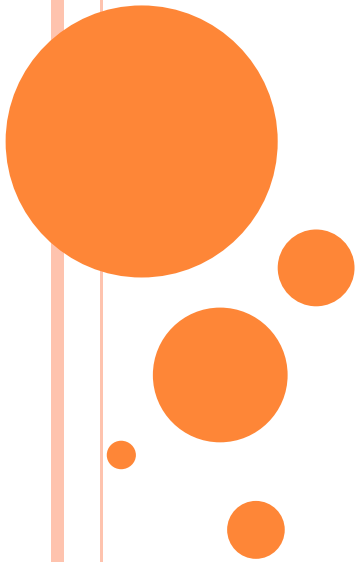
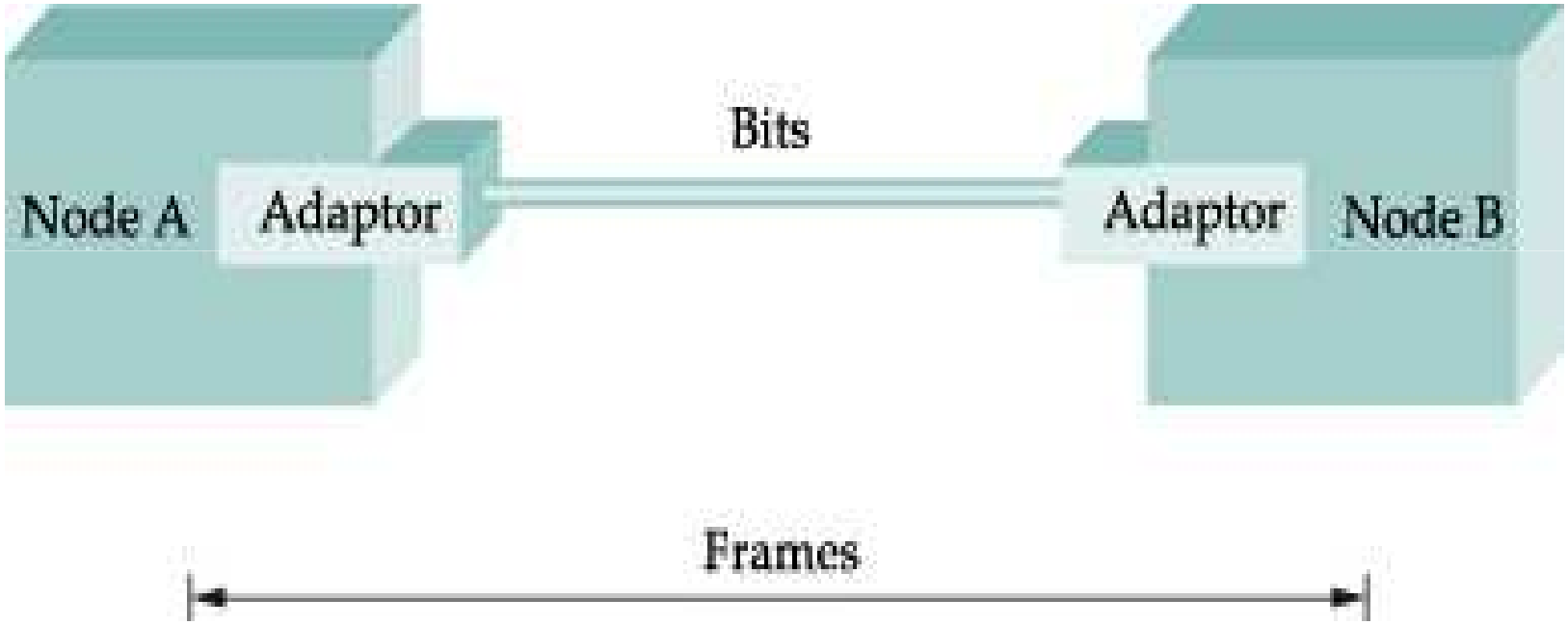
Framing



Introduction

- When node A wishes to transmit a frame to node B, it tells adapter to transmit a frame from the node's memory.
- Sequence of bits transmitted over the link.
- Node B's adapter collects the sequence of bits arrived and stores in B's memory.
- Where the frame begins and ends?
- Several ways to address the framing problem.

