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Data Link Layer - comm.n b/w node-node Two functions
one of the major responsibility is Framing. - Framing
- flow & error control

DLL needs to pack bits into frames.

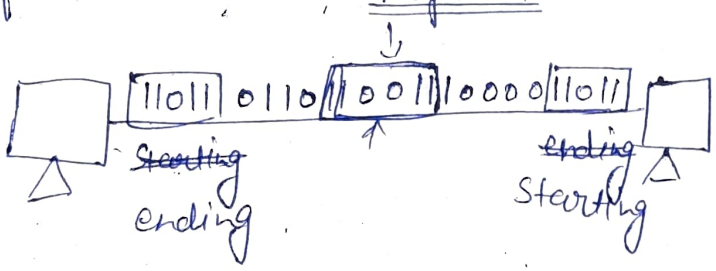
eg - Postal System

evelope + source address + destination address

when we add zero and 1's in header and trailer is called frames.

Before starting communication, they agree on a mutual protocol.

Protocal - Let the Steard of frame and end of the frame be 11011



It is adding header and trailer.

There is possibility to find the same sequence of bits in b/w data.

Framing the data link layer separates a frame distinguishable from another frame.

Frame = Header + N/w layer PDU + Trailer

In packet switched N/w, the block of data called frames are exchanged b/w nodes, not bit streams.

Types of framing

1) Fixed size framing
2) Variable size framing.

1) Fixed size framing

- Here the size of the frame is fixed and so the frame length acts as delimiter of frame
- Consequently, it does not require additional boundary bits to identify the start and end of the frame.

2) Variable size framing

- The size of each frame to be transmitted may be different.
- In this we mark the end of one frame and beginning of the next frame.

Framing approach

- Bit-oriented approach
  - It is concerned with bits
  - It views the frame as a collection of bits
  - It can be any text or multimedia.

Bit oriented protocol - HDLC
(High level data Link Control)

- Byte-oriented approach (character oriented)
  - oldest approach to framing
  - In this frame is a collection of bytes (Characters) rather than bits
  - also known as byte oriented approach.

Protocol - PPP - Point-to-Point protocol.

Bit HDLC protocol. frame format

Beginning seq. (8)	Header (16)	Body (variable length)	CRC (16)	Ending sequence (8)

Header: Address, Control field. Body: Payload. CRC: Error detection

→ 01111110 | 1111 0101 0 11111 0 1000000 | 11 11110

Bit stuffing

Q Bit sequence without stuffing

11010111110101111111010 11111110

Bit sequence with bit stuffing:

11010 11111 00 10 11111 0 10 10 11 1110 110

frame in a character-oriented protocol.

Data from upper layer.

Flag	Header			...			Trailer	flag

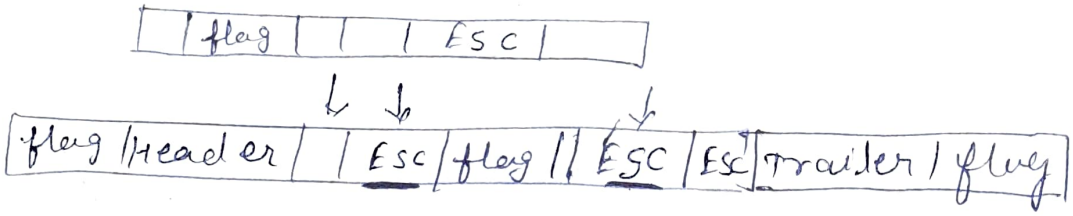
eg- if data contains flag. then

sender → flag A flag C flag

data entered A

~~flag Header | | Esc | flag | | Esc~~

flag A ESC flag C flag



Bit framing

01111 1

000

01111110 Header - 0111111000110 ... 11011110 Trailer 01111110

HDLC

- The synchronous Data Link control (SDLC) protocol developed by IBM, is an example of bit oriented protocal.
- SDLC was Later standardized by the ISO as the High Devel data Link control protocol (HDLC)
- Bit oriented protocal.
- To synchronize their clocks.

Types of HDLC Frames

- The type of frame is determined by the control field.

I-Frame - Information frame - 1st bit is 0
S-Frame - Supervisory Frame - 1st two bits is 10
U-Frame - Un-numbered frame - 1st two bits is 11 (Link Management)

Bit stuffing

Framing Error

Sender → 01111101010001000001111101101 01111110 Received

Solution

Bit stuffing

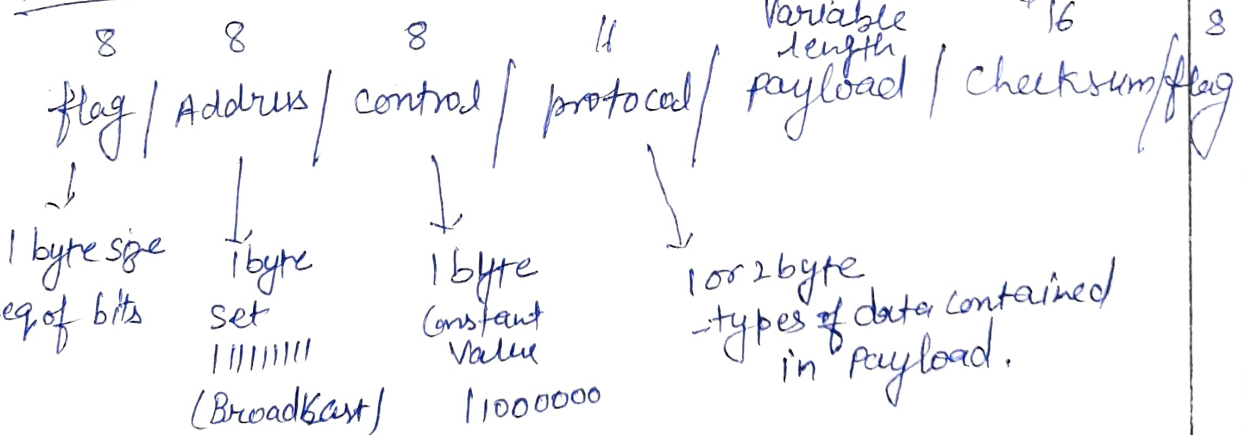
S → 01111101010001000001111101101 01111110

Insert one zero after four consecutive 1's.

Point-to-point protocol

- PPP is a data link layer protocol.
- PPP is a WAN protocol and which is commonly run over Internet links
- It is widely used in broadband communications having heavy loads and high speeds.
- It is used to transmit multiprotocol data between two directly connected (P to point) computers.

Format



Character stuffing

Byte stuffing or Character Stuffing is the process of adding one extra byte whenever there is a flag sequence appear in the Payload