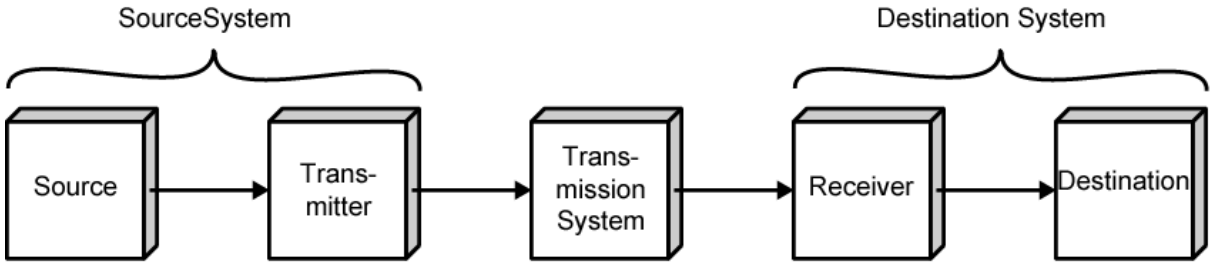
Network Model Architecture

LECTURE-1

Data Communication

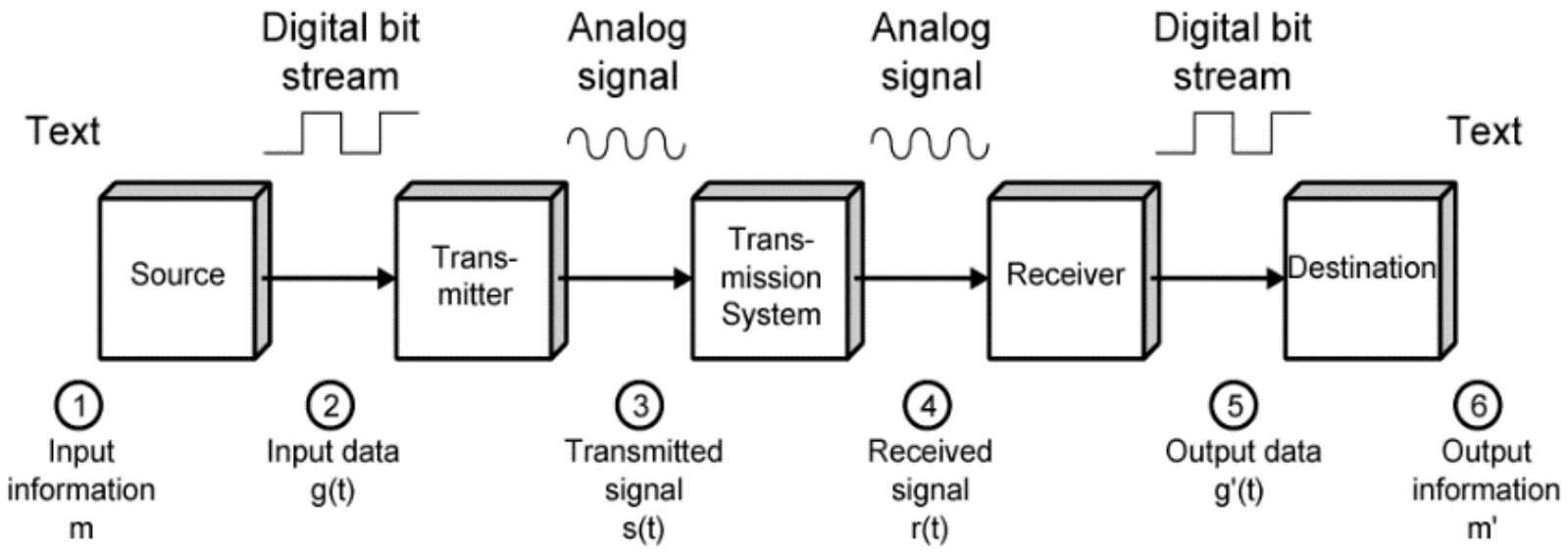
Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable.



