IT301: Data Communication & Computer Network(DCCN)

Class: B. Tech (CS) Sec A
Semester : V
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Week 8

Data Link Control Protocols

HDLC

High-level Data Link Control Protocol

- Widely used data link control protocol
- HDLC is bit oriented
- It is basis for other data link control protocols

HDLC

It defines 3 types of stations-

- **Primary Station**
- - Responsible for controlling the operation on the link
  - Frames issued by the primary stations are called as commands
- **Secondary Station**
  - Operates under the control of the primary station
  - Frames issued by the secondary station are called as responses
  - Primary station maintains a separate logical link with each of the secondary station on the line
- **Combined Station**
  - It can play the role of both primary and secondary station
  - It can issue command as well as response

HDLC

Link configurations

- Unbalanced configuration- consists of one primary and one or more secondary stations
- Balanced Configuration- consists of two combined stations

Data Transfer Modes

1. Normal Response Mode
   - Used in unbalanced configuration
   - Data transfer is initiated by the command of the primary station
   - Secondary station can transmit data only in response to the command
   - Used in both multipoint and point to point links

HDLC

2. Asynchronous Balanced Mode
   - Most widely used on point to point links
   - Used with balanced configuration
   - Any station can initiate transmission

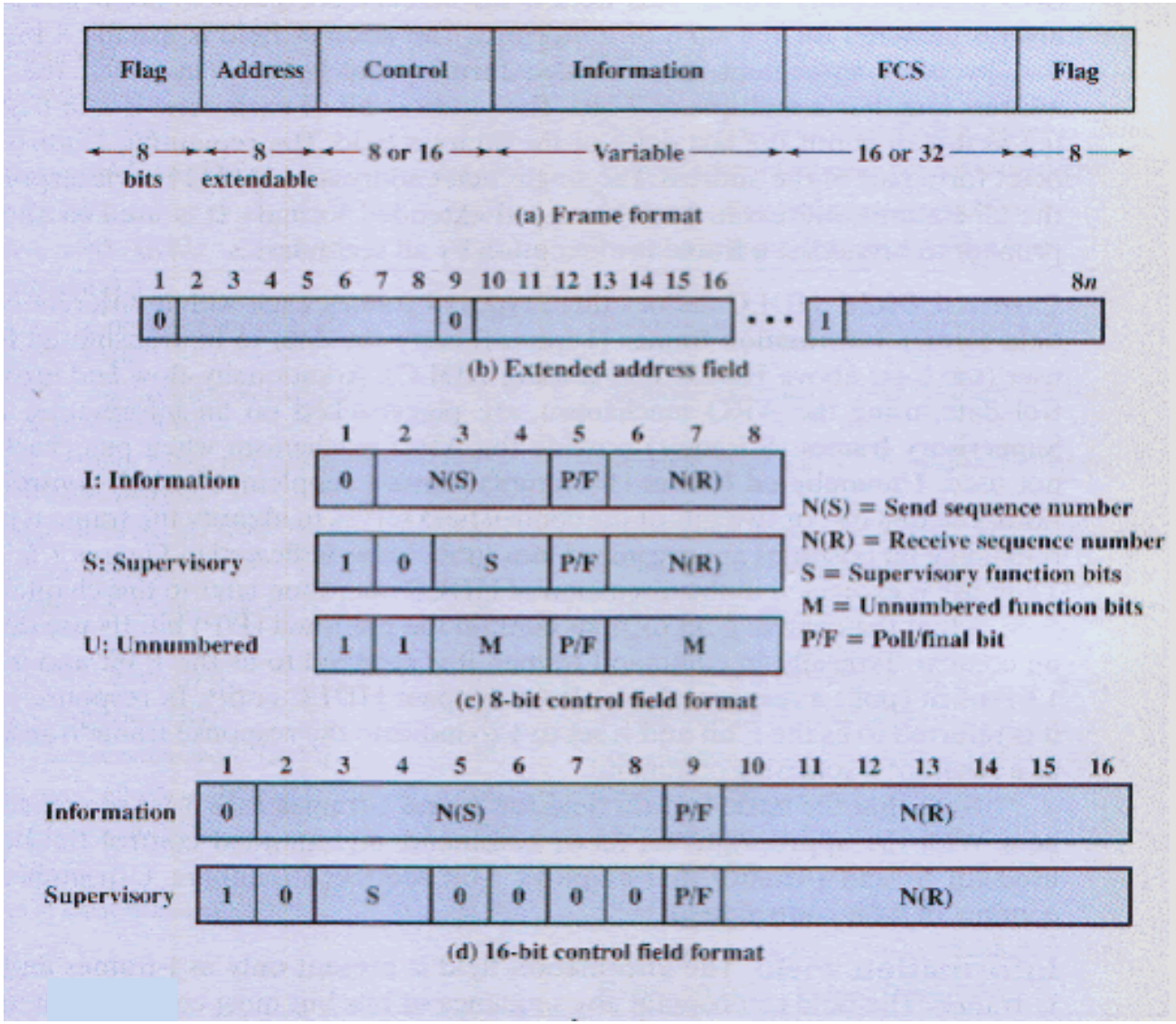
3. Asynchronous Response Mode
   - Used with unbalanced configuration
   - Line management and error recovery is done by primary station
   - Secondary station can initiate transmission without taking permission from primary station
   - This mode is rarely used

