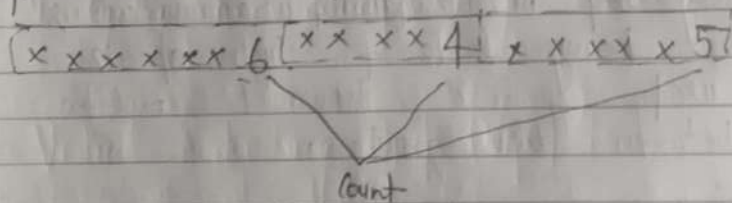* **DDCMP:**
Digital Data Communications Message Protocol:

- Byte-Oriented communication Protocol.
- It uses "byte-counting" format.
- count = how many bytes are contained in frame body?

- FRAME FORMAT!

8	8	8	14	42		16
SYN	SYN	class	Count	Header	Body	CRC

> Danger with Count field :-

Suppose we have 3-frames →

[x x x x x x 6 [x x x x 4 x x x x x 5]

Count

↳ Reciever understands next bytes are belonging to respective frame.

If transmission error could corrupt the count field then the end of the frame would not be correctly detected by the reciever.
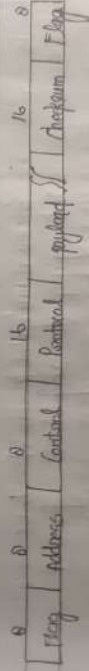
It is handled by "Character Stuffing" on byte Stuffing.

© Byte Stuffing on Character Stuffing : It is the process of adding one extra byte whenever those is a flag on escape character in the text.

This is done by DLE in BISYNC protocol.
↳ Data link Escape character

✱ PPP :- Point - to - Point Protocol

• PPP is a data link protocol.
• It is widely used in broadband communications having heavy loads & high speeds.
• It is used to transmit multiple protocols between two routers.

Flag	Address	Control	Protocol	payload	Checksum	Flag
8	8	8	16	16	8	8

Flag = 01111110

Address = 11111111 in case of broadcast

control = 1 byte set to a constant value 11000000

Protocol = Defines type of data contained in payload field.

Payload = Carries data of network- layer

Checksum = Error detection

⑧

• Types of HDLC frames: The type of the frame
  is determined by the control field.

  I - Frame: Information frame = 1st bit is 0

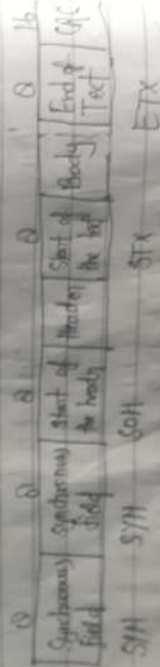 S - Frame: Supervisory Frame = 1st two bits is 0

  U - Frame: Un-numbered frame = 1st two bits of
                              control field is 1 1

---

* BYSYI BISYNC:
  Binary Synchronous Communication Protocol

• It is byte oriented family protocol in
  data link layer.
• It follows Sentinel-approach.
• Also called ASC protocol.

• Frame Format:

Synchronous field	Synchronous field	Start of the body	Header	Start of the body	Body	End of Text / Text	CRC
8	8	8	8	8		8	16
SYN	SYN	SOH		STX		ETX	

• Starting point of transmission

> STX and ETX are guarded the body.
  ↳ What if a bit resembling to STX or ETX
     occurs in body? →

✳ HDLC : High Level Data Link Control

- It is the bit-oriented framing protocol in data link layer.

- It was first named SDLC [Synchronous data link control] protocol developed by the IBM but later standardized by the ISO as the HDLC protocol.

- It is the basis of other protocol in link layer.

- **FRAME FORMAT :**

8 bit	16 bit	16 bit	8 bit
Beginning Sequence	Header	Body // CRC	Ending Sequence

➤ Beginning & Ending Sequence : 0 1 1 1 1 1 1 0

\# This sequence It also transmitted during any time, that the link is idle so that the sender and reciever can keep their clocks synchronized.