Introduction Cont…

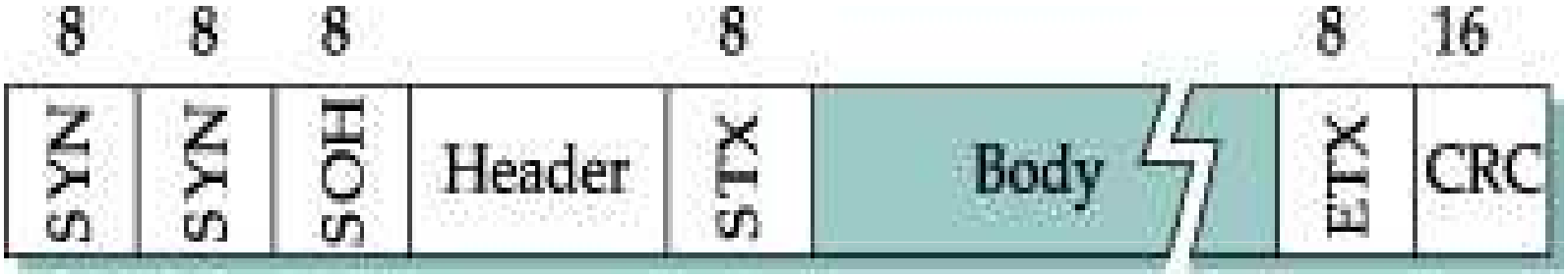


Byte Oriented Protocols (PPP)

- Oldest approach to framing.
- Views each frame as a collection of bytes.
- Example BISYNC – Binary Synchronous Communication developed by IBM.
- PPP widely used. Point to Point Protocol.
- Used in router to router traffic and home user to ISP (Internet Service Provider) traffic.

SENTINEL BASED APPROACH

- Frame format for BISYNC



- Uses sentinel characters to indicate where frames start and end.
- Beginning→ special sync. Character SYN.
- STX, ETX start and end of text.
- ETX can appear in data

