Telecom Systems
Chae Y. Lee

HDLC

Contents

HDLC frame formats:

- Information/Supervisory/Non-sequenced

Flow/Error Control in HDLC (Supervisory format)

Link establish/disconnect (Non-sequenced format)

HDLC (High-level Data Link Control)

Used on both point-to-point and multipoint lines

Used for half-duplex (HDX) and full-duplex (FDX)

Operation between peer devices and between the primary and secondary devices

HDLC (High-level Data Link Control)

HDLC defines

Three types of stations;

- Primary station, Secondary station, combined station

Two link configurations;

- Unbalanced configuration: 1 primary and ≥1 secondary stations
- Balanced configuration: 2 combined stations

HDLC (High-level Data Link Control)

Three data transfer modes of operation;

- Normal response mode (NRM): used with unbalanced configuration
- Asynchronous balanced mode (ABM): used with balanced configuration
- Asynchronous response mode (ARM): used with unbalanced configuration, the secondary may initiate transmission without explicit permission of the primary

BIT-ORIENTED FRAMING

FRAME FORMAT

	Flag	Address	Control	Information (optional)	FCS	Flag
Number of octets	1	1 or 2	1 or 2	0 to N	2 or 4	1

Bit-oriented Data Link Layer (Layer 2) Protocols:

High-level data link control (HDLC) developed by the ISO as ISO 3309

Advanced data communication control procedures (ADCCP) developed by ANSI as ANSI X3.66

Link access procedure, balanced (LAP-B) developed by the CCITT, and

Synchronous data link control (SDLC) developed by IBM as part of their System network architecture (SNA). IBM was the inventor of this protocol family. SDLC was released in 1974 as part of the first release of SNA. Other followed IBM.

Flag Synchronizes and delineates the beginning and end of the frame. It is always 01111110.

Address Identifies outlying terminals that are in communications with the primary host computer. Since the address always appears in the frame, the primary station can interleave and accept frames from a number of stations.
The address can also be used to “broadcast” information.

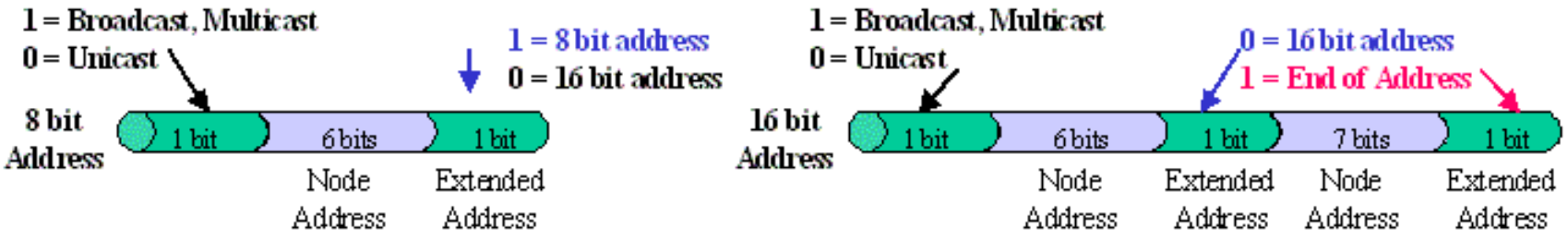
The address field always contains the address of a secondary station. When the primary station transmits, it is the receiving secondary station's address, if it is a secondary responding, it is it's own address. This field is only populated for Unbalanced connections, it is otherwise empty for point-to-point (Balanced) links.

Control This is used for machine-to-machine talk or conversation. It is used by the primary to control the secondary operation, by the secondary to respond, and by co-equals to negotiate and pass information.

Information No constraints on length or content. There are certain conditions when there will be no information. It is rare if this frame exceeds 1000 octets

Frame Check Sequence Contains a CRC-16 or 32 error detection code that checks for errors between the flags.

