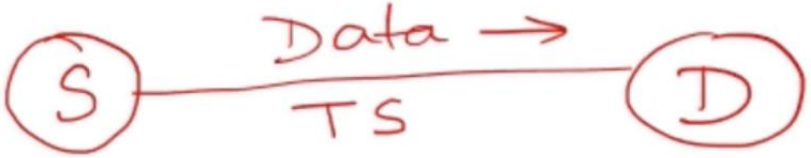
13 Tasks

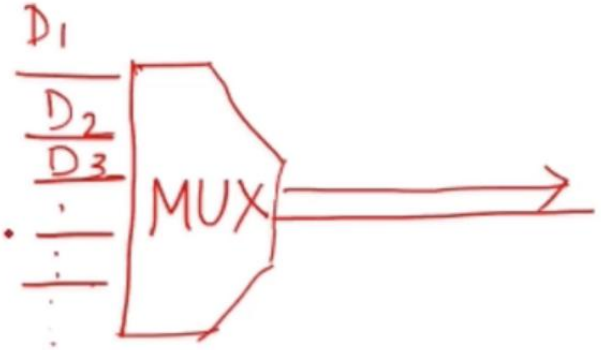
1. Transmission system utilization
2. Interface
3. Signal generation
4. Synchronization
5. Exchange Management
6. Error detection and correction
7. Flow control
8. Addressing
9. Routing
10. Recovery
11. Message formatting
12. Security
13. Network Management

Tasks 1 & 2

Transmission system utilization



Resource
frequency / channels
Time



Multiplexing

Time Slots
D_1, D_2, D_3 .....
Df_1, Df_2 .....

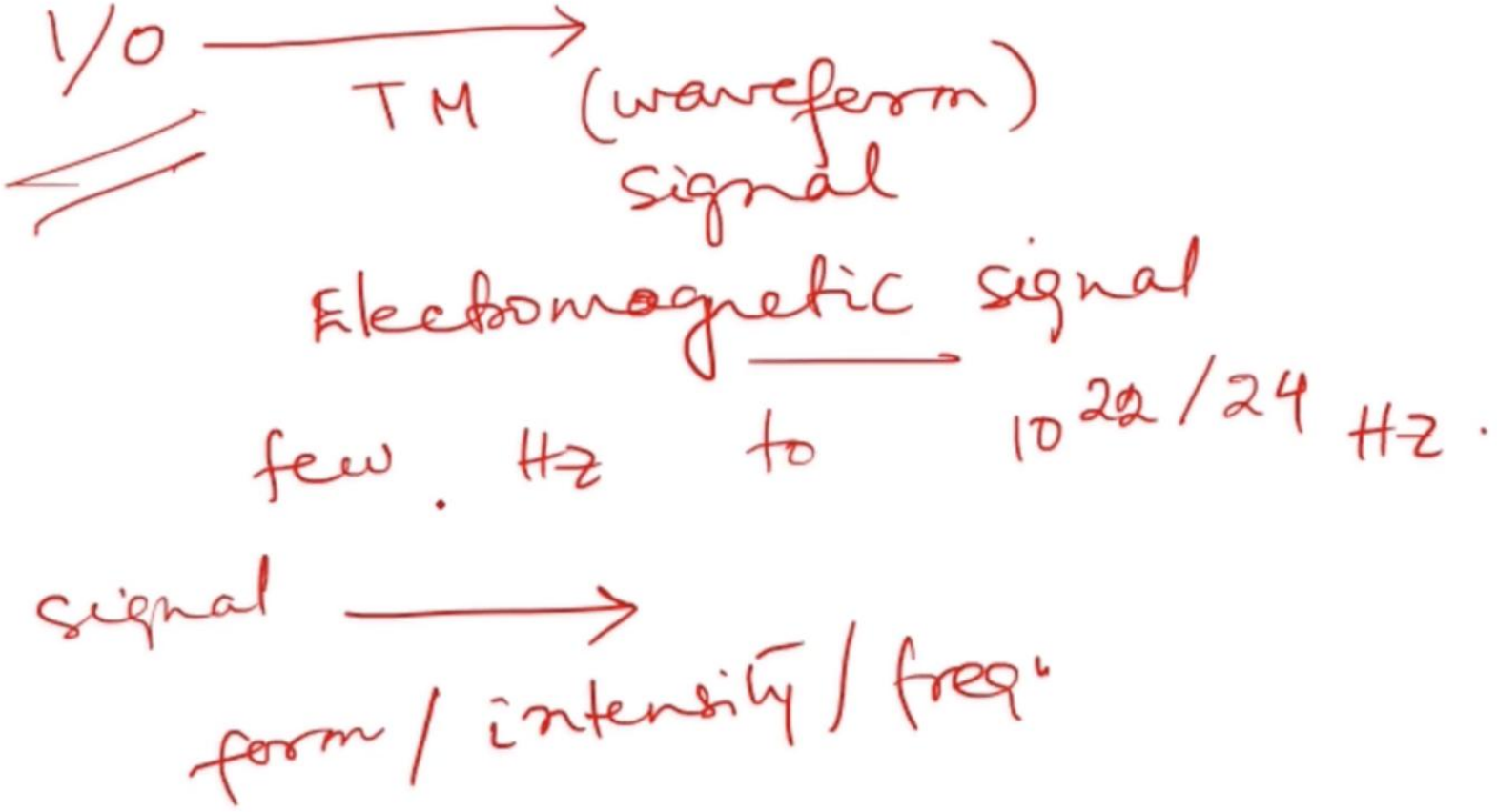
Tasks 1 & 2

Transmission system utilization

Interface — Physical Connection of device to the TS/TM Ethernet port / RJ45 Connector.