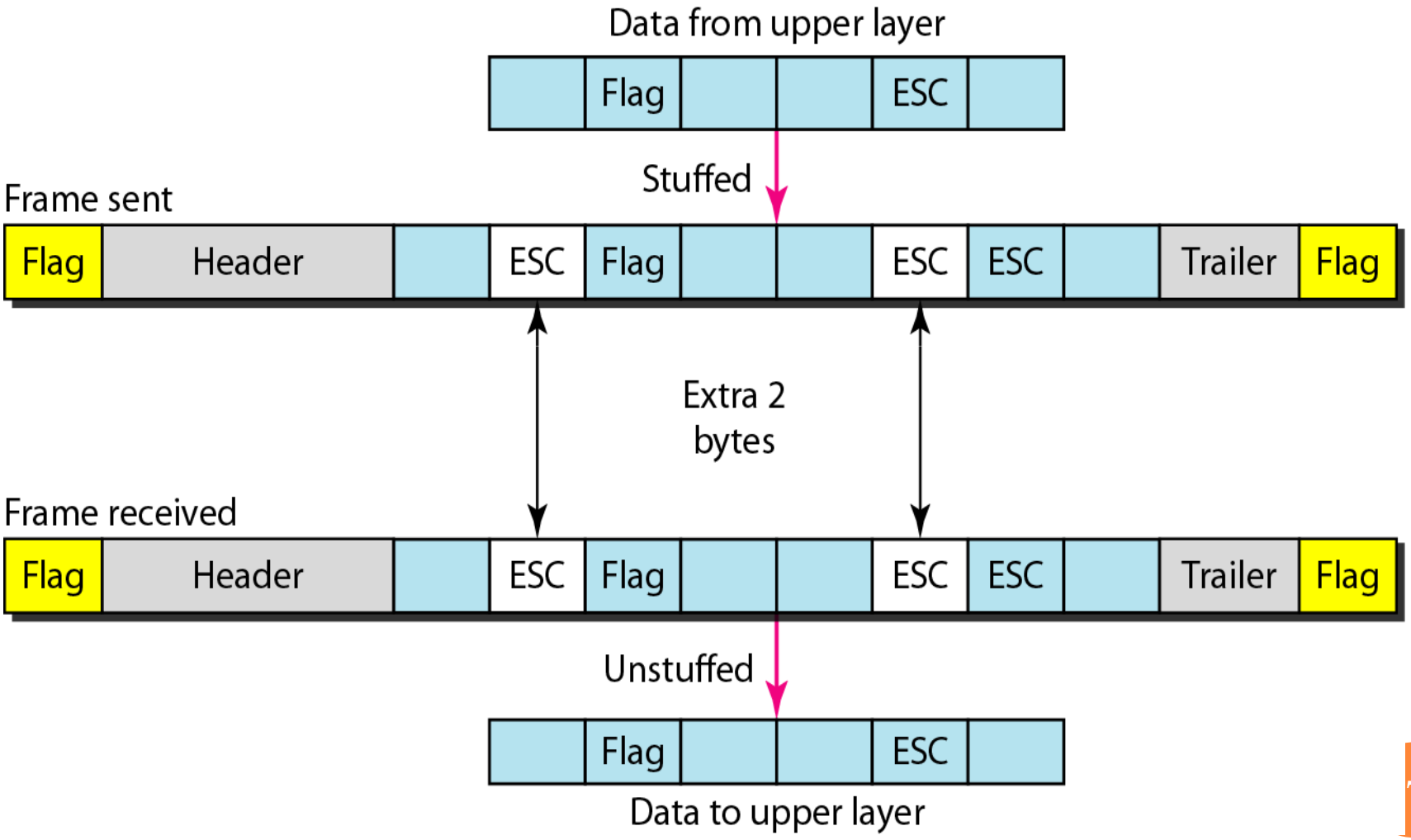
CONT…

- Escape ETX with a DLE (Data Link Escape)
- Character Stuffing

A ETX B	A DLE ETX B
A DLE B	A DLE DLE B
A DLE ETX B	A DLE DLE DLE ETX B
A DLE DLE B	A DLE DLE DLE DLE B

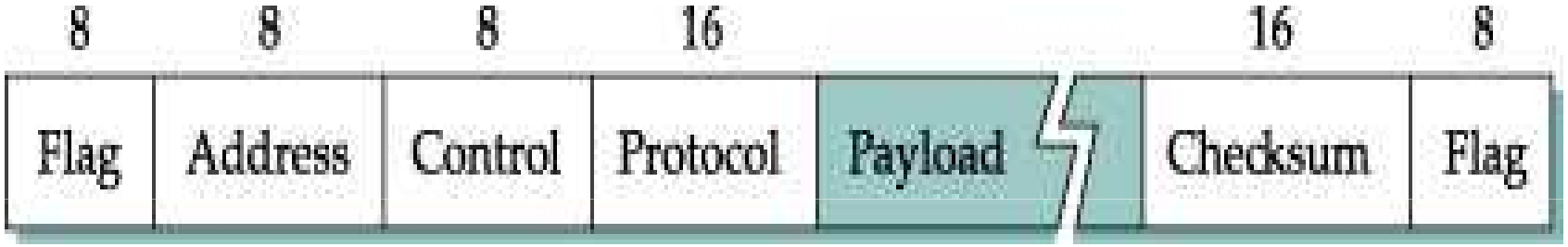
- CRC →detect transmission errors.

Another Example



POINT TO POINT PROTOCOL (PPP)

- Uses sentinels and character stuffing.