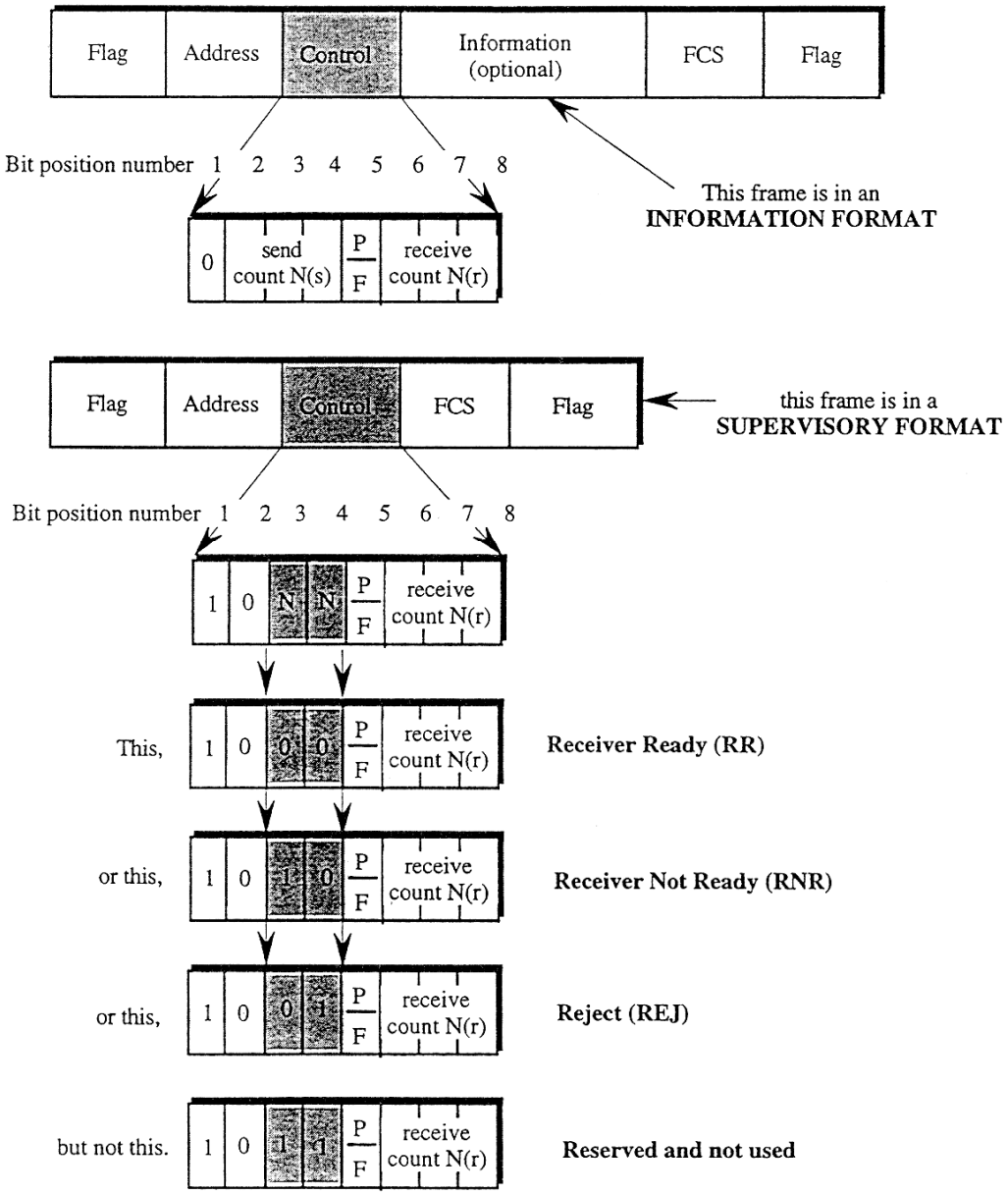
HDLC Address Field



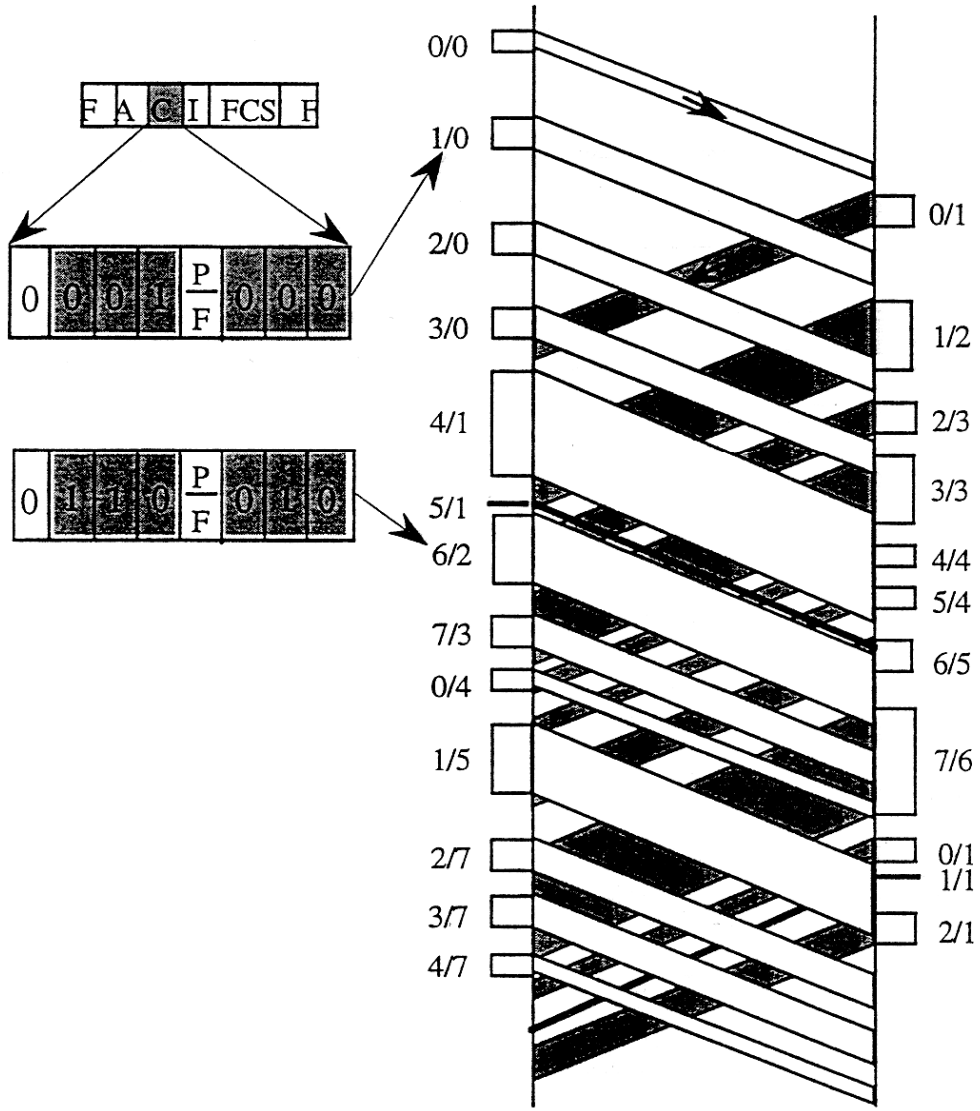
HDLC Address Field

The length of the address field depends on the data link layer protocol used, but is normally 0, 8 or 16 bits in length. In many cases the address field is typically just a single byte, but an Extended Address [EA] bit may be used allowing for multi-byte addresses. A one residing in the LSB bit indicates [the end of the field] that the length of the address field will be 8 bits long. A zero in this bit location [now the first byte of a multi-byte field] indicates the continuation of the field [adding 8 additional bits]. The SDLC protocol will use only an 8 bit address. The SS7 protocol, which is used in point-to-point links, does not use an address field at all.

