Computer Communication and Networks

OSI Reference Model

Session 2
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Learning Outcome:- At the end of the lesson, you are expected to be able to:

1. Sketch on OSI reference model.

2. Identify 7 layers of OSI model.

3. Underline the need for Layering.

4. Explain the encapsulation

5. Describe the data communication.

❖ **Introduction**:

➢ Emergence of different hardware and software vendors.

  ✓ Standardization was needed for interoperability

➢ In1947, **International Standard Organization** (ISO)-a multinational body dedicated to world wide agreement on international standard was established.

➢ In 1977, ISO established a subcommittee to develop communication architecture called **Open Systems Interconnection** (OSI) reference model.

➢ **OSI model is not a protocol**.

The OSI Model: purpose

❖ **Purpose of OSI model**:
  - ❏ To show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.

    - ✓ allows interoperability across all types of computer systems.
      - ▪ allows any two different systems to communicate regardless of their underlying architecture.
        - ○ Dell, IBM, Microsoft systems.

    - ✓ for understanding and designing a network architecture that is flexible, robust, and interoperable.

    - ✓ is layered architecture and its ordered.

❖ **7 layers of OSI model:**

➤ It consists of 7 separate but related layers.

➤ Each layer relies on the next lower layer and provide service to the next higher layer.
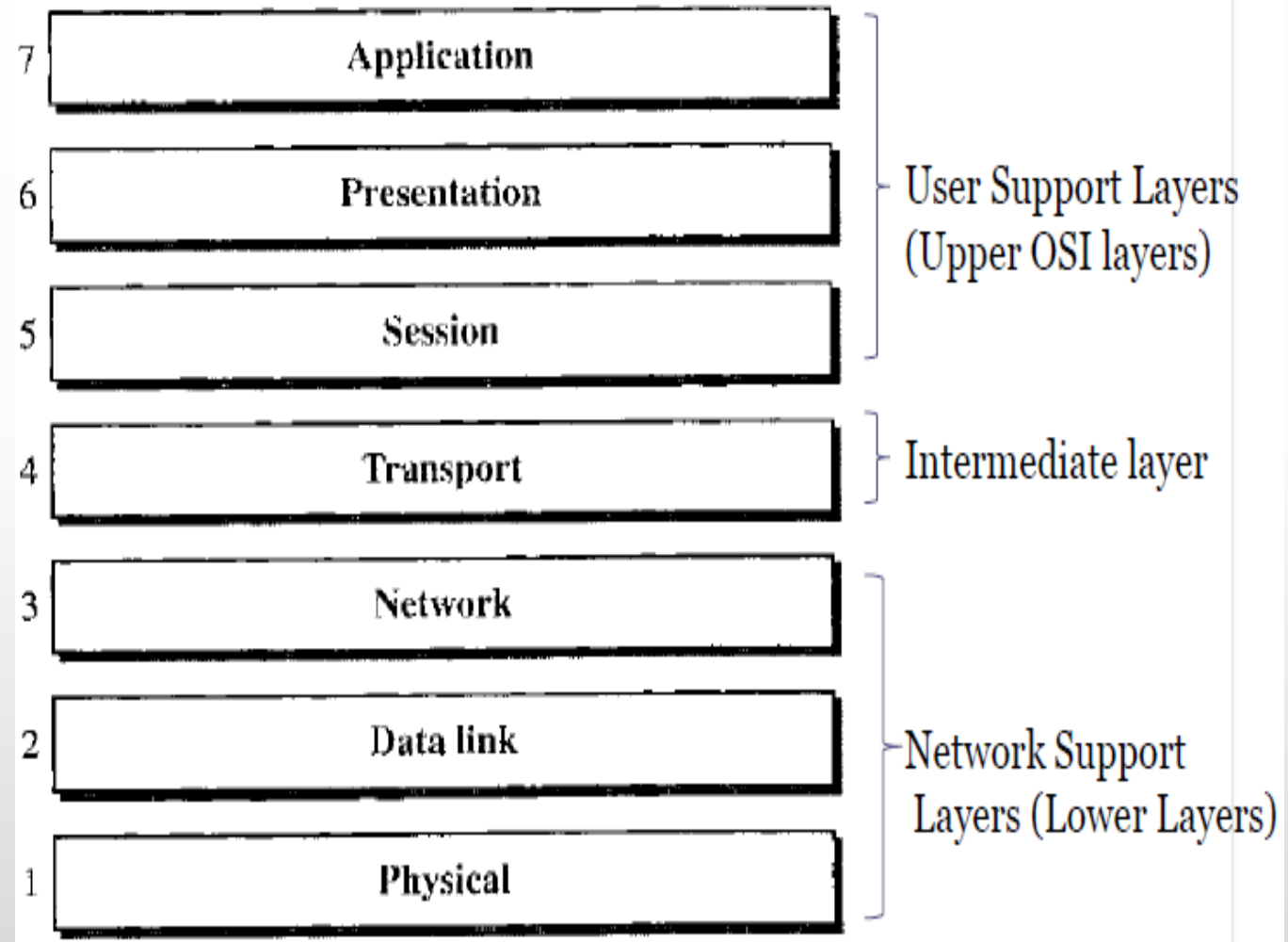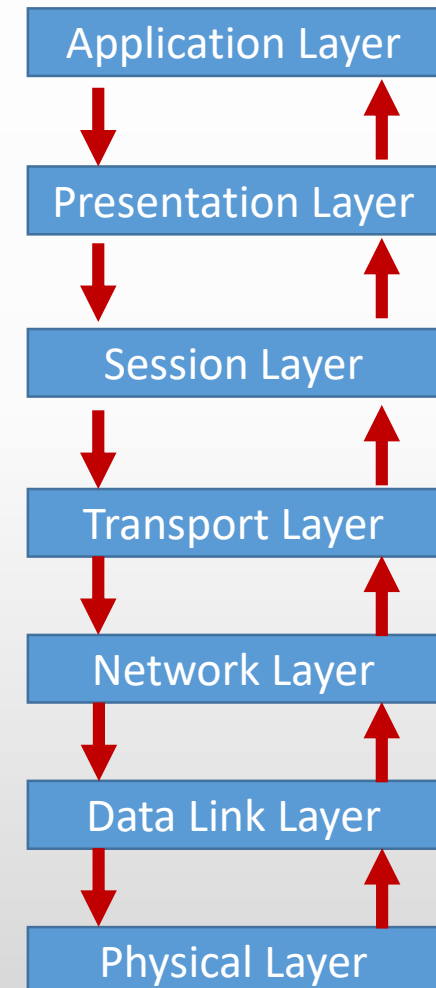
❖ **Organization of layers:**

