HDLC Protocol Overview

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HDLC – A Brief Overview

What is HDLC?

- High Level Data Link Control is a protocol, which operates at the data link layer. The HDLC protocol embeds information in a data frame that allows devices to control data flow and correct errors
- HDLC is an ISO Standard developed from the Synchronous Data Link Control (SDLC) standard proposed by IBM
- Operates at the data link layer
- Used on both point-to-point and multipoint (multi-drop) data links
- Role of HDLC is to ensure that the data has been received without any loss or errors and in the correct order
- Provides connection-oriented and connection-less service
- ISO Standards: 3009, 4305

HDLC Basics

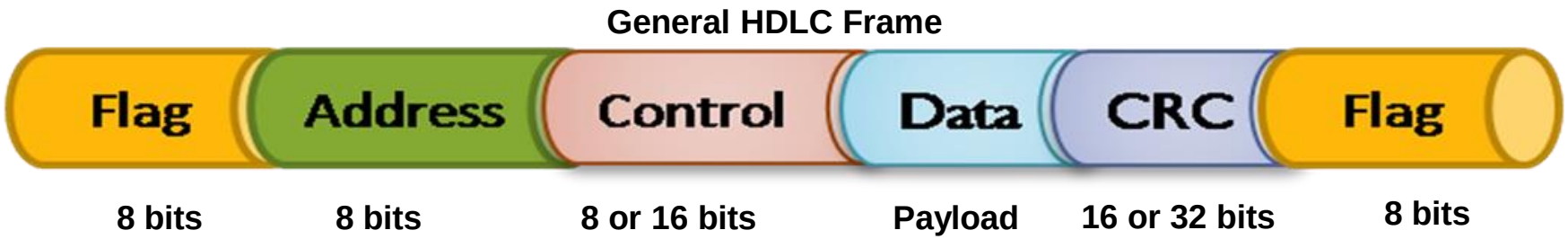
- Stations:
  - Primary: sends data, controls the link with commands
  - Secondary: receives data, responds to control messages
  - Combined: can issue both commands and responses

- Link configuration:
  - Unbalanced: one primary station, one or more secondary stations
  - Balanced: two combined stations

Operation Modes

- HDLC has three operation modes –
  - Normal Response Mode (NRM)
    - Used with unbalanced configuration
    - Primary initiates data transfer; secondary can only reply
  - Asynchronous Response Mode (ARM)
    - Secondary station initiates a transmission without receiving permission from the primary station
    - Primary terminal still retains responsibility for line initialization, error recovery, and logical disconnect
    - Allows the secondary station to send frames asynchronously with respect to the primary station
  - Asynchronous Balanced Mode (ABM)
    - Used with Balanced configuration
    - Either station may initiate the transmission at any time

HDLC Frame Structure



- Flag – Identifies the beginning and end of a frame – 01111110 (7E Hex)
- Address – Address of the station: Single byte
- Control – Defines the frame type and is protocol dependent
- Data – Data field may vary in length depending upon the protocol using the frame. Layer 3 frames are carried in the data field
- FCS – Frame Check Sequence is used to verify the data integrity

Frame Types

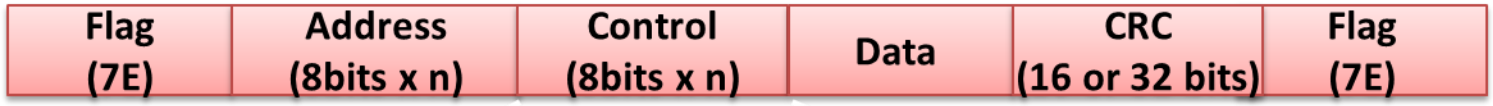
Three classes of frames are used -

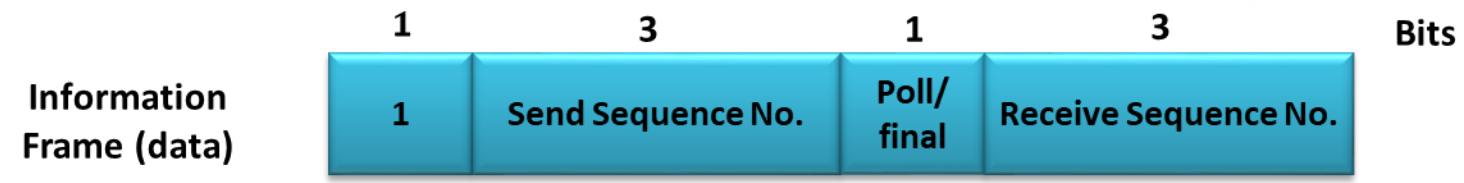
- Information frames (I-Frames) – Carry the actual data. Transport user data from the network layer. In addition, they can also include flow and error control information piggybacked on data

