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6	Presentatio
5	Session

4	Transport
3	Network

2	Data Link
1	Physical

Communication and Layered Architecture OSI MODEL:

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INTRODUCTION

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APPLICATIONS

A lot of things we take for granted are the result of computer networks.

- Email
- Chat
- Web sites
- Sharing of documents and pictures
- Accessing a centralized database of information
- Mobile workers

THE NEED FOR STANDARDS

- Over the past couple of decades many of the networks that were built used different hardware and software implementations, as a result they were incompatible and it became difficult for networks using different specifications to communicate with each other.
- To address the problem of networks being incompatible and unable to communicate with each other, the International Organisation for Standardisation (ISO) researched various network schemes.
- The ISO recognised there was a need to create a NETWORK MODEL that would help vendors create interoperable network implementations.

1. Organizations For

Communication Standards

Standards are developed by cooperation among standards creation committees, forums, and government regulatory agencies.

Standards Creation Committees

- a) International Standards Organization (ISO)
- b) International Telecommunications Union (ITU)
- c) American National Standards Institute (ANSI)
- d) Institute of Electrical and Electronics Engineers (IEEE)
- e) Electronic Industries Association (EIA)
- f) Internet Engineering Task Force (IETF)

a) International Standards Organization (ISO)

- A multinational body whose membership is drawn mainly from the standards creation committees of various governments throughout the world
- Dedicated to worldwide agreement on international standards in a variety of fields.
- Currently includes 82 memberships industrialized nations.
- Aims to facilitate the international exchange of goods and services by providing models for compatibility, improved quality, increased quality, increased productivity and decreased prices.

b) International Telecommunications

Union (ITU)

- Also known as International Telecommunications Union-Telecommunication Standards Sector (ITU-T)
- An international standards organization related to the United Nations that develops standards for telecommunications.
- Two popular standards developed by ITU-T are:
 - i) V series – transmission over phone lines
 - ii) X series – transmission over public digital networks, email and directory services and ISDN.

c) American National Standards Institute (ANSI)

- A non-profit corporation not affiliated with US government.
- ANSI members include professional societies, industry associations, governmental and regulatory bodies, and consumer groups.
- Discussing the internetwork planning and engineering, ISDN services, signaling, and architecture and optical hierarchy.

- d) Institute of Electrical and
Electronics Engineers (IEEE)
- The largest national professional group involved in developing standards for computing, communication, electrical engineering, and electronics.
 - Aims to advance theory, creativity and product quality in the fields of electrical engineering, electronics and radio.
 - It sponsored an important standard for local area networks called Project 802 (eg. 802.3, 802.4 and 802.5 standards.)

e) Electronic Industries Association (EIA)

- An association of electronics manufacturers in the US.
- Provide activities include public awareness education and lobbying efforts in addition to standards development.
- Responsible for developing the EIA-232-D and EIA-530 standards.

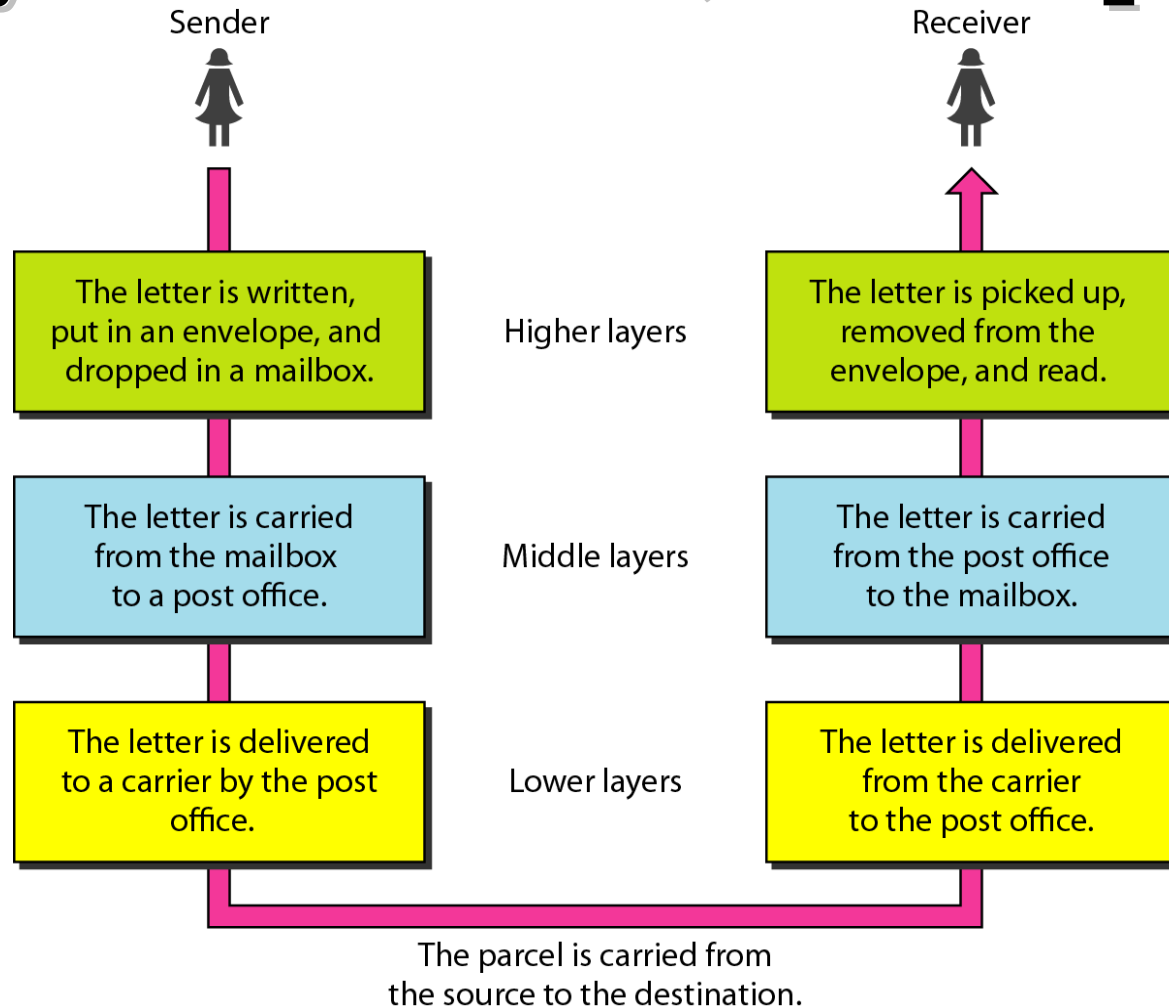
f) Internet Engineering Task Force (IETF)