➢ User support layers (Layer 5, 6, 7):- Upper Layers
  - ✓ Allow interoperability among unrelated software systems.
  - ✓ Almost use software only

➢ Network support layers (Layer 1, 2, 3):- Lower Layers
  - ✓ Deals with physical aspects of moving data from one device to another.
  - ✓ Used combination of hardware and software

➢ Intermediate layer (Layer 4):
  - ✓ Links upper layers and lower layers subgroups.
  - ✓ It ensures that delivering of exact data format from lower to upper layers is successful

The OSI Model: Layering

❖ **Layering:**

- ✓ To decompose communication into set of smaller, well-defined components.

- ✓ Components build on top of one another (layered).

- ✓ Each layer has a well-defined interface & clear responsibilities.

- ✓ Each layer can work-out independently

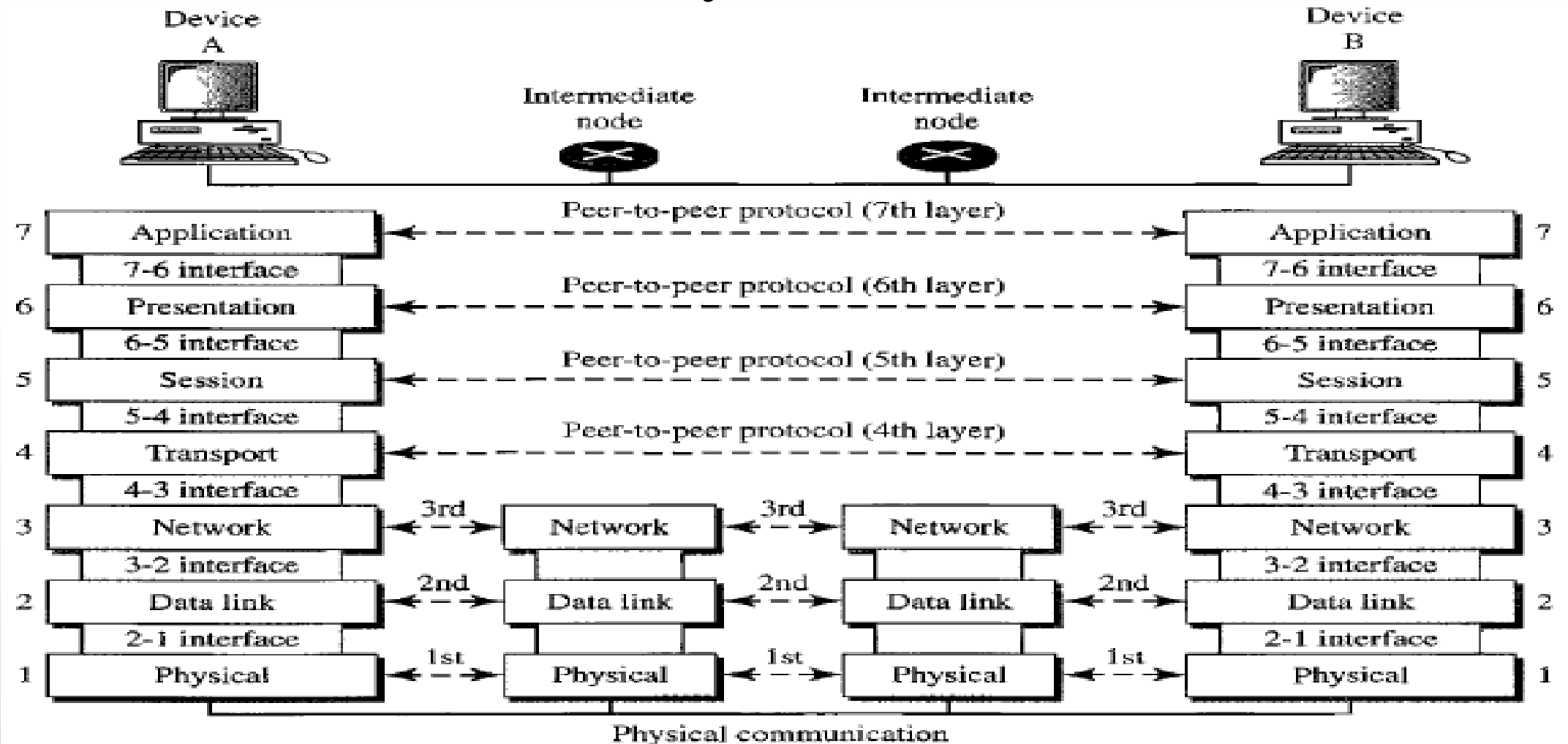| Application Layer |
| Presentation Layer |
| Session Layer |
| Transport Layer |
| Network Layer |
| Data Link Layer |
| Physical Layer |

❖ Principle of Layering:

- ✓ Data format.

- ✓ Packetization.

- ✓ Reliability, error checking.

- ✓ Congestion and flow control.

- ✓ Packet delivery and routing.

- ✓ Link delivery

- ✓ Signal Modulation and framing.

❖ **The interaction between layers:**

❖ **Peer-to-peer Process:**

➤ Lets take an example of communicating machine A and machine B.
  - ✓ Within single/individual machine, each layer depends upon the service of layer just below it. For example, Layer 3 uses service provided by Layer 2 and it provides service to Layer 4.
  - ✓ Between machines, layer n on one machine communicates with layer n on another machine.
    - ▪ Communication is governed by an agreed-upon series of rules and conventions called protocol.