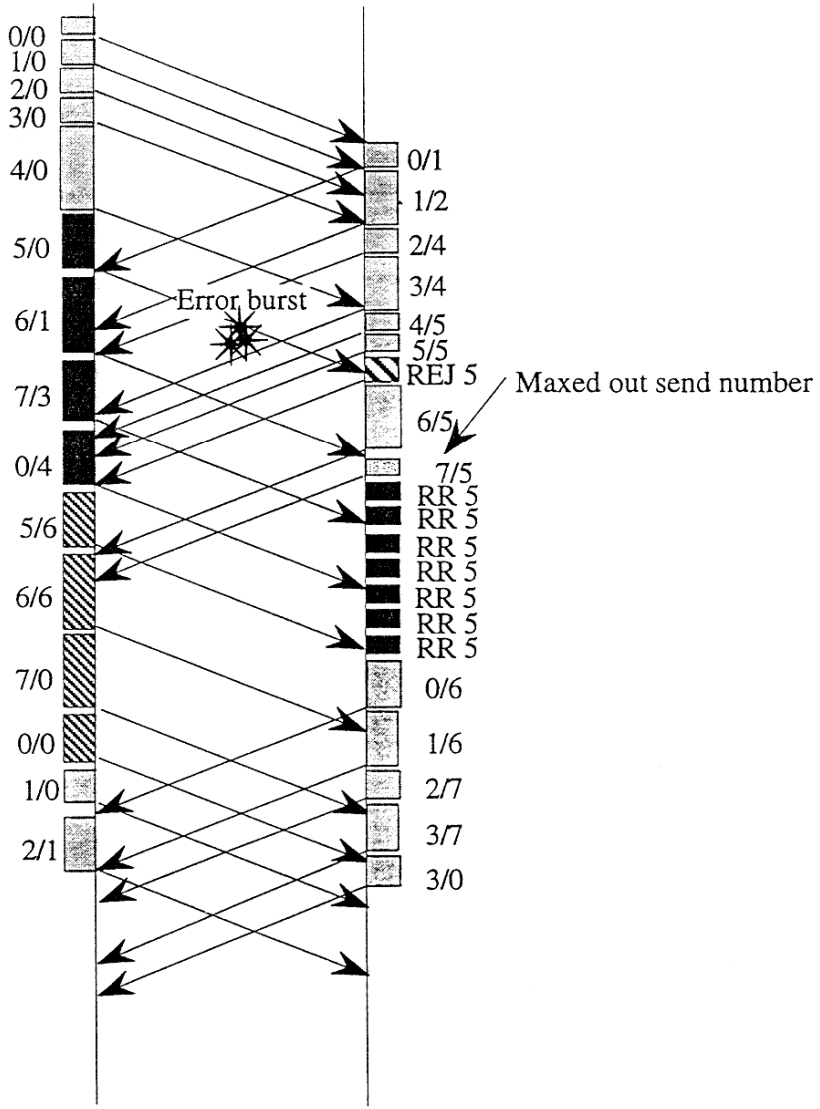
HDLC FRAME EXPANSION



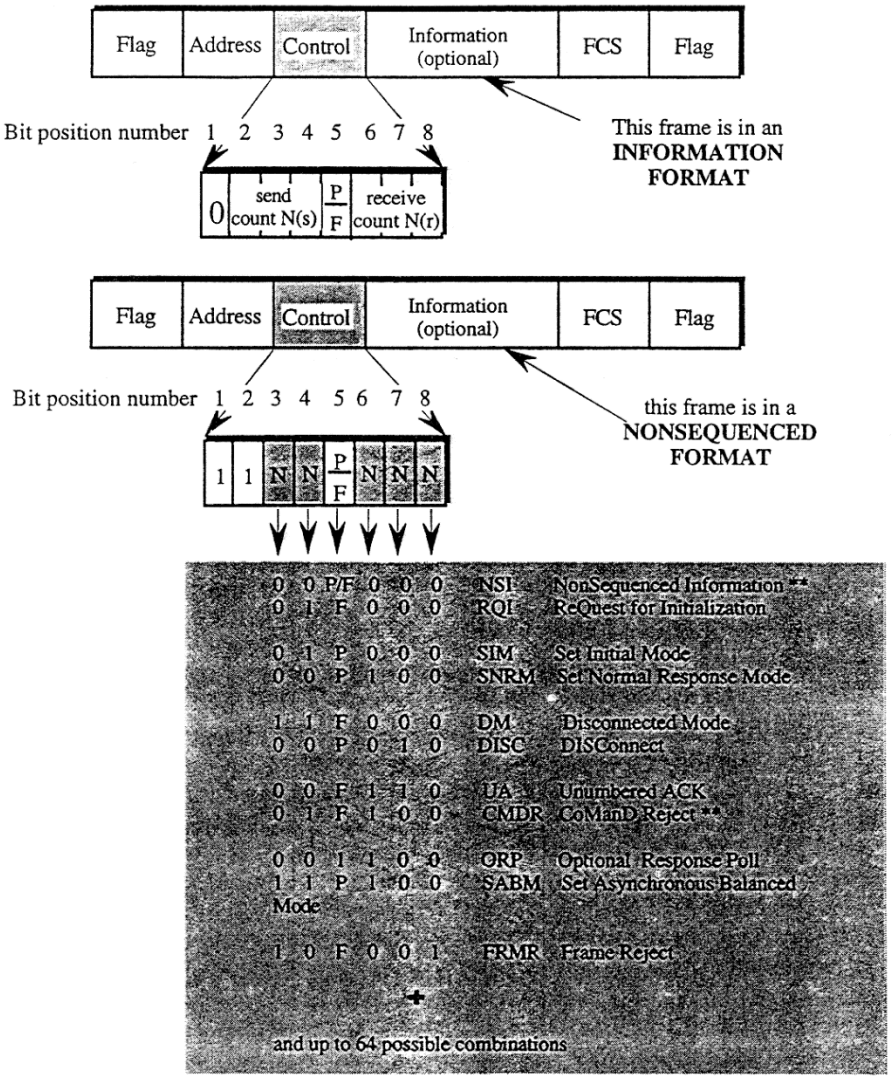
ERROR-FREE POINT-TO-POINT HDLC INFORMATION EXCHANGE