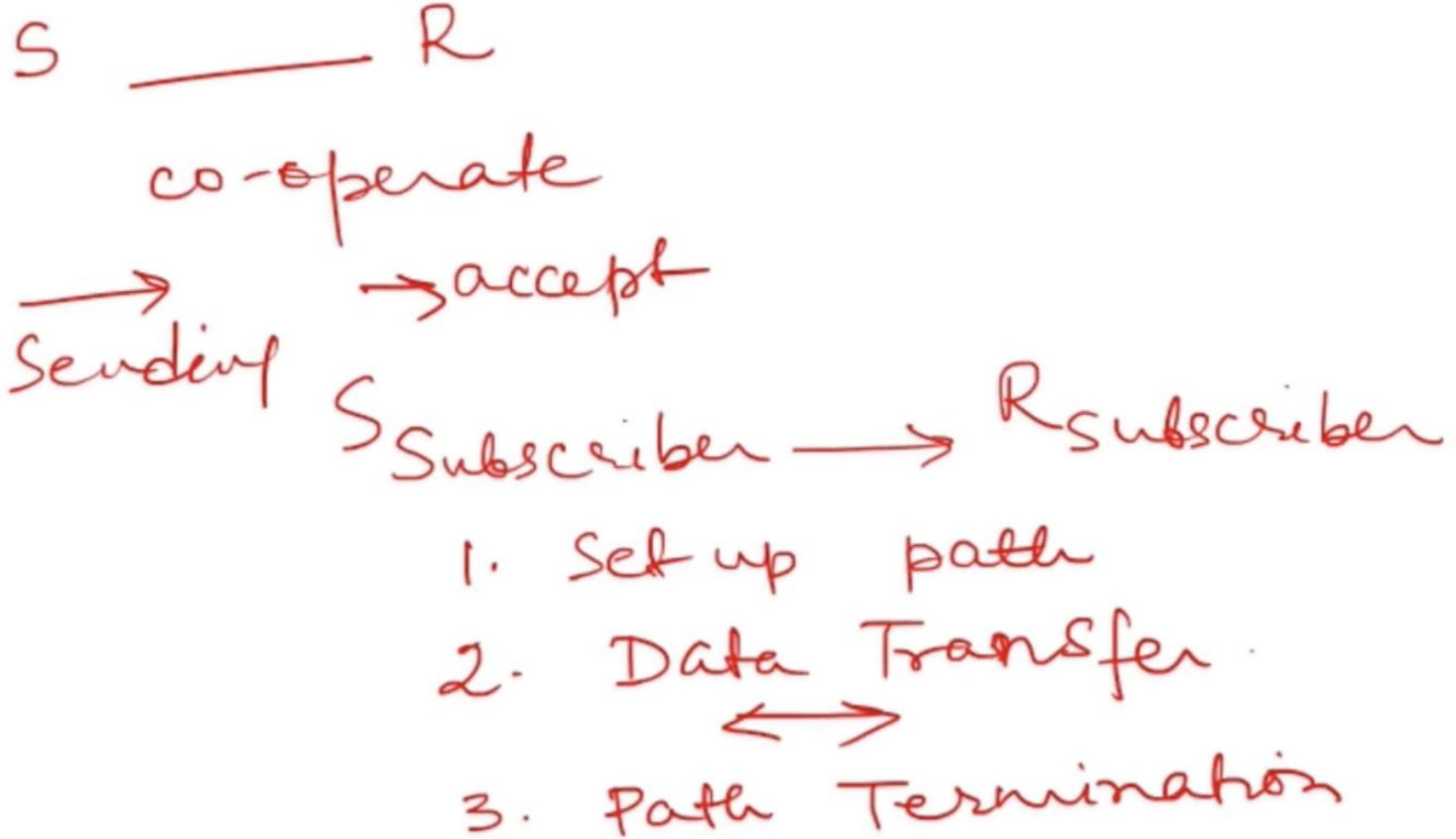
Tasks 3 & 4

Signal generation



Tasks 5 & 6

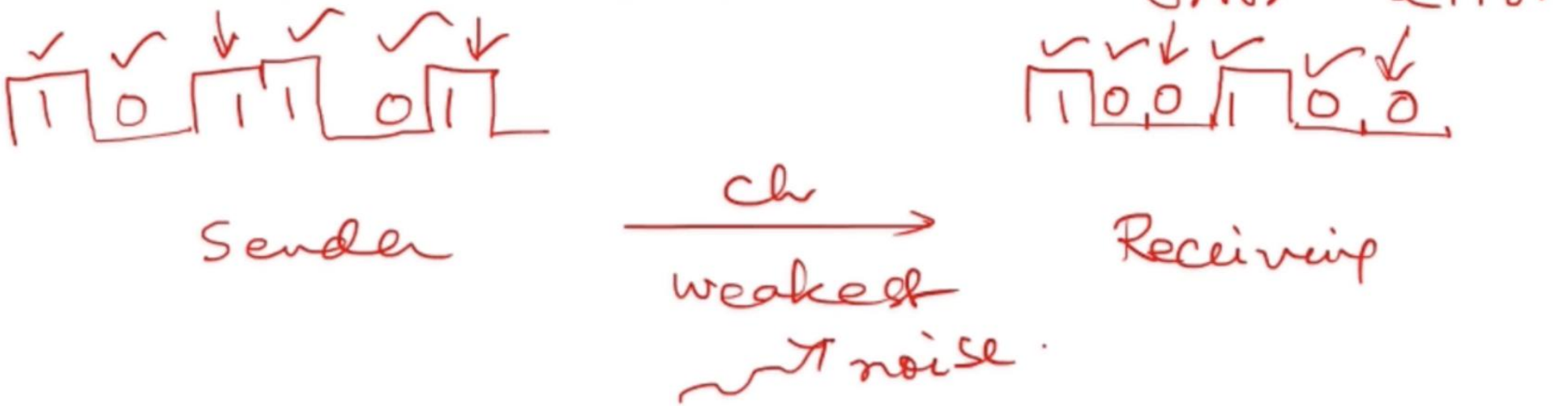
Exchange Management



Tasks 5 & 6

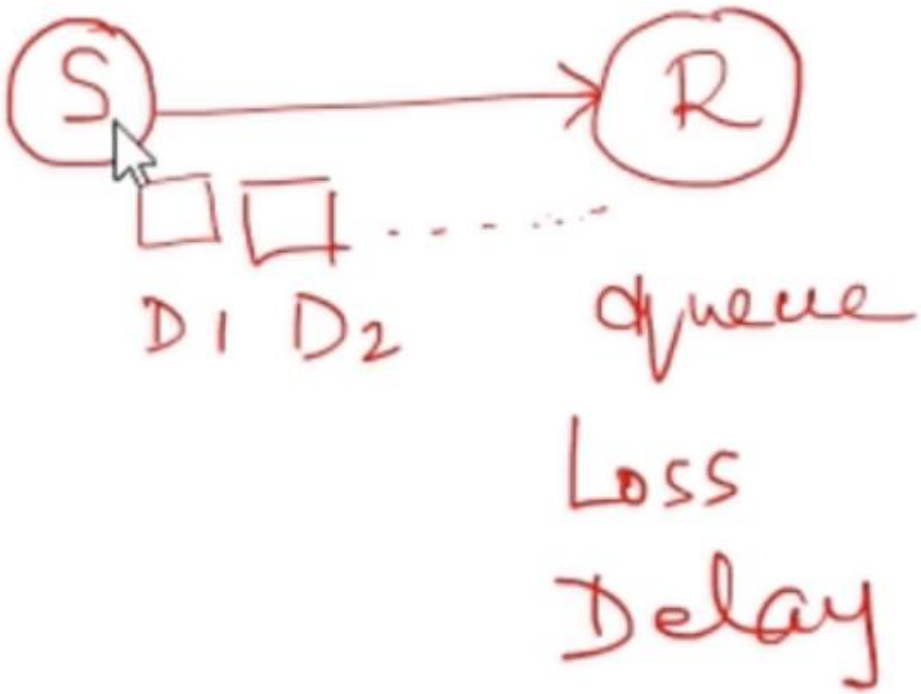
Exchange Management

Error detection and correction



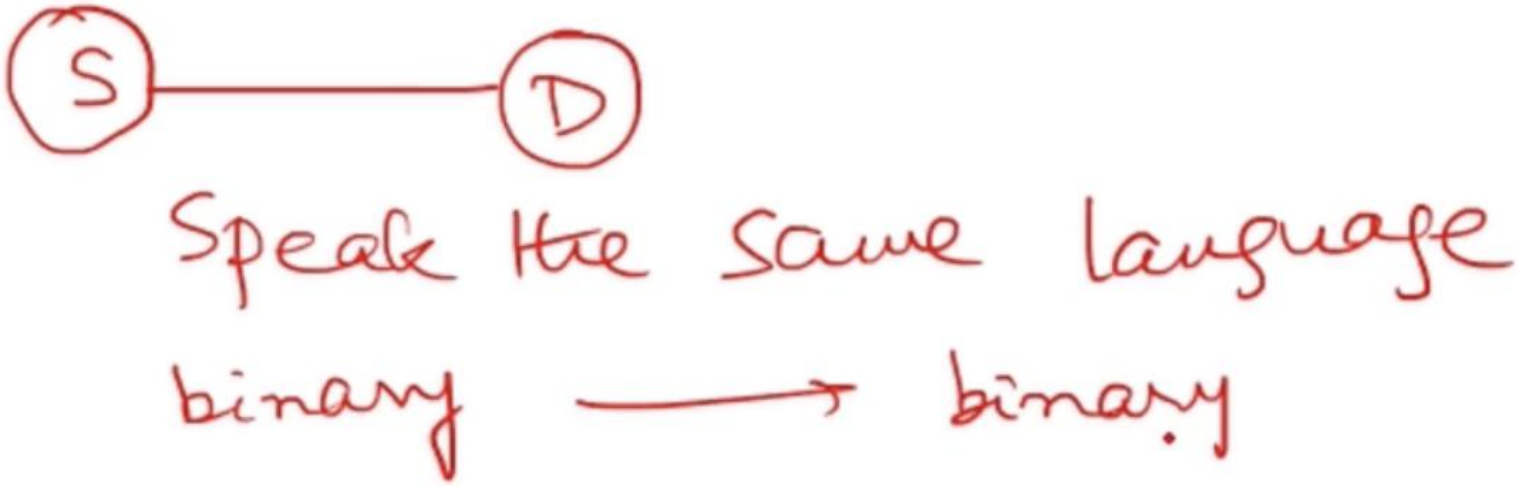
Tasks 7 & 8

Flow control



Tasks 11, 12, 13

Message formatting



Tasks 11, 12, 13

Message formatting

Security

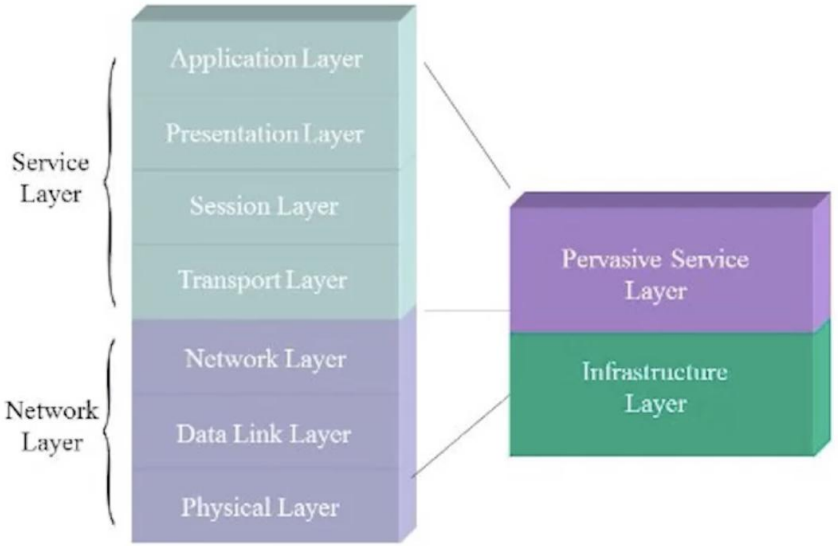
-Authentication
-Access Control
-Data Confidentiality
-Data Integrity
-Non Repudiation
-Availability

Network Management

System Configuration
Monitoring
→ overloads/failures
→ future growth

OSI Model: Overview & Purpose

- A conceptual framework that standardizes the functions of a network into 7 distinct layers
- Developed by the International Organization for Standardization (ISO) in 1984
- Provides a common language and reference for network designers, vendors, and administrators
- The primary purpose is to simplify network communication by dividing the complex process into smaller, more manageable functions