➤ The process of each machine that communicate at a given layer is called Peer-to-Peer Process.

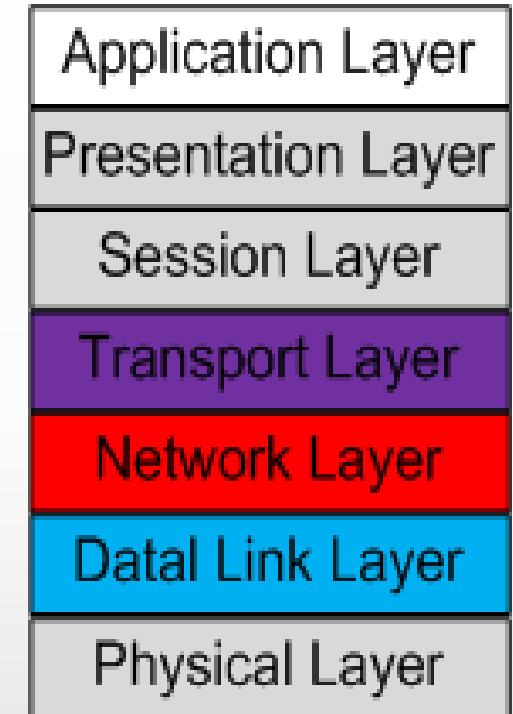➤ Each interface defines the information and services a layer must provide for the layer above.

❖ **Encapsulation:**

➢ A packet (header & data) at level 7 is encapsulated in a packet at level 6. The whole packet at level 6 is encapsulated in a packet at level 5 and so on. This concept is called Encapsulation.
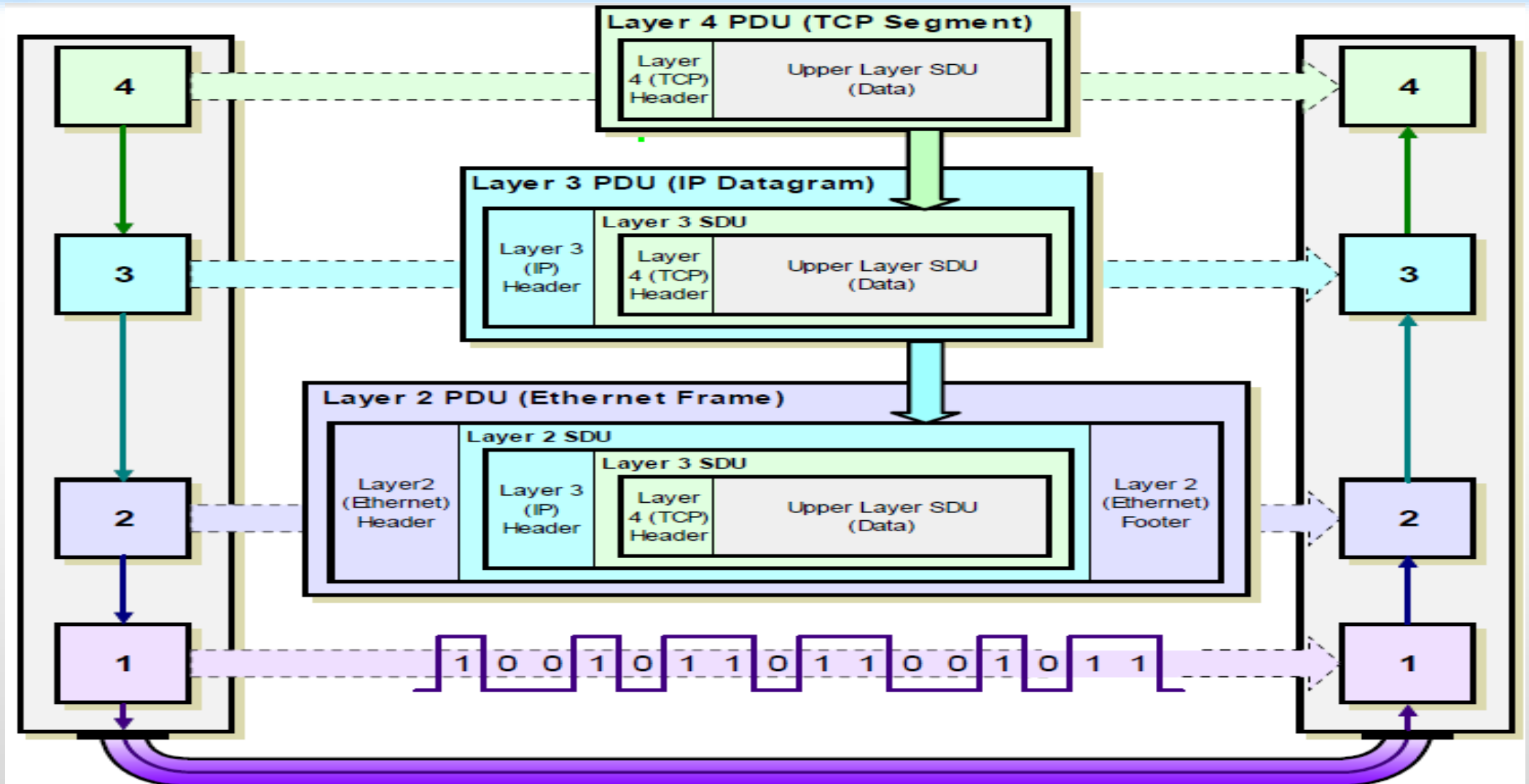
➢ Example:
- ✓ HTTP (Web) application payload in
- ✓ A TCP transport segment in
- ✓ An IP network packet in
- ✓ An Ethernet link frame