- Concerned with speeding the growth and evolution of Internet communications.
- The standards body for the Internet itself
- Reviews internet software and hardware.

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.

Layered Tasks, Example



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NETWORK ARCHITECTURES

A set of layers and protocols is called the network architecture.

1. Protocol Hierarchies

Networks are organized as layers to reduce design complexity. Each layer offers *services* to the higher layers. Between adjacent layers is an *interface*.

Basic concept of layering Network architectures define the standards and techniques for designing and building communication systems for computers and other devices.

In the past, vendors developed their own architectures and required that other vendors conform to this architecture if they wanted to develop compatible hardware and software.

There are proprietary network architectures such as IBM's SNA (Systems Network Architecture) and there are open architectures like the OSI (Open Systems Interconnection) model defined

The previous strategy, where the computer network is designed with the hardware as the main concern and software is afterthought, no longer works. Network software is now highly *structured*.

To reduce the design complexity, most of the networks are organized as a series of **layers**
or **levels**, each one build upon one

NETWORK ARCHITECTURES

2. Design Issues for the Layers

- Mechanism for connection establishment
- Rules for data transfer
- Error control
- Fast sender swamping a slow receiver
- Inability of processes to accept long messages
- Routing in the case of multiple paths

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OSI REFERENCE MODEL

The Open Systems Interconnection is the model developed by the International Standards Organization.

Benefits

- Interconnection of different systems (open)
- Not limited to a single vendor solution

Negative Aspect

- Systems might be less secure
- Systems might be less stable

OSI REFERENCE MODEL

1. Physical Layer

- a) Convert the logical 1's and 0's coming from layer 2 into electrical signals.
- b) Transmission of the electrical signals over a communication channel.

Main topics:

- Transmission mediums
- Encoding
- Modulation
- RS232 and RS422 standards
- Repeaters
- Hubs (multi-port repeater)

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OSI REFERENCE MODEL

2. Data Link Layer

- a) Error control to compensate for the imperfections of the physical layer.
- b) Flow control to keep a fast sender from swamping a slow receiver.

Main topics:

- Framing methods
- Error detection and correction methods
- Flow control
- Frame format
- IEEE LAN standards
- Bridges
- Switches (multi-port bridges)