- Supervisory frames (S-Frames) – Used for error and flow control. They contain, send and receive sequence numbers

- Unnumbered frames (U-Frames) – Used for various miscellaneous purposes, including link management

Control Fields





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Information Frames (I-Frames)

- N(S): Sending Sequence Number
- N(R): Receiving sequence number
- P/F: Poll or Final bit

Supervisory Frames (S-Frames)

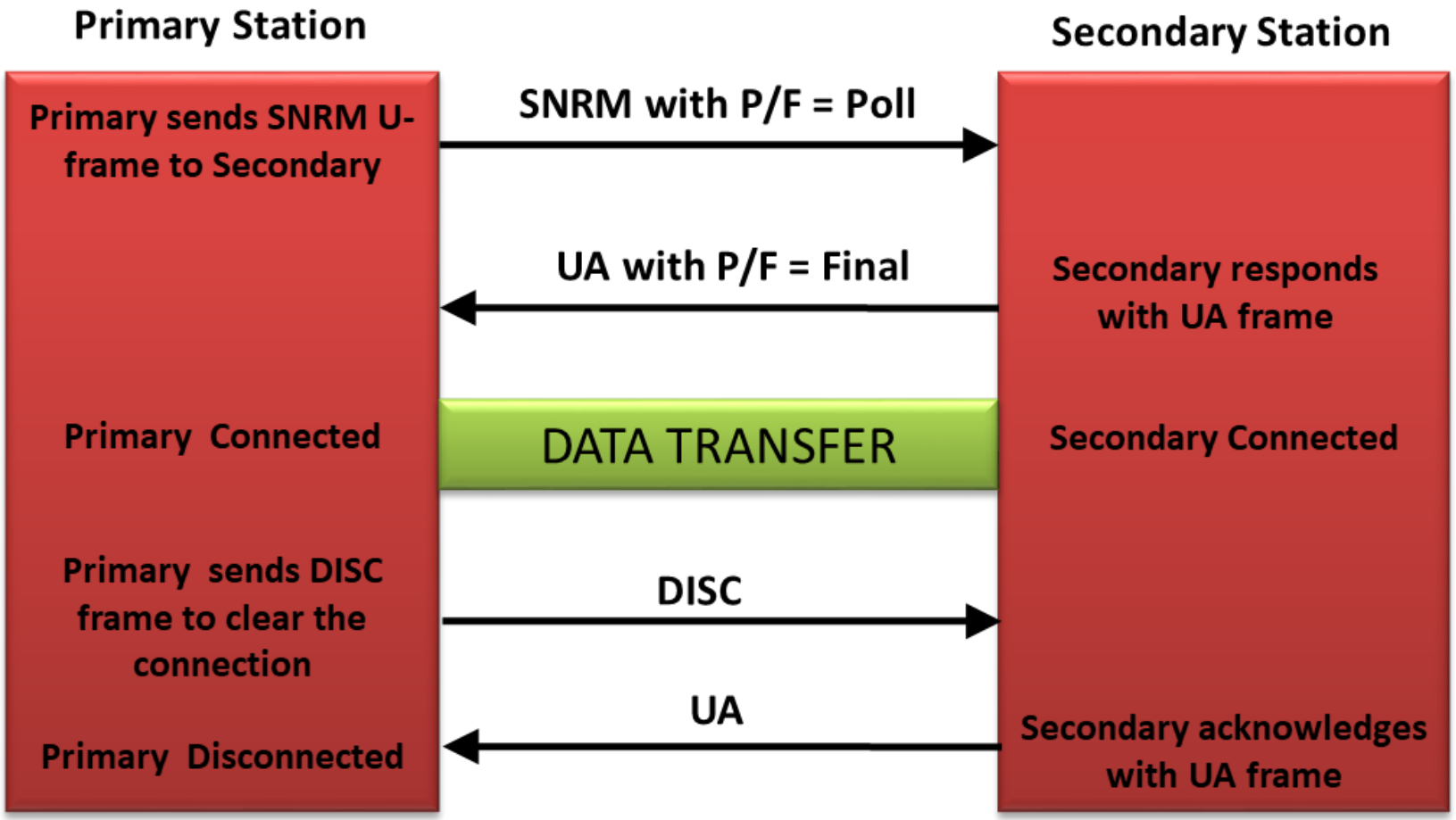
- S =00 RR - Receiver Ready to accept more I-frames (data)
- S =10 RNR - Receiver Not Ready to accept more I-frames
- S =01 REJ - Go-Back-N retransmission request for an I-frame
- S =11 SREJ - Selective retransmission request for an I-frame