THE HDLC "GO BACK N" ERROR RECOVERY PROCESS

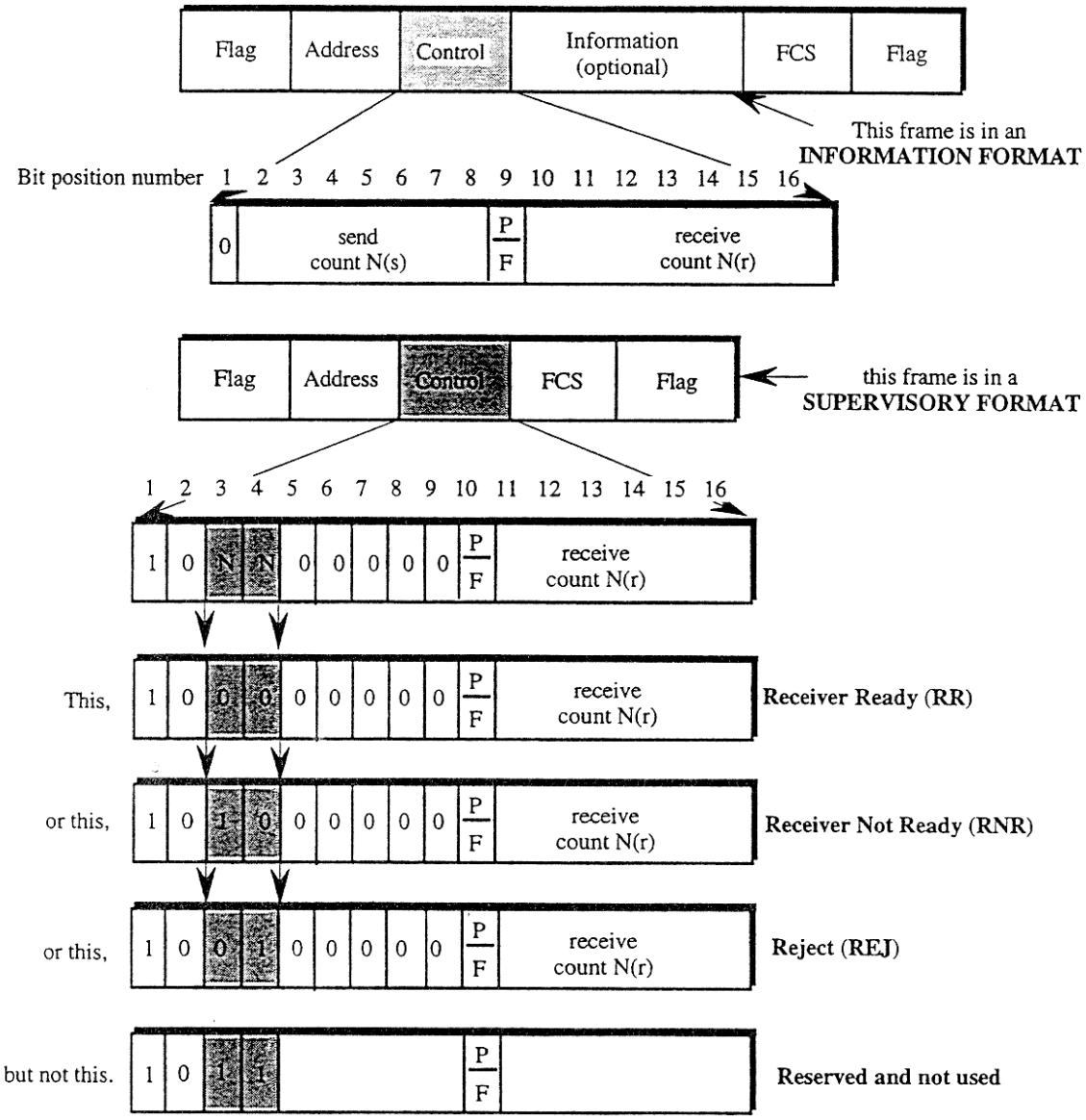


HDLC NONSEQUENCED FRAME FORMAT & COMMANDS



** Information Field follows the Control Field and is followed by a FCS Field.

MODULO 128 HDLC FRAME EXPANSION