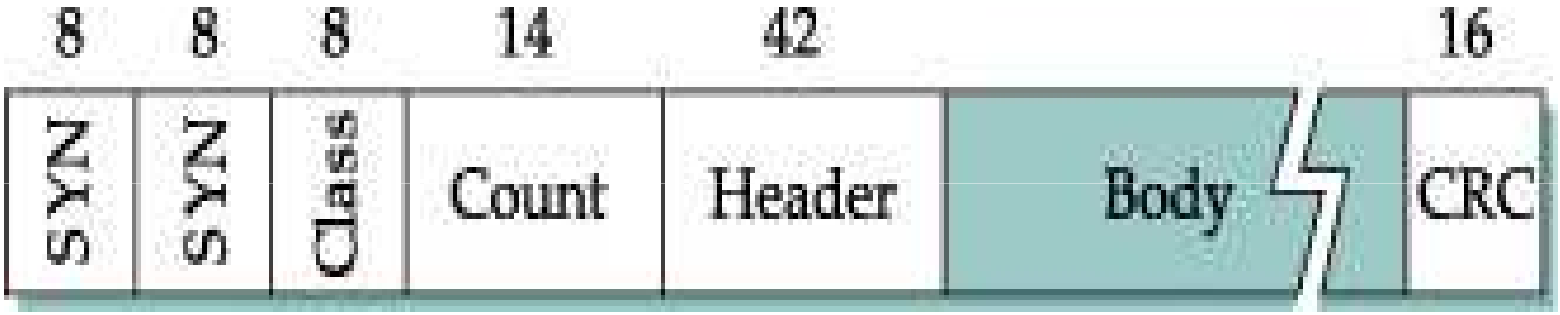
- Flag → Start and end of character 01111110. Byte stuffed when occurs with payload field
- Address → Set to 11111111 indication broadcast.(All stations are to accept the frame.)

CONT…

- Control → set to 00000011 indicating an unnumbered frame. PPP does not provide reliable transmission using sequence number and ack.
- Protocol → What kind of packet in the payload field. Codes are defined for IP, IPX, AppleTalk etc.
- Payload → maximum size 1500 bytes.
- Checksum →Error detection Technique

Byte Counting Approach

- The number of bytes in the frame can be included in the header.



- Count → number of bytes in frame body.
- Error in count field could not detect the end of frame correctly.
- Error in count field →Framing Error.

CONT…

- When framing error occurs receiver waits for next SYN character to start reading the next frame.

Bit Oriented Protocol

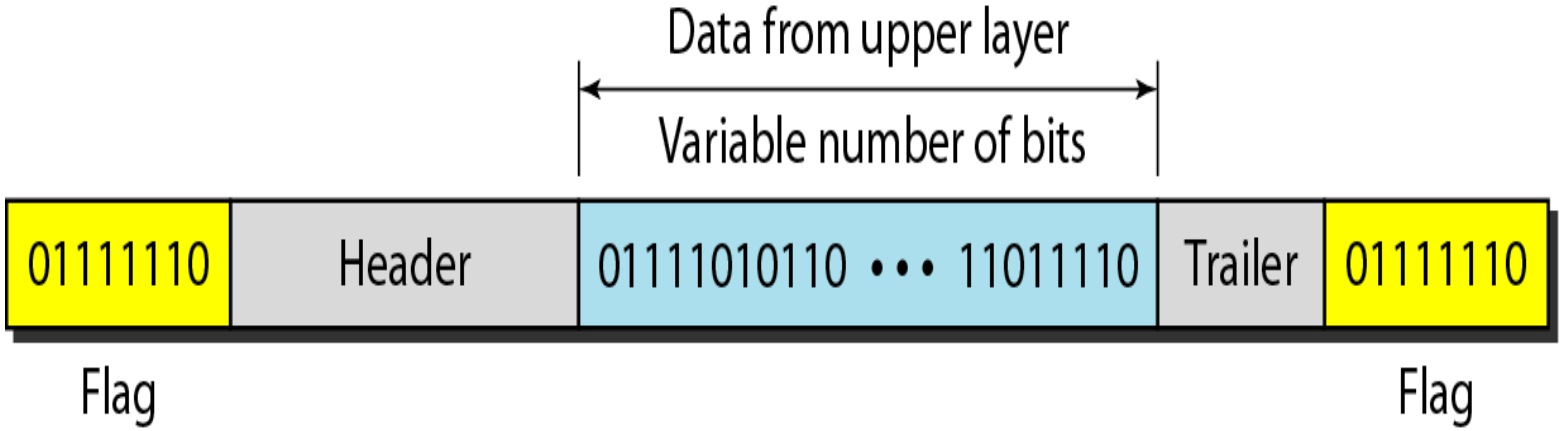
- Views the frame as collection of bits.
- Bits can be ASCII, pixels from an image, or instructions and operands from an executable file.
- SDLC (Synchronous Data Link Control) developed by IBM
- Later standardized by ISO as HDLC (High Level Data Link Control)