Unnumbered Frames (U-Frames)

- SNRM: set normal response mode (M1 = 00, M2 = 001)
- SABM: set asynchronous balanced mode (M1 = 11, M2 = 100)
- SABME: set asynchronous balanced mode, extended (M1 = 11, M2 = 110)
- DISC: disconnect (M1=00, M2=010)
- UA: un-numbered acknowledgement (M1 = 00, M2 = 110)
- RSET: resets send and receive sequence numbers (M1 = 11, M2=001)
- FRMR: frame reject (M1 = 10, M2=001)

Protocol Operation

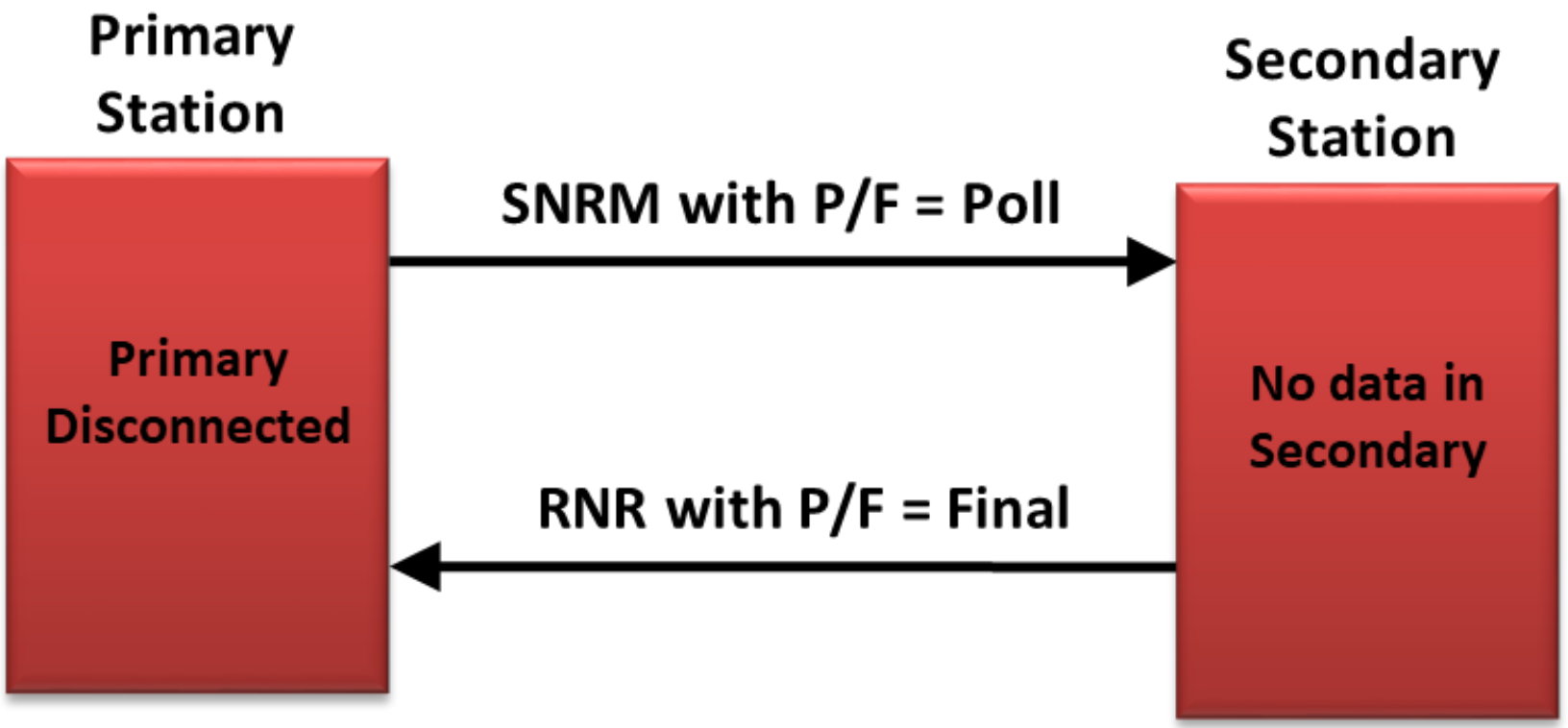
- Basic functions involves –
  - Link management
  - Data transfer (includes error and flow control)