(a) General block diagram

(b) Example

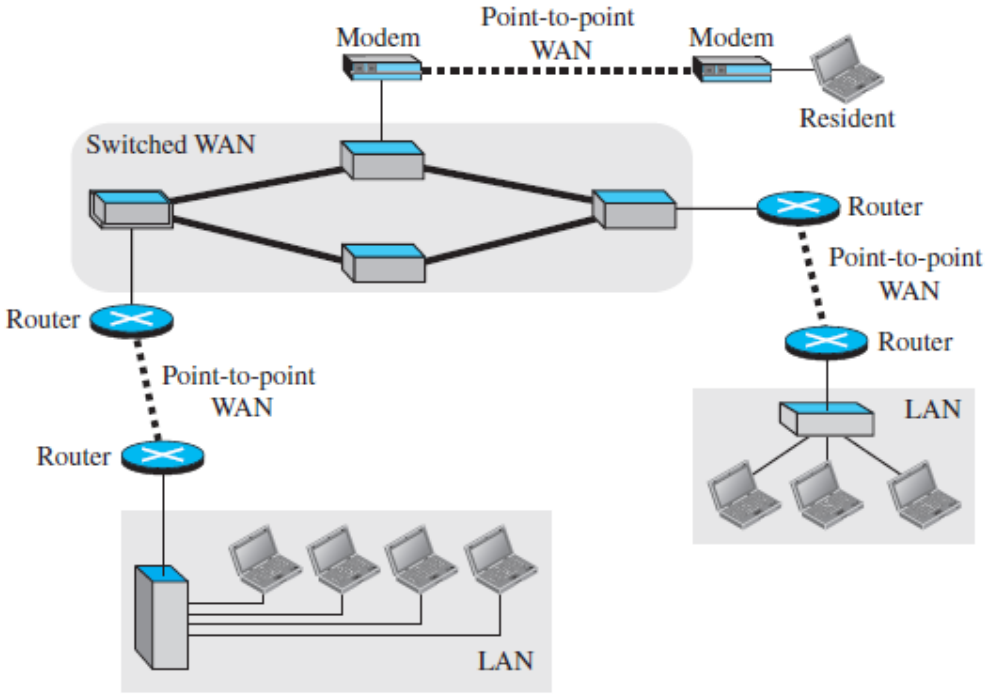
Data Communication Cont.



Network

A network is a set of devices (often referred to as nodes) connected by communication links.

A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.



Network Models

A network is a combination of hardware and software that sends data from one location to another.

Hardware → consists of the physical equipment that carries signals from one point of the network to another.

Software → consists of instruction sets that make possible the services that we expect from a network.

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.

Purpose of Layered Tasks:

1. Troubleshooting
2. Standards
3. Change

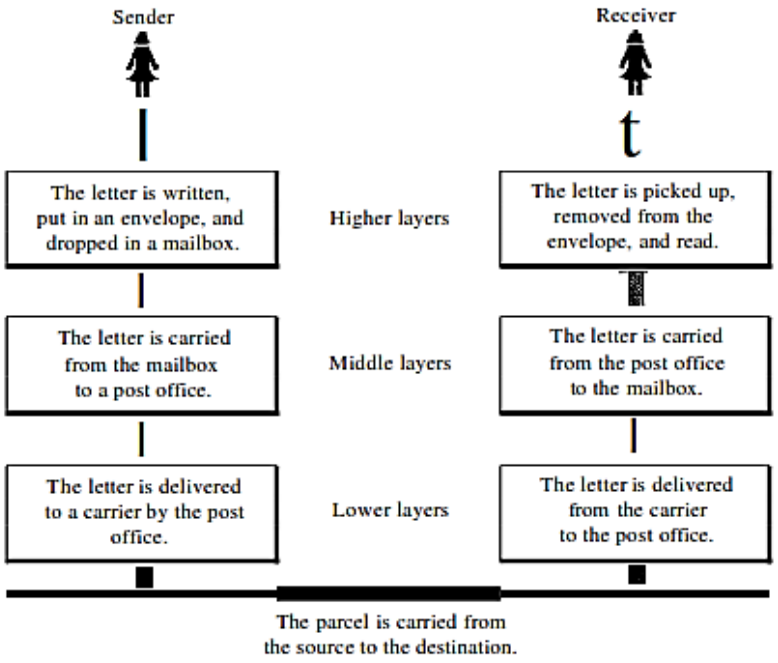
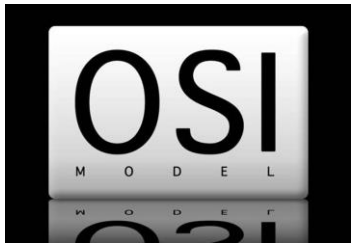