FRAMING IN HDLC

- Example protocol for bit oriented approach.
- Designed to support both half duplex and full duplex communication over point to point and multipoint links.
- Frame Format

FRAMING IN HDLC CONT…

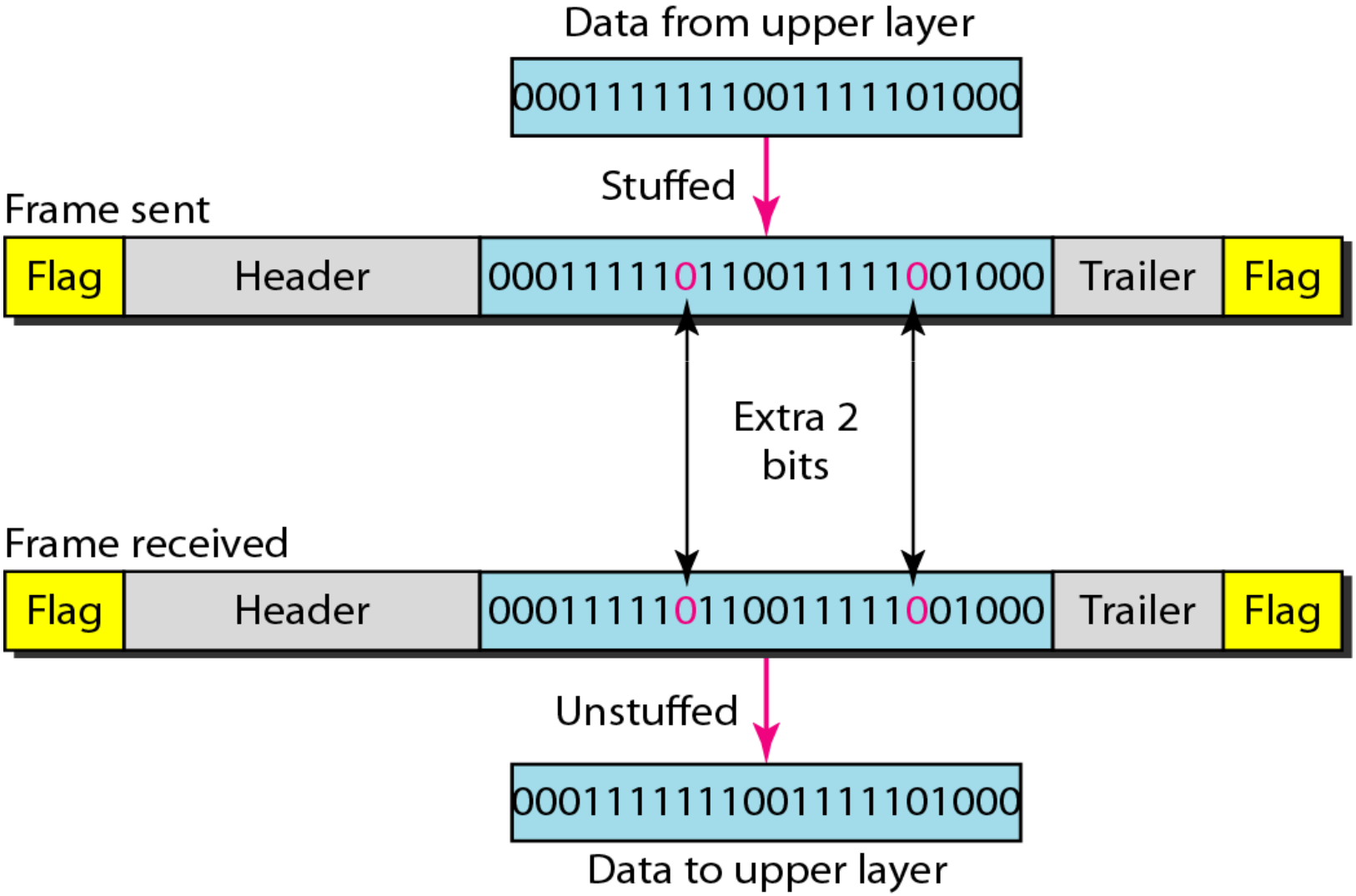
- Beginning and ending sequence → 01111110
- This sequence can occur anywhere in the body of the frame.
- Now do bit stuffing.



