

Computer Network Models

*The OSI Model
and
TCP/IP Model*

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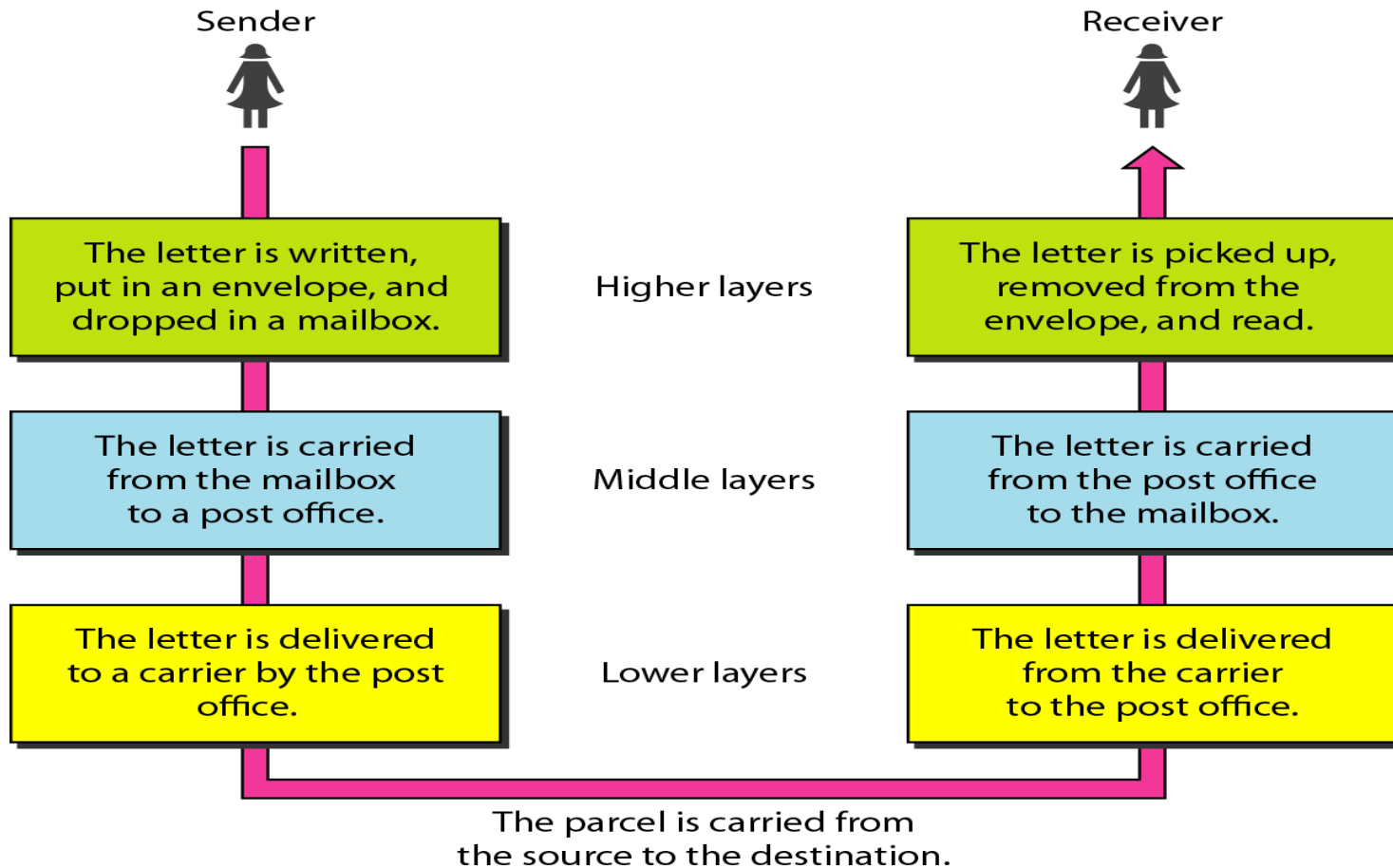
- **THE OSI MODEL**
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- **TCP/IP MODEL**
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What is a Protocol?

- A network protocol is a formal set of **rules, conventions and data structure** that governs how computers and other network devices exchange information over a network.
- In other words, protocol is a standard procedure and format that two data communication devices must **understand, accept and use to be able** to talk to each other

Tasks involved in sending a letter

Example of protocols



Why Use Protocol Architecture?

- Data communications requires complex procedures
 - Sender identifies data path/receiver
 - Systems negotiate preparedness
 - Applications negotiate preparedness
 - Translation of file formats
- For all tasks to occur, high level of cooperation is required

Network Models

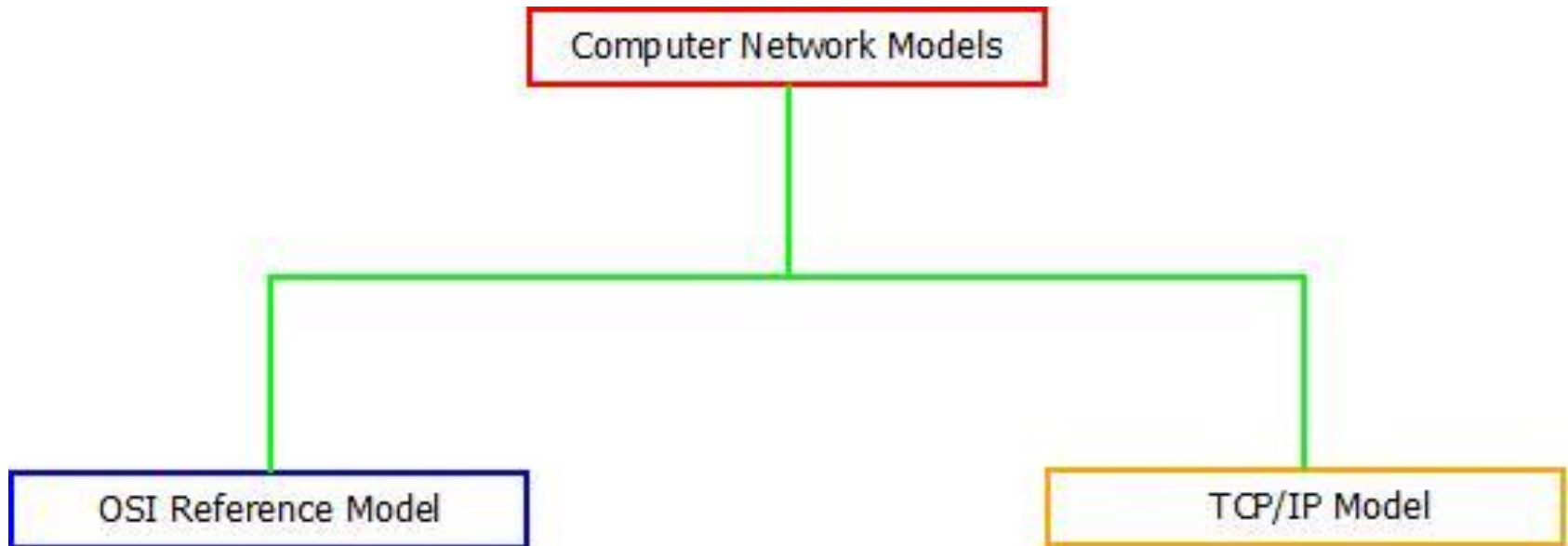
- For data communication to take place and **two** or more users can transmit data from one to other, a **systematic approach** is required. This approach enables users to communicate and transmit data through efficient and ordered path.
- It is implemented using **models** in computer networks and are known as computer network models.

	Network Model	Protocol
Definition	Conceptual framework for communication	Set of rules/standards for communication
Purpose	Explains how communication is organized (layers)	Implements communication between devices
Examples	OSI Model, TCP/IP Model	HTTP, TCP, IP, Ethernet, Wi-Fi
Nature	Theoretical / conceptual	Practical / implemented
Analogy	Blueprint / architecture	Actual language or instructions used

Networking models

- Computer network models are responsible for establishing a connection among the sender and receiver and transmitting the data in a smooth manner respectively.
- There are two computer network models i.e. **OSI Model** and **TCP/IP Model** on which the whole data communication process relies.

Networking models



The OSI Reference Model

- OSI stands for “**Open System Interconnection**”
- the name of this reference model was given by an organization known as “**International Organization for Standardization**”
- It is not a protocol
- It is a model

OSI (Open system Interconnection)

- Open system is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture.
- OSI model is called as “**Open Source**” because of its “fit anywhere” ability.
- Any connection can be established using the OSI model unless and until any protocols are not used as OSI model does not support protocol establishment.

Note

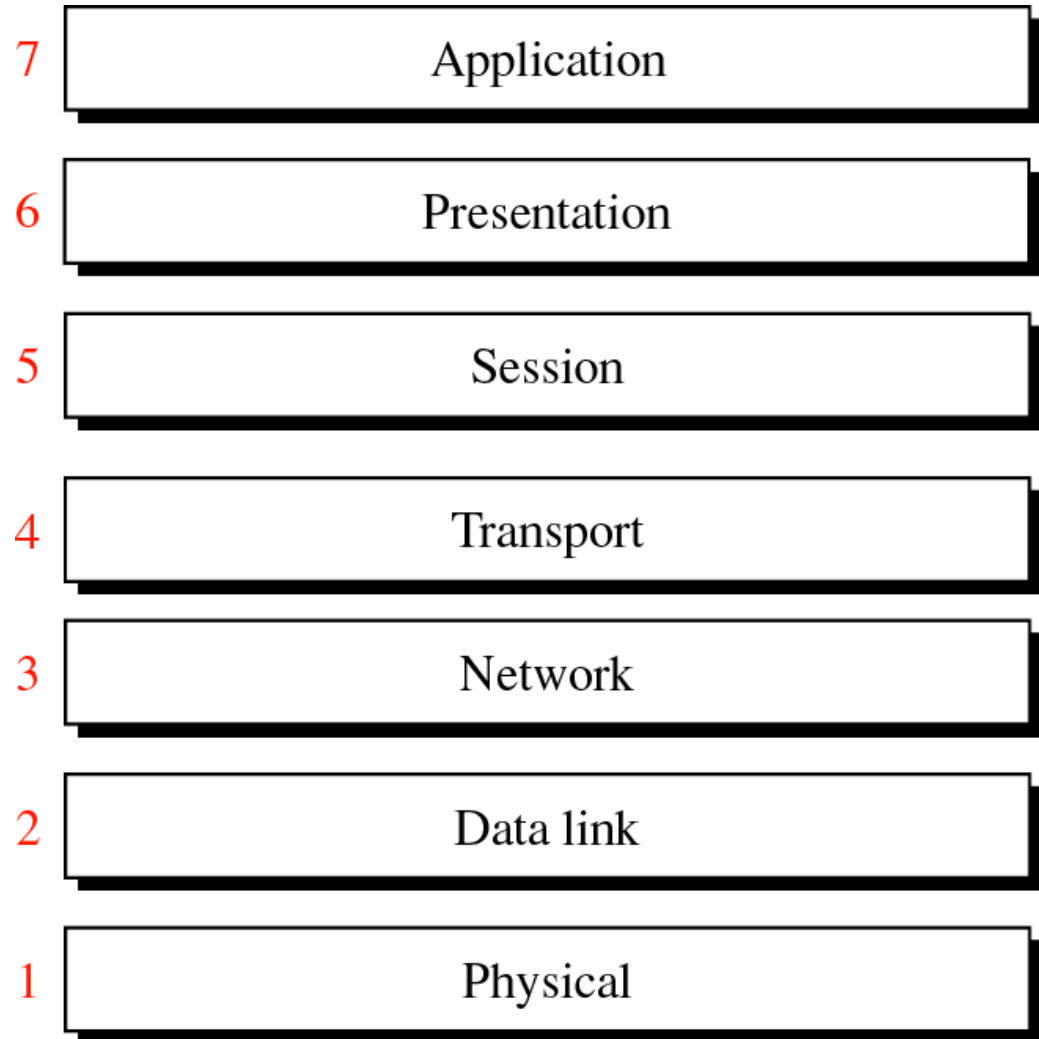
*ISO is the organization.
OSI is the model.*

