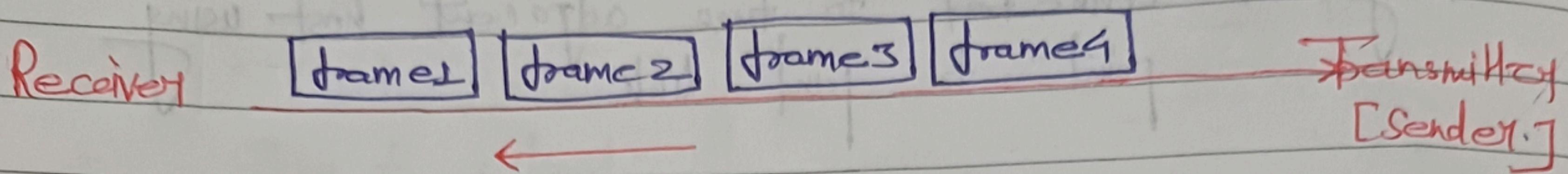


## \* Framing :—

Problem :— How receiver identify frame boundaries while receiving multiple frames ?  
[ Variable length frames and transmitted with time-gap ] \*

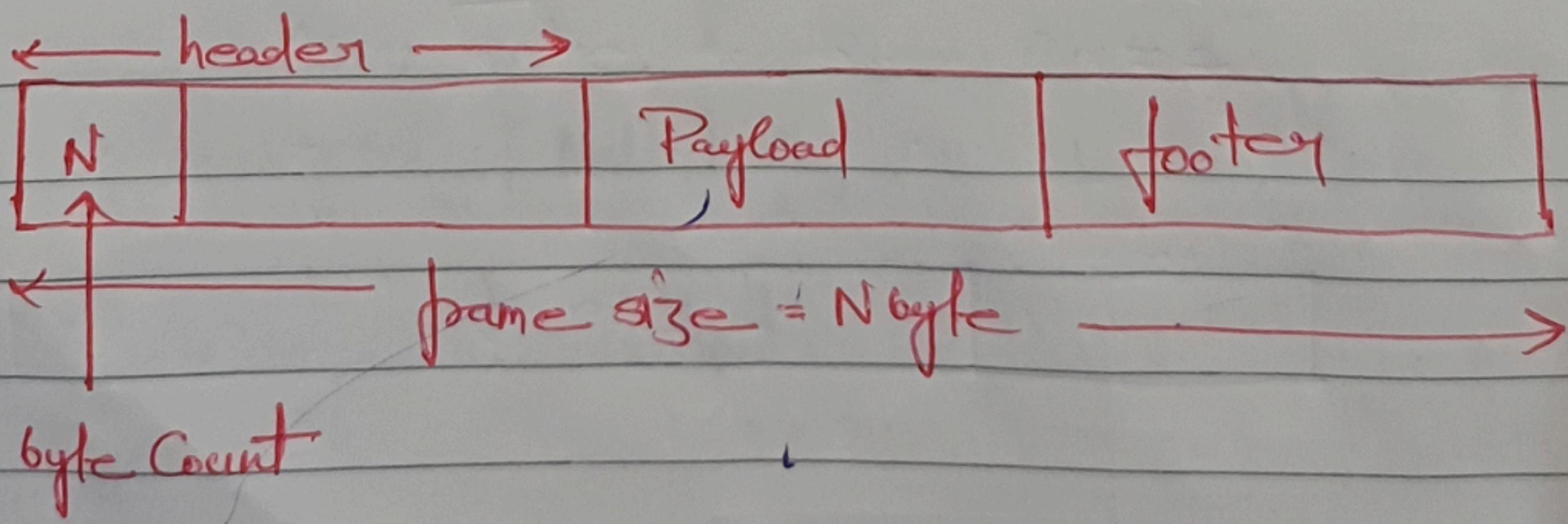


- Sol ⇒
- 1) Byte (Character) Count
  - 2) Byte (Character) Stuffing
  - 3) Bit Stuffing

## \* Byte Count :

### Byte count field :—

- One or two byte in size
- At the begin of the frame [part of Header]
- Constant length of frame in bytes.  
[Size of Byte count field inclusive]



if error occurred in the "Byte count field".  
then entire long transmission is garbled [

\* Byte Stuffing : —

Special Character : —

↳ "STX" : [ start of text / transmission ]  
Start Frame Delimiter (SFD), ASCII Value = 2

↳ "ETX" : [ End of text / Transmission ]  
End Frame Delimiter (EFD), ASCII Code value = 2.