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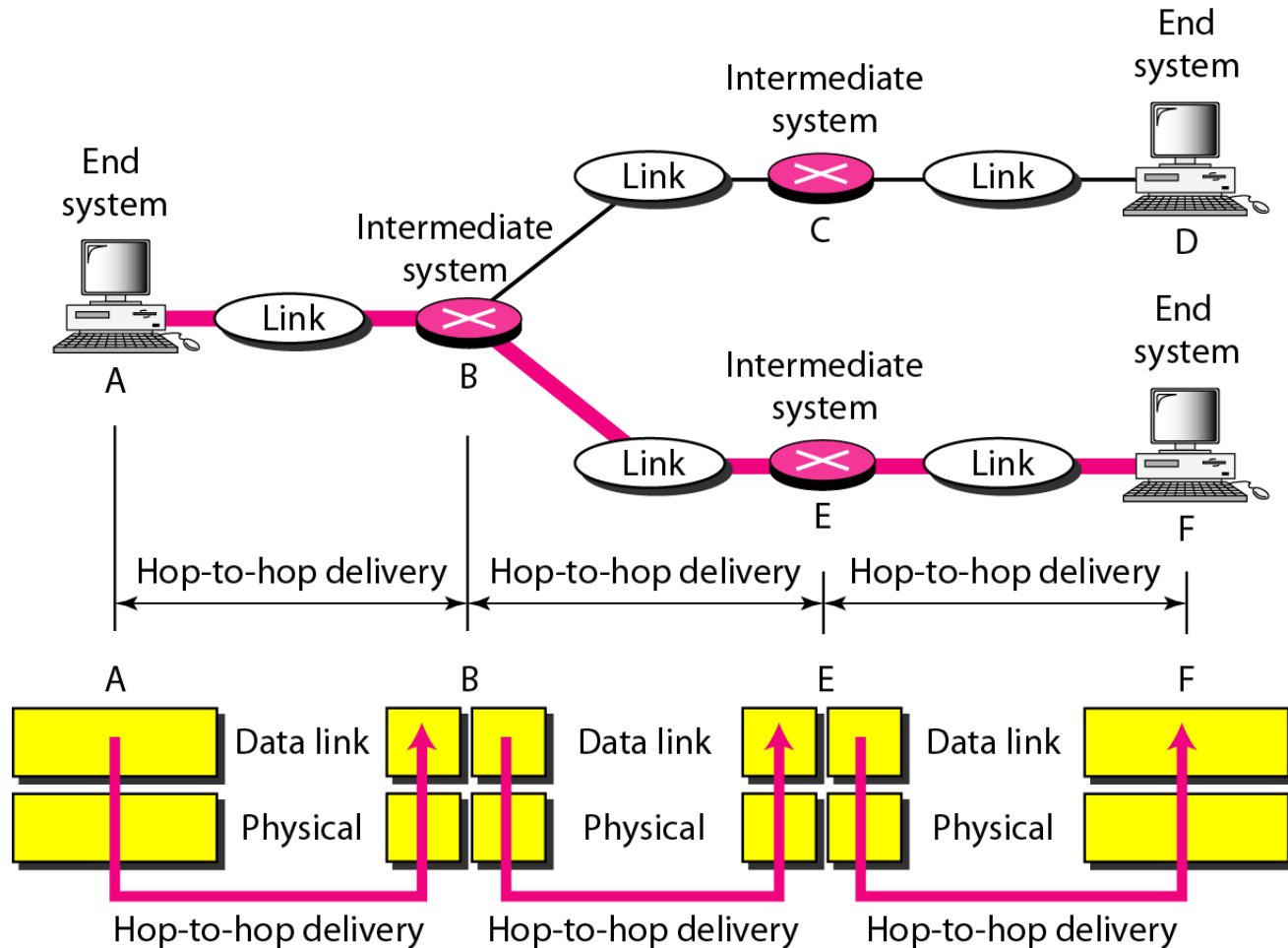
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Hop-to-hop Delivery



OSI REFERENCE MODEL

3. Network Layer

- a) Controls the operation of the subnet.
- b) Routing packets from source to destination.
- c) Logical addressing.

Main topics:

- Internetworking
- Routing algorithms
- Internet Protocol (IP) addressing
- Routers

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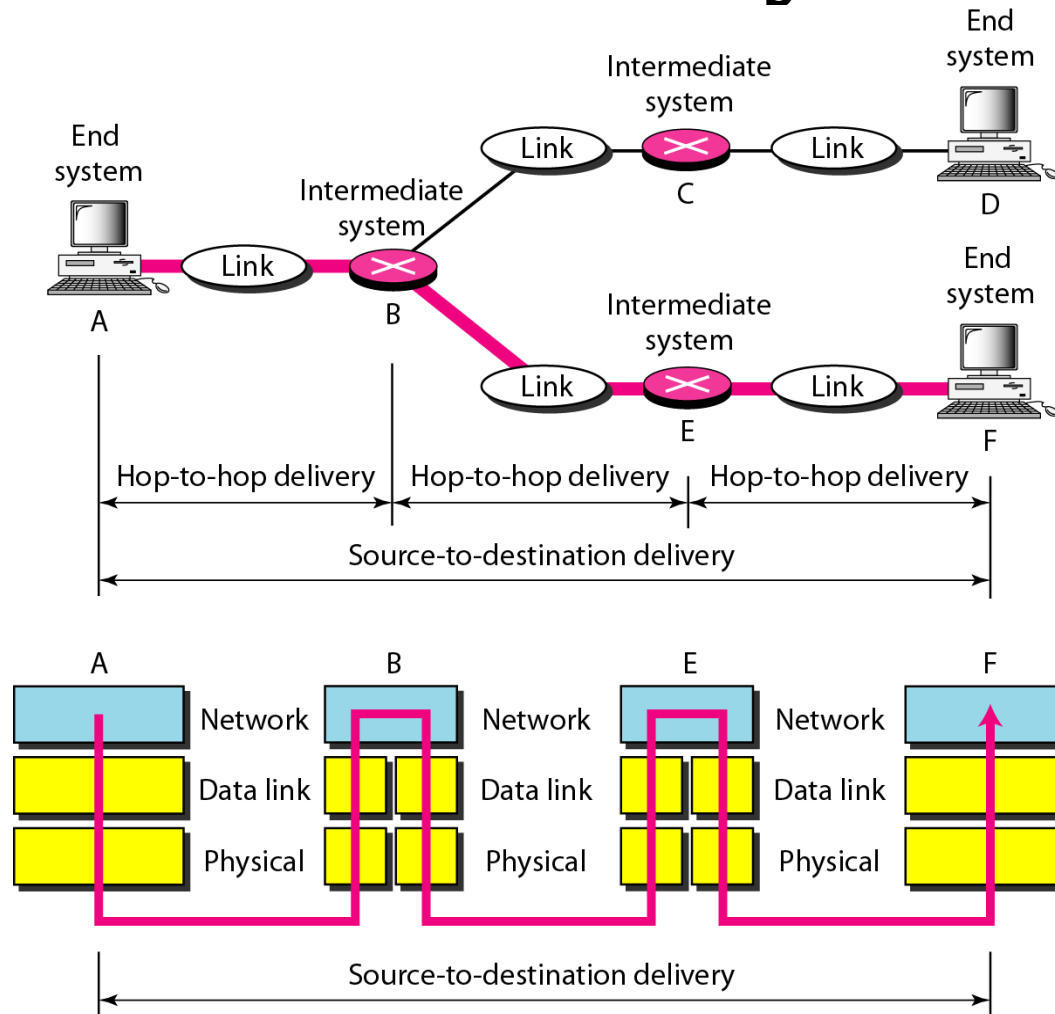
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Source-to-destination delivery