2.1

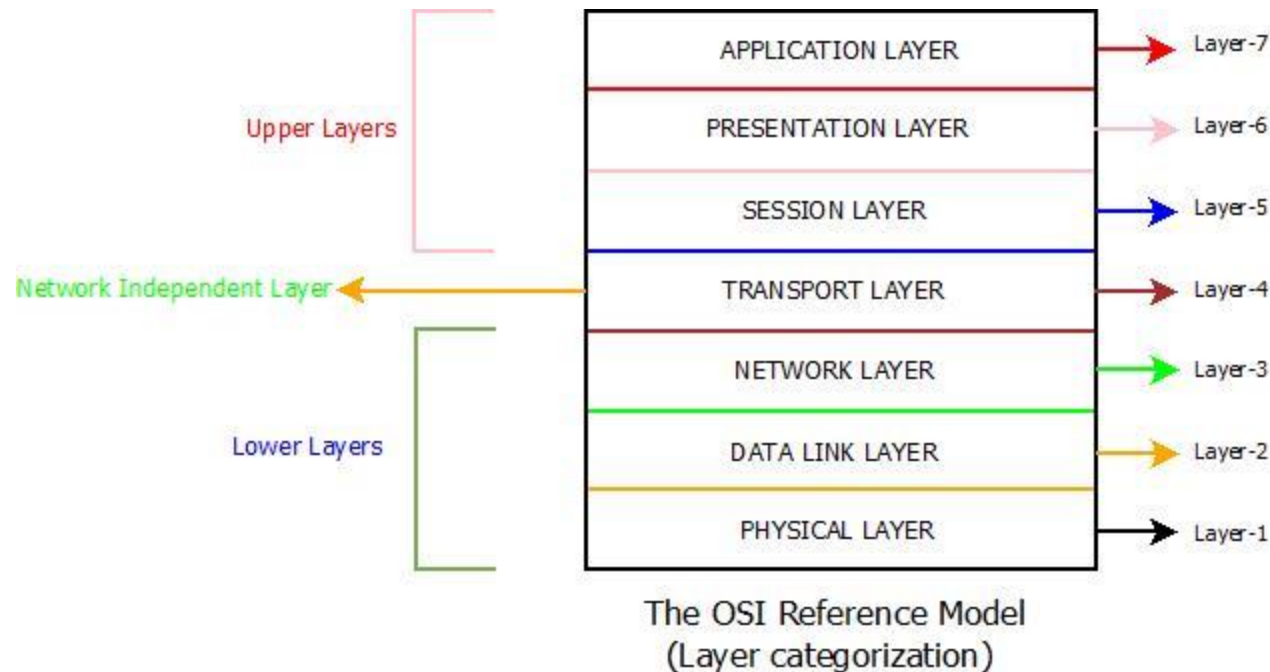
THE OSI MODEL

OSI Model

- The functionalities are different for each layer and thus when combined together forms the OSI Model. There are in total seven layers in general purpose OSI model.



OSI Model



- The seven layers of OSI model are further categorized into **Upper Layers**, **Network Independent Layer** and **Lower Layers**.
- Physical Layer, Data link Layer and Network Layer are categorized as Lower Layers.
- Transport Layer as Network Independent Layer and
- Session Layer, Presentation Layer, Application Layer as Upper Layers.

Figure 2-2

Architecture of OSI Model

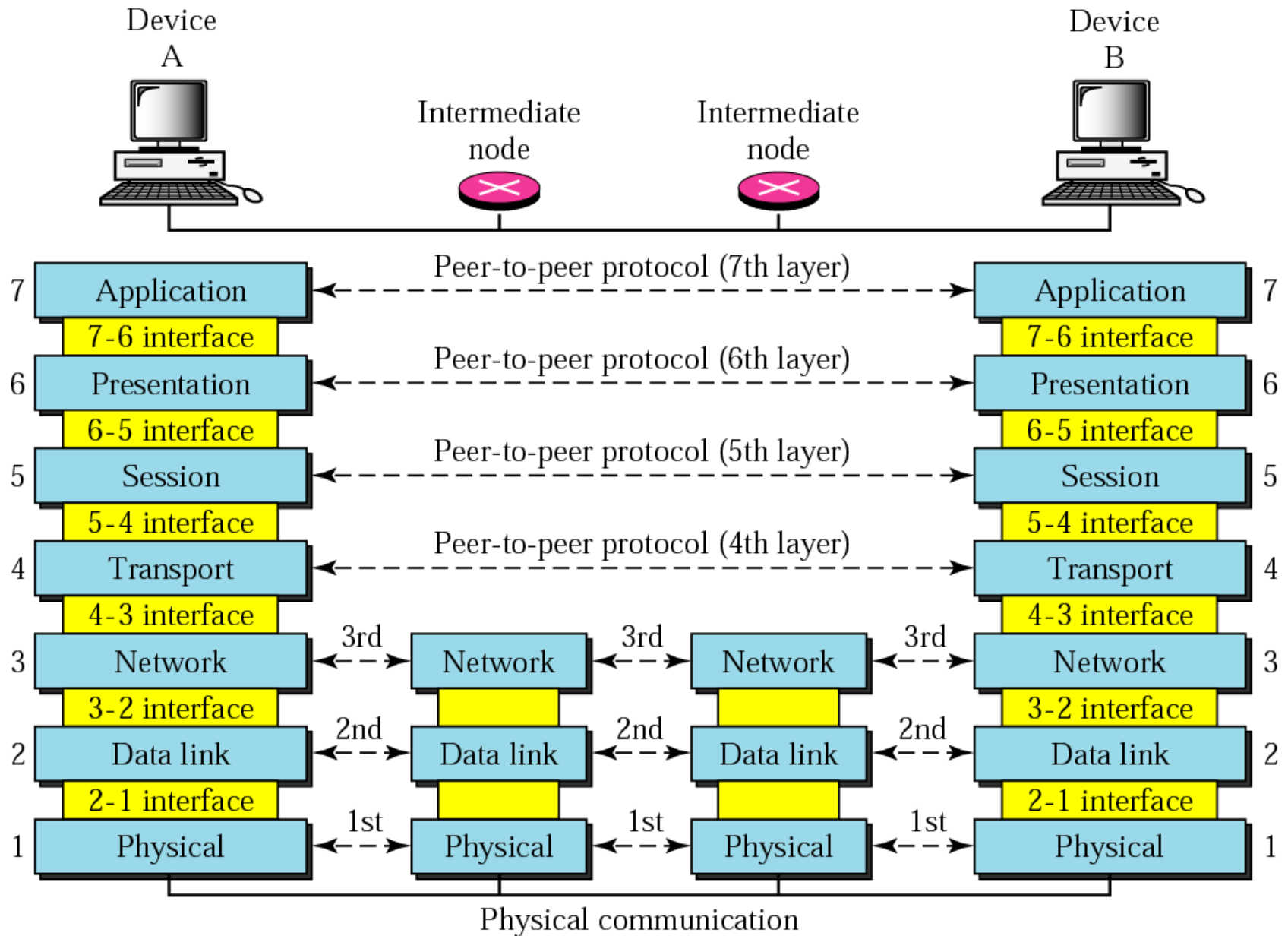
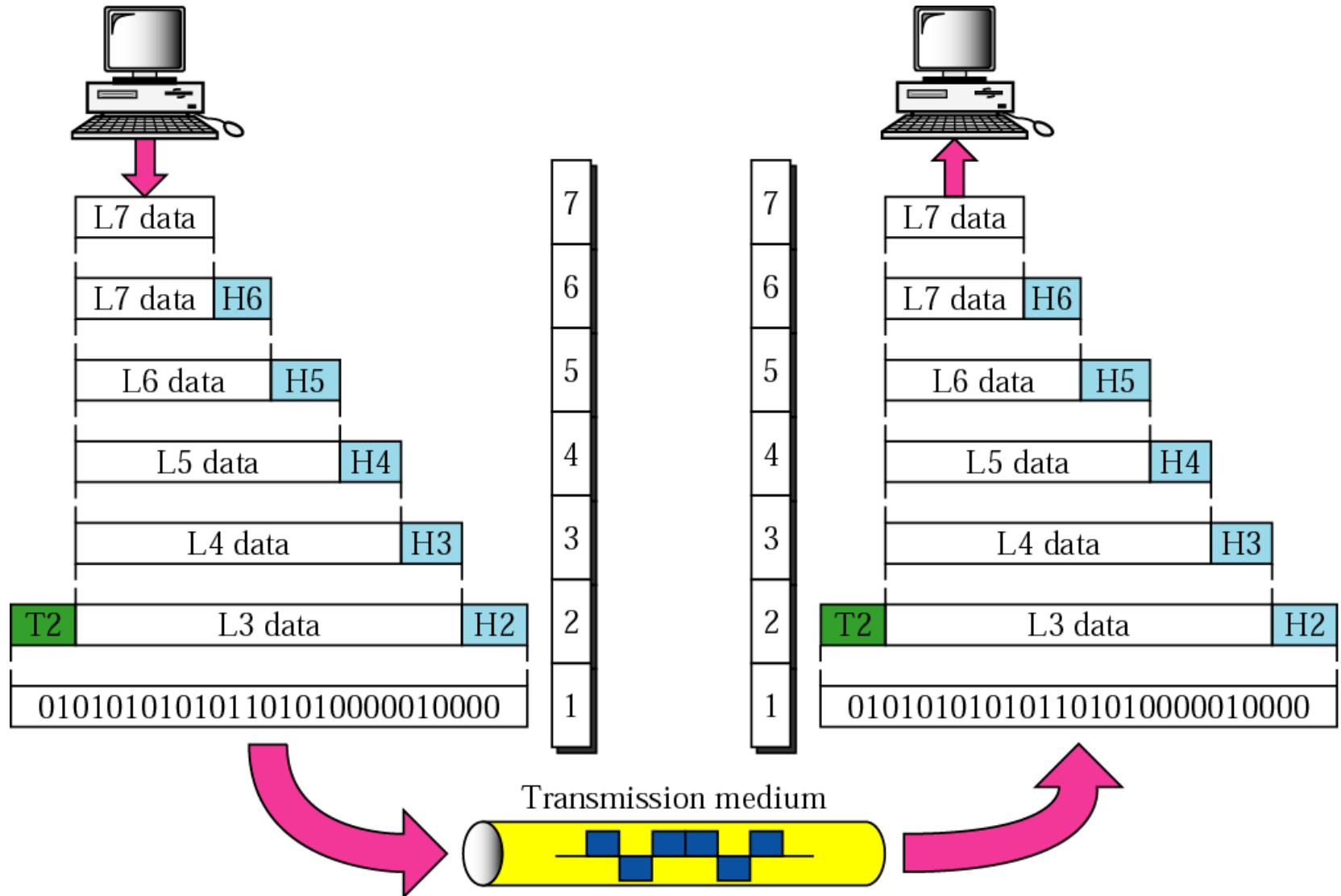


