

CS & IT ENGINEERING



Computer Network

Introduction

Lecture No. - 06



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Recap of Previous Lecture



Topic

Physical Layer

Topic

Network Topology

Topic

Framing



Topics to be Covered



Topic

Byte Count

Topic

Byte Stuffing

Topic

Bit Stuffing

ABOUT ME



Hello, I'm **Abhishek**

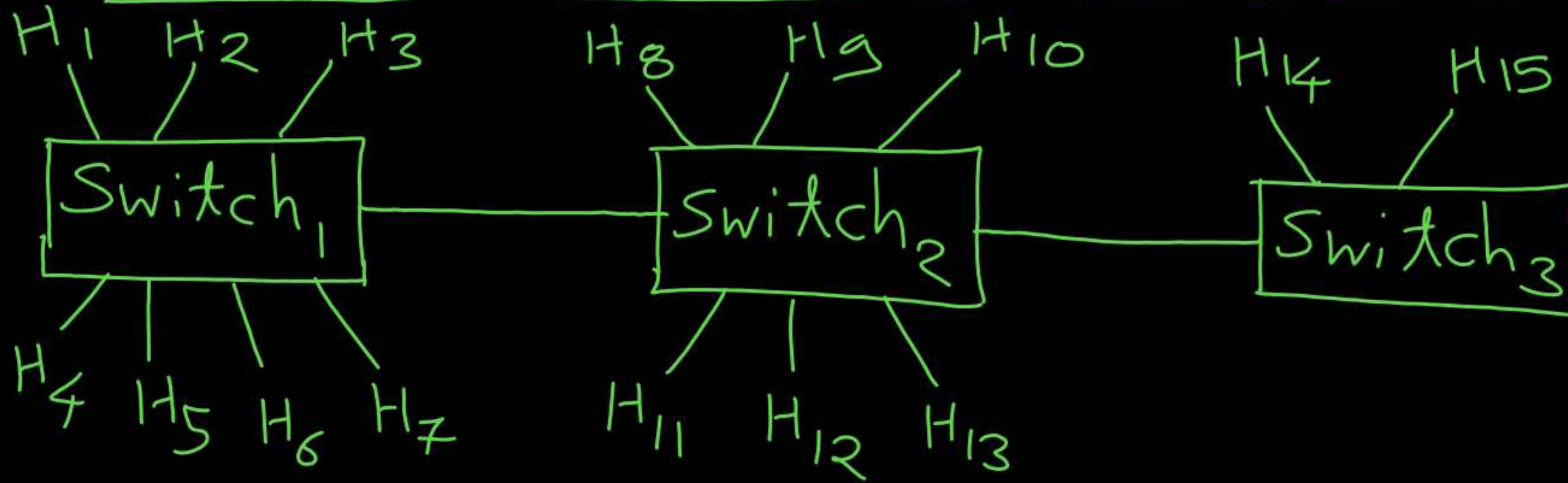
- GATE CS AIR - 96
- M.Tech (CS) - IIT Kharagpur
- 12 years of GATE CS teaching experience

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#Q. Consider that 15 machines need to be connected in a LAN using 8-port Ethernet switches. Assume that these switches do not have any separate uplink ports. The minimum number of switches needed is _____.

[GATE 2019]



Ans: 3



Topic : Framing



Problem : How receiver identify frame boundaries while receiving multiples frames?

[Variable length frames and transmitted without time-gap]



Topic : Framing





Topic : Framing



Problem : How receiver identify **frame boundaries** while receiving **multiples frames**?

[Variable length frames and transmitted without time-gap]

Solution :