OSI REFERENCE MODEL

4. Transport Layer

- a) Provides additional Quality of Service.
- b) Heart of the OSI model.

Main topics:

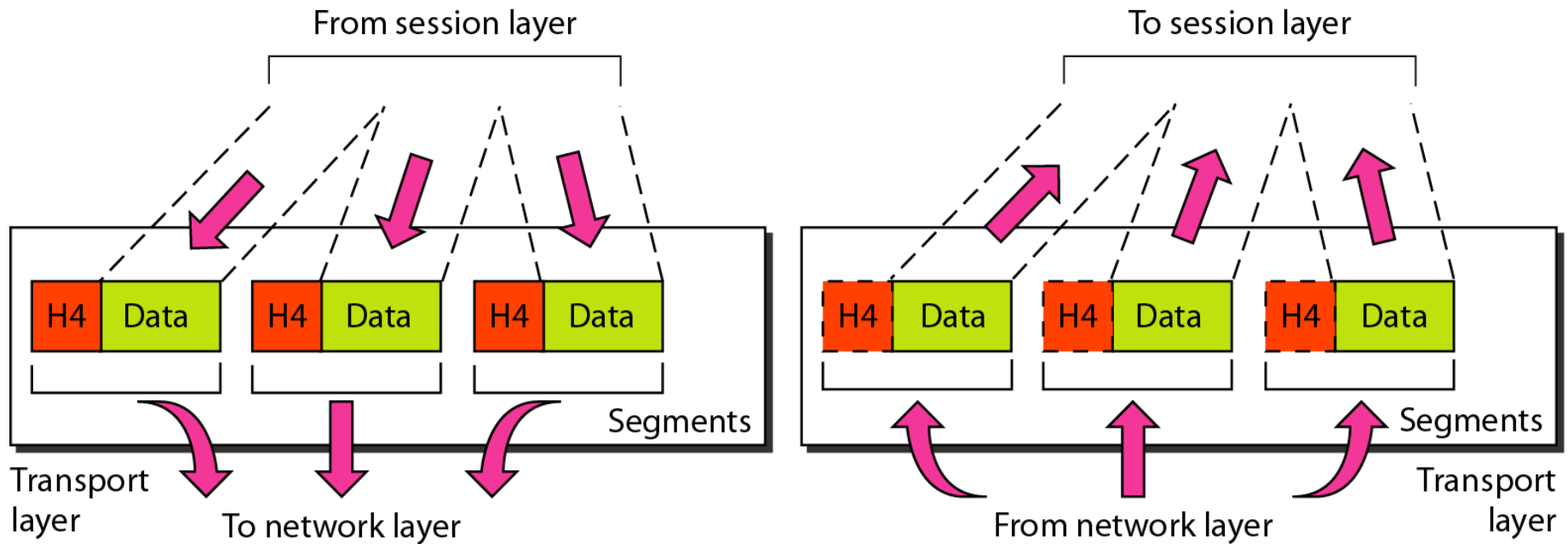
- Connection-oriented and connectionless services
- Transmission Control Protocol (TCP)
- User Datagram Protocol (UDP)