OSI Sever Layer Model

Fundamentals of OSI Model

Layers		Protocol Data Unit	Functions
7. Application	Host layers	Data	APIs
6. Presentation		"	Translation, compression/Encryption
5. Session		"	Dialogs —
4. Transport		Data Segment	End to End Reliable Delivery
3. Network		Packets	Routing Addressing
2. Data Link	Media layers	Frames	Reliable — node to node
1. Physical		Symbols	Raw bit Streams →

OSI Model: Layers

Let's discuss each layer of the OSI Model, starting from the bottom and working our way up.

- **Layer 1 - Physical Layer:**
  - Deals with the physical aspects of network communication such as cables, connectors, and electrical signals
  - Responsible for transmitting raw bits of data over the network medium
  - Defines characteristics of the physical connection such as voltage levels, timing, and data rates

Data Link Layer

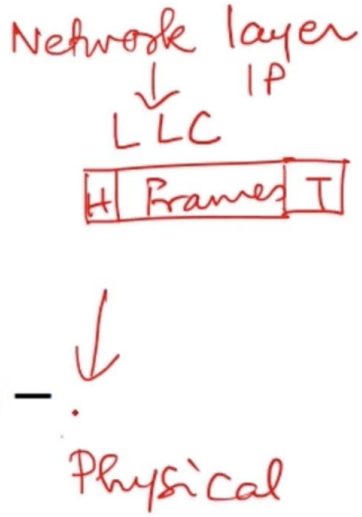
- Used for error free transfer of data frames
- Unique identification of each device