1. Byte (Character) Count
2. Byte (Character) Stuffing
3. Bit Stuffing ✓

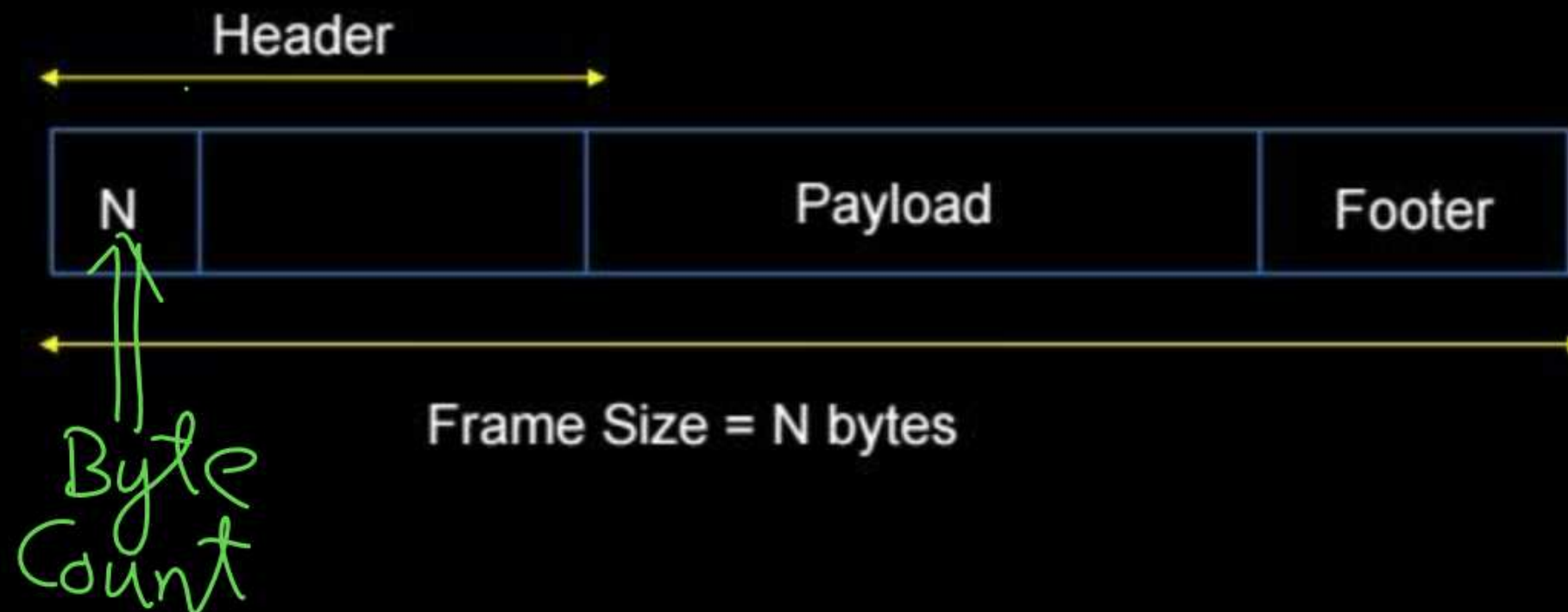


Topic : Byte Count



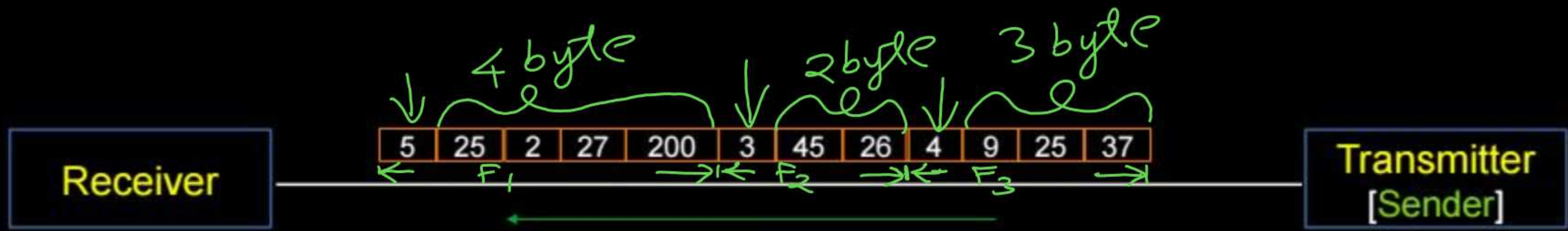
Byte Count field :

- One or two byte in size
- At the begin of the frame [Part of Header]
- Contains length of frame in bytes
[Size of Byte Count field inclusive]





Topic : Byte Count





Topic : Byte Count



Disadvantage :

if error occurred in the “Byte Count field”

then entire transmission is garbled [that frame onwards]

[Need to retransmit more than one frame]



Topic : Byte Stuffing



Special characters :