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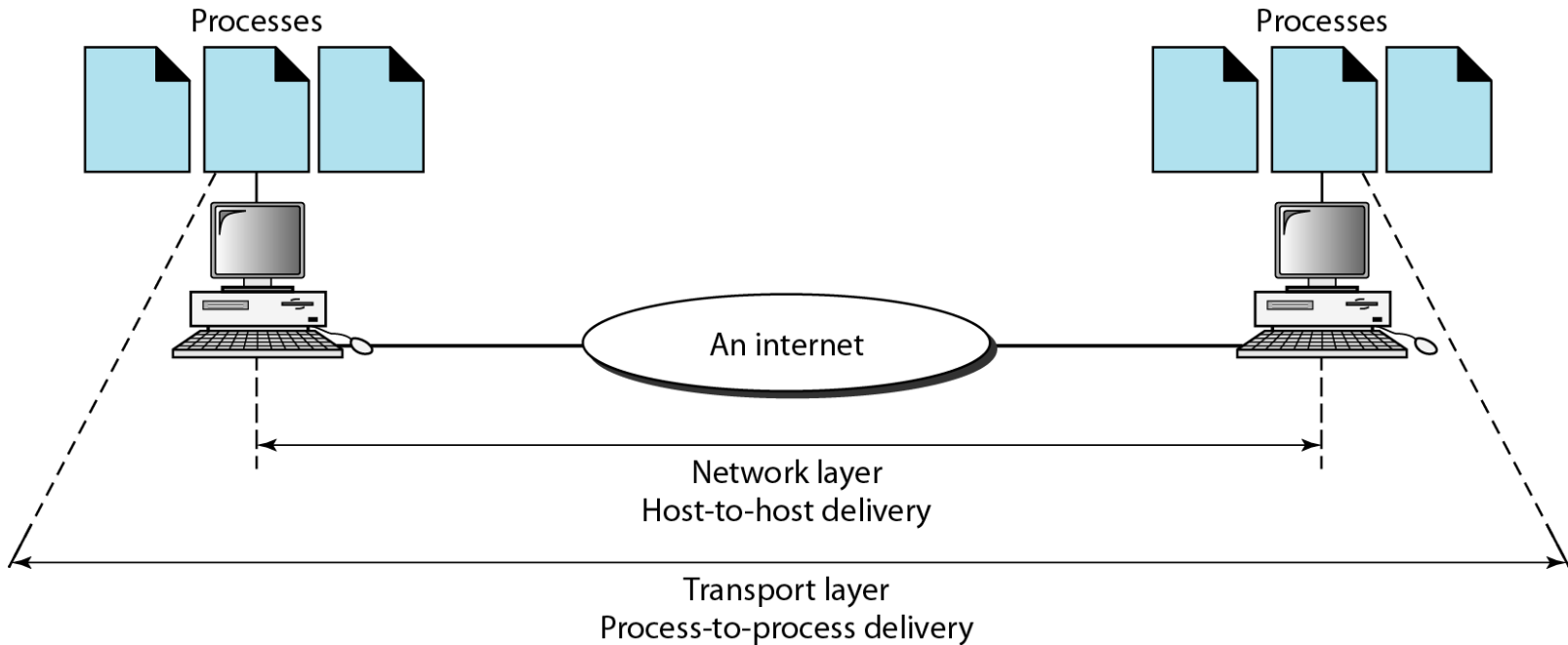
Transport layer

- The transport layer is responsible for the delivery of a message from one process to another.
 - Service-point addressing
 - Segmentation and reassembly
 - Connection control
 - Flow control
 - Error control

Segmentation and Reassembly



Reliable process-to-process delivery of a message



OSI REFERENCE MODEL

5. Session Layer

- a) Allows users on different machines to establish *sessions* between them.
- b) One of the services is managing dialogue control.
- c) Token management.
- d) Synchronization.

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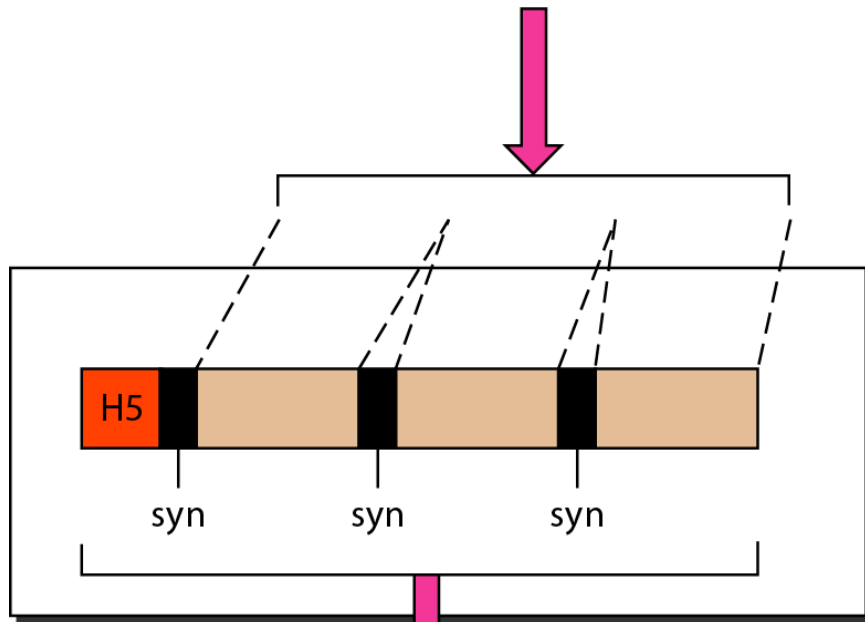
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Session layer