- Translating bits to frames
  - Physical addressing
  - Flow control
  - Error control
  - Access control

MAC = NIC

checksum / CRC

Data Link Layer

- Logical link control (LLC) –
- Medium access control (MAC) –



OSI Model: Layers (Cont.)

- **Layer 2 - Data Link Layer:**
  - Responsible for organizing raw bits into structured data packets called frames
  - Ensures reliable data transmission by detecting and correcting errors that may occur at the Physical Layer
  - Manages access to the shared network medium through techniques such as Media Access Control (MAC) addressing and flow control

- **Layer 3 - Network Layer:**
  - Responsible for routing data packets between networks and determining the best path for data transmission.
  - Uses logical addressing, such as IP addresses, to identify devices on the network and make routing decisions.
  - Handles fragmentation and reassembly of data packets when necessary

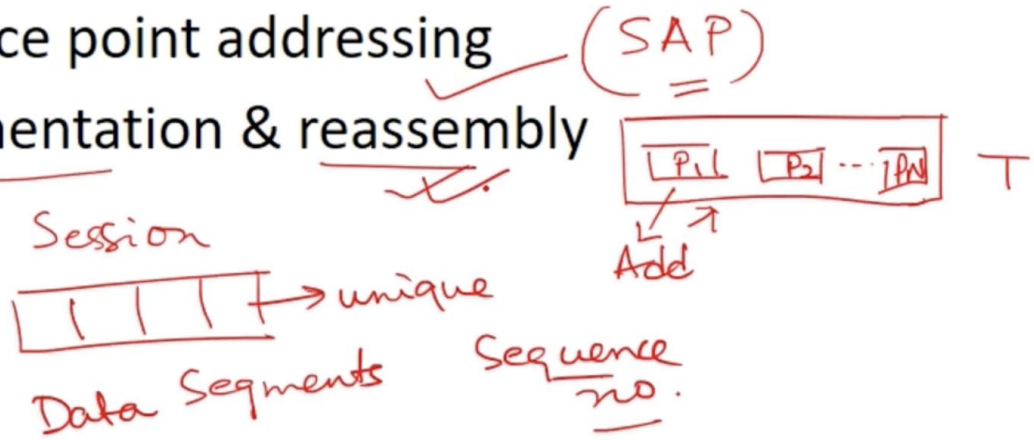
OSI Model: Layers (Cont.)

