



SNS COLLEGE OF ENGINEERING



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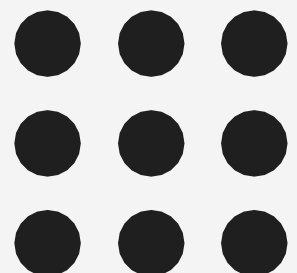
Department of Information Technology

Course Name – 19IT401 Computer Networks

II Year / IV Semester

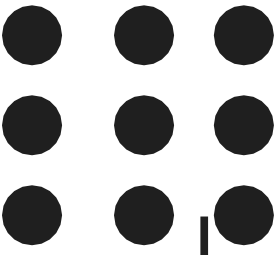
Unit 2 – Link Layer

Topic 2- HDLC,PPP





HDLC



High-level Data Link Control (HDLC) is a bit-oriented protocol for communication over point-to-point and multipoint links. It implements the Stop-and-Wait protocol.

Configurations and Transfer Modes

HDLC provides two common transfer modes that can be used in different configurations:

- Normal response mode (NRM) and
- Asynchronous balanced mode (ABM).

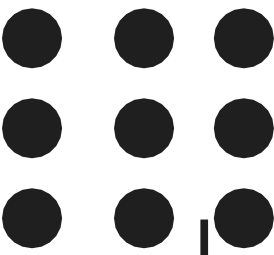
In normal response mode (NRM), the station configuration is unbalanced. We have one primary station and multiple secondary stations.

A primary station can send commands; a secondary station can only respond.

In ABM, the configuration is balanced. The link is point-to-point, and each station can function as a primary and a secondary (acting as peers),



HDLC



Framing

To provide the flexibility necessary to support all the options possible in the modes and configurations just described, HDLC defines three types of frames:

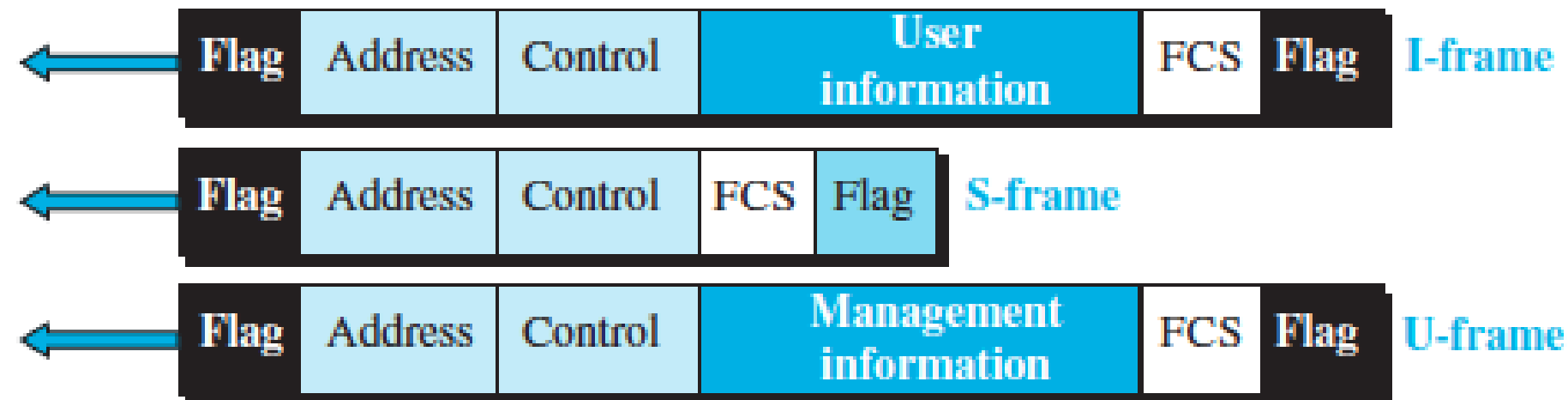
- information frames (I-frames),
- supervisory frames (S-frames), and
- unnumbered frames (U-frames).

Each type of frame serves as an envelope for the transmission of a different type of message.

- I-frames are used to data-link user data and control information relating to user data (piggybacking).
- S-frames are used only to transport control information.
- U-frames are reserved for system management. Information carried by U-frames is intended for managing the link itself. Each frame in HDLC may contain up to six fields

HDLC

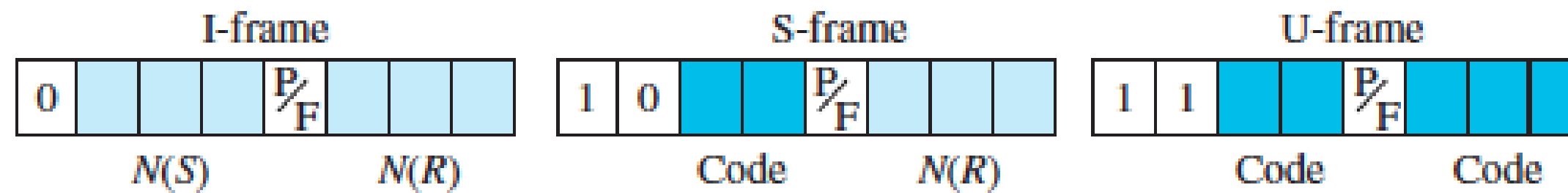
Framing



- Flag field. This field contains synchronization pattern 01111110, which identifies both the beginning and the end of a frame.
- Address field. This field contains the address of the secondary station. If a primary station created the frame, it contains a to address. If a secondary station creates the frame, it contains a from address. The address field can be one byte or several bytes long, depending on the needs of the network.
- Control field. The control field is one or two bytes used for flow and error control.
- Information field. The information field contains the user's data from the network layer or management information. Its length can vary from one network to another.
- FCS field. The frame check sequence (FCS) is the HDLC error detection field. It can contain either a 2- or 4-byte CRC.

