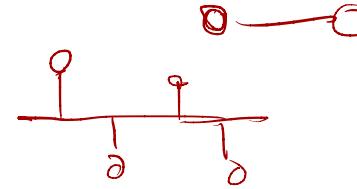


HDLC

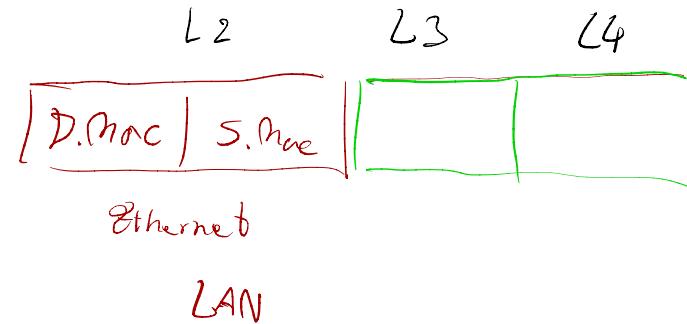


- High-level Data Link Control (HDLC) is a bit-oriented protocol for communication over point-to-point and multipoint links. It implements the ARQ mechanisms we discussed in this chapter.

- Configurations and Transfer Modes

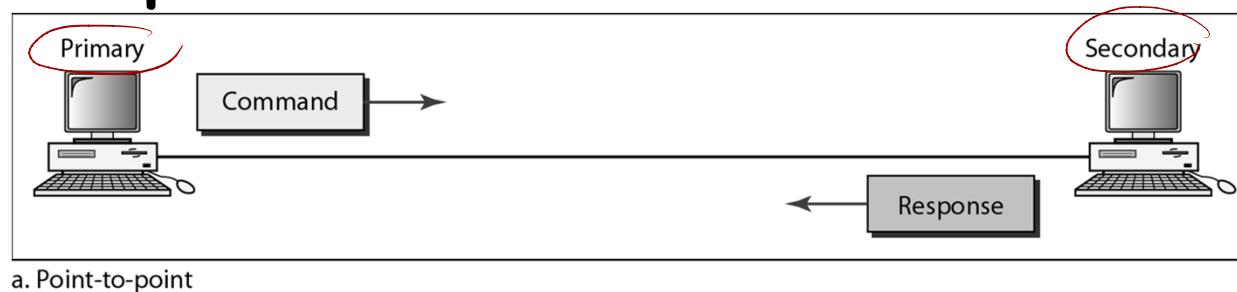
- Frames

- Control Field

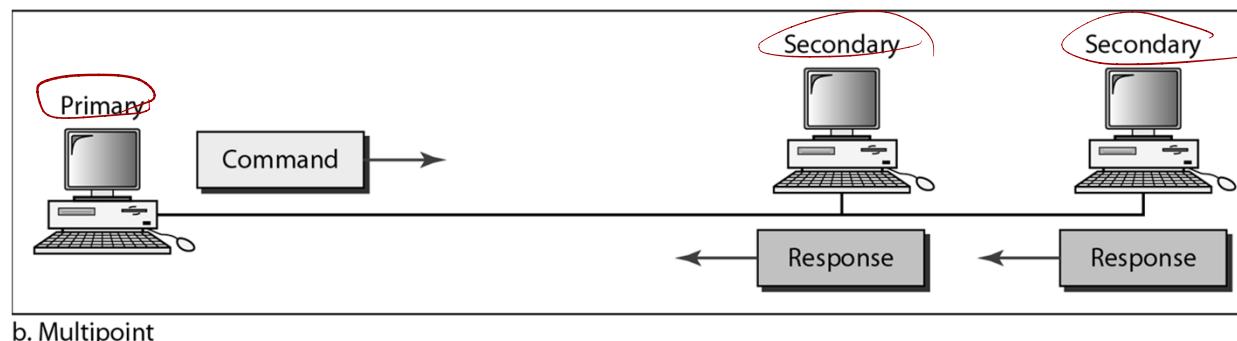


Transfer Modes

- Normal response mode (NRM)

