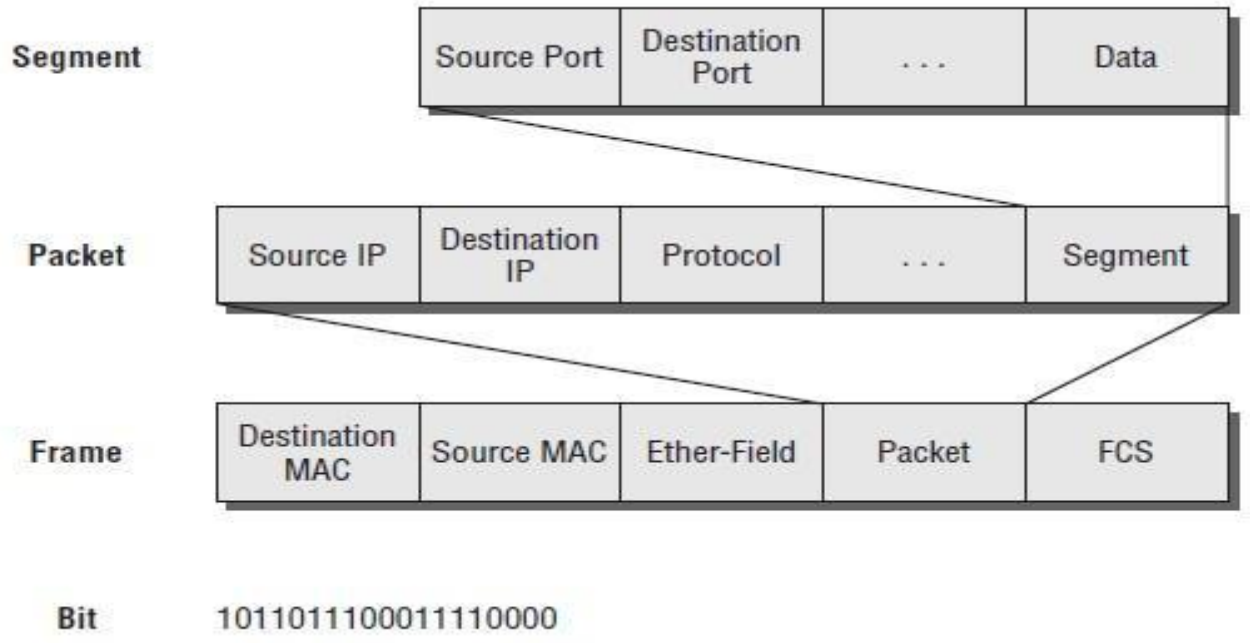
At a transmitting device, the data encapsulation method works like this:

Five steps of Encapsulation

1. User information is converted into data.
2. Data is converted into **segments** for transport across the network.
3. Segments are converted into **packet** for transport across the network.
4. Packets and datagram's are converted into **frames** and the Data Link header is added.
5. The data in the frames is converted into **bits** for transmission over the physical media.

To explain this in more detail using the layer addressing, I'll use Figure below.



FUNCTIONS OF THE LAYERS

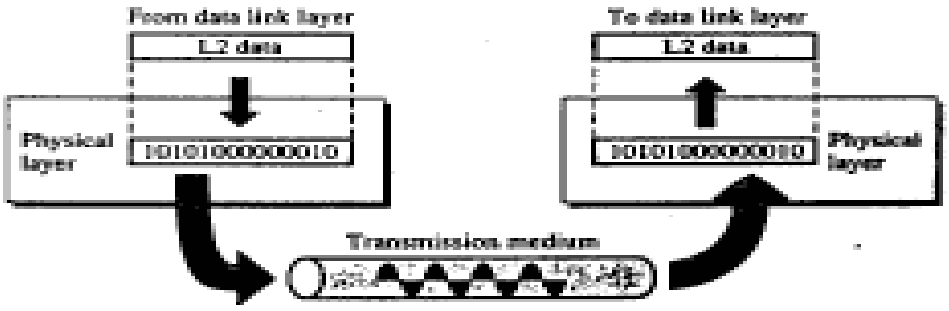
1)Physical Layer

The physical layer coordinates the functions **required to** transmit a bit streams over a physical medium. It **deals with** the **mechanical and electrical specifications** of the primary connections, such as cables, connectors, and signalling options that physically link two nodes on a network and timing interfaces, and the physical transmission medium Specifications include voltage levels, maximum cable lengths, connector types, and maximum data rates.