1. "STX" : [Start of Text / Transmission]
Start Frame Delimiter (SFD), ASCII value = 2
2. "ETX" : [End of Text / Transmission]
End Frame Delimiter (EFD), ASCII value = 3
3. "ESC" : [Escape character]
ASCII value = 27



Topic : Byte Stuffing



Transmitter Protocol :

1. Transmit “STX” just before frame transmission start.
2. Transmit “ETX” just after frame transmission completed.
3. Stuff “ESC” character just before every “STX” / “ETX” / “ESC” character appear in data while transmission. [Except start and end of frame]

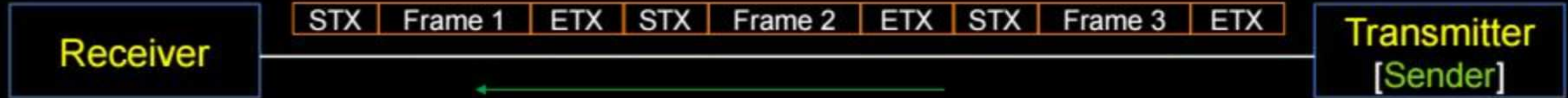


Topic : Byte Stuffing





Topic : Byte Stuffing





Topic : Byte Stuffing



CASE I :

Frame 1 : "A B C D"

Frame 2 : "P Q R S"





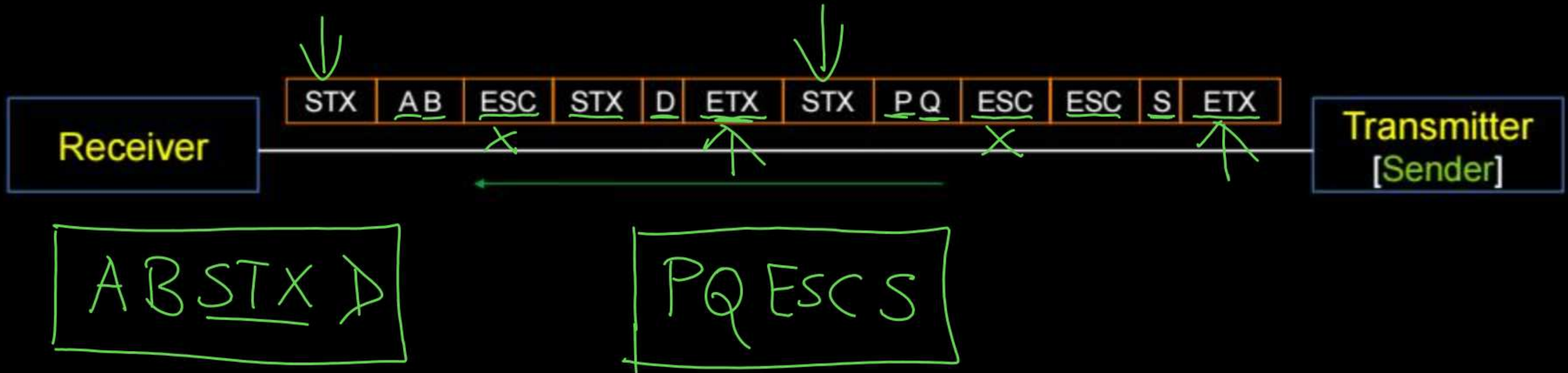
Topic : Byte Stuffing



CASE II :

Frame 1 : "A B **STX** D"

Frame 2 : "P Q **ESC** S"





Topic : Byte Stuffing



Receiver Protocol :

1. Looking for “STX” (start of frame)
2. After “STX”, looking for “ETX” (End of frame)
3. Discard “ESC” character while receiving the data frame
and copy next character into the receiving buffer



Topic : Byte Stuffing



Disadvantage :

Every "STX" / "ETX" / "ESC" (special character) in the data frame
will increase length of frame by "one-byte".

[Except Start and End of Frame]



Topic : Bit Stuffing



Replace “**STX**” and “**ETX**” with “**FLAG**” character.

