HIGH LEVEL DATA LINK CONTROL PROTOCOL

(HDLC)

High-Level Data Link Control (HDLC)

- HDLC was defined by ISO for use on both point-to-point and multipoint data links.
- It supports full-duplex communication
- Other similar protocols are
  - (i)Synchronous Data Link Control (SDLC) by IBM
  - (ii)Advanced Data Communication Control Procedure (ADCCP) by ANSI
  - (iii)Link Access Procedure, Balanced (LAP-B) by CCITT, as part of its X.25 packet-switched network standard

HDLC Overview

Broadly HDLC features are as follows:

1. It is most widely accepted protocol.It offers a high level of flexibility ,adaptability,reliability and efficiency.
2. Full duplex communication is possible.
3. It is Bit-oriented protocol ie use bits to stuff flags occurring in data
4. Flow control-adjust window size based on receiver capability.

HDLC Overview

To make HDLC protocol applicable to various network configrations,three types of stations have been defined:

1. Primary Station
2. Secondary Station
3. Combined Station

- There are three types of data transfer mode :-
  1. Normal Response mode(NRM)

2. Asynchronous Response mode(ARM)
3. Asynchronous Balanced mode(ABM)

- Three types of frames
  1. Unnumbered or U-frame
  2. Information or I-frame
  3. Supervisory or S-frame

HDLC

- The three stations are discussed as:
  1. Primary station
     - It looks after data link management.
     - In case of communication between primary and secondary station,primary station has responsibility of connecting and disconnecting the data link.
     - Frames issued by the primary station are called *commands*.

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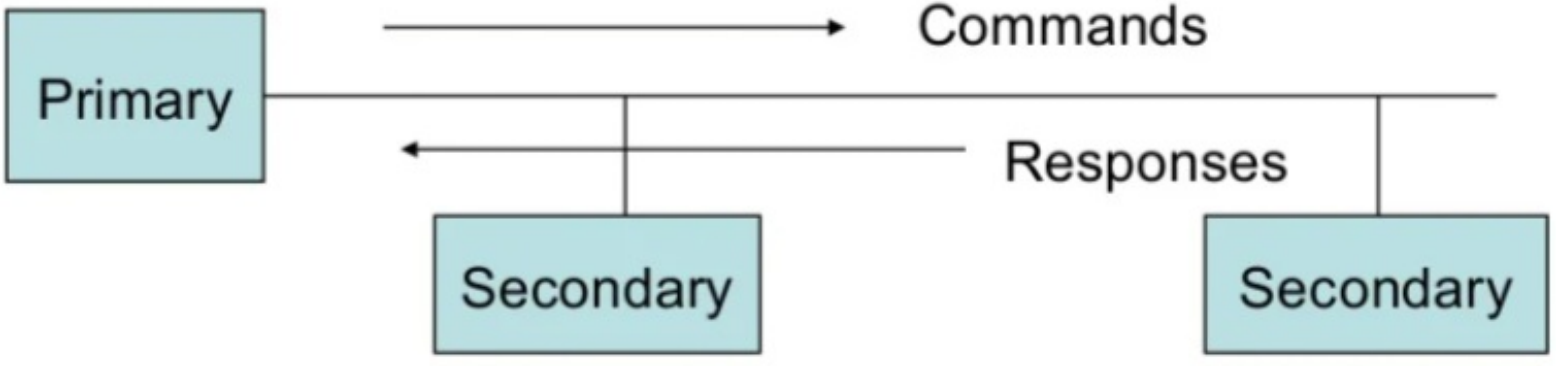
2. Secondary station,
   - Operates under the control of the primary station.
   - Frames issued by a secondary station are called *responses*.
3. Combined station,
   - Acts as both as primary and secondary station.
   - It issue both commands and responses

HDLC

Unbalanced Mode



Balanced mode

HDLC

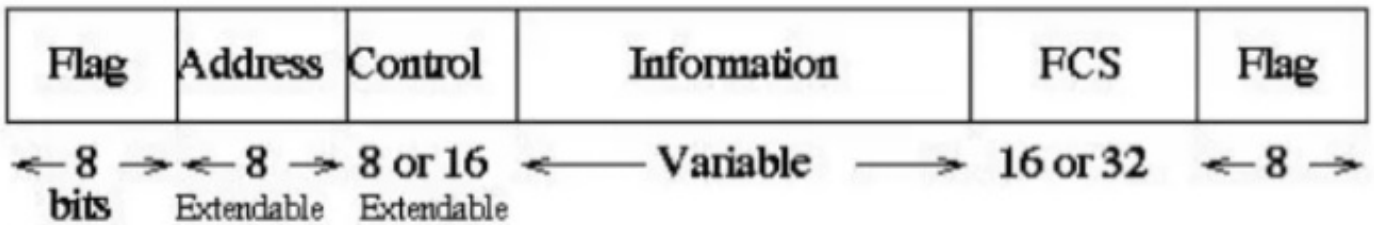
- The three modes of data transfer operations are:
  1. Normal Response Mode (NRM)
     (i) This mode is suitable for point to point and point to multipoint configrations.
     (ii) Primary station controls the overall data link management.
  2. Asynchronous Response Mode (ARM)
     - In ARM secondary station can transmit response(frame) without taking permission from primary station.

- Reduces overhead as no frames need to be sent to allow secondary nodes to transmit.
- Transmission proceeds when channel is detected idle , used mostly in point-to-point-links.
- NRM is more disciplined than ARM.

3.Asynchronous Balanced Mode (ABM)

- Mainly used in point-to-point links, for communication between combined stations
- Information frames can be transmitted in full duplex manner.

Data Link Control HDLC frame structure



(a) Frame format

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	1	2	3	4	5	6	7	8
I: Information	0	N(S)			P/F	N(R)		
S: Supervisory	1	0	S		P/F	N(R)		
U: Unnumbered	1	1	M		P/F	M		

N(S) = Send sequence number
N(R) = Receive sequence number
S = Supervisory function bits
M = Unnumbered function bits
P/F = Poll/final bit

(b) Control field format

(b) Control field format

HDLC

There are three different classes of frames used in HDLC

1. Unnumbered frames, used for exchanging session management and control information between communicating devices.
2. Information frames, which carry actual information. If the first bit in control field is 0 it is identified as I-frame.
3. Supervisory frames, which are used for error and flow control purposes and hence contain send and receive sequence numbers.If first two bits of control field are 1 and 0 it is identified as S-frame.

Flag field is unique 8-bit word pattern(01111110) used to identify start and end of each frame and to fill idle time between consecutive frames.

Address field consist of secondary station.

Control field carries sequence number of frame,ACKs etc.

Frame check Sequence is used for error detection in address.It is 16 bit CRC code for error detection.

Four types of S-frames are possible corresponding to four values of 'S'

1.SS=00→corresponds to receive ready(RR) frames

2.SS=01→corresponds to Reject frame which are used by receiver to send NAK when error has occurred.

3.SS=10→corresponds to Receive not Ready(NRN) frame and is used for flow control.

4.SS=11→corresponds to selective repeat Frame which indicates to transmiter to retransmit the frame indicated in N(R) subfield

N(R) corresponds to value of ACK when piggybacking is used.(to include flow and error control information is piggybacking)

P/F can have two possible values 0 or 1.

- When P/F=1,it means poll when frame is sent by primary station to secondary station(when address field contains address of receiver).
- When P/F=0,it means final when frame is sent by secondary station to primary(when address field contains address of sender).