Figure 2-3

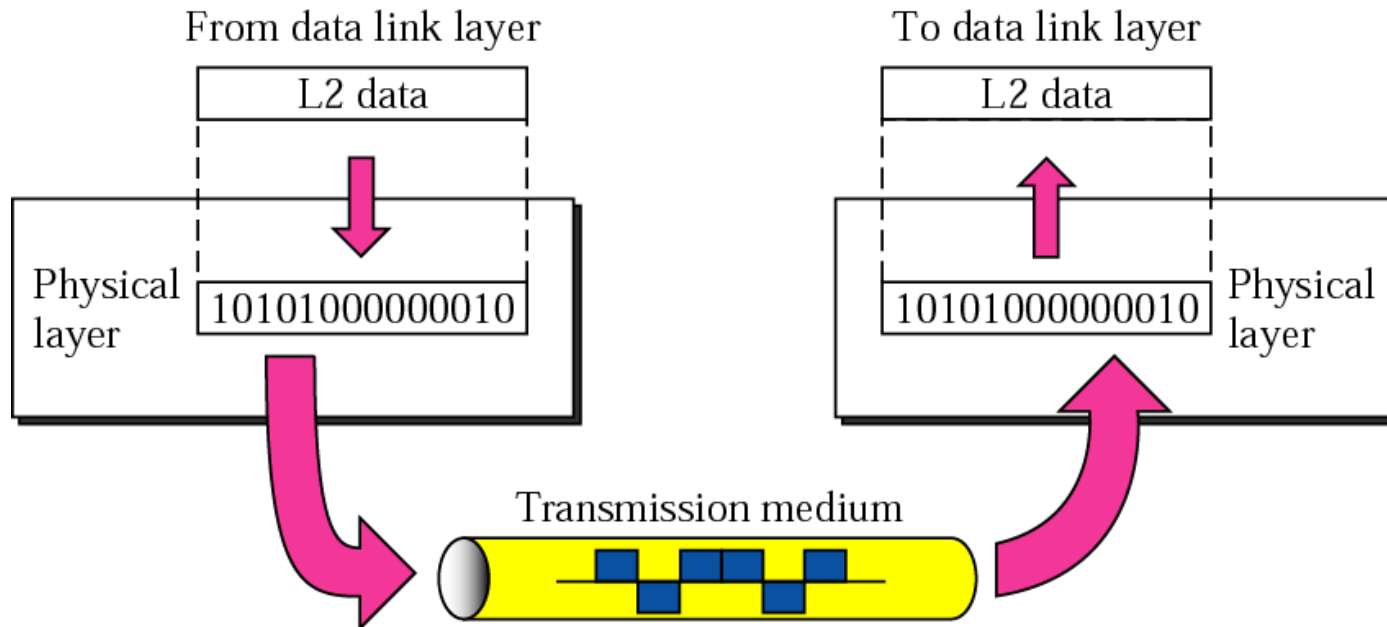
Data exchange using the OSI model



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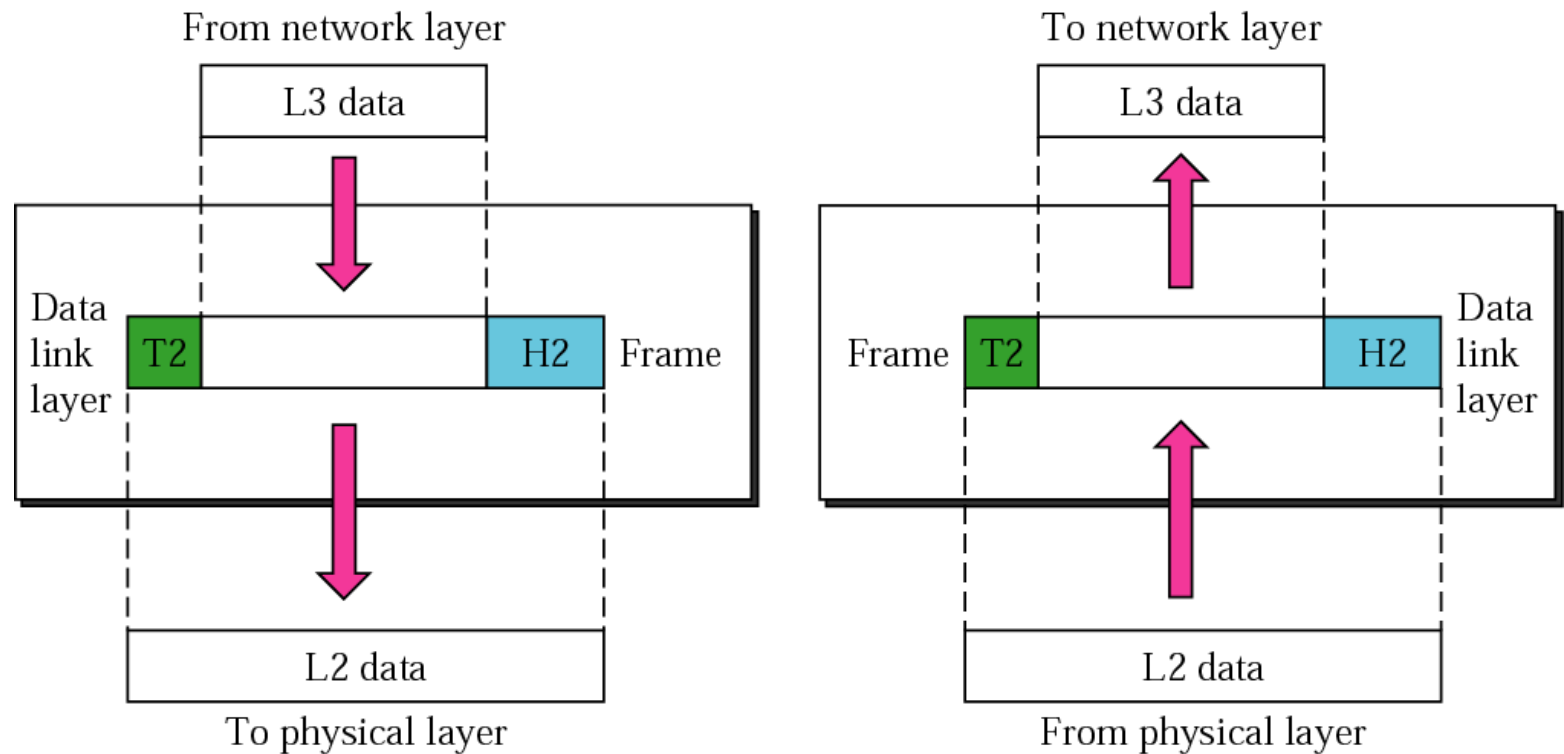
LAYERS IN THE OSI MODEL

Physical Layer



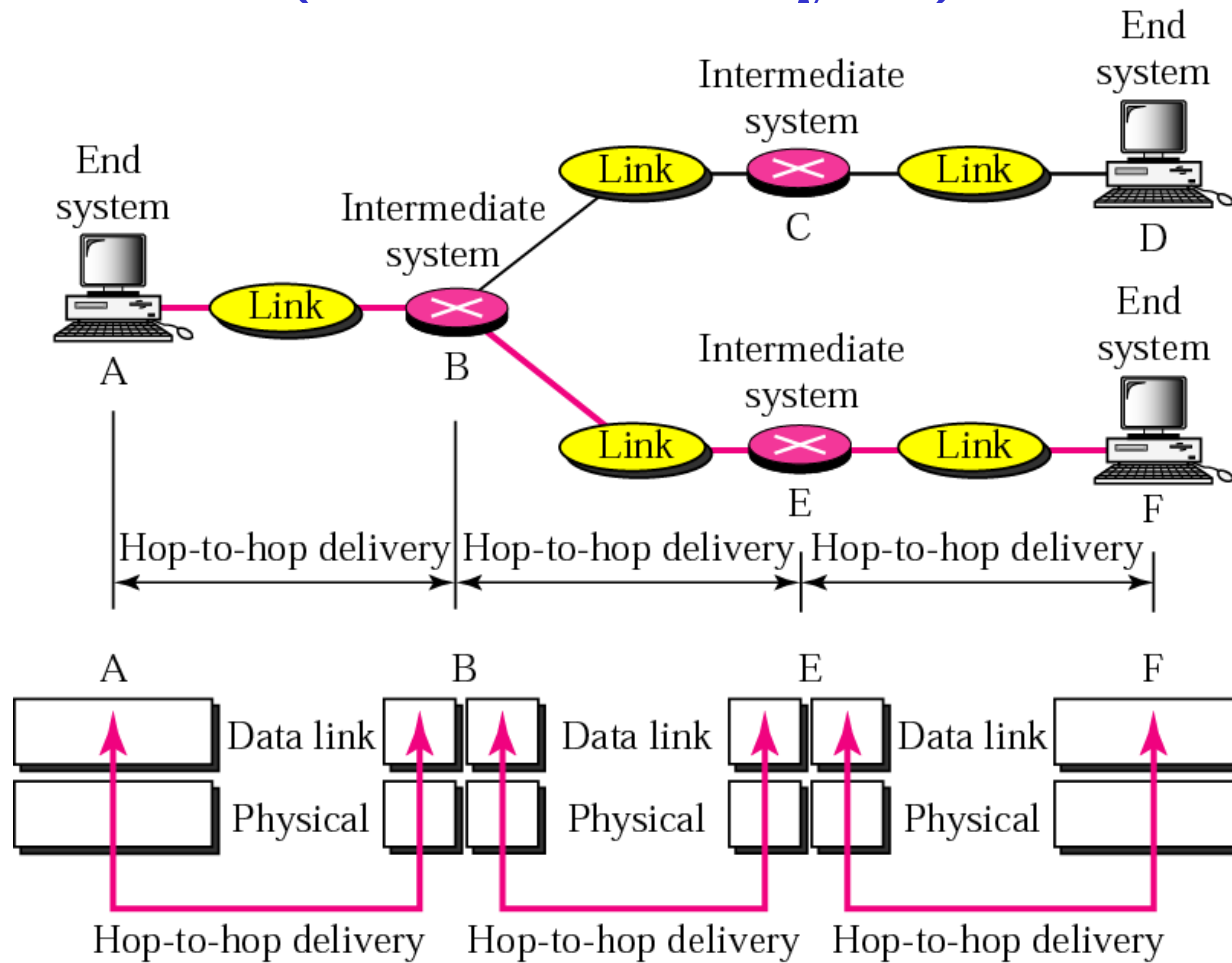
- The Physical Layer is the bottom most layer and is associated with electrical, mechanical and functional aspects of the transmission media for information and receiving over internet.