HDLC

Control Fields

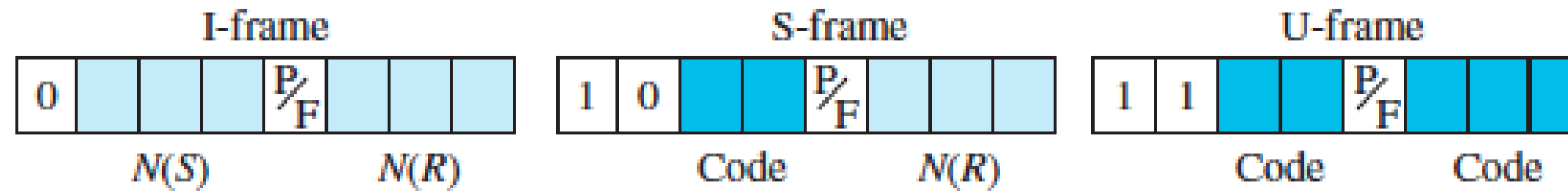


Control Field for I-Frames

- I-frames are designed to carry user data from the network layer. In addition, they can include flow- and error-control information (piggybacking).
- The first bit defines the type. If the first bit of the control field is 0, this means the frame is an I-frame.
- The next 3 bits, called $N(S)$, define the sequence number of the frame.
- The last 3 bits, called $N(R)$, correspond to the acknowledgment number when piggybacking is used.
- The P/F field is a single bit with a dual purpose. It has meaning only when it is set (bit = 1) and can mean poll or final. It means poll when the frame is sent by a primary station to a secondary.
- It means final when the frame is sent by a secondary to a primary

HDLC

Control Fields



Control Field for S-Frames

- Supervisory frames are used for flow and error control whenever piggybacking is either impossible or inappropriate.
- S-frames do not have information fields. If the first 2 bits of the control field are 10, this means the frame is an S-frame.
- The last 3 bits, called $N(R)$, correspond to the acknowledgment number (ACK) or negative acknowledgment number (NAK)
- The 2 bits called code are used to define the type of S-frame itself. With 2 bits, we can have four types of S-frames, as described Receive ready (RR), Receive not ready (RNR), Reject (REJ), Selective reject (SREJ).



HDLC



Control Fields

Control Field for S-Frames

Receive ready (RR). If the value of the code subfield is 00, it is an RR S-frame.

- This kind of frame acknowledges the receipt of a safe and sound frame or group of frames. In this case, the value of the N(R) field defines the acknowledgment number.

Receive not ready (RNR). If the value of the code subfield is 10, it is an RNR Sframe. This kind of frame is an RR frame with additional functions. It acknowledges the receipt of a frame or group of frames, and it announces that the receiver is busy and cannot receive more frames. The value of N (R) is the acknowledgment number.

Reject (REJ). If the value of the code subfield is 01, it is an REJ S-frame. This is a NAK frame, indicating last frame is lost or damaged. The value of N (R) is the negative acknowledgment number.

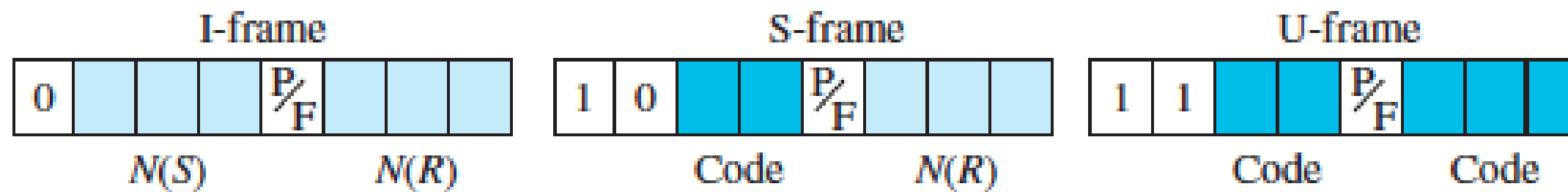
Selective reject (SREJ). If the value of the code subfield is 11, it is an SREJ Sframe. This is a NAK frame used in Selective Repeat ARQ. The value of N (R) is the negative acknowledgment number.

HDLC

Control Fields

Control Field for U-Frames

- Unnumbered frames are used to exchange session management and control information between connected devices.
- Unlike S-frames, U-frames contain an information field, but one used for system management information, not user data.
- U-frame codes are divided into two sections: a 2-bit prefix before the P/ F bit and a 3-bit suffix after the P/F bit.
- Together, these two segments (5 bits) can be used to create up to 32 different types of U-frames.





THANK YOU