- **Layer 4 - Transport Layer:**
  - Responsible for establishing, maintaining, and terminating connections between devices on the network
  - Provides reliable and efficient data transmission by managing error detection, flow control, and congestion control
  - Uses protocols such as Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) to ensure data is transmitted accurately and in the correct sequence

- **Layer 5 - Session Layer:**
  - Responsible for establishing, maintaining, and terminating sessions between devices on the network
  - Coordinates the communication process by managing the exchange of data and synchronizing data flows
  - Provides mechanisms for recovery in case of communication failures

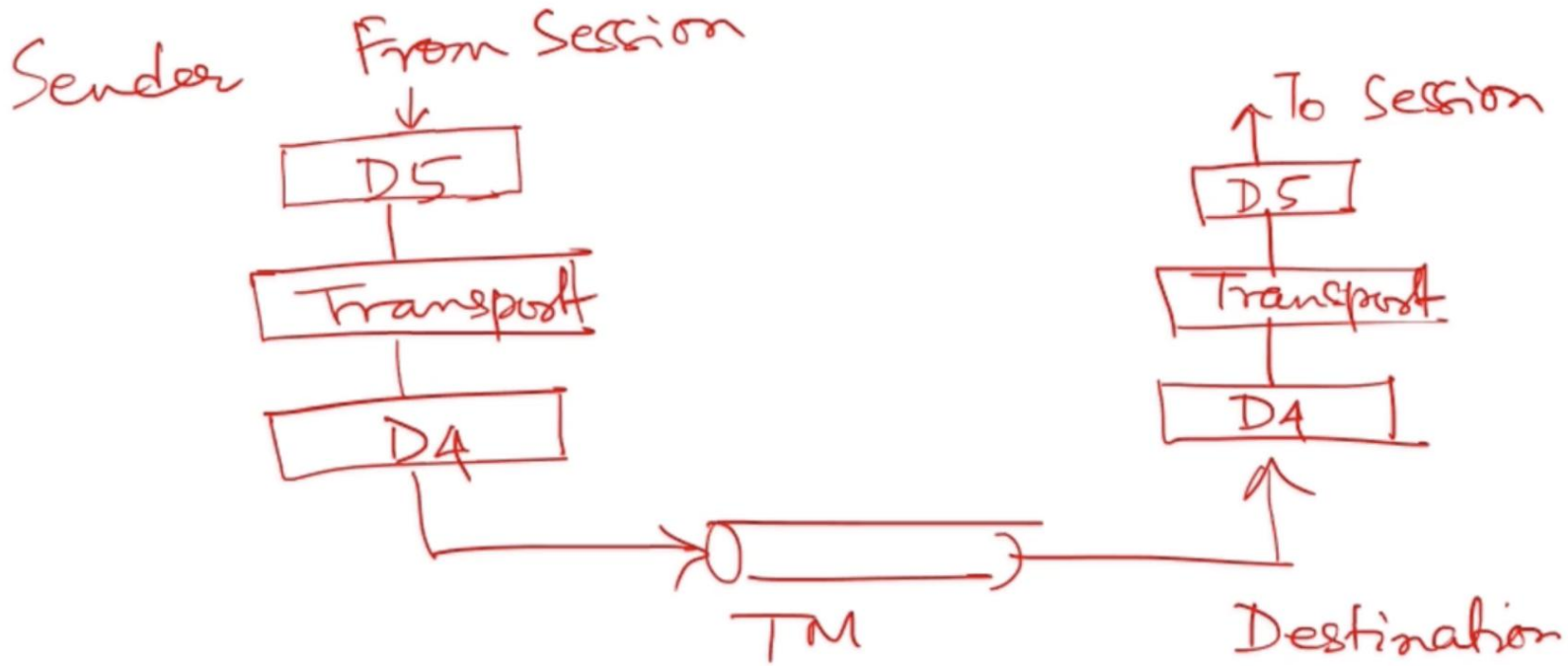
Transport Layer

- Functionalities:
  - Service point addressing (SAP)
  - Segmentation & reassembly