Data Link Layer

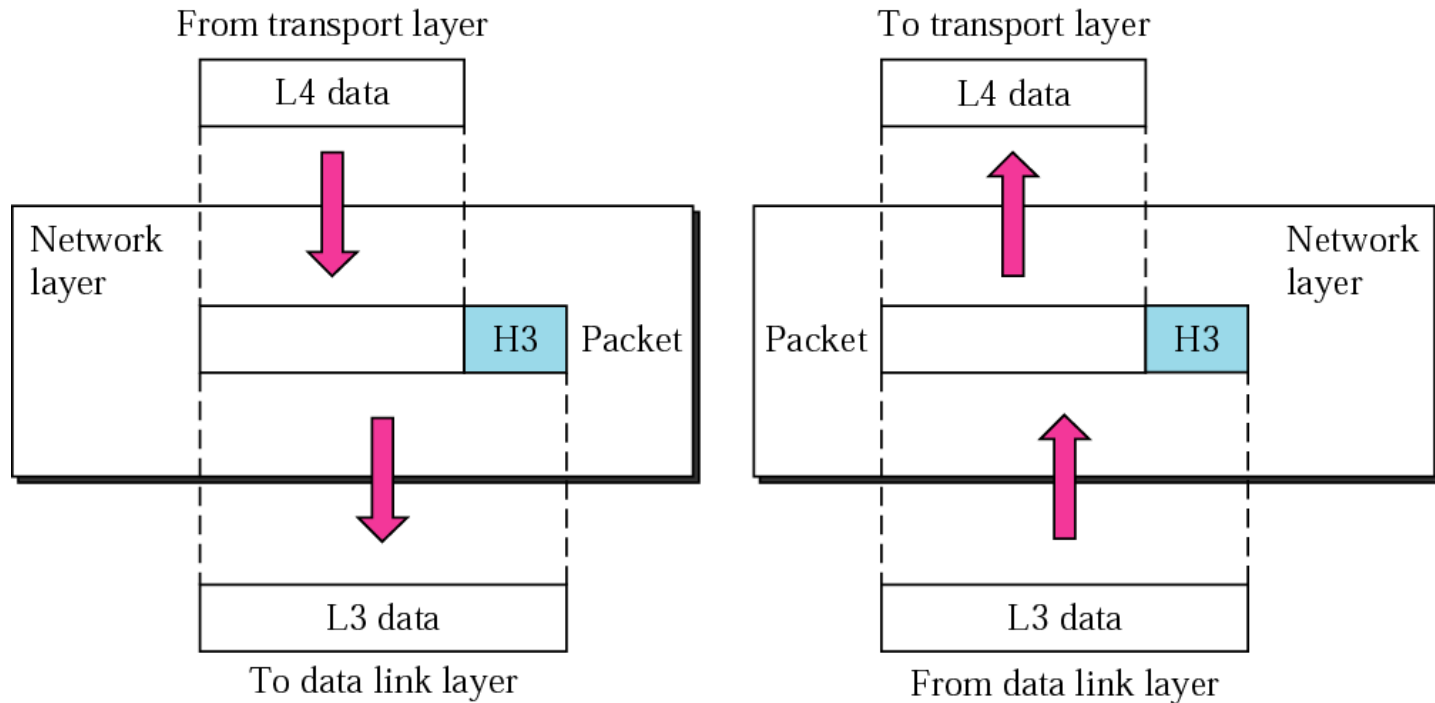


The Data Link Layer is second from bottom and comes under the lower layer category. It ensures that the **data framing. **Error detection and control** are enabled in this layer.**

Node-to-node delivery (Data link layer)



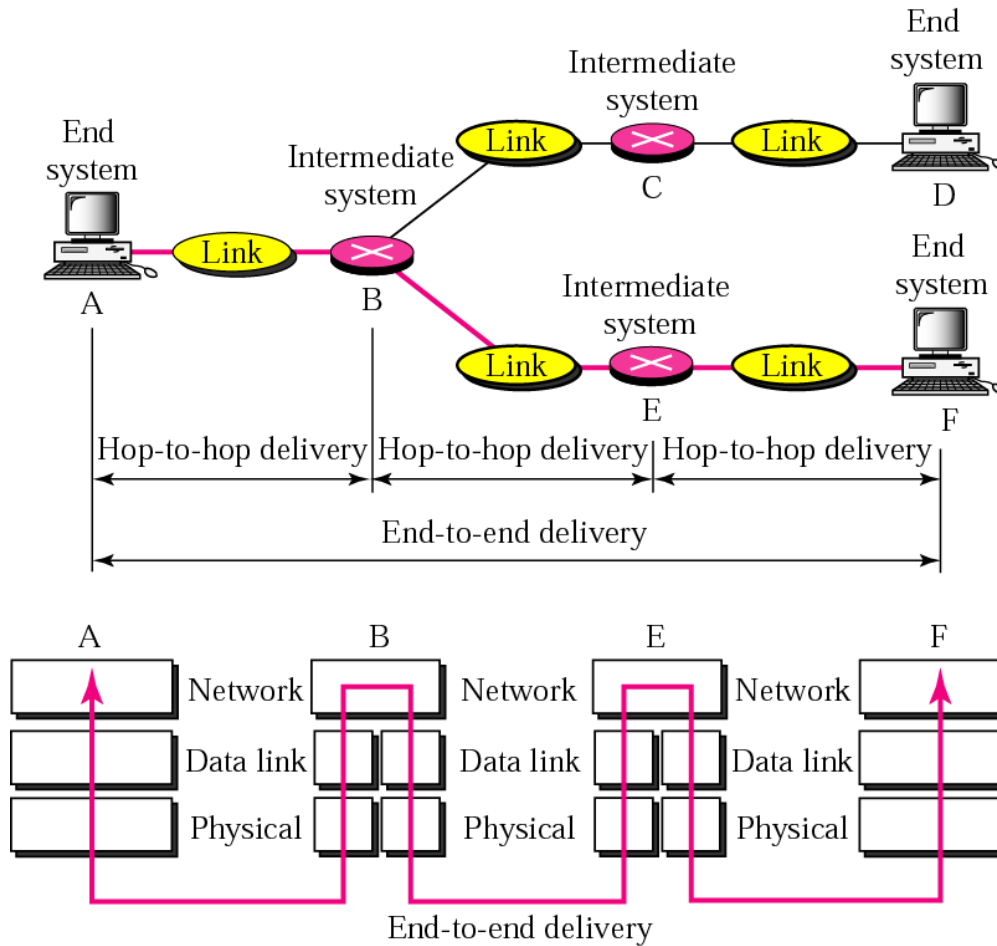
Network Layer



The Network Layer is third from bottom in OSI model and is responsible for **establishing data communication channel** between multiple networks or devices or hosts or nodes. It controls the operation of the **subnet and routing packet** from source to destination.