Frames Types

There are 3 classes of frames

- **Unnumbered Frames (U-Frames)**
  - These are used in functions such as link setup and disconnections
- **Information Frames (I-Frames)**
  - These frames carry the actual data
  - They can be used to piggyback acknowledgement information related to the I-frame flow
- **Supervisory Frames (S-Frames)**
  - These are basically used for error control and flow control. And therefore they contain send and receive sequence numbers

Frame Format



Flags and Bit Stuffing

- Frames are delimited by a sequence of bits known as a "flag".
- The flag sequence is a unique 8-bit sequence of the form 0111 1110.
- If the flag sequence occur within the content of a frame it could be confused with the end flag
- Data is encoded by inserting a 0-bit after any sequence of 5 consecutive 1's within the payload (Bit stuffing)

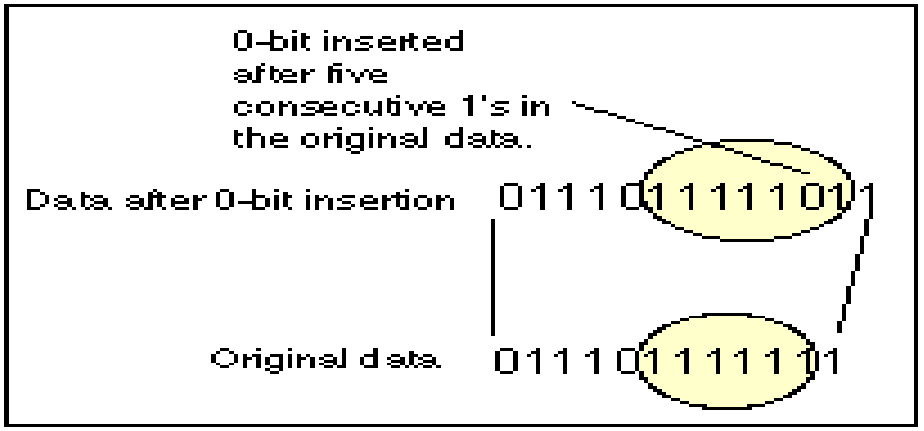


Image Source:
https://www.erg.abdn.ac.uk

Frame Structure

- **Address Field**
  - Identifies secondary station that sent or will receive the frame
  - Usually 8 bits long
  - It may be extended to multiples of 7 bits and the LSB of each octet indicates that it is the last octet (1) or not (0)
  - Mainly used in multipoint link configuration, and not used in point-to-point
  - All address bit is 1's, then it is a broadcast address
- **Control Field**
  - Control field is different for a different frame (I, S , U)
- **Frame Check Sequence**
  - Used for error detection. CRC16 or CRC32 is used for error detection
- **Information Field**
  - Present in I-Frames and some of U-Frames
  - Contains integral number of octets

U-Frames Types

- SNRM – Set Normal Response Mode
- SARM – Set Asynchronous Response Mode
- SABM – Set Asynchronous Balanced Mode
- UP – unnumbered polling
- UA – unnumbered acknowledge
- DISC – disconnect
- RD – request disconnect
- DM – Disconnect mode