This task requires a number of considerations:

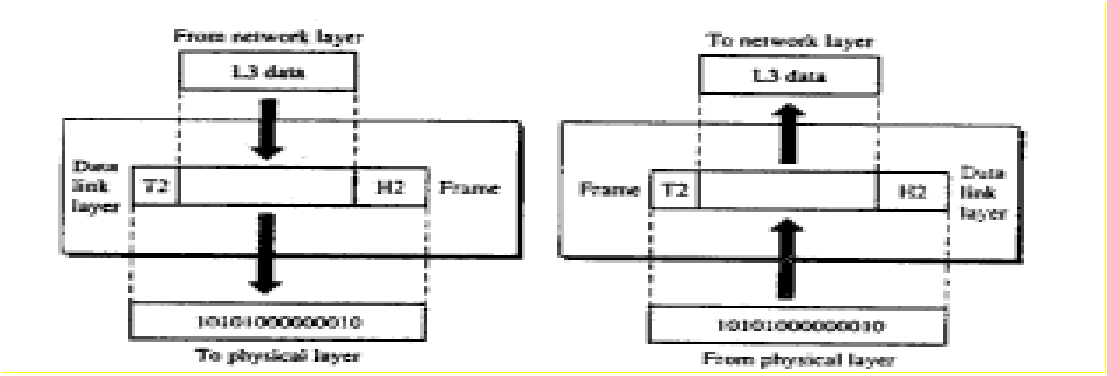
- **Line configuration**: How can two or more devices are linked physically? Are transmission lines to be shared or limited to use between two devices? Is the line available or not?

- **Data transmission mode:** It does transmission flow one way or both ways between two connected devices? Or does it alternate?
- **Topology:** How are network devices arranged? Do they pass data directly to each other or through an intermediary? And by what paths?
- **Signals:** What type of signals is useful for transmitting information?
- **Encoding:** How are bits (0s and 1s) to be represented by available signalling systems? How are data represented by signals?
- **Interface**. What information must be shared between two closely linked devices to enable and facilitate communication? What is the most efficient way to communicate that information?
- **Medium**. What is the physical environment for the transmission of data?



2)Data link Layer

The data link layer is **responsible for** delivering data units (groups of bits) from one station to the next without errors.

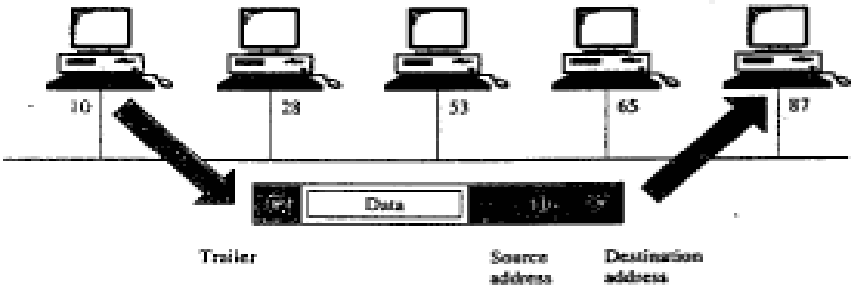


Specific responsibilities of the data link layer include the following:

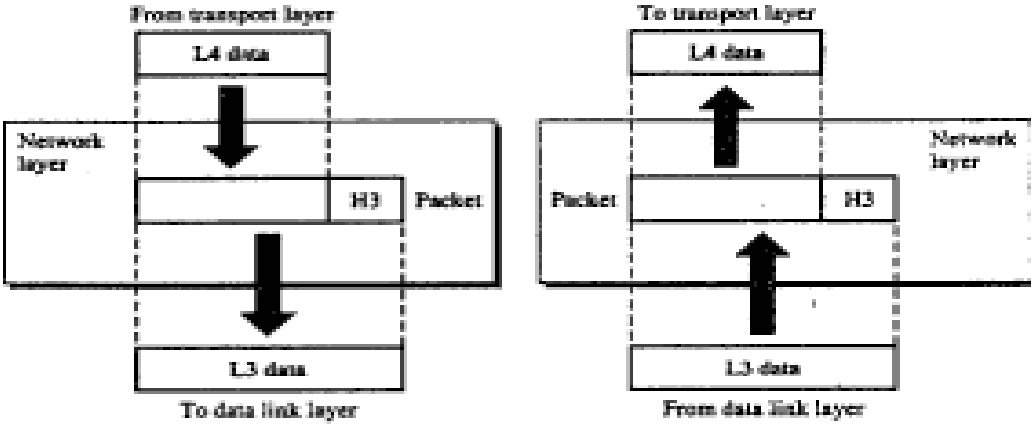
- **Node-to-node delivery:** The data link layer is responsible for node-to-node delivery.
- **Addressing:** Headers and trailers added at this layer include the physical address of the most recent node and the next intended node.
- **Access control:** When two or more devices are connected to the same link, the data link layer

protocols are necessary to determine which device has control over the line at any given time.