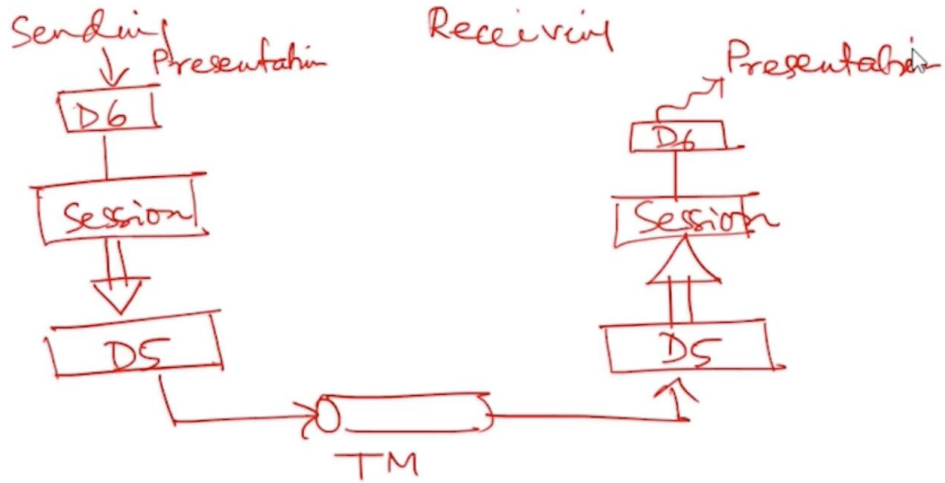
Transport Layer

- Flow Diagram



Session Layer

- Flow diagram



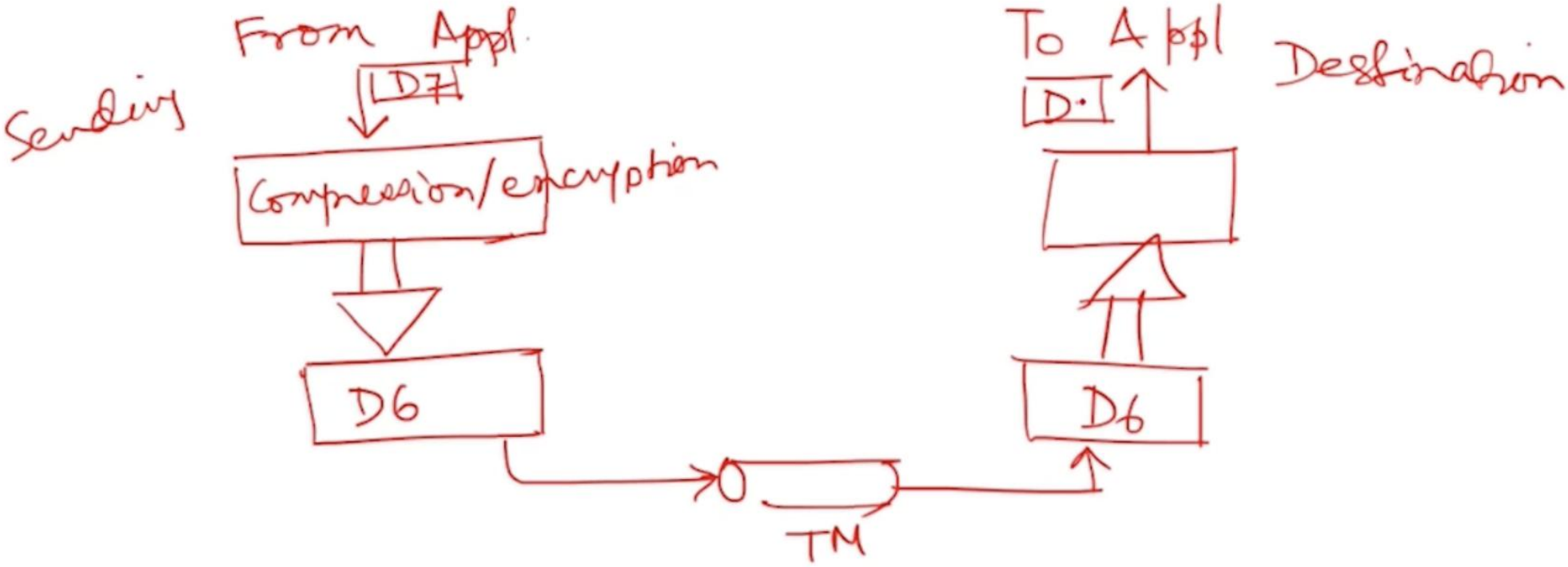
OSI Model: Layers (Cont.)

- **Layer 6 - Presentation Layer:**
  - Responsible for translating, encrypting, and compressing data to ensure it is transmitted in a format that both the sender and receiver can understand
  - Handles data conversion, character encoding, and encryption tasks to maintain data integrity and confidentiality

- **Layer 7 - Application Layer:**
  - The highest layer of the OSI Model and responsible for providing the interface between users and the network
  - Encompasses the protocols and services that enable users to access and utilize network resources, such as email, file transfers, and web browsing