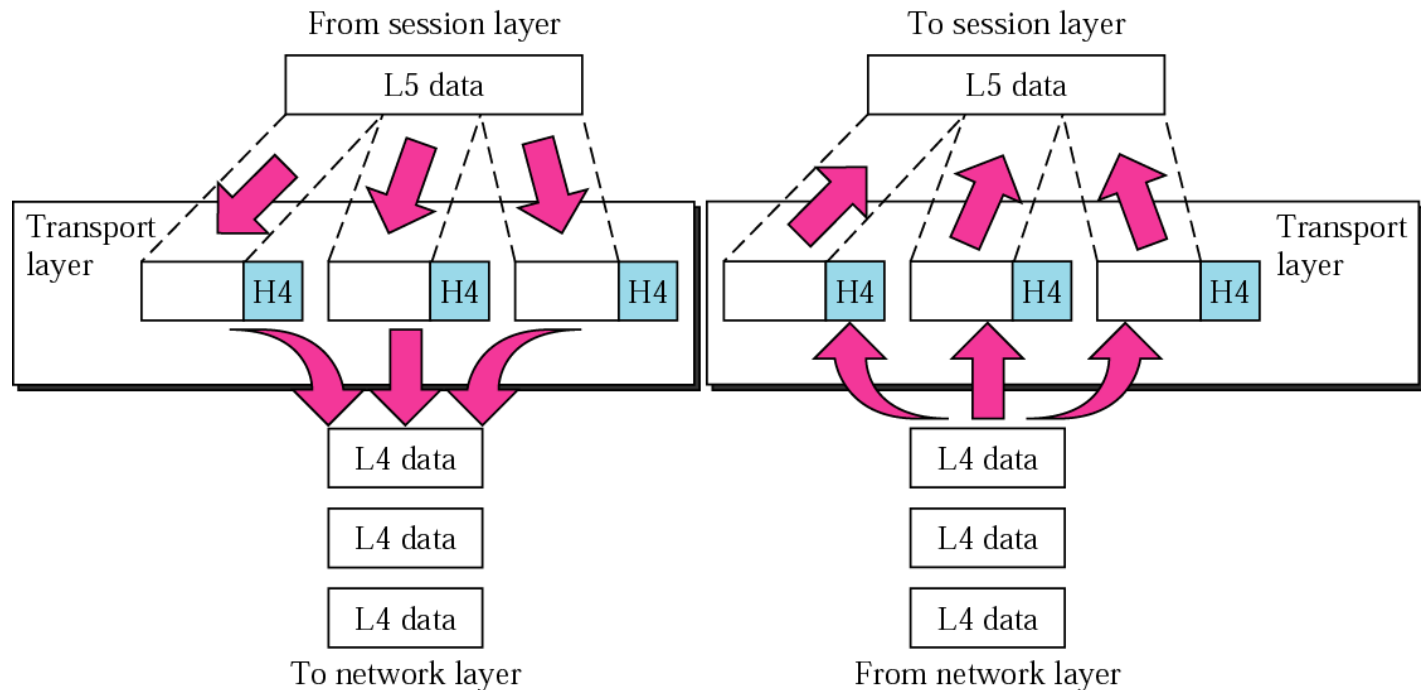
Figure 2-8

End-to-end delivery



Network layer is responsible for End-to-End Delivery

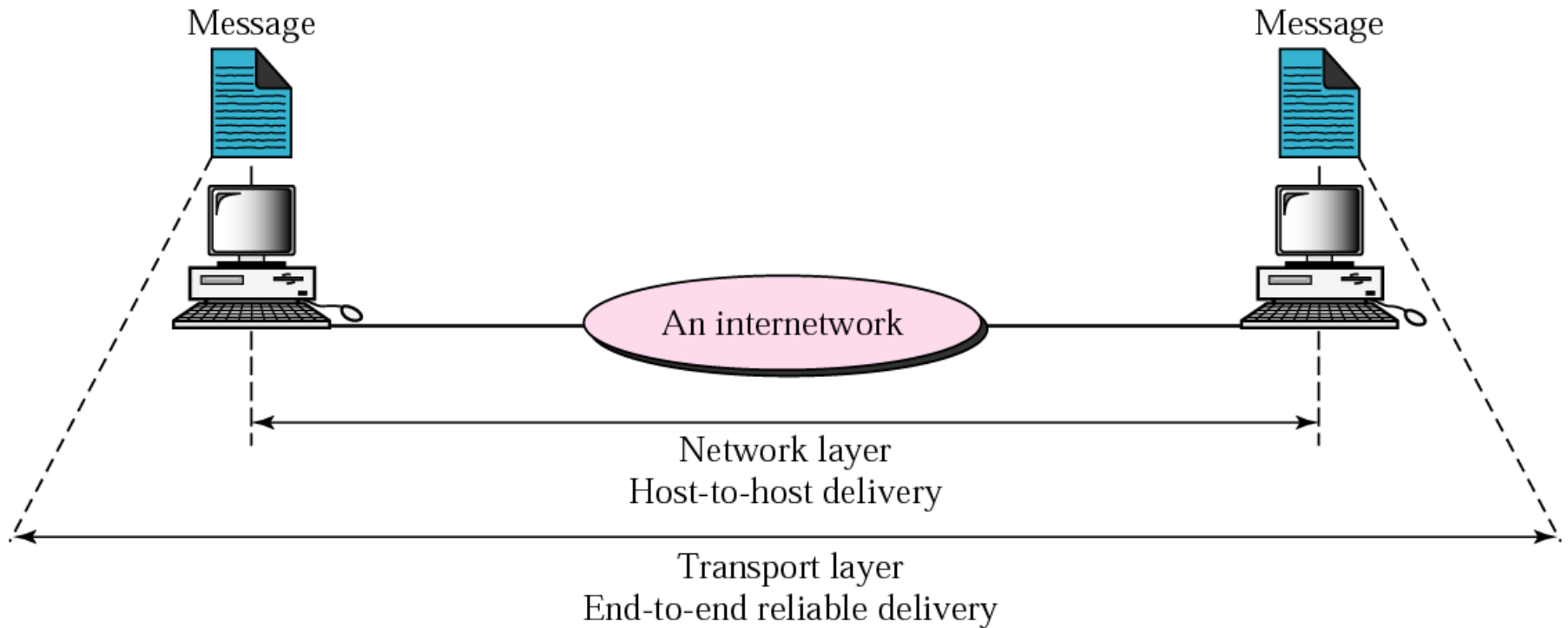
Transport Layer



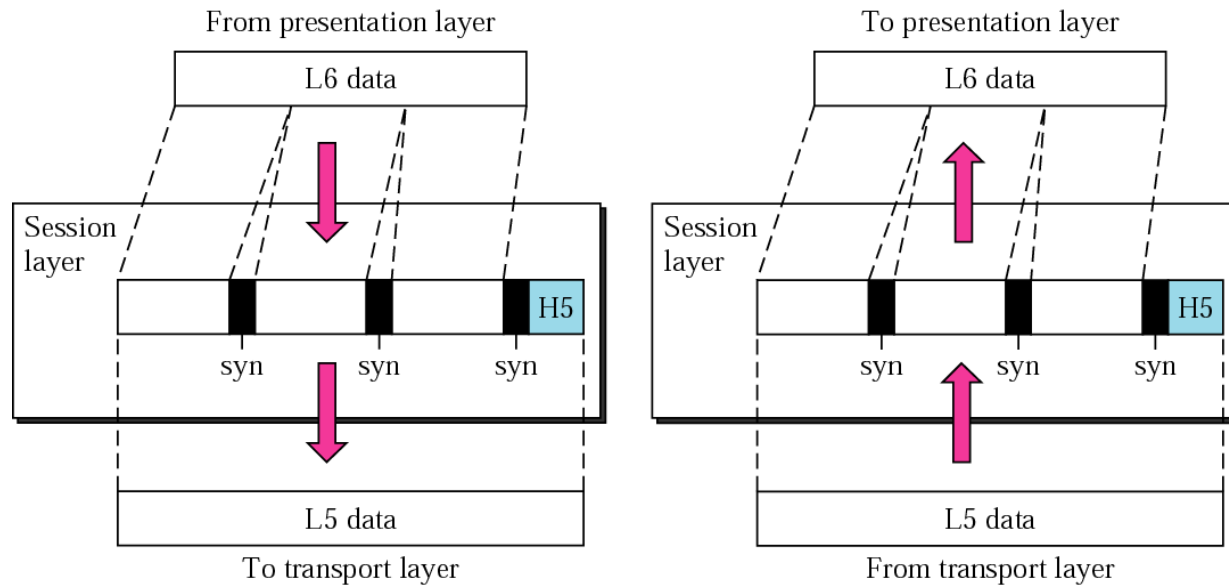
- Transport Layer is the middle most layer in OSI model and it acts as Network Independent Layer.
- Transport layer is responsible for reliable process-to-process delivery

Figure 2-10

Reliable end-to-end delivery of a message

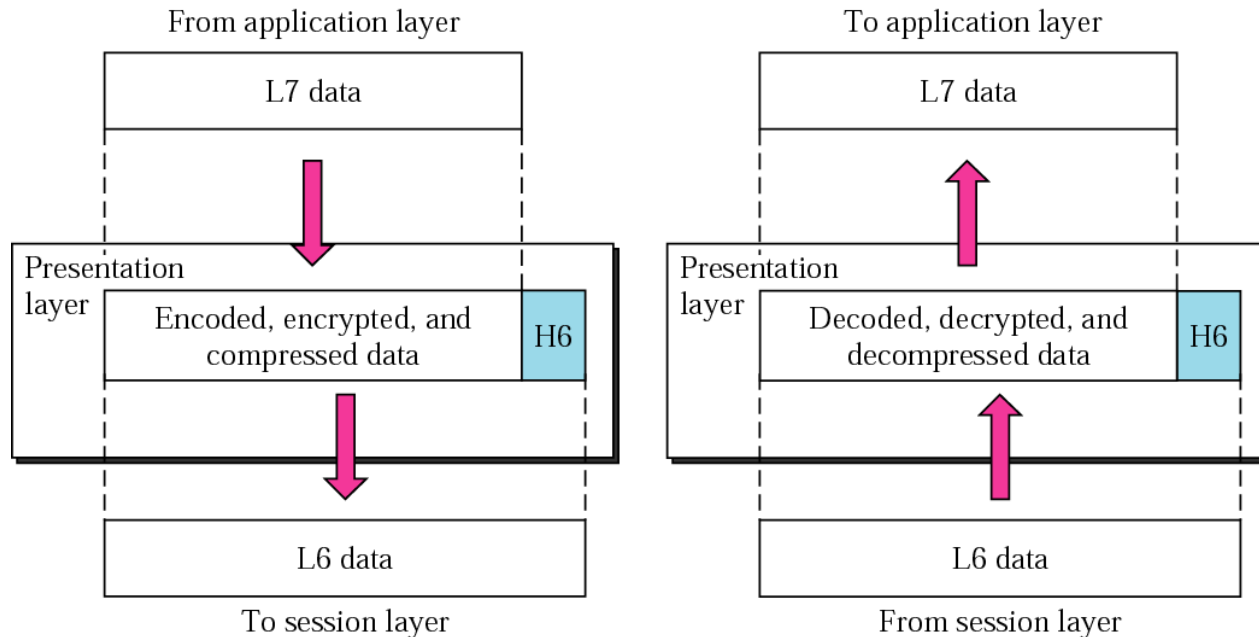


Session Layer



- Session Layer is the fifth layer of OSI model and it provides appropriate sessions between users and entities.
- It can be skipped too if not required.
- For example : Login Sessions in online banking.

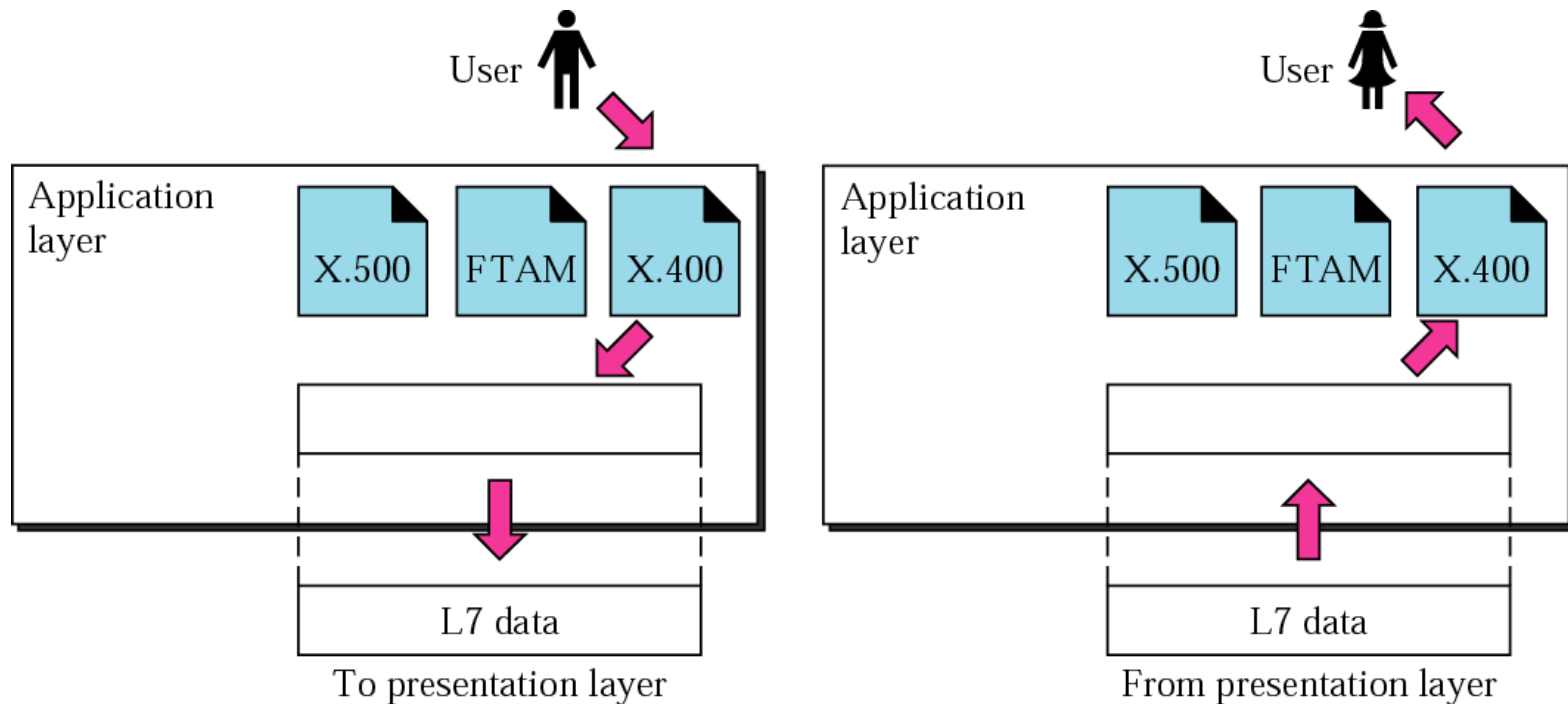
Presentation Layer



This is the sixth layer of OSI model and it provides appropriate representation of data through various data presentation techniques.