➤ Header : [Address Field | Control Field]

➤ Body : Payload (Variable Size)

➤ CRC : Cyclic Redundancy Check = Error Detection.
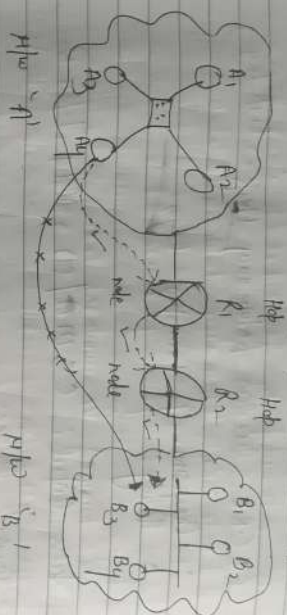   ↳ Trailer

③ Error Control: General method duplicate node-to node

- CRC = Circular Redundancy Check ⇒ Link Layer

- Checksum ⟶ Transport Layer
  Parity

④ Access Control: CSMA/CD, Aloha, Token Ring

⑤ Physical Address

→ functionalities / responsibility of data link layer :

H/w 'A'

H/w 'B'

① Hop-to-Hop delivery of Node-to-Node delivery :-

It is the responsibility of data-link-layer to deliver data from one node to another node then another — then final destination.

It does not responsible for deliver data directly from source —→ destination, because network layer is responsible for that.

② flow-control : It what speed data should be transferred from one node to another, that is exactly the flow control in data-link Layer. However, transferring speed from source to direct destination layer flow control.

flow-control methods / Protocol :- 1. Stop & wait
2. Go back N
3. Selective Repeat

(b) byte Oriented approach :- Oldest approach of framing.
Here each frame is viewed as a
collection of bytes (characters) rather
than bits.

Protocols :

BIYNC : Binary Synchronous communication protocol

DDCMP : Digital Data Communication Message Protocol

PPP : Point - to - Point Protocol

(c) Clock based framing : It is used in
optical medium.

☀ Bit Stuffing :- If the beginning sequence or
ending sequence one
data/payload then reciever may misunderstood
this hence it will be a framing - error.
To cure this :- ↳

01111110 | 111101010101011110 | 0000 | 011110

↳ Beginning
sequence   ↳ To tune this   ↳ Ending
                    bit stuffing   sequence

Estab sequence | 0 ; will be added after
5 consecutive one 1.

01111110 | 11110101010 | 0 | 111110 | 0 | 0000 | 011111D

reciever will undo bit stuffing.

It is easy to understand a frame by recieuer when it know the size of the frame.

* Types of framing :

1. Fixed-Size framing ; Here size of frames are fixed and so the frame length acts as delimetre of the frame. Hence, it does not require additional boundary bits to identify the the start and end of the frame.

2. Variable-Size framing ; It is necessary to maintain start of frame & end of the frame. Thus, additional mechanism are used.

Bit Oriented ⟍⟋ Byte Oriented

[q] Bit-Oriented approach ⇒ It simply views the frame as a collection of bits. In bit-oriented framing, data is transmitted as a sequence of bits that can be interpreted in the upon layers both as text as well as multimedia data.

* HDLC = High-Level Data Link Conbrol. is a bit Oriented framing protocol.

DATALINK LAYER

↓ Network

Adds, control information/flow control
DLC or LLC Sublayers

• Data Encapsulation

• Responsible for creation of frames

• Error control [MAC Sublayer]
• Adds, header/trailer to network layer PDU.
↓ • Physical Addressing
• Physical   NIC cards

↓ Physical

⟹

Node   Bits
A   [Adapter] ———————— [Adapter] / Node B

Bits flow between adapters, frames between hosts.

Protocol: Let the start of frame and end of frame be

                   [1 1 0 1 1]   [1 1 0 1 1]
                          End frame

[1 1 0 1 1] 0 1 1 0 1 1 0 1 1 0 0 0 0 0 1 1 1 0 1 1
   ↓ start   ↓
   of frame
        Data/Payload ⟹ Resembling start of
                        frame or end of frame

[Framing - Error] → Solution of this

→ ↑ Data-Link Layer ↑ ←

* Services offered:
    1. Framing
    2. Physical Addressing
    3. Flow control
    4. Error control ⟶ ⎡→ Error Detection
    5. Access control ⎣→ Error Correction

1. Framing ⟹

↳ When we deliver speeches, we take pause after completing one sentence (like full stop).

↳ When we post, the simple act of inserting a letter into an envelope seperates one piece of information from another.

• The data-link Layer needs to pack bits into frames, so that each frame is distinguishable from another.

" A frame is the encapsulation of header and trailer information with the packet.

↳ Header containes the source mac-adress and destination mac-address.