.18 *Relationship of layers and addresses in TCP/IP*



DEVICES :

1. **Hub, a distributor that has a lot of ports which connected to computers.**
2. **Switches, like a hub but it transmit packets to it destination**
3. **Bridge, it is used to connect two similar LANs.**
4. **Routers, choose the best path to transmit the packet.**
5. **Gateway, it is use to connect two deferent LANs and connect different application protocols.**
6. **Repeaters, repeats signals that travels via long distance**

Network devices With Layer

Layers	Network Devices
Application Layer	Application gateway
Transport Layer	Transport gateway
Network Layer	Router and gateway
Data link layer	Bridge and Switch
Physical Layer	Repeater, Hub and Modem.

Questions