Unit: Data Link Layer (Marks 5)
Computer Network
BSc 6th Semester
Sub: Computer Science(General)

Data Link Layer: The data link layer, or layer 2, is the second layer of the seven-layer OSI model reference model. This layer describes the techniques to access a shared communication channel and to ensure reliable transmission of data frame in computer communication environment. The main functions of data link layer include framing, error detection and correction, acknowledgement, flow control, ensuring well-defined reliable service interface to the network layer, encapsulating packets from network layer to frames, etc. There are different types of link-level technologies that can be used to connect two nodes of machines. Examples of data link layer protocols are Ethernet, Token Ring, FDDI and PPP.

Functions of Data Link Layer: The data link layer has a number of specific functions it can carry out. These functions include:

1. Providing a well-defined service interface to the network layer.
2. Framing
3. Dealing with transmission errors.
4. Regulating the flow of data so that slow receivers are not swamped by fast senders.

1. **Services provided to the network layer**: It provides a well-defined and reliable service interface to the layer 3 or Network layer, which is also contingent upon the efficiency and error rate of the underlying physical layer. The data link layer accomplishes these activities in the following manner:
   (a) Unacknowledged connectionless service.
   (b) Acknowledged connectionless service.
   (c) Acknowledged connection-oriented service.

2. **Framing:** The data link layer receives a raw bit stream from the physical layer that may not be error free. To ensure a reliable transfer of bit streams to the network layer, the data link layer breaks the bit stream into frames. It then computes the checksum for each frame, which is transmitted with the frame itself. The destination host receives a frame and computes another checksum from its data to compare it with the transmitted frame. This ensures that the data link layer of the receiver detects as well as correct frames.

3. **Error detection and correction**: It is a collection of methods involving coding which are used to detect errors in transmitted or stored data and also to correct them. There are

different methods depending upon Single Error Correction, Double Error Correction (SECDEC). There are different techniques for detecting errors in the transmitted data:

(a)Parity Checks: Parity check deploys single parity bit and is considered the simplest form of error detection method. It comprises of even parity and odd parity methods.

(b)Checksum: It is a simple type of redundancy check that is used to detect error. Through this method, an algorithm calculates the binary values in a packet or other block of data and stores the results with the data.

(c)Cyclic Redundancy Check: In the TCP/IP or OSI reference model, CRC is added to a packet frame at the data link layer. It is a method of checking for errors in data that have been transmitted on a communications link.

(d) Hamming code: It is an error-detecting and error-correcting binary code.

4. **Flow control:** Another important factor in the design of the data link layer is to control the rate of data transmission between two sources and destination hosts. If there is a discrepancy between the sources and destination hosts data sending and receiving speed, then it will cause dropping of packets at the receiver end. It further causes the sender to cease the acknowledgement packets, thereby causing retransmission making the network less efficient.

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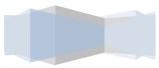
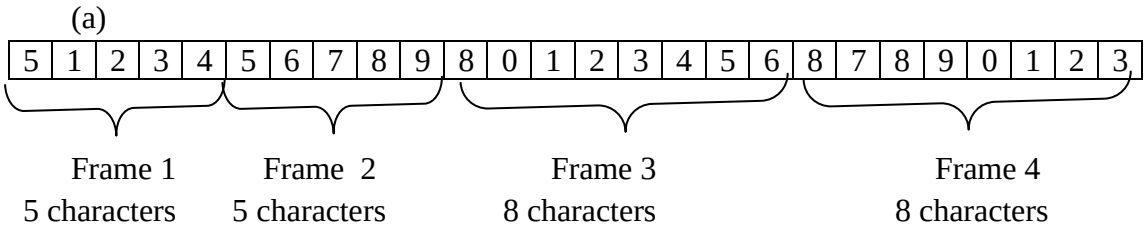
Different framing methods:

1. Character Count
2. Flag bytes with byte stuffing
3. Starting and ending flags, with bit stuffing.
4. Physical layer coding violations

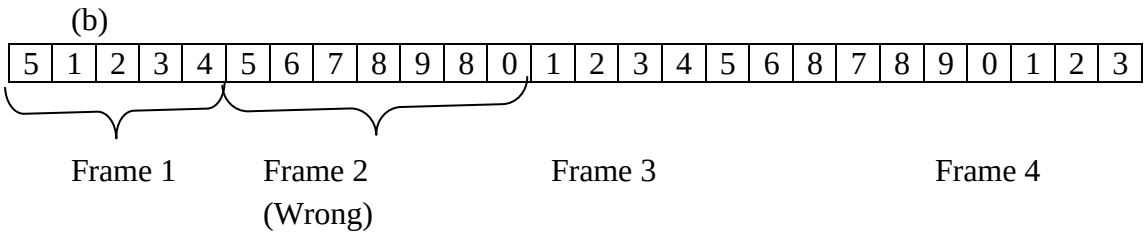
1. **Character Count method:**

This method uses a field in the header to specify the number of characters in the frame. When the data link layer at the destination sees the character count, it knows how many characters follow and hence where the end of frame is. This technique is shown in the following figure for four frames of sizes 5, 5, 8 and 8 characters , respectively.





Character stream without errors



Character stream with one error

The trouble with this algorithm is that the count can be garbled by a transmission error. For example, if the character count of 5 in the second frame of fig (b) becomes a 7, the destination will get out of synchronization and will be unable to locate the start of the next frame. Even if the checksum is incorrect so the destination knows that the frame is bad, it still has no way of telling where the next frame starts. Sending a frame back to the source asking for a retransmission does not help either, since the destination does not know how many characters to skip over to get the start of the retransmission.

Questions from this chapter:

1. Briefly explain the functions of data link layer. 5
2. Briefly explain any one framing method. 5
3. Define flow control. 2
4. Define framing. 2