BIT STUFFING

- The process of adding one extra 0 whenever five consecutive 1s follow a 0 in the data, so that the receiver does not mistake the pattern 0111110 for a flag.

Bit Stuffing and Unstuffing



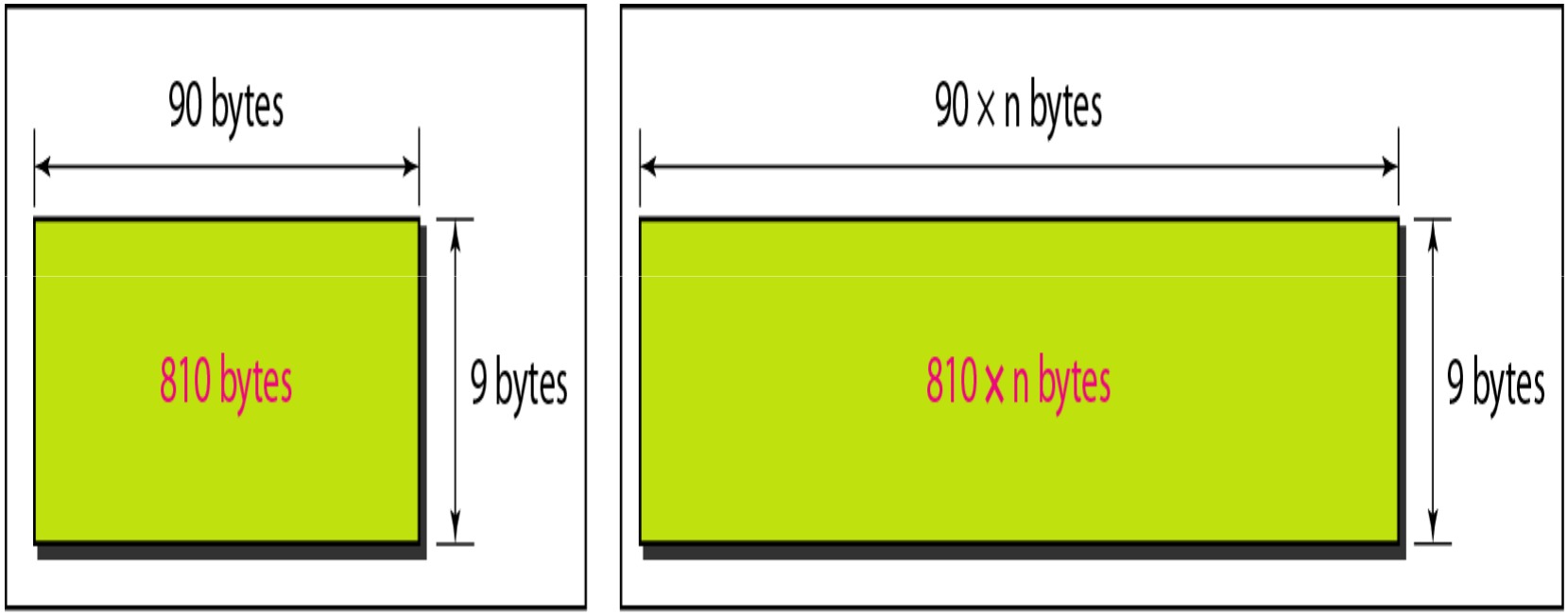
CONT…

- Bit stuffing and Character Stuffing are used with variable sized frames.
- ie. Frame size depends on the payload of the frame.
- The size of payload can vary from frame to frame.