Fig: Tasks involved in sending a letter

OSI Model

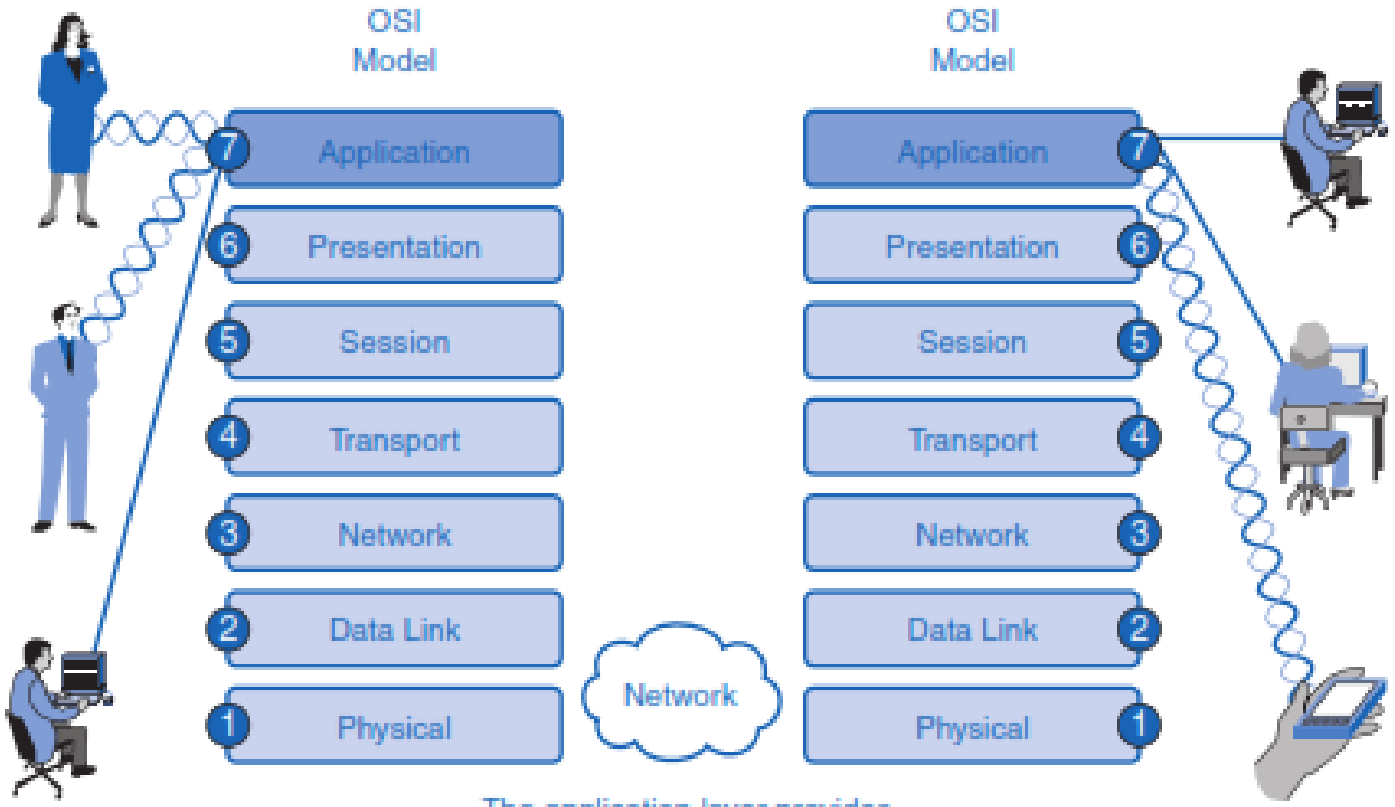
Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO standard that covers all aspects of network communications is the Open Systems Interconnection model (OSI) in late 1970s.

The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hard ware and software. The OSI model is not a protocol; it is a model for understanding and designing a network architecture that is flexible, robust, and interoperable.



International Organization for Standardization

OSI Model cont.



Application Layer

This section introduces two important concepts:

1. Application layer: The application layer of the OSI model provides the first step of getting data onto the network.

2. Application software: Applications are the software programs used by people to communicate over the network. Examples of application software, including HTTP, FTP, e-mail, and others, are used to explain the differences between these two concepts.