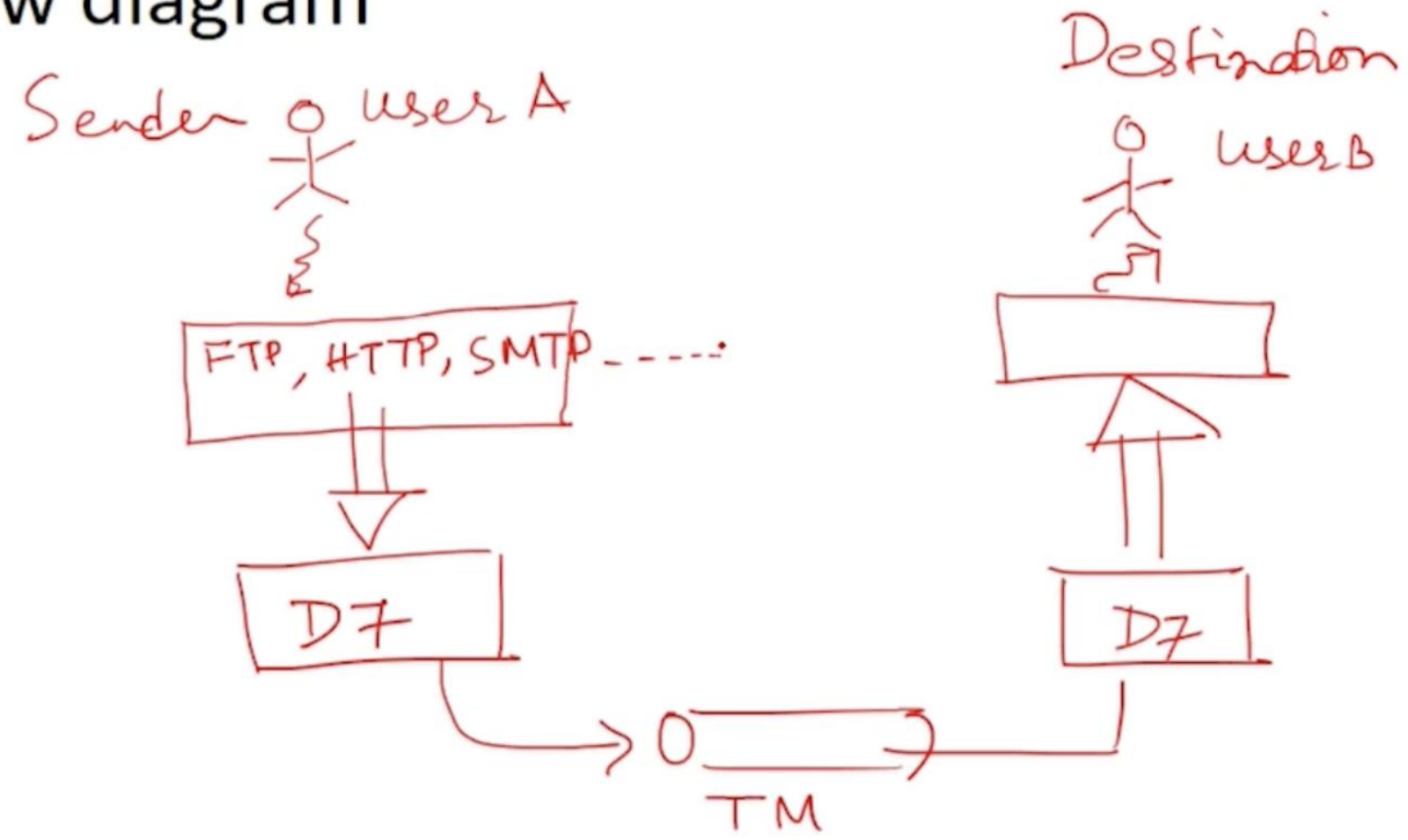
Presentation Layer

- Flow diagram



Application Layer

- Flow diagram



OSI Model: Applications

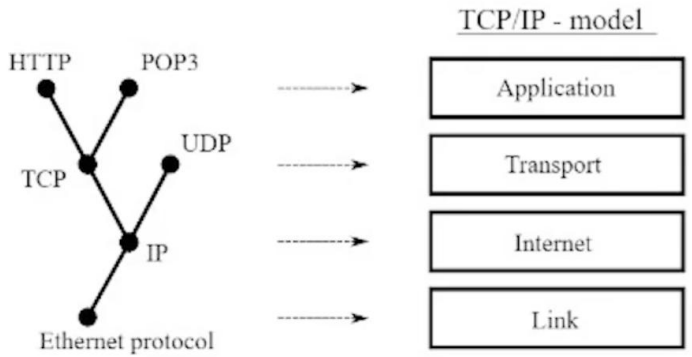
The OSI Model serves as a valuable reference for understanding, designing, and troubleshooting networks. Its applications include:

- **Standardization:**
  - Provides a common language for network designers, vendors, and administrators
  - Promotes interoperability and compatibility between devices and protocols

- **Network Design:**
  - Simplifies the network design process by breaking down network communication into manageable layers
  - Allows engineers to focus on specific aspects of data transmission and optimize network performance

TCP/IP Model: Overview & Purpose

- TCP/IP Model (Transmission Control Protocol/Internet Protocol Model) is also called the Internet Protocol Suite
- A set of networking protocols that form the foundation of the modern Internet
- Developed by the U.S. Department of Defense in the 1970s
- A more practical and streamlined alternative to the OSI Model
- The primary purpose is to provide a set of rules and standards for data transmission over networks, enabling devices to communicate with each other reliably and efficiently



TCP/IP Model: Layers

Let's discuss each layer of the TCP/IP Model, starting from the bottom.

