

Date : 25.07.2023

Subject : Data communication & Networking  
UNIT - 04

HDLC - High level data link control.

- bit oriented protocol for communication.
- Implements ARQ mechanisms.

HDLC provides 2 common transfer modes.

1. Normal Response Mode. - NRM
2. Asynchronous Balanced Mode - ABM

NRM - normal Response mode

- station configuration is unbalanced
- 1 primary station and multiple secondary stations.
- Primary stations can only send commands and secondary stations can only respond.
- used for both point - to - point and multiple point links.

ABM - Asynchronous Balanced Mode.

- station configuration is balanced.
- each station can function as primary and secondary stations.
- link is point - to - point.

FRAMES [ HDLC ]

- HDLC defines 3 types of frames.
  1. Information frames [ I - frames ]
  2. Supervisory frames [ S - frames ]
  3. Unnumbered frames [ U - frames ]

- I - frames : transport user data & control information relating to user data.
- S - frames : transport only control-information.
- U - frames : reserved for system management.

### Frame Format

- six fields (upto 3)
- In multiple-frame transmissions - ending flag of one frame can serve as beginning flag of next frame.

I frame	Flag	Address	Control	User data	FCS	Flag
S frame	Flag	Address	Control	FCS	Flag	
U frame	Flag	Address	Control	Management Information	FCS	Flag
→ Flag : 8 bit pattern - 0111110 - identifies as beginning and end of frame with 11 bits.						
→ Address field : contains address of secondary station 1 byte → 128 stations primary station creates frame - to address						
→ Control field : used for flow & error control.						
→ Information field : user data or management information.						
→ FCS - frame check sequence - error detection field.						

## CONTROL FRAMES

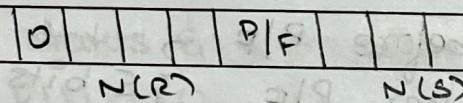
### → I FRAMES

- carry user data from network layer
- include flow & error control
- first bit - 0
- next 3 bits - N(S) - sequence number
- last 3 bits - N(R) - acknowledgement number
- bit b/w N(S) & N(R) - P/F bit.

has meaning only when set to 1

→ poll : frame by primary station  
to address.

→ final : frame by secondary station  
from address.



### → S FRAME

- used for flow & error control when piggybacking is impossible
- first 2 bits - 10
- last 3 bits - N(R) - acknowledgement number
- 2 bits called code - type of S frames.

### → 00 - Receive Ready - RR

• safe & sound frame.

### → 10 - Receive Not Ready - RNR

• receiver is not ready or busy and cannot take more frames.

### → 01 - Reject - REJ

• NAK frame

• used in Go-Back-N - ARQ.

- 11 - Selected reject - SREJ
- NAK frame
  - used in selective repeat ARQ.
  - RR & RNR N(R) is acknowledgement #
  - REJ & SREJ N(R) is negative acknowledgement #

1 0 1 P/F

code

N(R)

## → U-FRAMES

- exchange session management information.
- most info. carried is contained in codes
- first two bits 11
- 2 bit prefix before P/F
- 3 bit suffix after P/F 5 bits form 32 types
- eg: 00 001 SNRM - set normal response mode.

## POINT-TO-POINT PROTOCOL

- service by PPP
- 1. defines format of frame
- 2. defines establishment of link
- 3. defines how 2 devices can authenticate each other.
- 4. provides multiple network layer services
- 5. provides connections over multiple links.
- 6. provides network address configuration.

- \* PPP does not provide flow control.
- \* has simple mechanism for error control  
CRC field used to detect errors.
- lack of error control & sequence numbering  
cause packets to be received in out of order.
- \* PPP does not provide sophisticated addressing mechanisms

### FRAMING

- PPP is byte oriented protocol.

| Flag | Address | Control | Protocol | Payload | FCS | Flag |  
1 byte, 1 byte

- Flag : starts & ends with 1 byte flag  
01111101
- Address : constant value 111.1.1.1 - broadcast address.
- Control : constant value 11000000  
PPP provides no flow or error control, that means this field can be omitted if agreed upon by 2 parties.
- Protocol : defines what is being carried - user data or other info. - has 2 bytes but can also use only 1 byte.
- Payload : → carries user data or other information  
→ default max 1500 bytes, changed if both parties agree  
→ padding required if size is less than negotiated value  
→ byte stuffing is done if flag pattern is repeated.

- FCS - frame check sequence - standard CRC

#### TRANSITION PHASES

- Dead : link is not being used
- Establish : when one of the nodes starts communication.
  - options are negotiated
  - if successful negotiation takes place system goes to authentication phase
- Authenticate : optional phase, decided during establishment phase
  - if authentication is successful after sending several authentication packets, it goes to networking phase or goes to terminate phase
- Network : PPP specifies 2 nodes establish network layer agreement before data can be exchanged.
- Open : data transfer takes place connection remains until one end point wants to terminate connection
- Terminate : connection is terminated several packets are exchanged for closing link