Presentation Layer

The presentation layer has three primary functions:

1. Coding and conversion of application layer data to ensure that data from the source device can be interpreted by the appropriate application on the destination device
2. Compression of the data in a manner that can be decompressed by the destination device
3. Encryption of the data for transmission and decryption of data upon receipt by the destination

Session Layer

Functions at the session layer create and maintain dialogs between source and destination applications. The session layer handles the exchange of information to initiate dialogs and keep them active, and to restart sessions that are disrupted or idle for a long period of time.

This layer support the session by –

1. Establishing Connections
2. Maintaining Connections
3. Synchronizing Connections
4. Controlling Dialogues
5. Terminating Connections

Transport Layer

The Transport layer provides for the segmentation of data and the control necessary to reassemble these pieces into the various communication streams. Its primary responsibilities to accomplish this are:

1. Multiplexing and Demultiplexing
2. Segmenting data and managing each piece
3. Reassembling the segments into streams of application data
4. Identifying the different applications (HTTP 80, FTP 20,21)

Network Layer

The Network layer, or OSI Layer 3, provides services to exchange the individual pieces of data over the network between identified end devices. To accomplish this end-to-end transport, Layer 3 uses following basic processes:

1. Logical Addressing
2. Encapsulation
3. Routing
4. Decapsulation
5. Error handling & Diagnostics

Data Link Layer

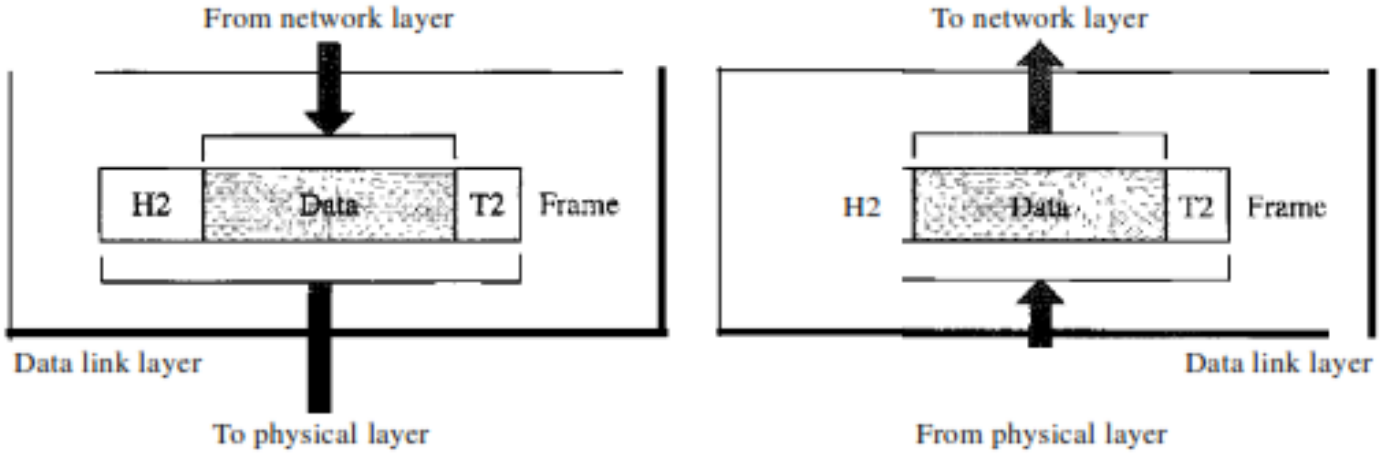
The data link layer transforms the physical layer, a raw transmission facility, to a reliable link. It makes the physical layer appear error-free to the upper layer (network layer). Other responsibilities of the data link layer include the following:

1. Framing: The data link layer divides the stream of bits received from the network layer into manageable data units called frames.
2. Physical addressing: If frames are to be distributed to different systems on the network, the data link layer adds a header to the frame to define the sender and/or Receiver of the frame. If the frame is intended for a system outside the sender's network, the receiver address is the address of the device that connects the network to the next one.
3. Flow control: If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer imposes a Flow control mechanism to avoid overwhelming the receiver.

Data Link Layer cont.

4. Error control. The data link layer adds reliability to the physical layer by adding mechanisms to detect and retransmit damaged or lost frames. It also uses a mechanism to recognize duplicate frames. Error control is normally achieved through a trailer added to the end of the frame.

5. Access control. When two or more devices are connected to the same link, data link layer protocols are necessary to determine which device has control over the link at any given time.



