

## 2. Framing

- In order to provide service to the network layer, the data link layer must use the service provided to it by the physical layer.
- What the physical layer does is accept raw bit stream and attempt to deliver it to the destination. This bit stream is not guaranteed to be error free.
- It is up to the data link layer to detect, and if necessary, correct errors.
- The usual approach is for the data link layer to break the bit stream up into discrete frames and compute the checksum for each frame. When the frames arrive at the destination, the checksum is re-computed.

There are four methods of breaking up the bit stream

1. Character count.
2. Starting and ending character stuffing.
3. Starting and ending flags, with bit stuffing.
4. Physical layer coding violations.

**Character count**, uses a field in the header to specify the number of characters in the frame. When the data link layer at the destination sees the character count, it knows how many characters follow. Problem: count can possibly be misrepresented by a transmission error. This method is rarely used anymore.

**Starting and ending character stuffing**, gets around the problem of resynchronization after an error by having each frame start with the ASCII character sequence DLE STX and end with the sequence DLE ETX. (DLE is Data Link Escape, STX is Start of Text, and ETX is End of Text). **Problem:** a serious problem occurs with this method when binary data, such as object programs or floating-point numbers, are being transmitted it is possible that the DLE, STX, and ETX characters can occur, which will interfere with the framing. One way to solve this problem is to have the sender's data link layer insert an DLE character just before each "accidental" DLE and the data link layer on the other machine removes them before it gives the data to the network layer, this is called Character stuffing.

**Starting and ending flags with bit stuffing**, allows data frames to contain an arbitrary number of bits and allows character codes with an arbitrary number of bits per character. Each frame begins and ends with a special bit pattern, 01111110, called a flag byte. Whenever the sender's data link layer encounters five

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consecutive ones in the data, it automatically stuffs a 0 bit into the outgoing bit stream, which is called bit stuffing. The receiving machine destuffs the 0 bit. • The fourth method, Physical coding violations, is only applicable to networks in which the encoding on the physical medium contains some redundancy. For example, some LANs encode 1 bit of data by using 2 physical bits.