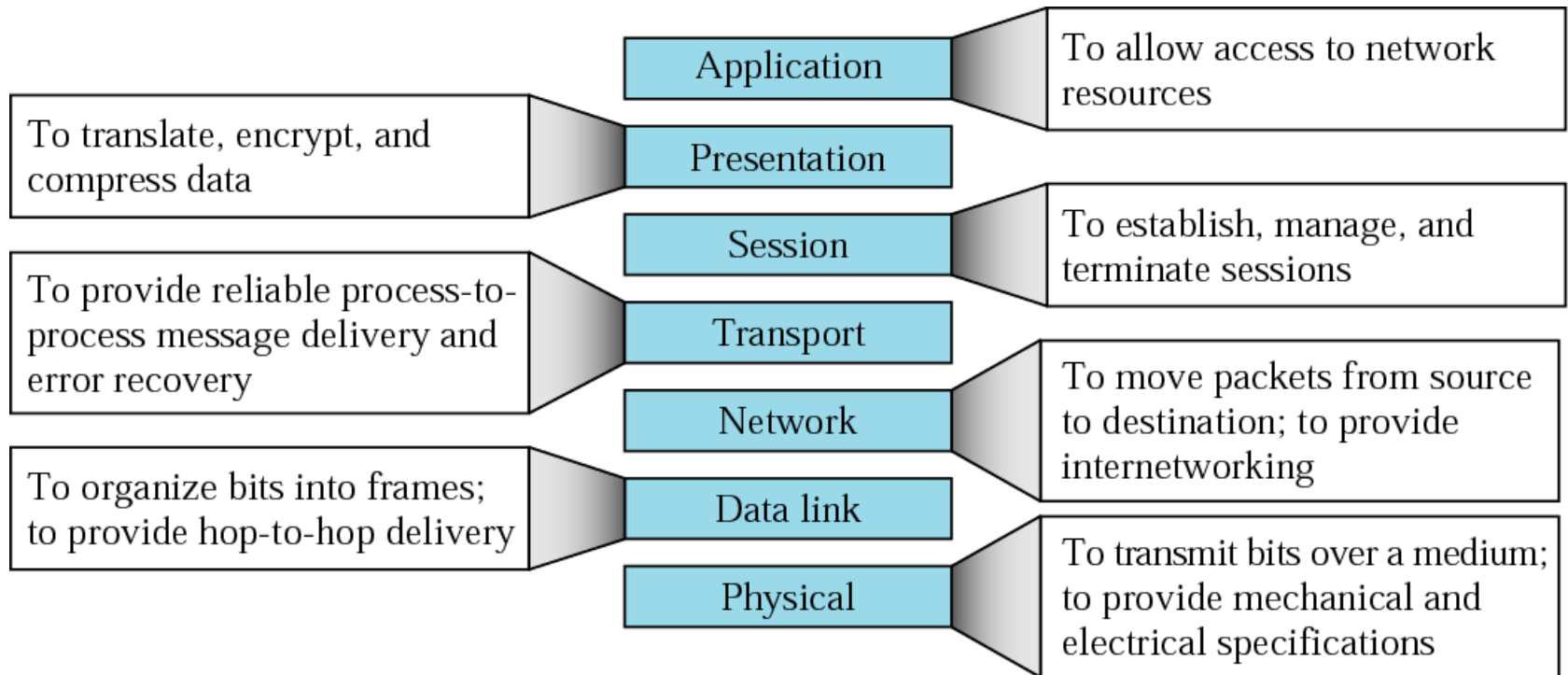
Figure 2-13

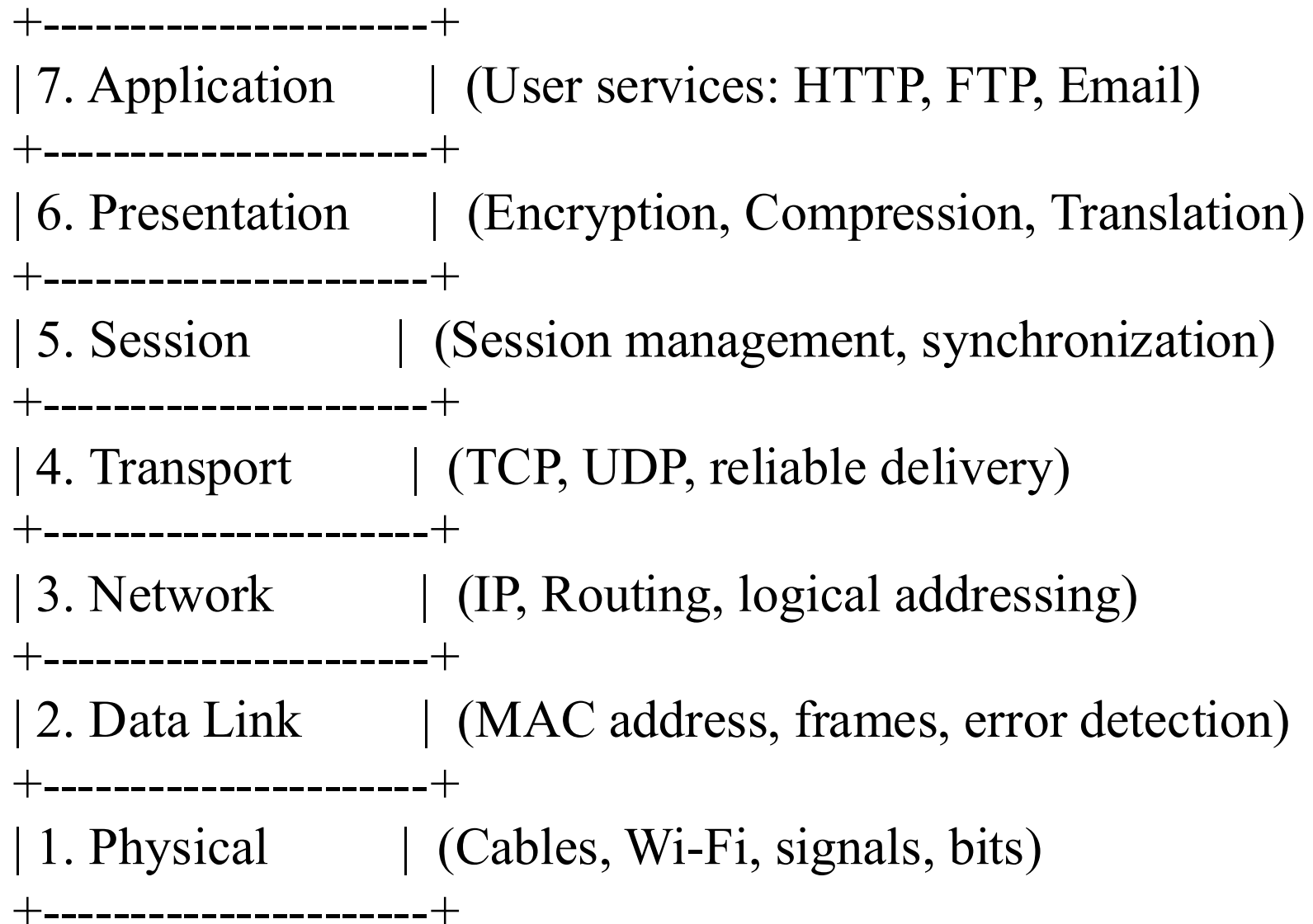
Application Layer



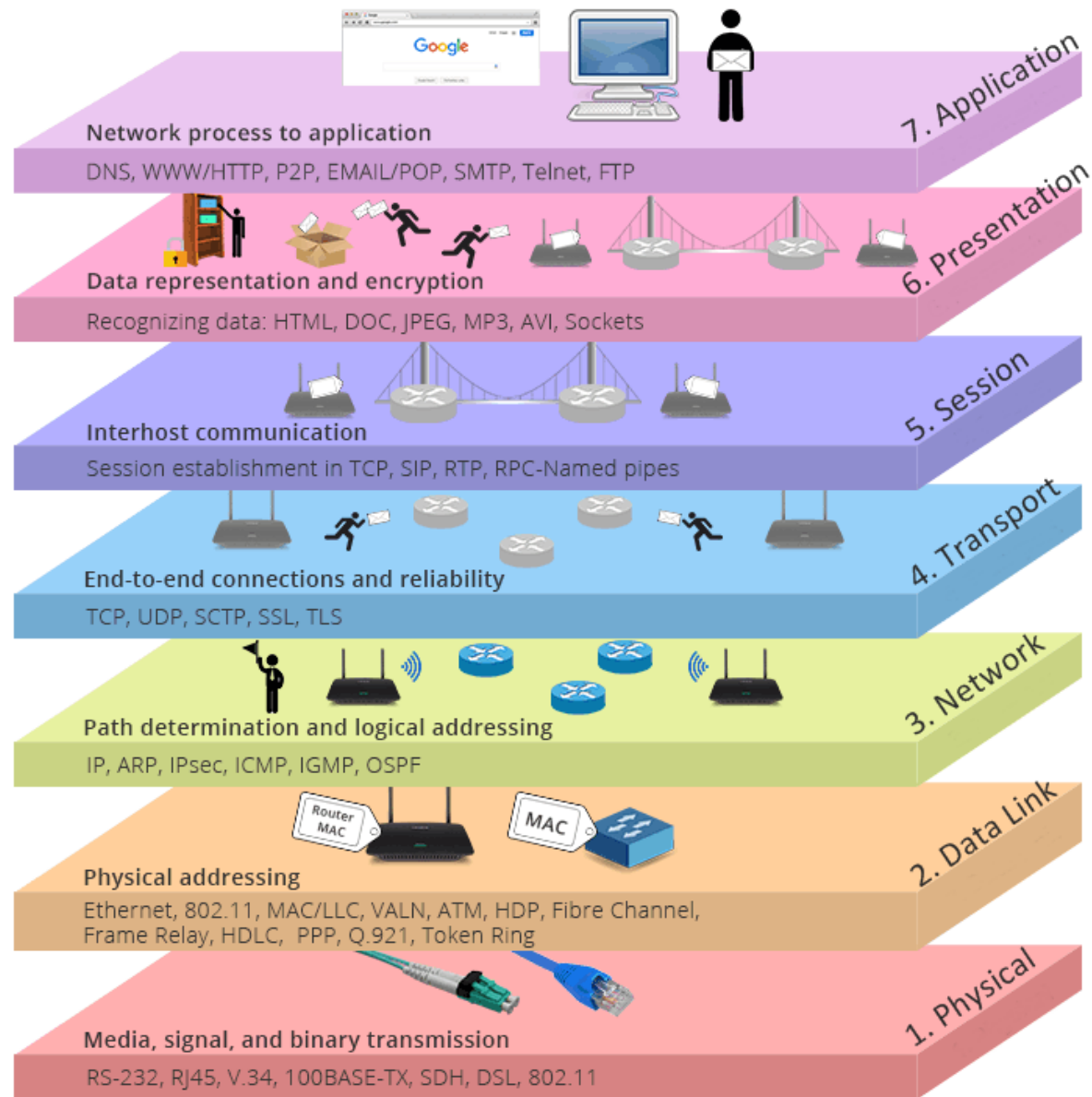
Application Layer is the topmost layer of the OSI model and has the responsibility for providing interface between various users and application.

