SET 4573: Data Communication and Switching System

Chapter 4: Data Link Layer Protocol

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High Level Data Link Control (HDLC)

- one of the most commonly-used protocols in layer 2 in OSI Model
- Manage the flow of packets at data link layer (layer 2)
- Variation of HDLC is also used in X.25, Frame Relay

HDLC Station Types

- Primary station
  - controls operation of network link
  - issue command to control other stations (secondary stations)
  - maintains logical link to each secondary stations
- Secondary station
  - under the control of primary station
  - will response to commands by primary station
- Combined station
  - Can both issue commands and responses

HDLC Transfer Modes (1)

- Normal Response Mode (NRM)
  - unbalanced configuration (primary & secondary stations)
  - primary initiates transfer to secondary and secondary will response to the command from primary
  - host computer as primary & terminal as secondary station
    - e.g mainframe computer environment

HDLC Transfer Modes (2)

- Asynchronous Balanced Mode (ABM)
  - balanced configuration with both primary and secondary can initiate transmission
  - widely used
    - e.g X.25

HDLC Transfer Modes (3)

- Asynchronous Response Mode (ARM)
  - unbalanced configuration where secondary station may initiate transmission without permission from primary station
  - rarely used

HDLC Frame Structure

- uses synchronous transmission
- single frame format for all data and control information transmission

Flag (8-bit)	Address (8 and extendable)	Control (8 or 16 bits)	Information (variable)	FCS (16 or 32 bits)	Flag (8-bit)

Flag Fields

- Preamble and postamble field at both ends of the frame with 01111110 pattern
  - used to synchronization process to determine the beginning and end of frame
- Bit stuffing used to avoid confusion with data containing 01111110
  - bit '0' inserted after every sequence of five consecutive bit '1's
  - receiver will delete bit '0' after detecting five '1's in the frame
  - otherwise it will accept as the normal bit/data

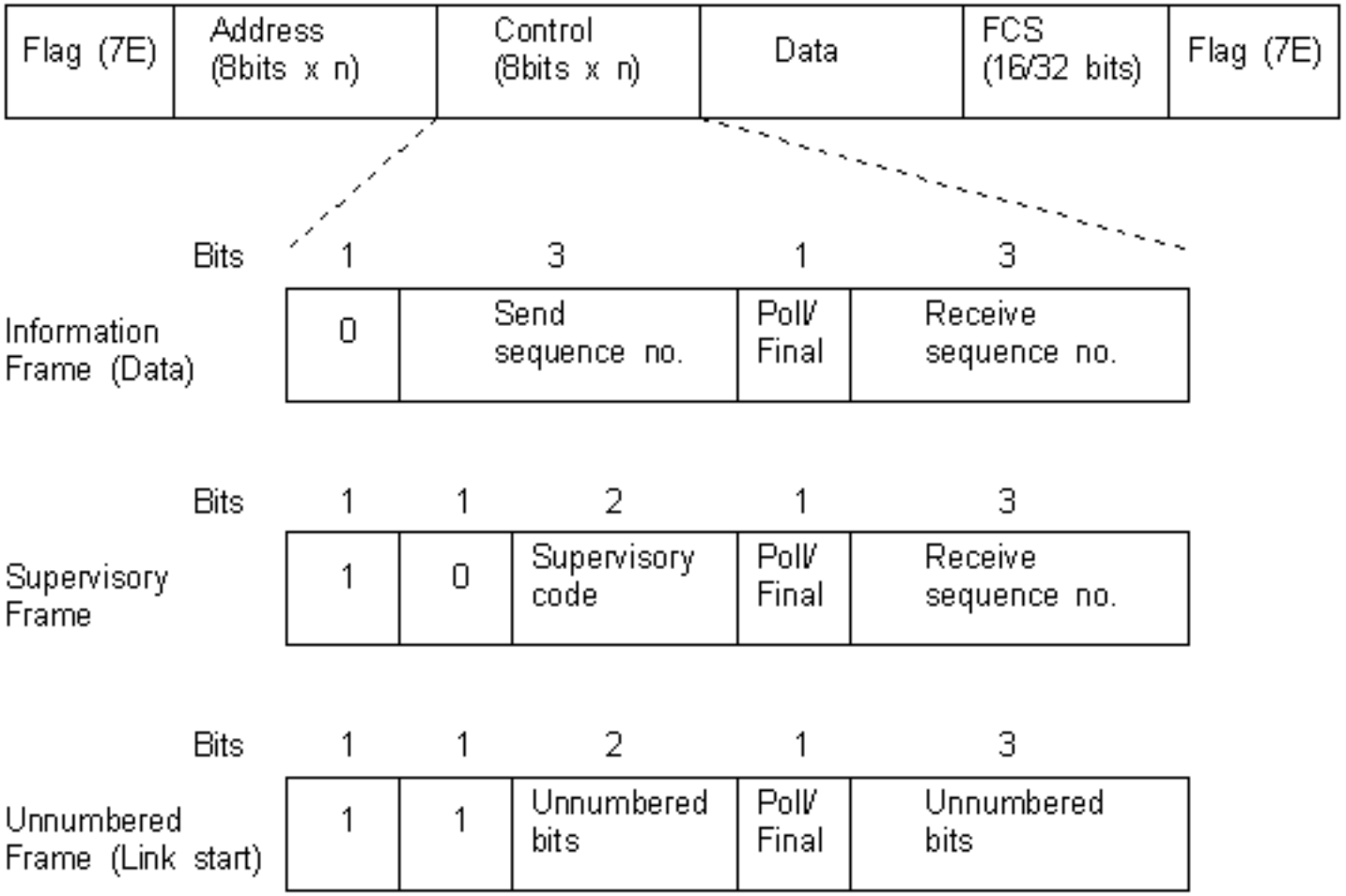
Address Field

- Identifies secondary station that sent or will receive frame with 8-bit long (an octet) or multiples of 7-bit
  - Least Significance Bit (LSB) of each octet indicates that it is the last octet (bit 1) or not (bit 0)
- Broadcast address is set to 11111111

Control Field

- to identify for different type of frames
  - Information frame (I-frame) – contains data to be transmitted to user (next layer up)
    - also contains frame sequence number for flow and error control or ACK
  - Supervisory frame (S-frame)- used as the ACK frame
  - Unnumbered frame (U-frame) – management data for link control
- The first or two bits of control field identify the frame type

Control Field Diagram



Poll/Final Bit

- Used by command frame
  - P bit
    - 1 to poll response from peer
- Used by response frame
  - F bit
    - 1 to indicate response to command

Information Field

- Filled with user information in I-frame and link management information for U-frame
- Contain integral number of octets
- Variable length

Frame Check Sequence

- FCS code
- Error detection
- 16 bit or 32 bit CRC code

HDLC Operation

- Exchange of I-frames, S-frames and U-frames
- Three phases
  - Initialization
    - initiated using U-frame to setup the link
  - Data transfer
    - uses I-frame to send user data and S-frame for ACK
  - Disconnect
    - uses U-frame to disconnect the logical link

Link Access Procedure Balanced (LAPB)

- Synchronous serial transmission to manage frame between DCE and DTE
- Support popular protocols
  - X.25
  - Frame Relay
  - ATM

Link Access Procedure D-channel (LAPD)

- Layer 2 protocol for D-channel in ISDN
- Used to transmit messages over D-channel
- Evolved from LAPB X.25