- **Layer 1 - Network Interface Layer:**
  - Responsible for transmitting data packets over the network medium
  - Encompasses the functions of the Physical Layer and Data Link Layer of the OSI Model
  - Error detection, flow control, and MAC addressing

- **Layer 2 - Internet Layer:**
  - Responsible for routing data packets between networks and ensuring that data is transmitted reliably and efficiently
  - Uses IP addressing and routing protocols, such as the Internet Protocol (IP) and the Internet Control Message Protocol (ICMP), to direct data packets to their intended destinations

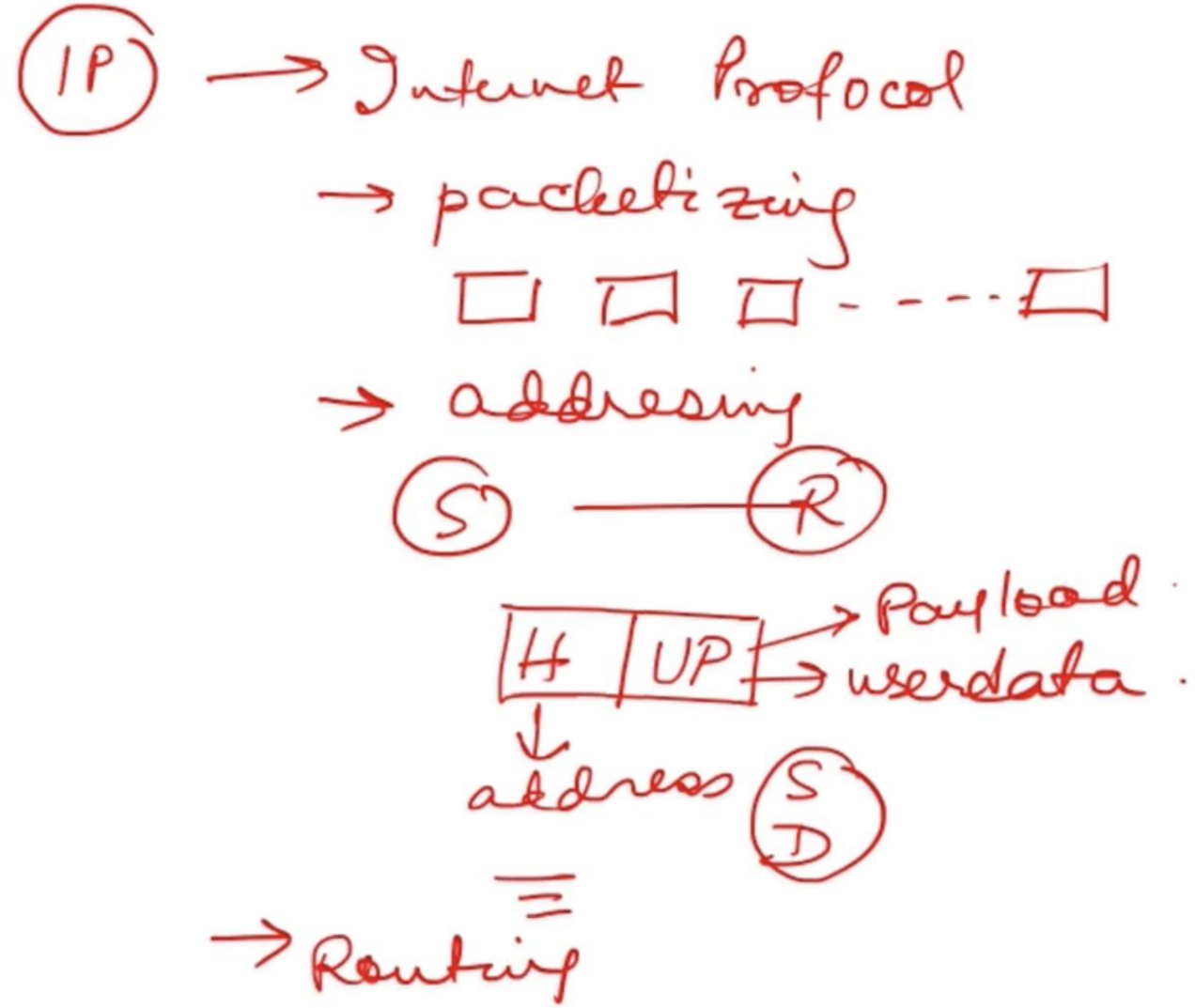
TCP/IP Model: Layers (Cont.)

- **Layer 3 - Transport Layer:**
  - Responsible for establishing, maintaining, and terminating connections between devices on a network
  - Provides reliable and efficient data transmission by managing error detection, flow control, and congestion control
  - TCP (Transmission Control Protocol) and UDP (User Datagram Protocol)

- **Layer 4 - Application Layer:**
  - The highest layer of the TCP/IP Model
  - Responsible for providing the interface between users and the network
  - Encompasses the protocols and services that enable users to access and utilize network resources
  - Email, file transfers, and web browsing
  - Corresponds to the Session, Presentation, and Application Layers of the OSI Model

TCP/IP Layers

Internet



TCP/IP Layers

Internet

— ARP → Address Resolution Protocol

→ physical address of the device

Sender → ARP Request
Broadcast

Receiver → ARP Reply
→ physical address

TCP/IP Layers

Internet

— ICMP

— Internet Control Message Protocol

→ fault of the datagram

→ not reachable/device

→ device is not responding

TCP/IP Model: Applications

The TCP/IP Model is the backbone of the modern Internet and is widely used in network design and implementation. Its applications include:

- **Internet Communication:**
  - The foundation for all communication over the Internet
  - Enables devices to exchange data and access online resources

- **Network Design:**
  - The TCP/IP Model serves as a practical reference for designing networks
  - Allows engineers to optimize network communication for better performance

OSI Vs. TCP/IP Model

- The OSI Model provides a comprehensive and theoretical framework for network communication
- The TCP/IP Model offers a more practical and implementation-focused perspective
- Both models are important for understanding and designing computer networks
- Understanding the TCP/IP Model and its layers enables efficient and secure network design, building, and management
- Knowledge of the TCP/IP Model is essential for troubleshooting issues that may arise during network operation