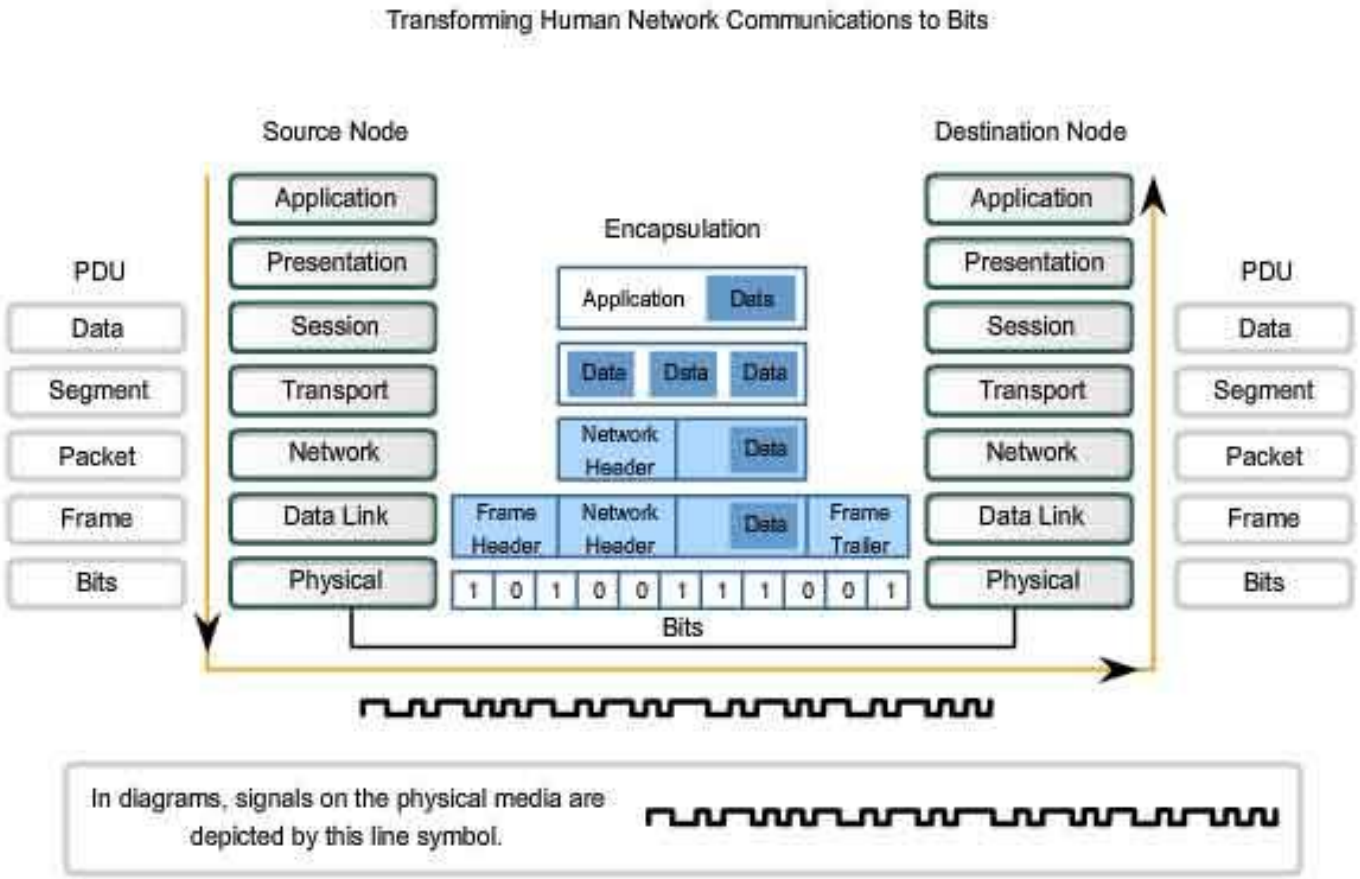
Physical Layer

The OSI Physical layer provides the means to transport across the network media the bits that make up a Data Link layer frame. This layer accepts a complete frame from the Data Link layer and encodes it as a series of signals that are transmitted onto the local media. The encoded bits that comprise a frame are received by either an end device or an intermediate device.

The delivery of frames across the local media requires the following Physical layer elements:

1. The physical media and associated connectors
2. A representation of bits on the media
3. Encoding of data and control information
4. Transmitter and receiver circuitry on the network devices

Encapsulation



OSI & TCP/IP Model