Clock Based Framing

- A form of framing that ensures that all frames are the same size.
- Example → SONET (Synchronous Optical NETwork)
- First proposed by Bell Laboratories and developed by American National Standards Institute (ANSI)
- Used for digital transmission over optical fiber.
- SONET addresses framing and encoding problem

SONET

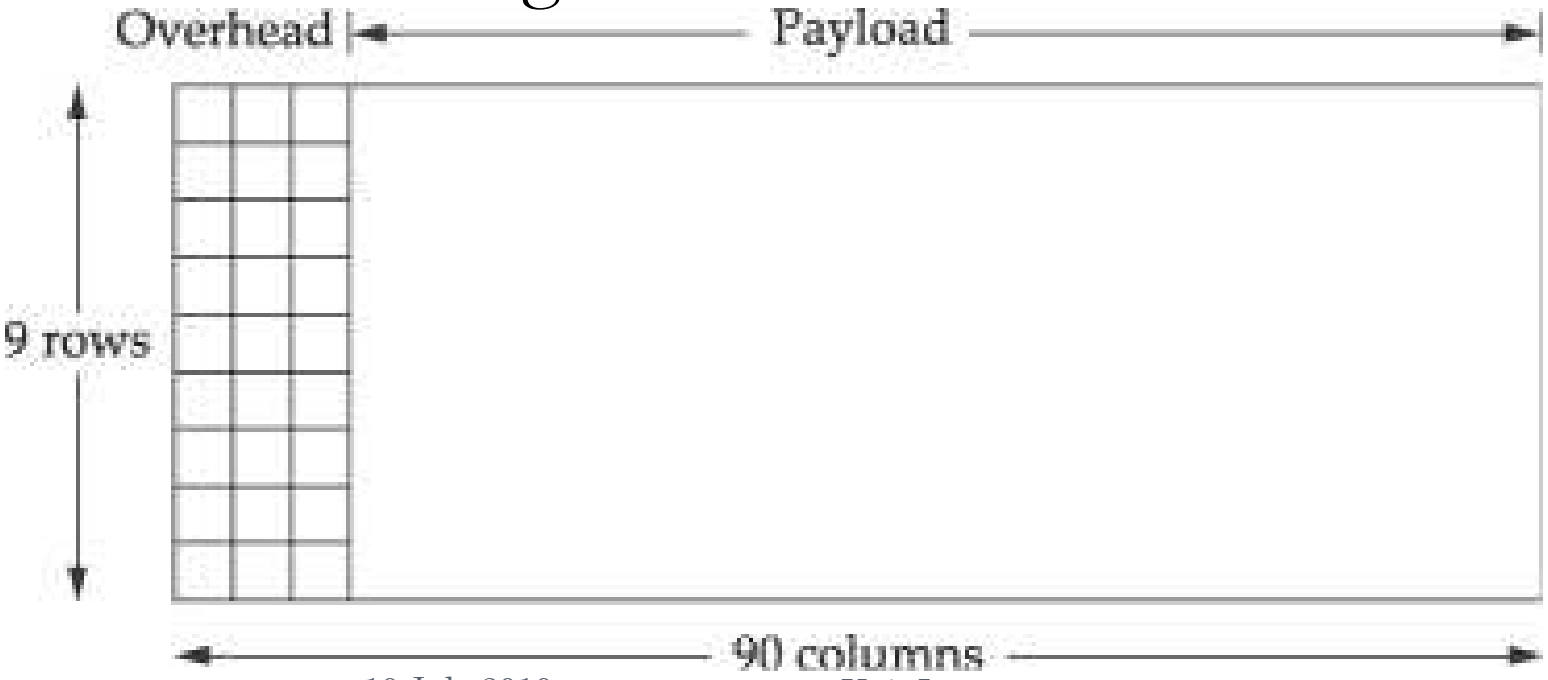


a. STS-1 frame

b. STS-n frame

SONET

- 3 bytes→ overhead rest da8 July 2011ta
- First 2 bytes →special bit pattern which tell the receiver where the frame starts.
- No bit stuffing used.



CONT…

- Transmits at 51.840Mbps
- 1 Frame = 810 bytes (9*90)
- 810*8 bits= 6480bits
- 51,840,000bps/ 6480bits= 8000 Frames/sec