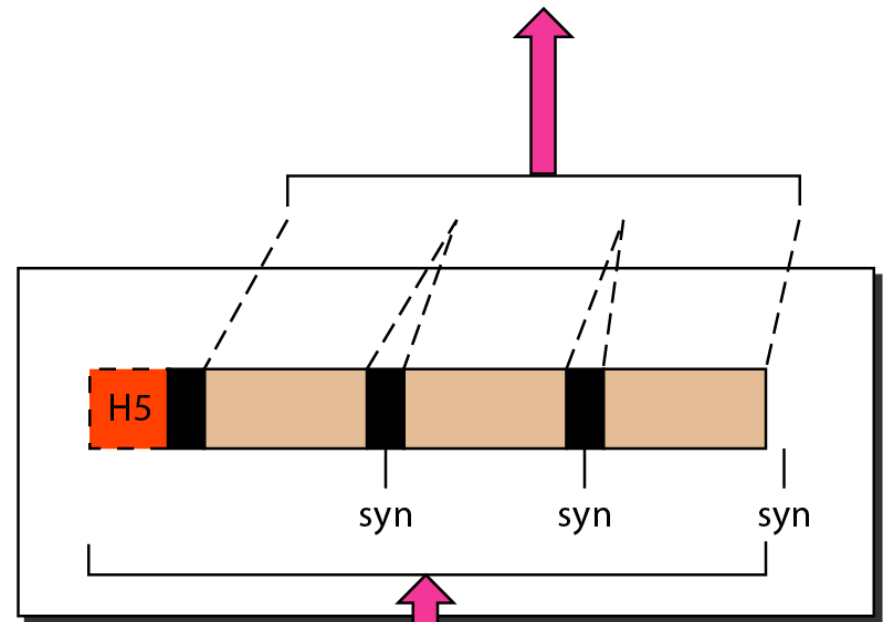
- The session layer is responsible for dialog

From presentation layer



To transport layer

To presentation layer



Session layer

From transport layer

OSI REFERENCE MODEL

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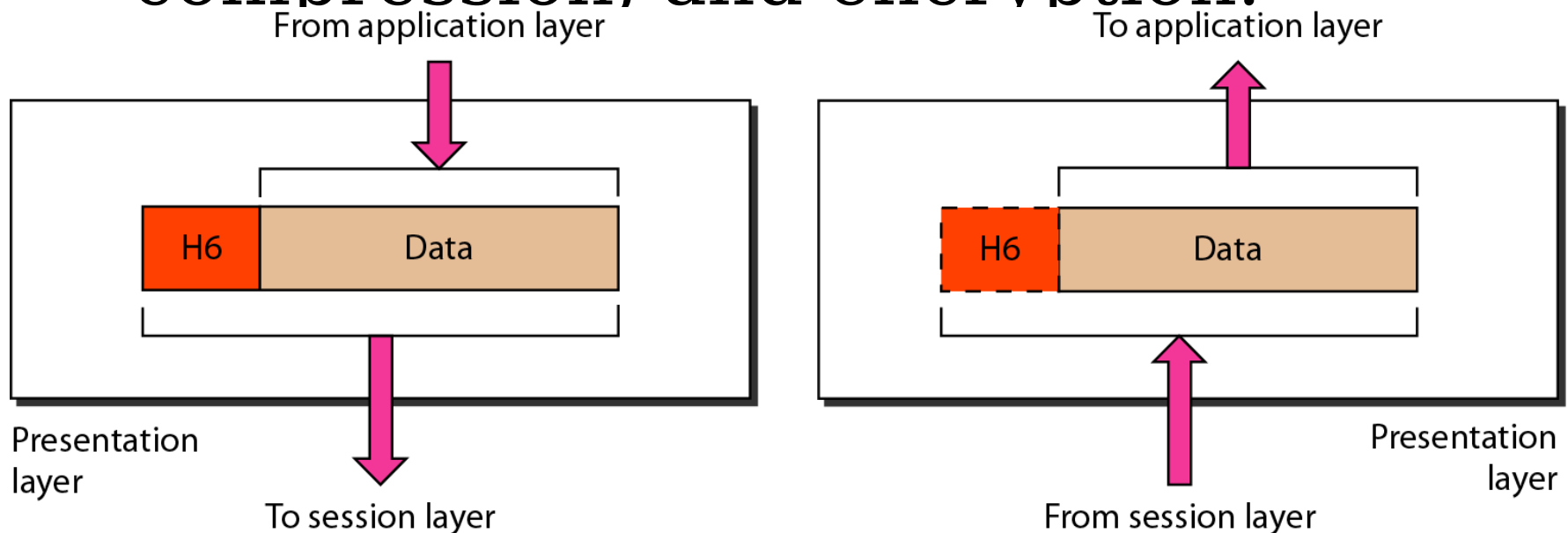
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6. Presentation Layer

- a) Concerned with the syntax and semantics of the information.
- b) Preserves the meaning of the information.
- c) Data compression.
- d) Data encryption.

