Framing Problem

- Communication protocols break data stream into frames or packets.
- Easier to multiplex several connections over one comms. channel.
- Problem…
  - Where does one frame begin and another end?

Solutions to Framing Problem

- Timed Delay: fixed delay between frames.
  - Delays may occur due to interrupts or breaks in transmission.
- Character count: include a header which contains length of frame, cover with a CRC.
  - If count becomes corrupted, may not find CRC and receiver loses synch.

Solutions to Framing Problem (cont.)

- Character stuffing: mark start of each frame with sequence DLE STX and end with DLE ETX (byte oriented).
  - What happens is DLE STX or DLE ETX occur naturally in the data? Solution - stuff it with another DLE! Receiver watches for double DLEs and destuffs them. Only true delimiters have a single DLE.

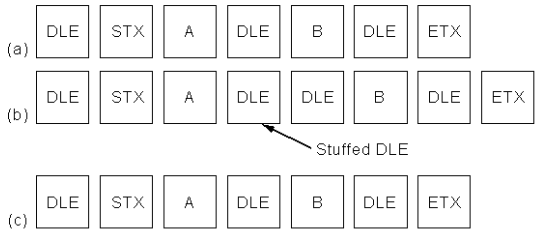

Fig. 3-4. (a) Data sent by the network layer. (b) Data after being character stuffed by the data link layer. (c) Data passed to the network layer on the receiving side.

Solutions to Framing Problem (cont.)

- Bit stuffing: Use unique bit sequence (bit oriented) such as 0111 1110 to mark start of frame.
  - If this occurs in data, stuff it with a 0 after 5 consecutive 1s!
  - Receiver destuffs five 1s followed by a 0, only 6 consecutive 1s is a real delimiter.

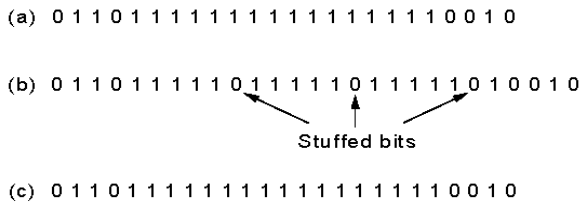

Fig. 3-5. Bit stuffing. (a) The original data. (b) The data as they appear on the line. (c) The data as they are stored in the receiver's memory after destuffing.