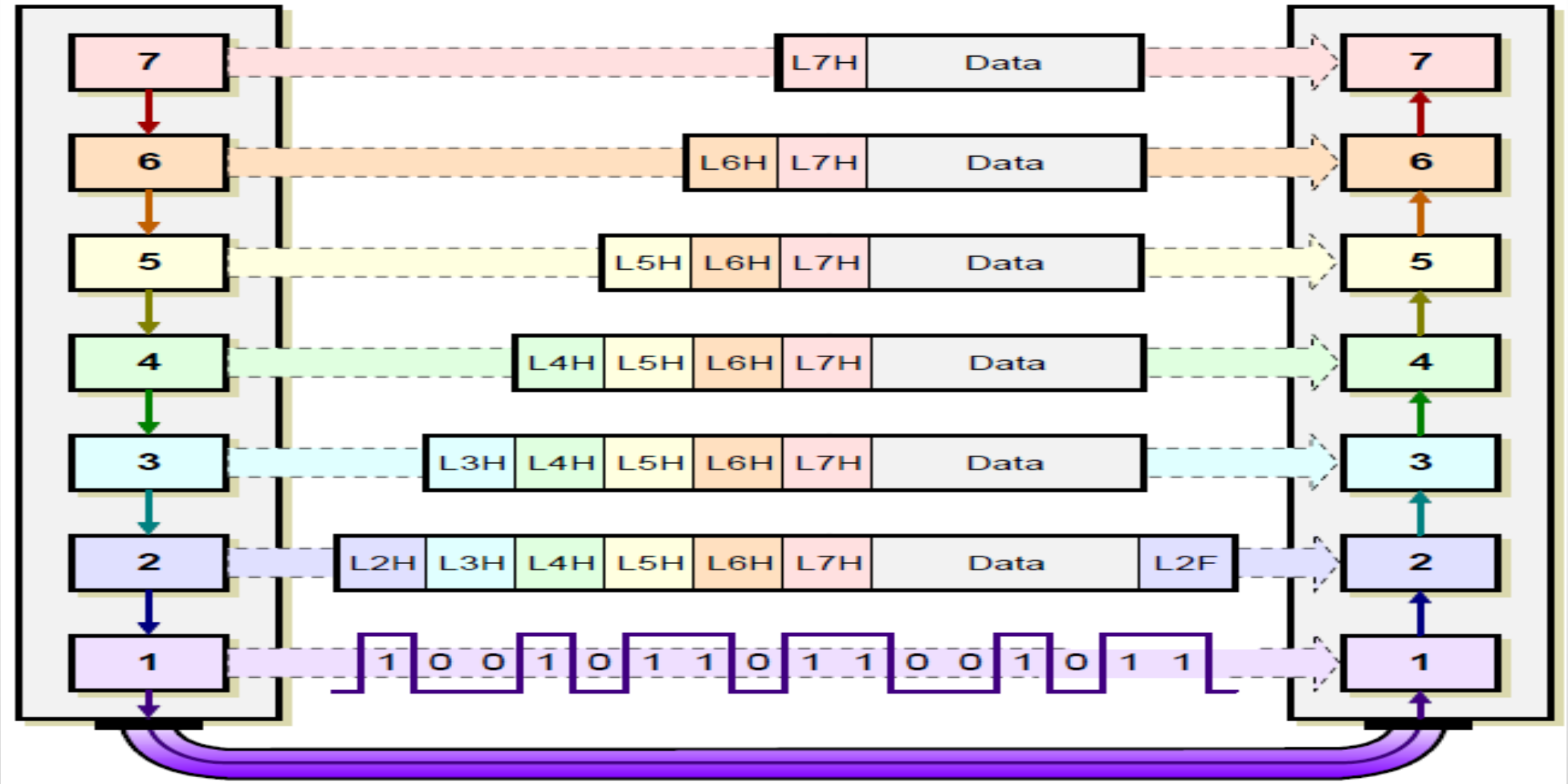| Application Layer |
| Presentation Layer |
| Session Layer |
| Transport Layer |
| Network Layer |
| Datal Link Layer |
| Physical Layer |