Summary of layers





Visualization of OSI layers



OSI layers Key-term

Application (7)	SMTP, FTP, Telnet
Presentation (6)	Format Data, Encryption
Session (5)	Start & Stop Sessions
Transport (4)	TCP, UDP, Port Numbers
Network (3)	IP Address, Routers
Data Link (2)	MAC Address, Switches
Physical (1)	Cable, Network Interface Cards, Hubs

OSI Model Explained | Real World Example

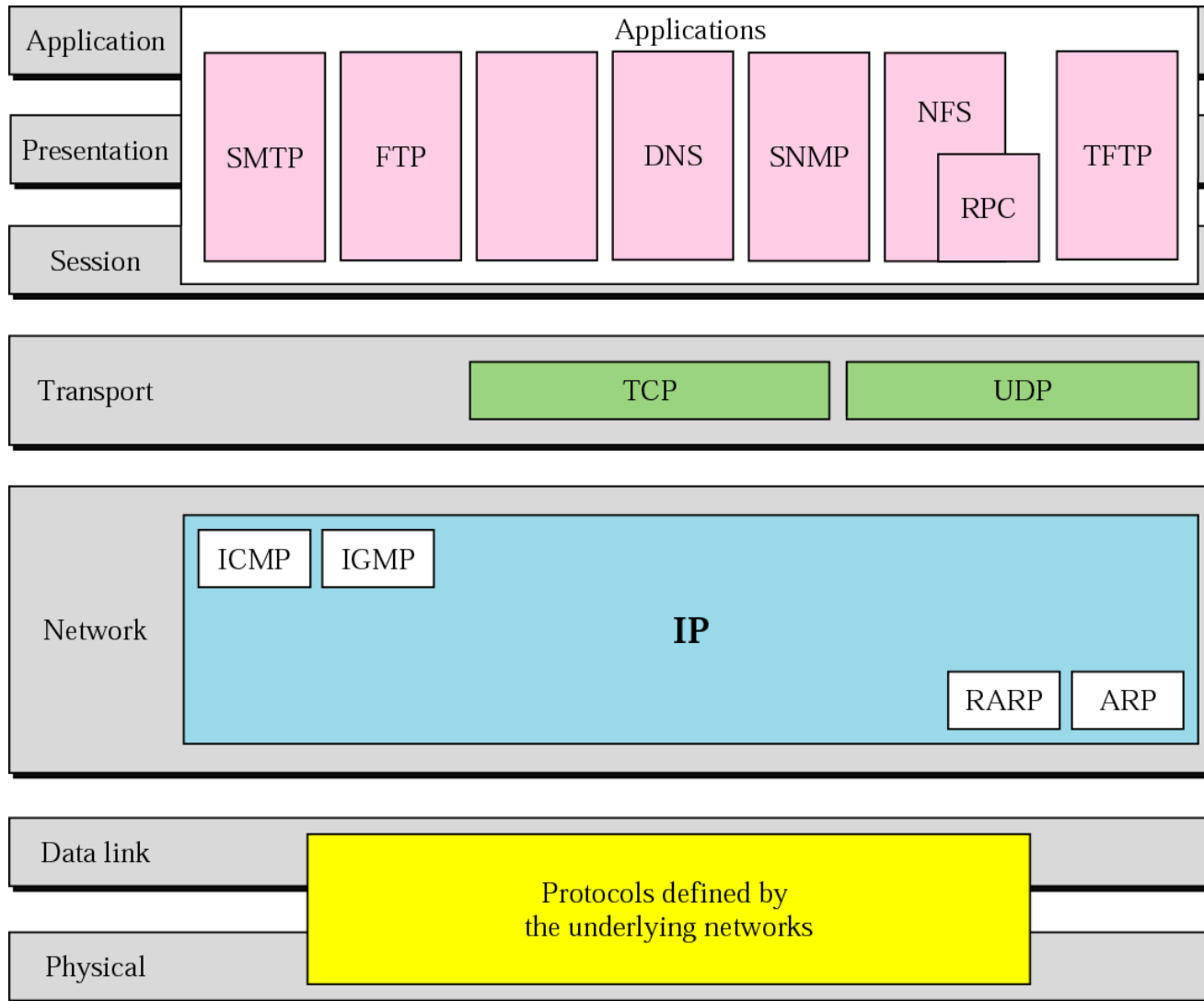
TCP/IP Model

TCP/IP Protocol Suite

Apart from OSI Model, another computer network models which is widely used is **TCP/IP Protocol Suite**.

Figure 2-15

TCP/IP and OSI model



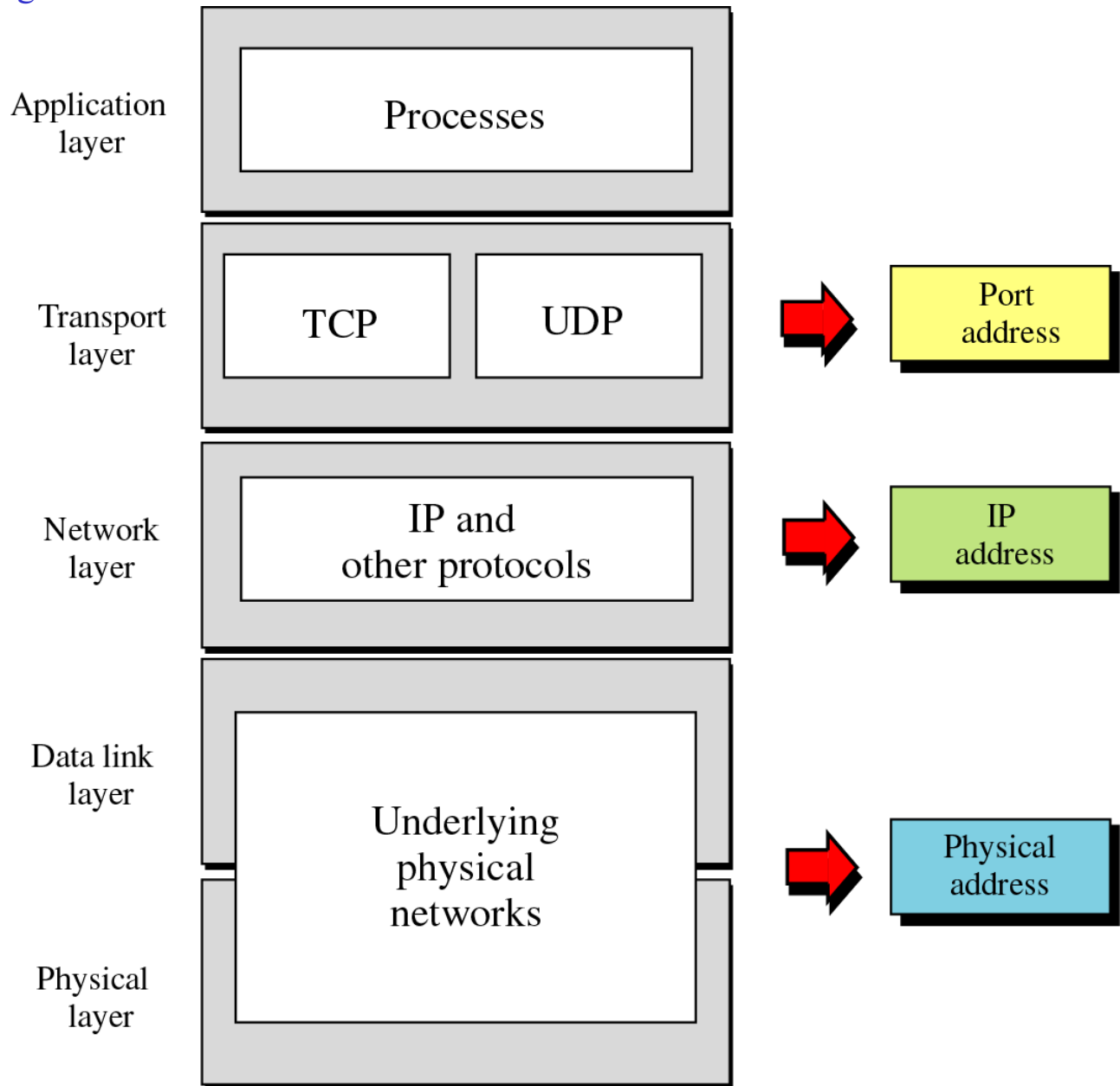
TCP/IP and OSI model

TCP/IP	OSI Model
Application Layer	Application Layer
	Presentation Layer
	Session Layer
Transport Layer	Transport Layer
Internet Layer	Network Layer
Link Layer	Data Link Layer
	Physical Layer