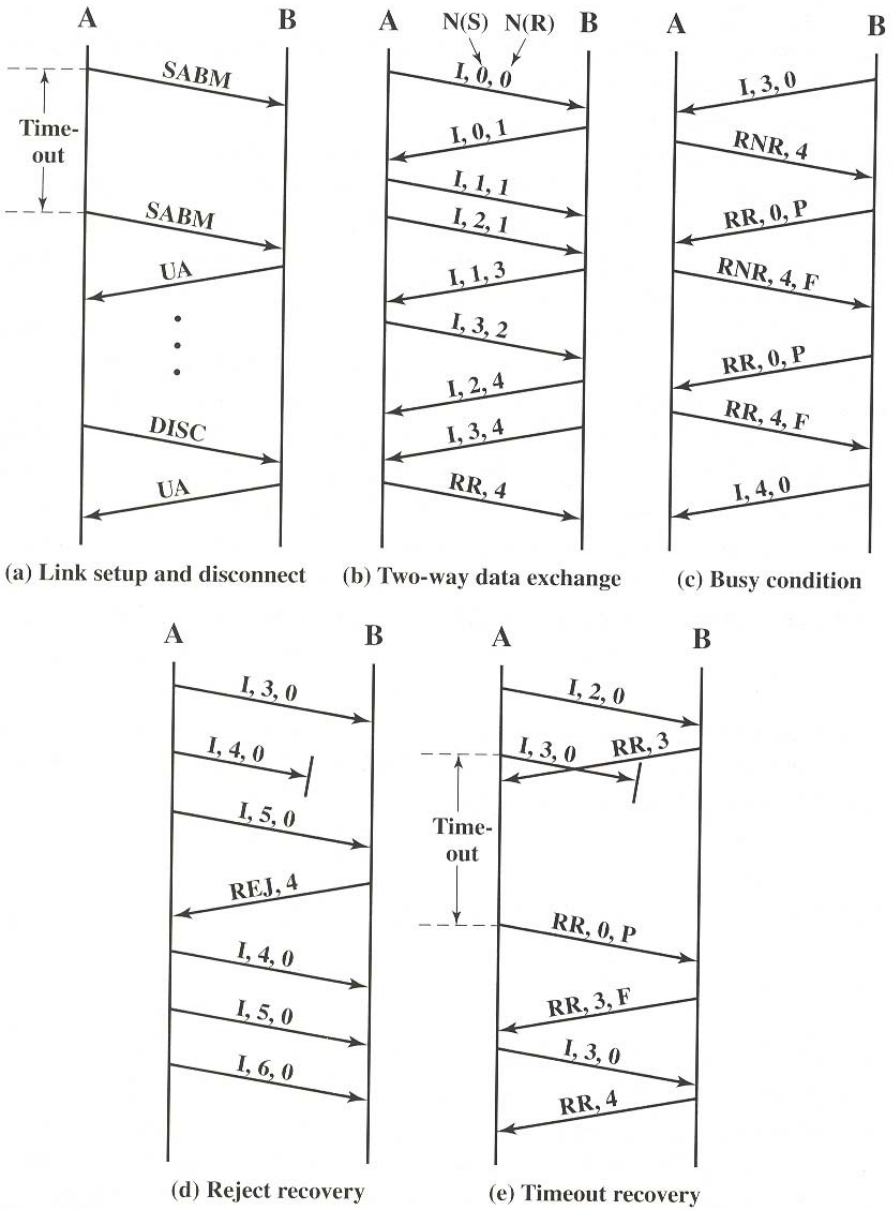
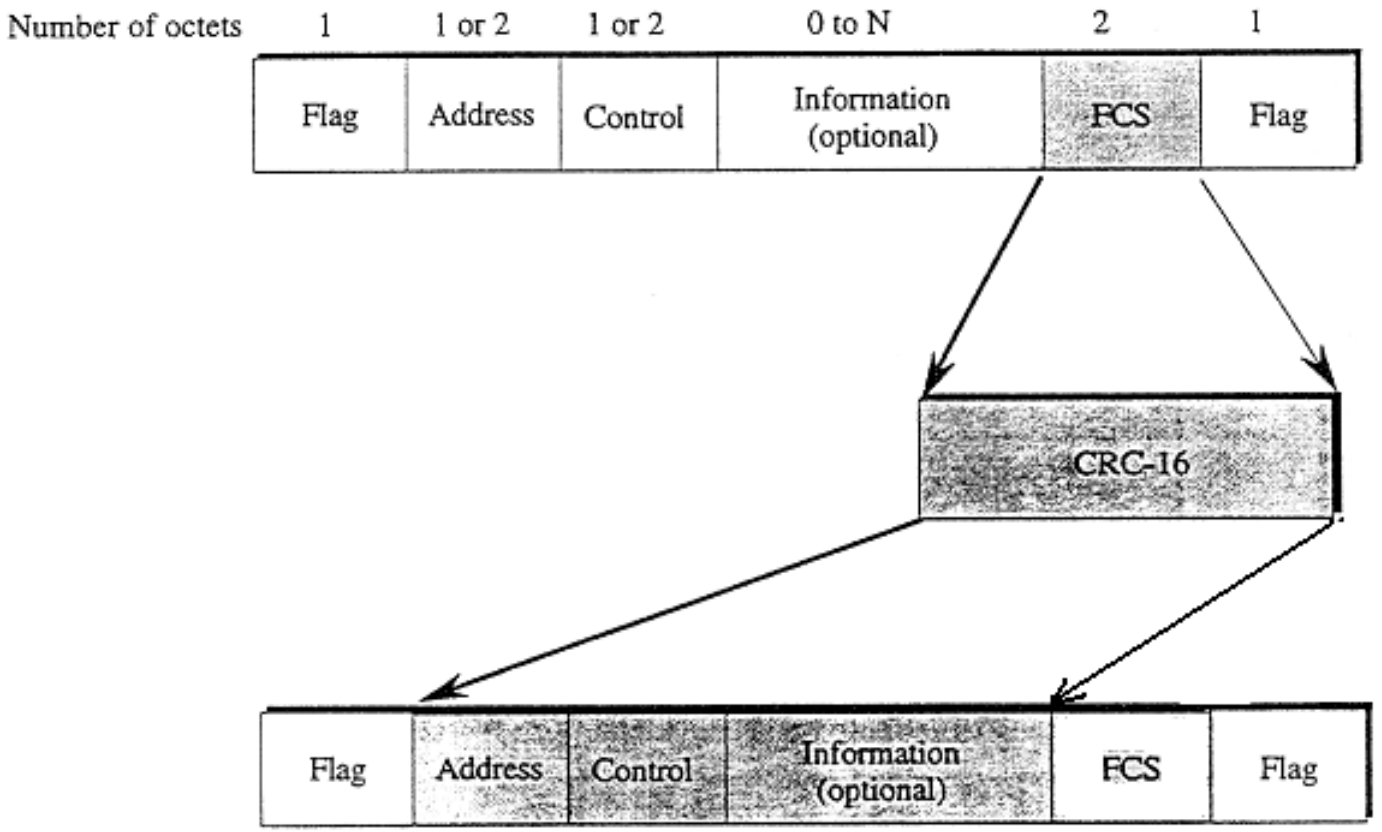
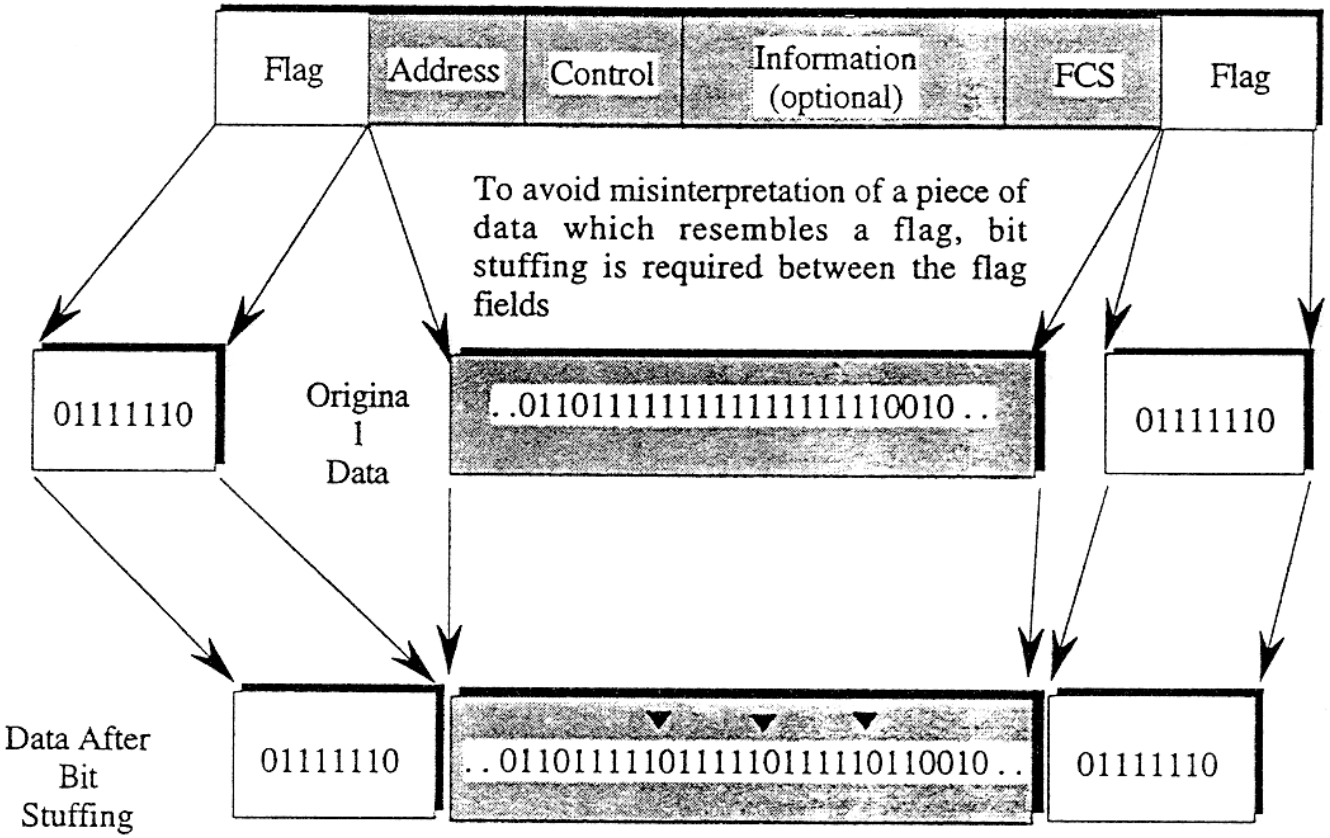


Figure 7.9 Examples of HDLC Operation

THE FRAME CHECK SEQUENCE (FCS)



BIT STUFFING OR 0 BIT INSERTION



Summary

Bit-oriented framing

Full Duplex (FDX)

Link establish/disconnect

- SABM/UA or DM, DISC/UA
- **Connection-oriented/Connectionless**: at layer3

Meant to be **reliable** (ACK/NAK from the receiver) at layer 2

- Sliding-window flow control
- Go-back-N ARQ

LAPB (Link Access Procedure Balanced)

Issued by ITU-T

Part of X.25 packet switching network interface standard

Subset of HDLC: same frame format

Provides only ABM: point-to-point link between a user system and a packet switched network node