Presentation layer

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



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OSI REFERENCE MODEL

7. Application Layer

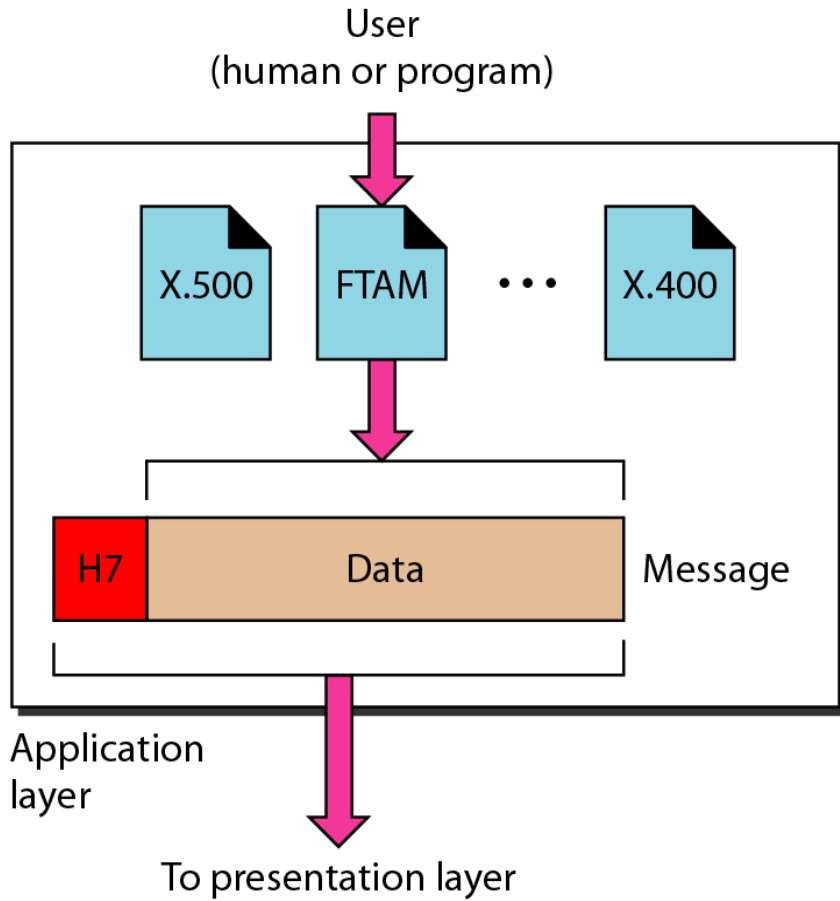
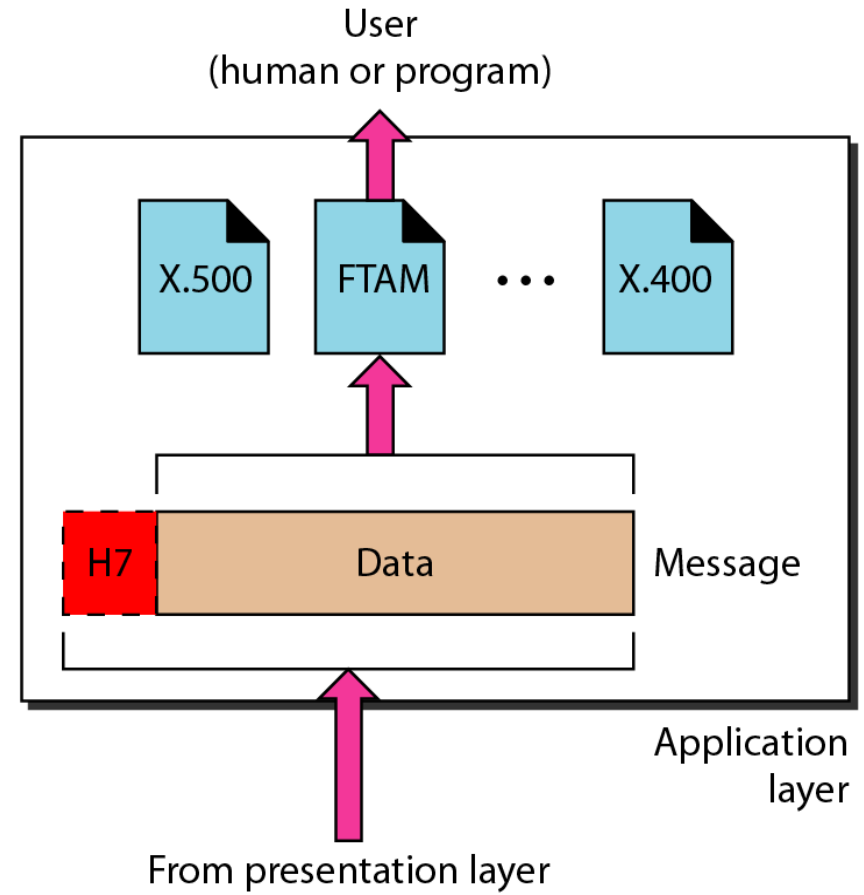
a) Provides protocols that are commonly needed.