2.4

ADDRESSING

Figure 2-17



Relationship of layers and addresses in TCP/IP

Addresses in TCP/IP

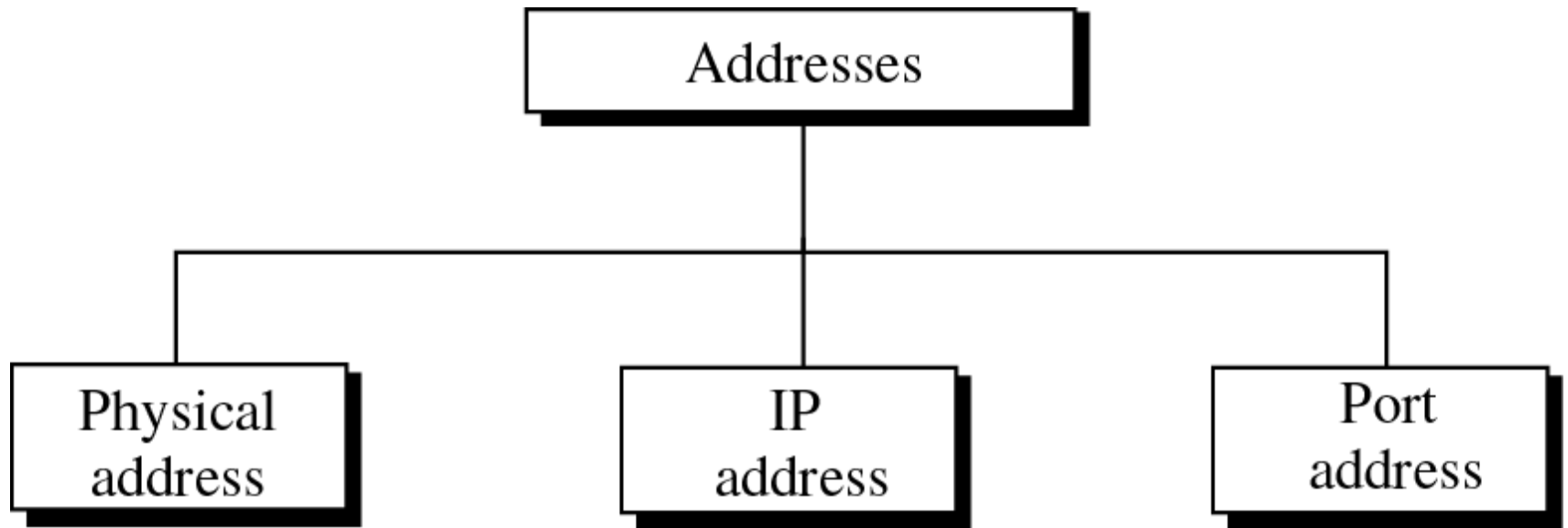


Figure 2-18

Physical addresses

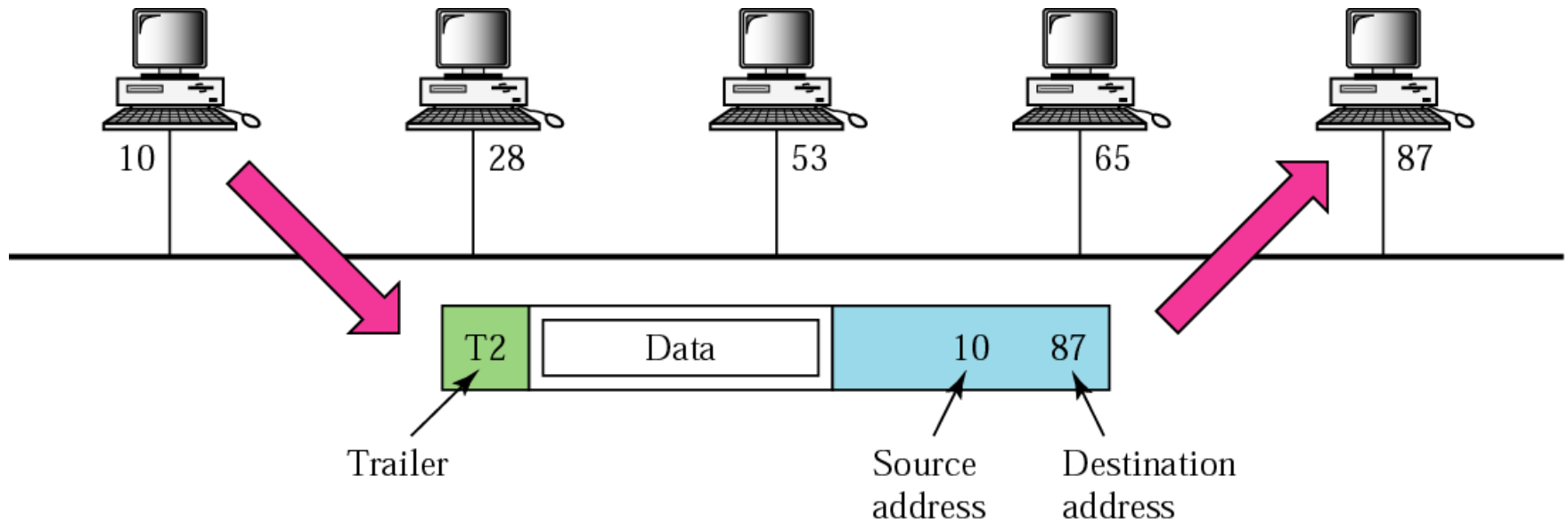
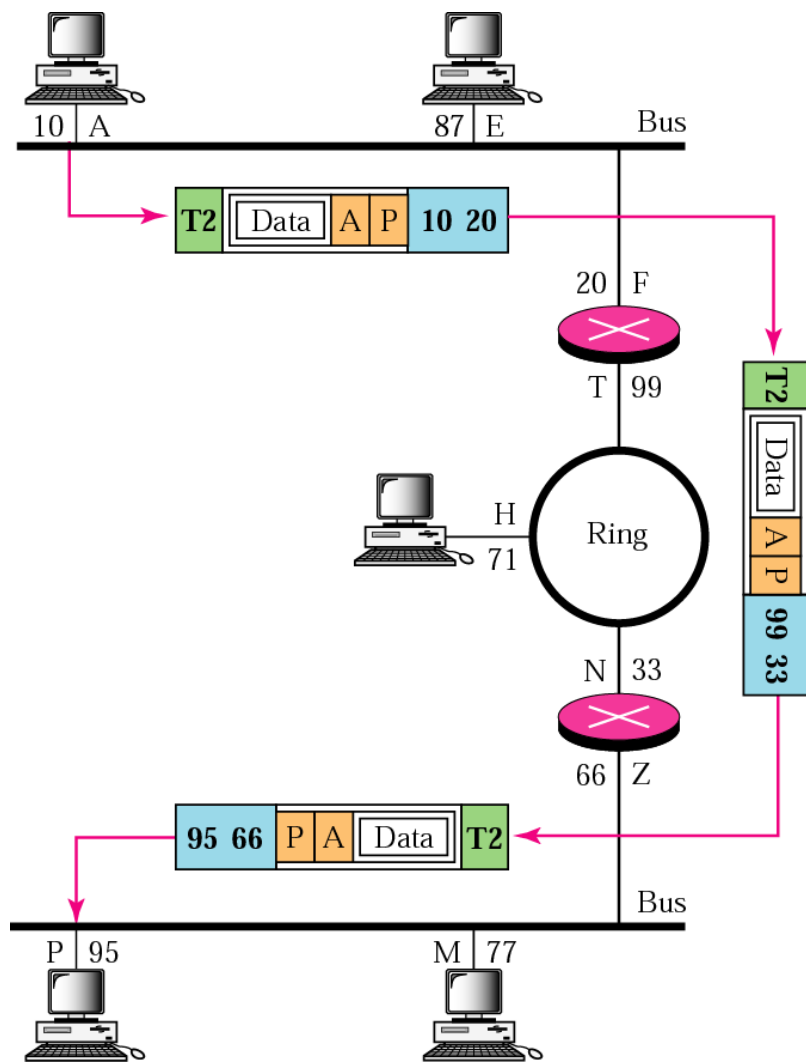


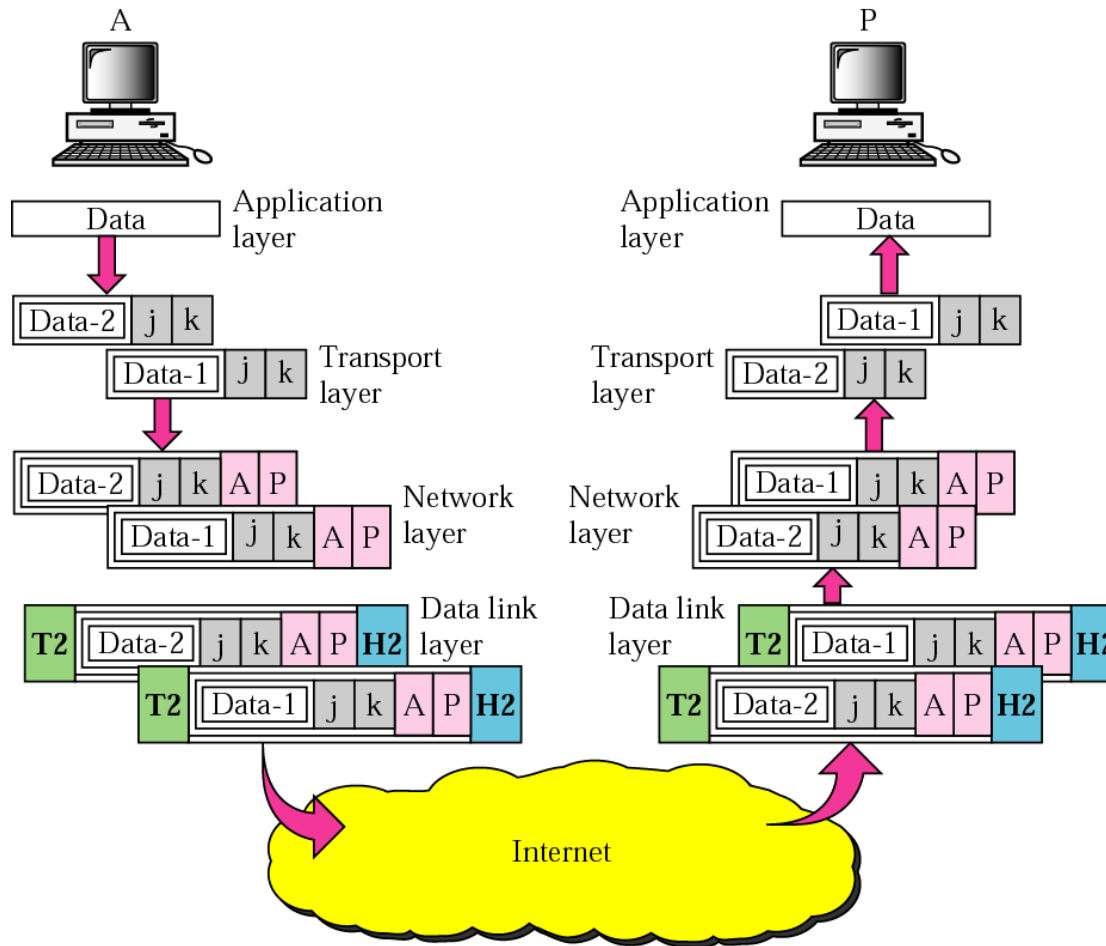
Figure 2-19



IP addresses

Figure 2-20

Port addresses



Advantages Of OSI Model

- The OSI Model being one of the most widely used computer network models does possess some major advantages which makes it so popular. These are :
 - Each layer has its **definite structure and functionality** which makes OSI model simple and easy to use.
 - It is a **general purpose reference model** that can be used for data communication.
 - Connection oriented and connection-less services are supported.
 - Connection between any type of devices or host or hardware or software is possible.

Disadvantages Of OSI Model

- Because of its inability to fit protocols, this model was replaced by TCP/IP Internet Model.
- Session and Presentation layers does not provide high end functionalities and are not of much use as compared to other layers.
- Connection oriented and connection-less services are supported.