Link Management and Data Transfer

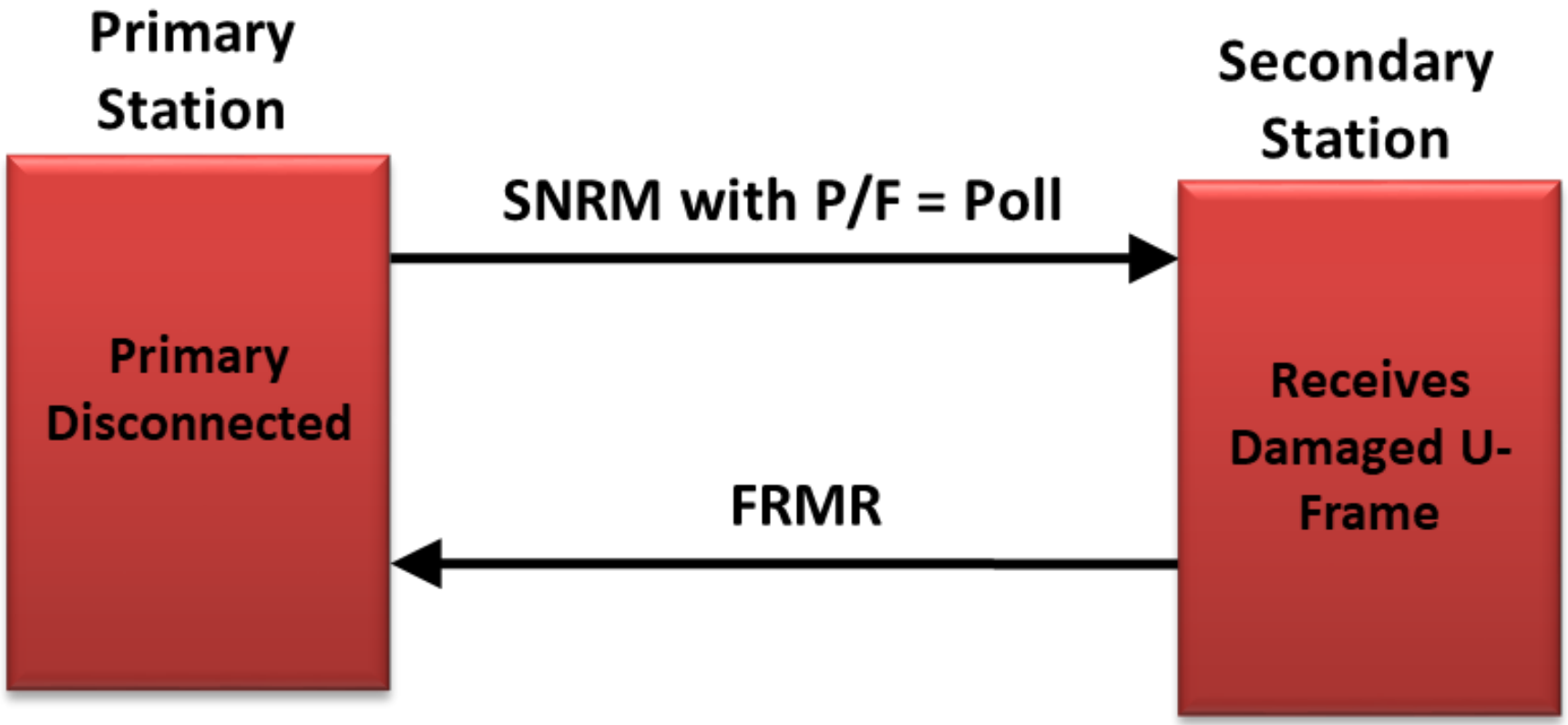
- Establishes a logical connection between the two communication parties prior to any transmission
- Primary station sends the SNRM (Set Normal Response Mode) , SABM (Set Asynchronous Balanced Mode), SABME (Set Asynchronous Balanced Mode, Extended) with the poll bit set to 1 and the address of the appropriate secondary in the address field
- Primary sets the mode, and the length of sequence numbers
- The secondary responds with a UA frame with the final bit set and its own address in the address field
- If data is waiting, it transmits the data, typically as a sequence of information frames
- Primary clears the link is cleared by sending a DISC (Disconnect) frame and the secondary responding with a UA

Link Management and Data Transfer



- If the secondary has no data to transmit, it returns an RNR frame with the F bit set

Link Management and Data Transfer



- If a damaged U-frame is received, FRMR is sent as a reply

GL Test Tools for HDLC

- For T1
  - HDLC Playback
  - HDLC Tx/Rx Utility
  - HDLC Tx/Rx Client Server Applications
  - HDLC Impairment
  - HDLC Analyzer
- For T3
  - HDLC Playback
  - HDLC Tx/Rx Utility
  - HDLC Tx/Rx Client Server Applications
  - HDLC Analyzer
- For Datacom
  - HDLC Playback
  - HDLC Impairment
  - HDLC Tx/Rx Client Server Applications
  - HDLC Analyzer

Thank You