FLAG : “ ~ ”

Binary (bit pattern) = “01111110”

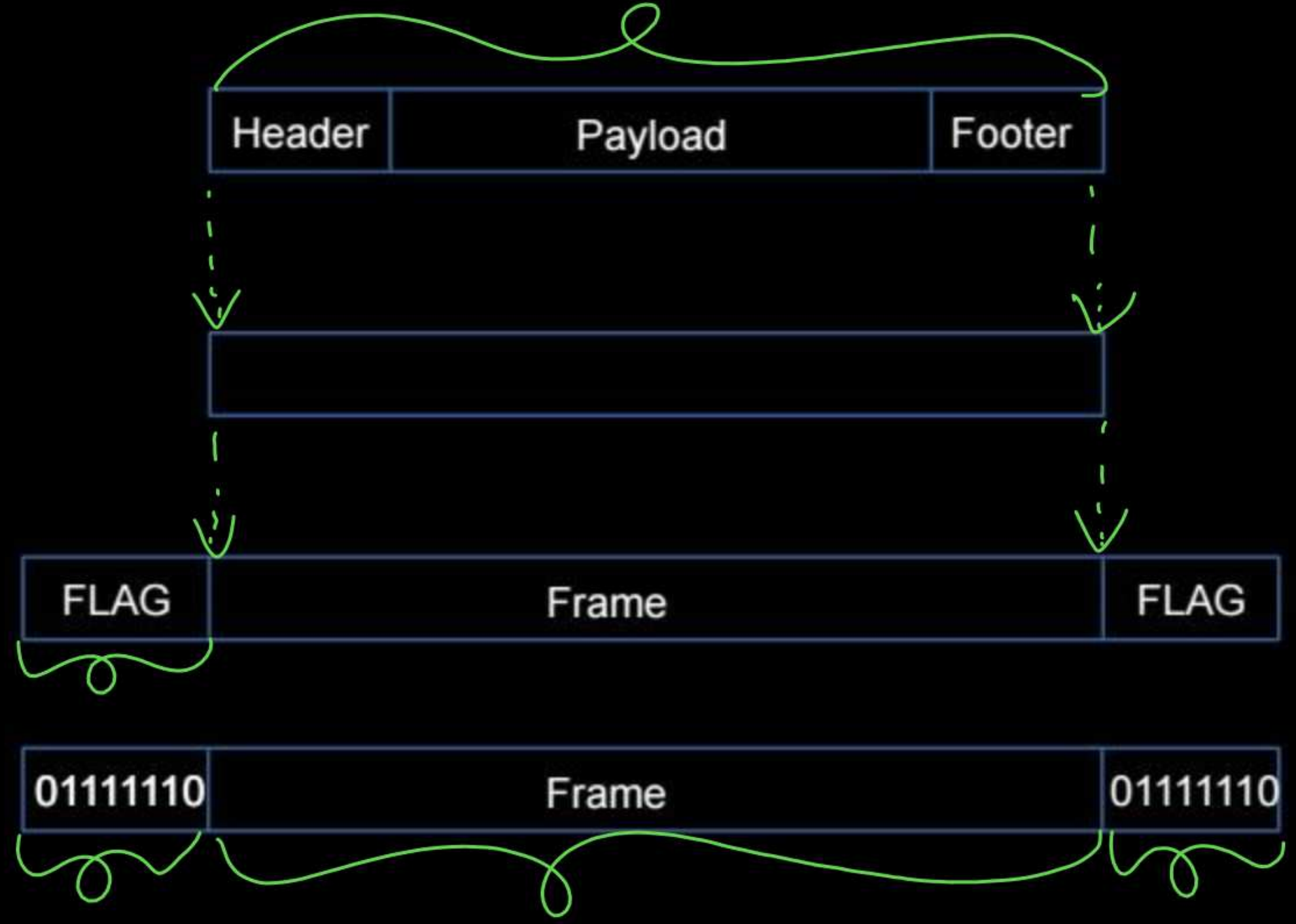
ASCII Value = 126 = 0x7E



Topic : Bit Stuffing



Frame





Topic : Bit Stuffing



Transmitter Protocol :

1. Transmit “FLAG” character, just before frame transmission start.
2. Transmit “FLAG” character, just after frame transmission completed.
3. Stuff “Zero Bit” after every five continuous one’s while transmission.
[Except start and end of frame]



Topic : Bit Stuffing



Receiver Protocol :

1. Looking for "Start of Frame" [FLAG].
2. After Start of Frame, it is looking for "End of Frame" [FLAG].
3. Discard "Zero Bit" that found after every five continuous one's while receiving data frame.