Main topics:

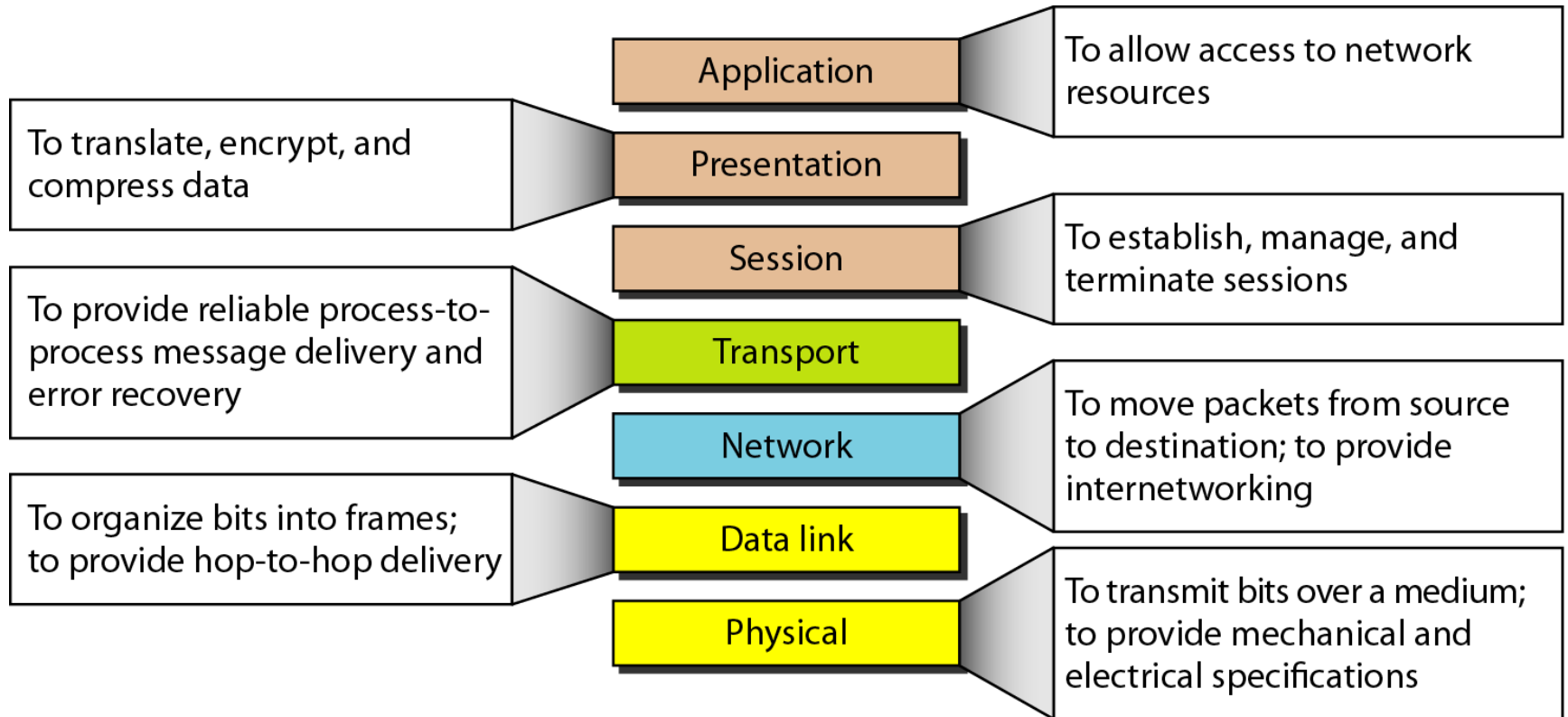
- File Transfer Protocol (FTP)
- HyperText Transfer Protocol (HTTP)
- Simple Mail Transfer Protocol (SMTP)
- Simple Network Management Protocol (SNMP)
- Network File System (NFS)
- Telnet

Application layer

- The application layer is



Summary of layers



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SERVICES

Connection-Oriented and Connectionless

Connection-Oriented – before data is sent, the service from the sending computer must establish a connection with the receiving computer.

Connectionless – data can be sent at any time by the service from the sending computer.

Q: Is downloading a music file from the Internet connection-oriented or connectionless?

Q: Is email connection-oriented or connectionless?

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SERVICES

3. Service Primitives

Request – entity wants the service to do some work

Indicate – entity is to be informed about an event

Response – entity responds to an event

Confirm – entity is to be informed about its request



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BANDWIDTH

The capacity of the medium to transmit data.

Analog Bandwidth

- Measurement is in Hertz (Hz) or cycles/sec.

Digital Bandwidth

- Measurement is in bits per second (bps).

Q: Is 100MHz = 100Mbps?

Q: Is 100Mbps = 100MBps?