- **Flow control:** To avoid overwhelming the receiver, the data link layer regulates the amount of data that can be transmitted at one time. It adds identifying numbers to enable the receiving node to control the ordering of the frames.
- **Error handling:** Data link layer protocols provide for data recovery, usually by having the entire frame retransmitted.
- **Synchronization: Headers** contain bits to alert the receiving station that a frame is arriving. In addition, these bits provide a pattern to allow the receiver to synchronize its timing to that of the transmission (to know the duration of each bit). **Trailers** contain bits for error control and also bits that indicate the frame has ended, a that anything to follow is either a new frame or an idle channel.



3) Network Layer



The network layer is **responsible for** the **source-to-destination** delivery of a packet across multiple network links. Whereas the data link layer oversees **node-to-node delivery**.

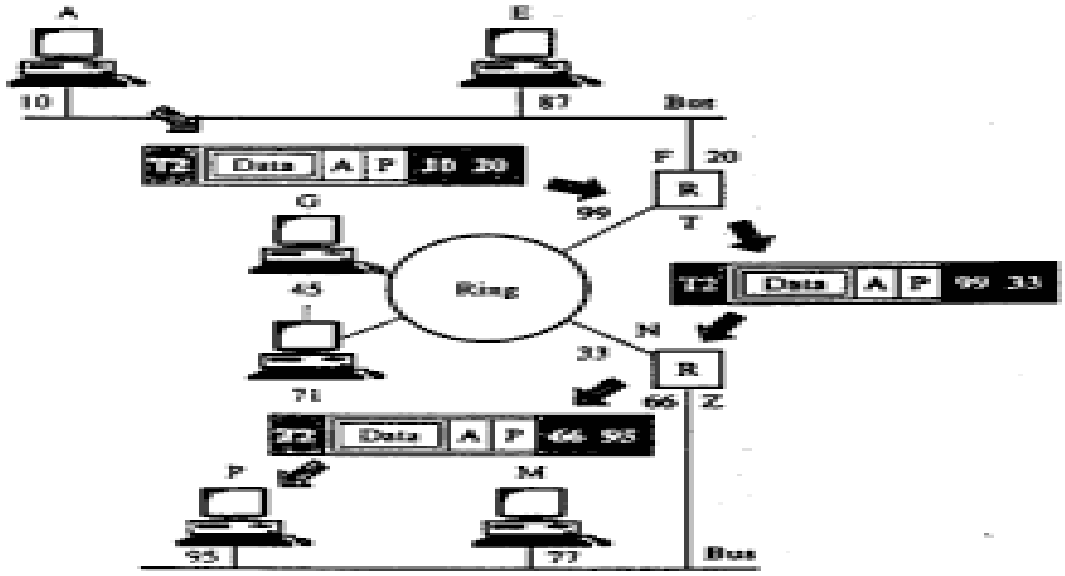
the network layer **ensures** that each packet gets from its point of origin to its final destination successfully and efficiently.

To make such end-to-end delivery possible, the network layer **provides** two related services: *switching and routing*. ***Switching*** refers to temporary connections between physical links resulting in longer links for network transmission.

Routing means selecting the best path for sending a packet from one point to another, when more than one path is available.

Specific responsibilities of the network layer include the following:

- **Source-to-destination delivery:** Moving a packet (best effort) from its point of origin to its intended destination across multiple network links.,
- **Logical addressing:** Inclusion of the source and destination addresses in the header.
- **Routing:** Deciding which of multiple paths a packet should take.
- **Address transformation:** Interpreting logical addresses to find their physical equivalents.