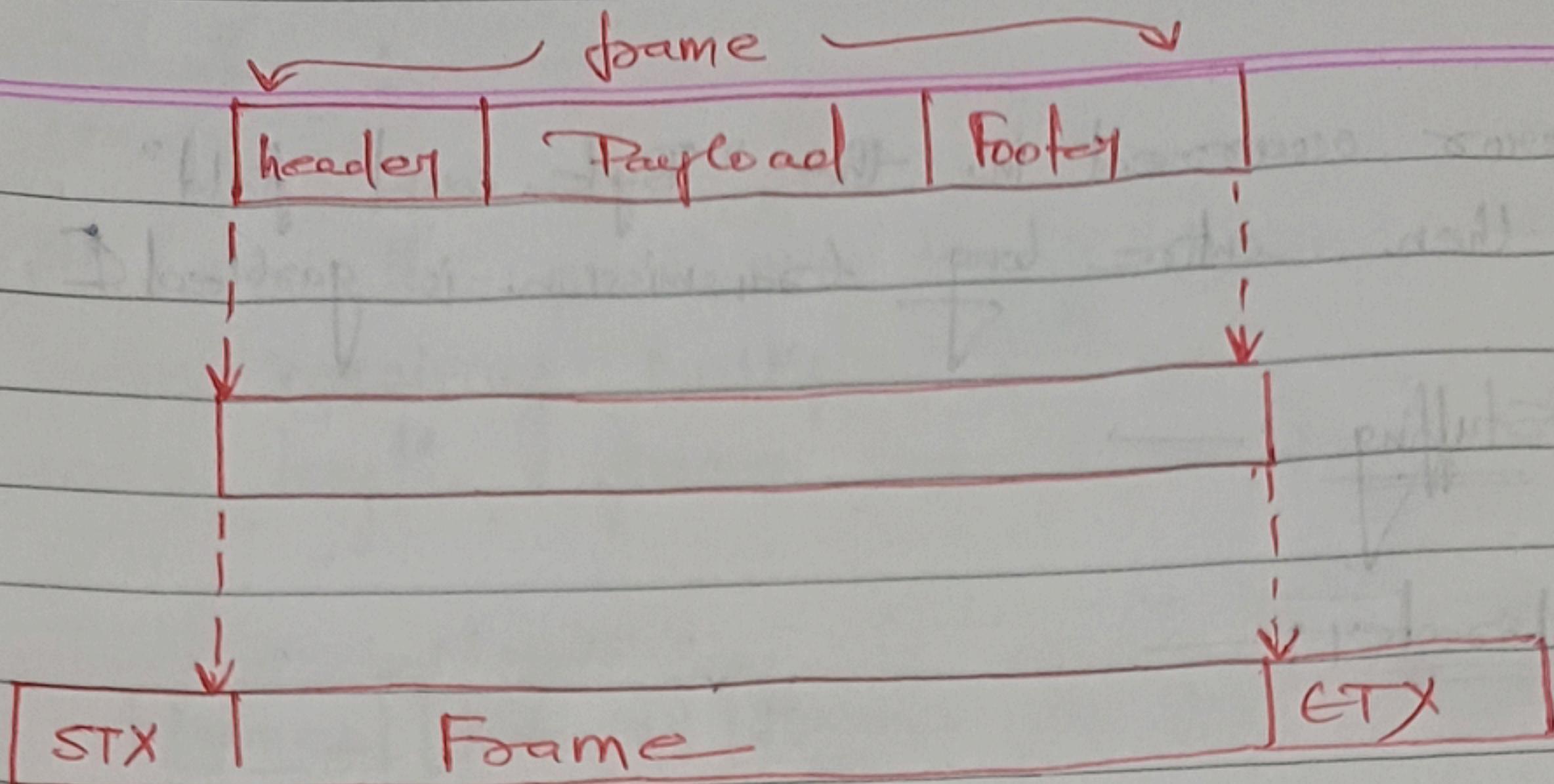
3) "ESC" : [ Escape character ]  
ASCII value = 27

Transmitter Protocol : —

↳ Transmit "STX" just before frame transmission start

↳ Transmit "ETX" just after frame transmission completed.

3) Discard "ESC" character while receiving the data frame  
and copy next character into the  
receiving buffer.



Disadvantages :-

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

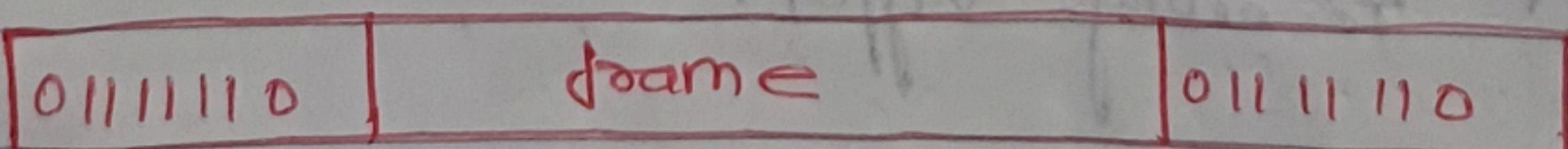
\* Bit Stuffing :-

Replace "STX" and "ETX" with "FLAG" character

flag: " ~ "

Binary (bit pattern) = 0111110.

ASCII Value = 126 = 0x7E



## \* 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 ones while transmission [Except start and end of frame]

### Case-1

frame  $\Rightarrow$  11011101110101

### Output :-

0111110 11011101110101 0111110  
flag ↓ flag  
Buffer [11011101110101]

### Case-2 :-

frame2  $\Rightarrow$  10111110101

Output:- 0111110 10111110101 0111110.

↓  
stuff zero bit.

Buffer [10111110101]

### Conclusion :-

Six Continuous ones can only appear in the start and end of frame while transmission

Advantages:

for overall five continuous ones present  
in the data frame length of frame  
increased by "one-bit".

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

$S_{(n)}$