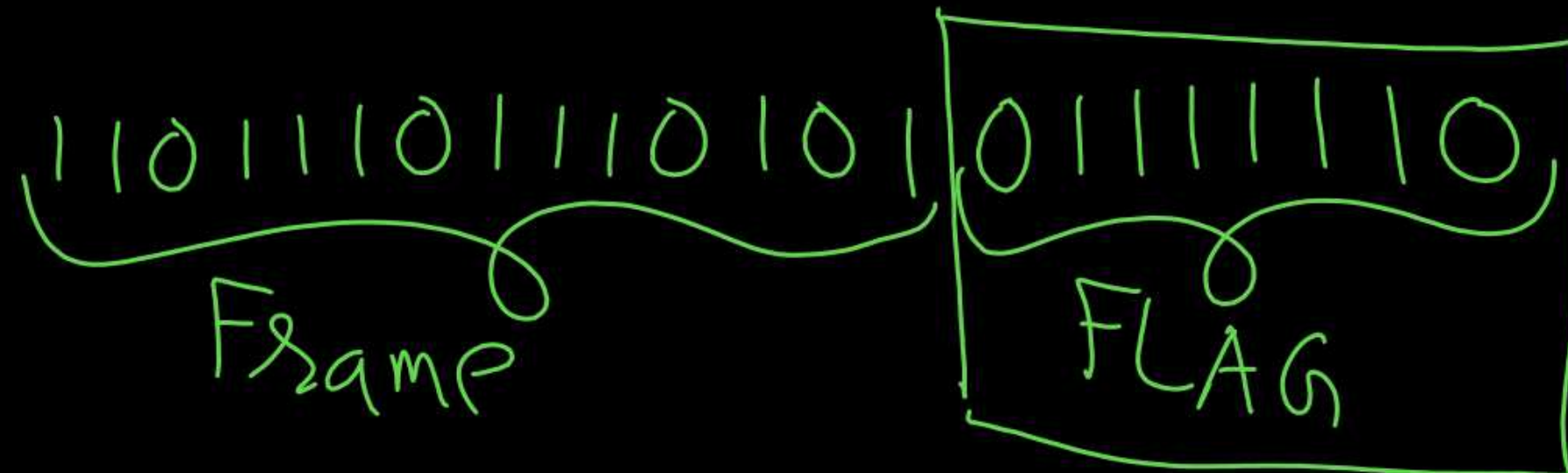
Topic : Bit Stuffing



CASE I :

Frame 1 = 11011101110101

Output = 01111110 11011101110101 01111110
FLAG





Topic : Bit Stuffing



CASE II :

Frame 2 = 101111110101

Output = 01111110 10 11111 0 10101 01111110

FLAG discard

101111110101 01111110

Frame FLAG



Topic : Bit Stuffing



CASE III :

Frame 3 = 10111101010

Output = 01111110 10111110 01010 01111110

FLAG

discard

10111101010

Frame

01111110

FLAG



Topic : Bit Stuffing



CASE IV :

Frame 4 = 111110111101

Output = 01111110 111110 0111101 01111110



Topic : Bit Stuffing



Conclusion :

Six continuous one's can only appear in the start and end of frame while transmission.

Advantage :

For every five continuous one's present in the data frame,
length of frame increases by "one-bit".

stuff bit pattern $\rightarrow 011110$

$\rightarrow 0111110$

#Q. A bit-stuffing based framing protocol uses an 8-bit delimiter pattern of 01111110. If the output bit-string after stuffing is 01111100101, then the input bit-string is

[GATE-2014]

H.W.

- (A) 0111110100
- (B) 0111110101
- (C) 0111111101
- (D) 0111111111

#Q. In a data link protocol, the frame delimiter flag is given by 0111. Assuming that bit stuffing is employed, the transmitter sends the data sequence 01110110 as

01110

[GATE-2004]

H.W.

- (A) 01101011
- (B) 011010110
- (C) 011101100
- (D) 0110101100



2 mins Summary



Topic

Byte Count

Topic

Byte Stuffing

Topic

Bit Stuffing



THANK - YOU