4)Transport Layer

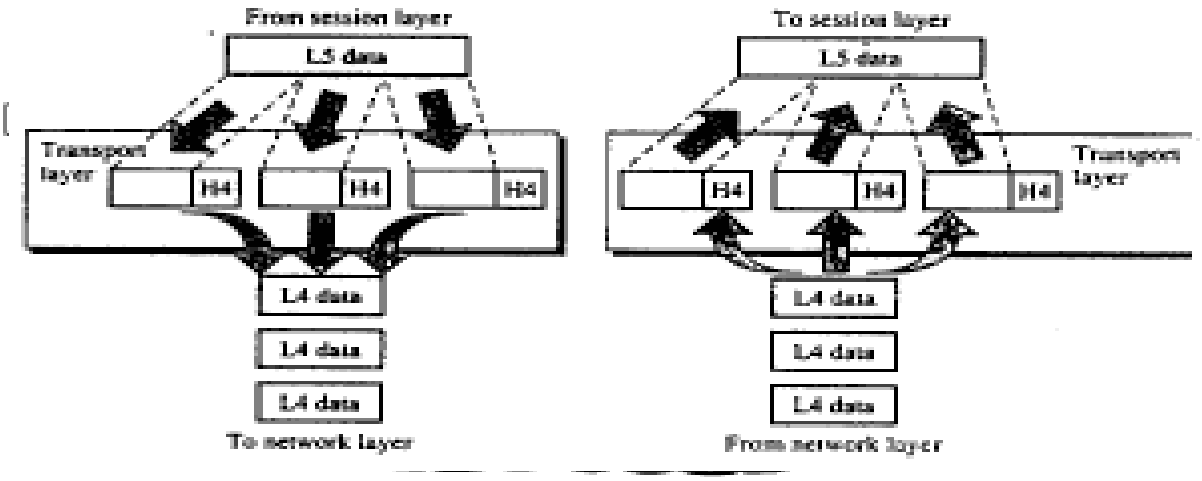
The transport layer is **responsible for** source -to-destination (end-to-end) delivery of the entire message.

Layer 4, the transport layer, is concerned with end-to-end connections between the source and the destination. The transport layer provides network services to the upper layers. Connection-oriented reliable transport establishes a logical connection and uses sequence numbers to ensure that all data is received at the destination. Connectionless best-effort transport just sends the data and relies on upper-layer error detection mechanisms to report and correct problems. Reliable transport has more overhead than best-effort transport.

Best-effort delivery means that the protocol will not check to see whether the data was delivered intact; a higher-level protocol, or the end user, must confirm that the data was delivered correctly.

Specific responsibilities of the transport layer include the following:

- **End-to-end message delivery:** Overseeing the transmission and arrival of all packets of a message at the destination point.
- **Service-point (port) addressing:** Guaranteeing delivery of a message to the appropriate application on **a** computer running multiple applications.
- **Segmentation and reassembly:** Dividing a message into transmittable segments and marking each segment with a sequence number. These numbers enable the transport layer to reassemble the message correctly at the destination and to identify and replace packets lost in transmission.
- **Connection control:** Deciding whether or not to send all packets by a single path.



5)Session Layer

The session layer is the network ***dialog controller***. It establishes, maintains, and synchronizes the interaction between' communicating devices.

Specific responsibilities of the session layer include the following:

- **Session management.** Dividing a session into sub sessions by the introduction of checkpoints and separating long messages into shorter units called dialog units a appropriate for transmission.
- **Synchronization.** Deciding in what order to pass the dialog units to the transport layer and where in the transmission to require confirmation from the receiver.
- **Dialog control.** Deciding who sends, and when.
- **Graceful close.** Ensuring that the exchange has been completed appropriately before the session closes.

6)Presentation Layer

The presentation layer **ensures** interoperability among communicating devices. It ***provide*** necessary translation of different control codes and character sets, graphics characters, and so on to allow both devices to understand the same transmission the same way.

Specific responsibilities of the presentation layer include following:

- **Translation.** Changing the format of a message from that used by the sender into one mutually acceptable for transmission. Then, at the destination, changing that format into the one understood by the receiver.
- **Encryption.** Encryption and decryption of data for security purposes.
- **Compression.** Compressing and decompressing data to make transmission more efficient.
- **Security.** Validating passwords and log-in codes.

7) Application Layer

The application layer **enables** the user, whether human or software, to access the network. It provides user interfaces and support for services such as electronic mail, remote file access and transfer, shared database management, and other types of distributed information services.

Specific services provided by the application layer include the following:

- **Network virtual terminal.** A software version' of a physical terminal. A virtual' terminal allows you to log on to a remote host.
- **File access, transfer, and management.** Allows a user at a remote computer to access files in another host (to make changes or read data); to retrieve files from remote computer for use in the local computer.
- **Mail services.** Provides the basis for electronic mail forwarding and storage.
- **Directory services.** Provides distributed database sources and access for global information about various objects