Application Data

The OSI Model: Encapsulation

❖ **Data Exchange:**

➢ D7 means Data unit at layer7 . D6 means Data unit at layer 6 and so on.

➢ Header and Trailer is added. **Trailer is added only in Layer 2.**

➢ When formatted data unit is reached at Physical layer, it changed into electromagnetic signal and transported along a physical link.

➢ Upon reaching destination, signal is transformed back to bits.
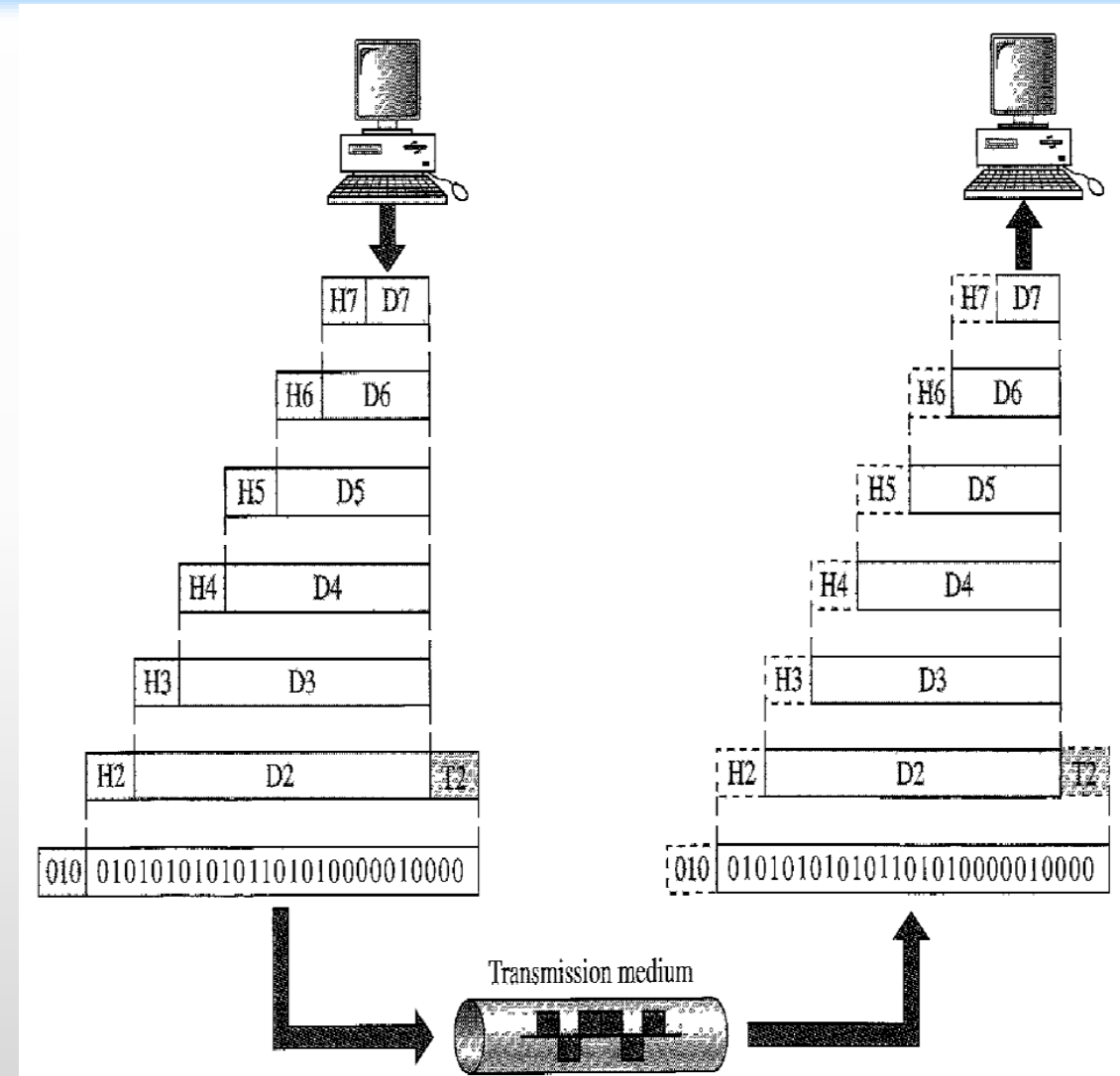
The OSI Model: Data Exchange

❖ **Data Communication:**

➢ When we communicate, we are sharing information. This sharing can be local or remote.

➢ Between individuals, local communication usually occurs face to face, while remote communication takes place over distance.

➢ The term telecommunication, which includes telephony, telegraphy, and television, means communication at a distance

❖ **Data Communication:**

➢ Data communications are the exchange of data between two or more devices in the computer network.

➢ The effectiveness of a data communications system depends on four fundamental characteristics:

1. Delivery
2. Accuracy,
3. Timeliness
4. Jitter

❖ **Data Communication:**

- ➢ **Delivery:** The system must deliver data to the correct destination. Data must be received by the intended device or user.

- ➢ **Accuracy:** The system must deliver the data accurately. Data that have been altered in transmission and left uncorrected are unusable.

❖ **Data Communication:**

➢ **Timeliness:** The system must deliver data in a timely manner. Data delivered late are useless.

➢ **Jitter:** Jitter means the variation in the packet arrival time. It is the uneven delay in the delivery.

➢ The five components of data communication are: Message, Sender, Receiver, Transmission Media and Protocol.

Recapitulation

> **We have learned:**

1. Emergence of OSI Model

2. 7 layers of OSI Model

3. Purpose and Layering architecture of OSI Model

4. Data communication from source to destination stations.

References

❖ **References:**

1. Stallings, W., Data & Computer Communication, Prentice-Hall

2. Tanenbaum, Computers Networks, PHI

3. Forouzan, B.A., Data Communication & Networkings, 4th Edition.

4. Mr. Yeshi Wangchuk's CCN Class Slides (2014), College of Science and Technology, Rinchending, Phuentsholing, Bhutan

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