S-Frames Types

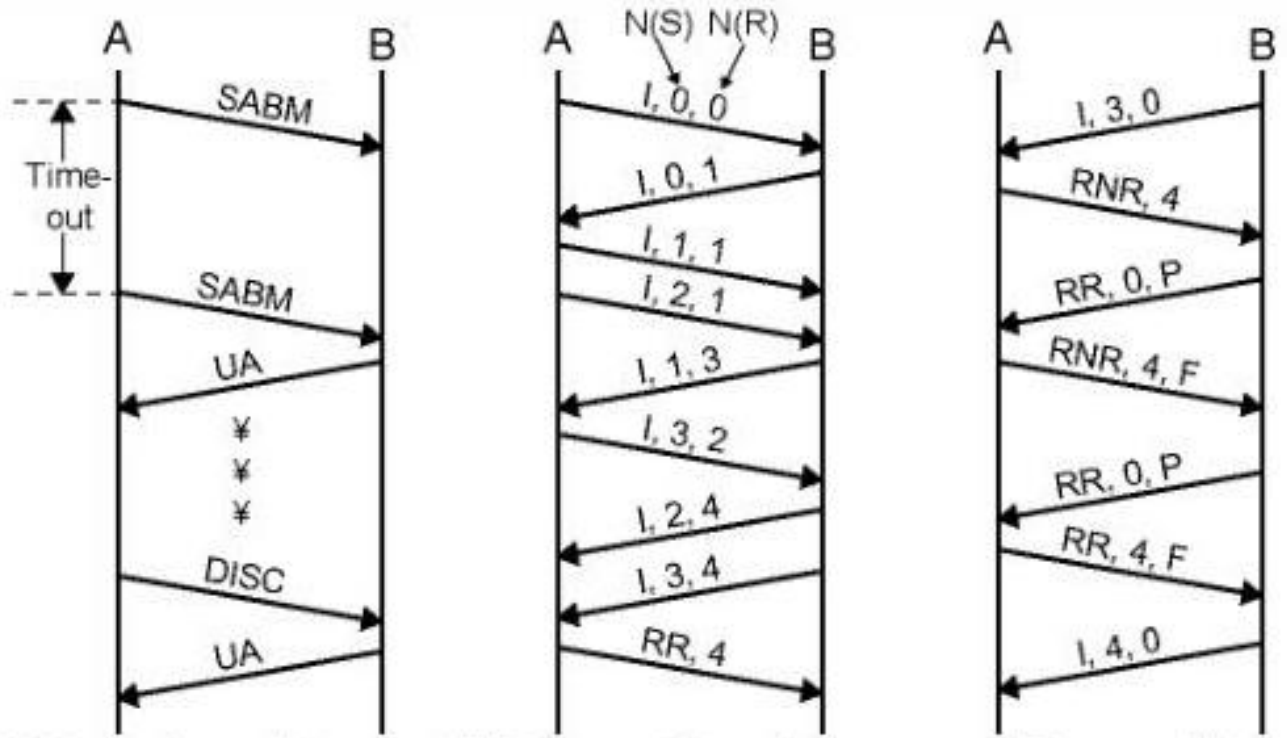
- RR — receive ready
- RNR — receive not ready
- REJ — reject on frame N(R)
- SREJ — selective reject on N(R)

HDLC Operation

HDLC operates in 3 phases:

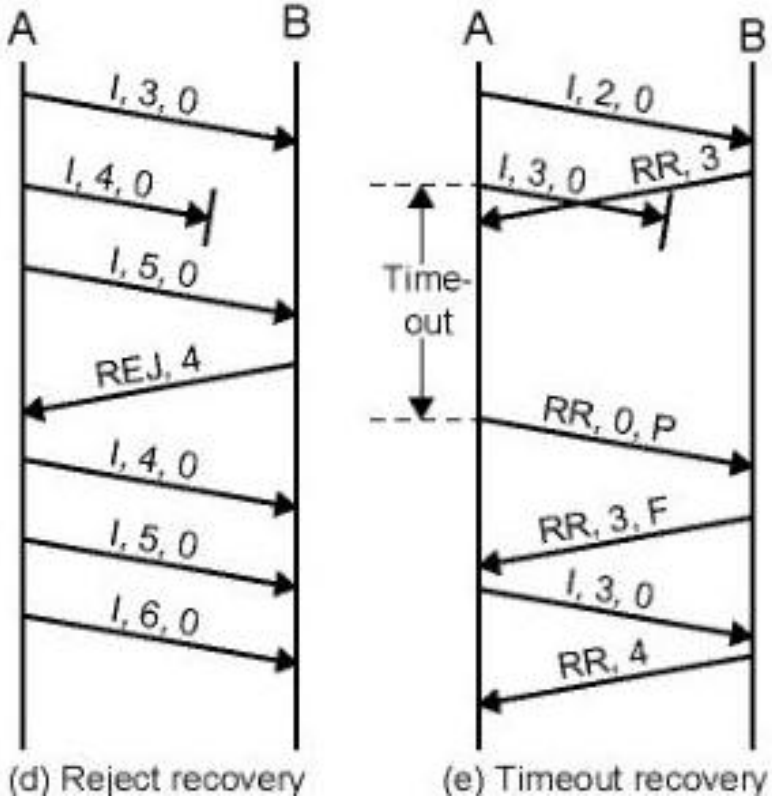
- **Initialization**
  - Signal other side that initialization is required
  - Specifies the data transfer mode
  - Specifies whether 3 or 7-bit sequence number is to be used
- **Data Transfer**
  - I-frames and S-frames are exchanged in this phase
- **Disconnect**
  - Any side can initiate a disconnect by sending a DISC frame

HDLC Operation



(a) Link setup and disconnect (b) Two-way data exchange (c) Busy condition

HDLC Operation



(d) Reject recovery

(e) Timeout recovery