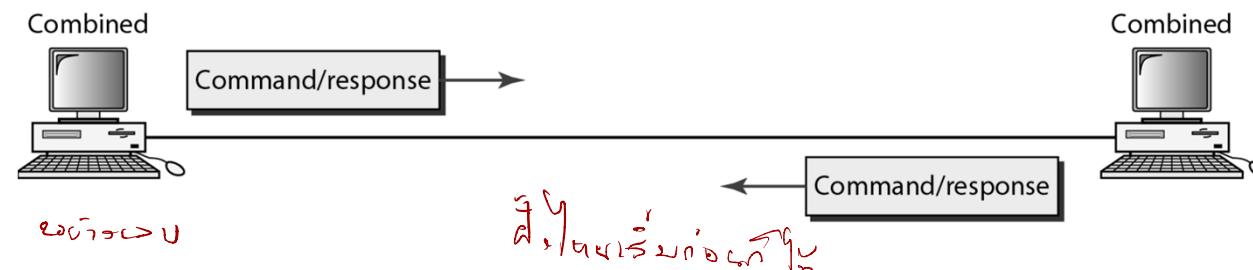


a. Point-to-point

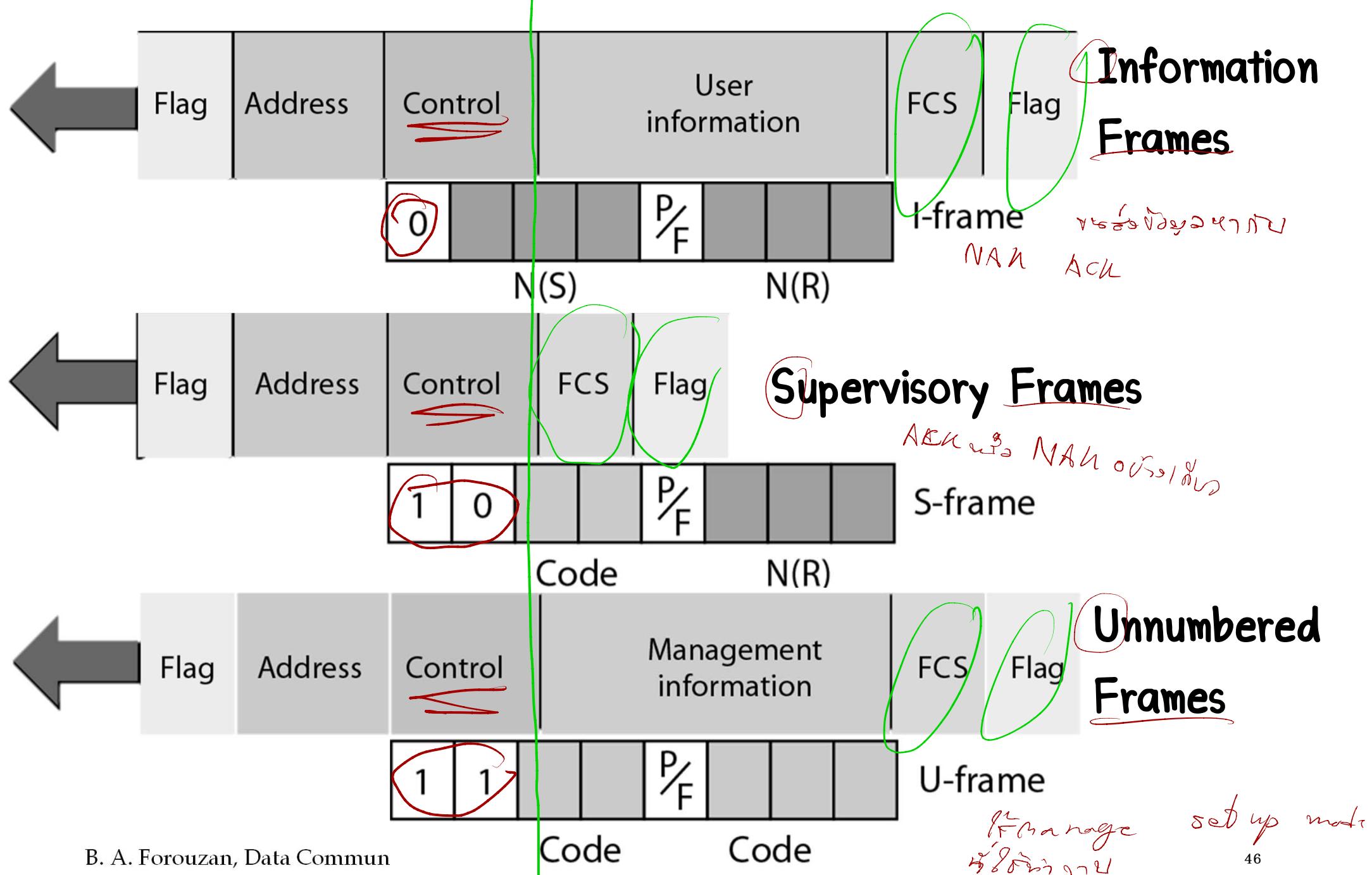


b. Multipoint

- Asynchronous balanced mode (ABM)



HDLC frames & Control field format

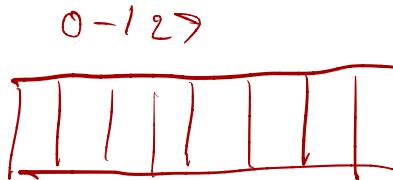


HDLC frames & Control field format

- Flag (8 bits) : "01111110"



- Address (>= 1 byte)
 - Receiving address
 - Length



- 1 byte : last bit in address field = '1'
- > 1 byte : last bit of each byte = '0'
except last bit of last address byte = '1'



- FCS (Frame Check Sequence) (2 or 4 byte)

- Error detection

- CRC (16-bit CRC-CCITT : 0x1021 or CRC-32 : 0x04C11DB7)

- Error detection for all fields

- Except Flag

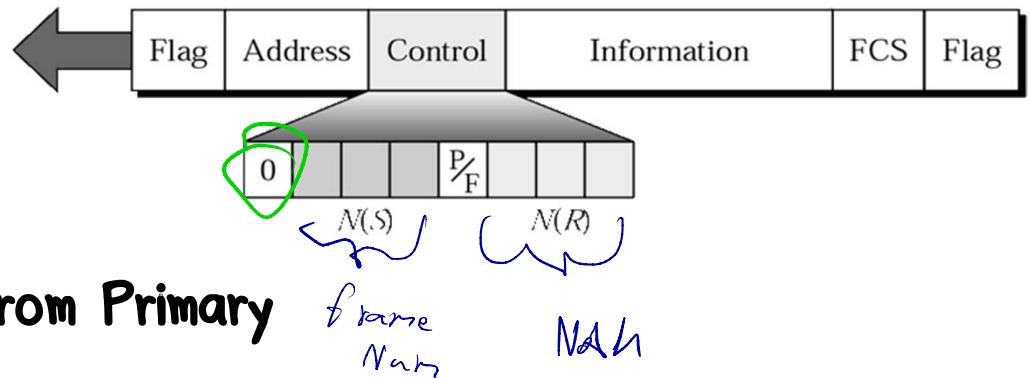
பின்னால் வெளியே போடுவதற்கு முன் தீர்வு செய்ய அரசு அனுமதி வேண்டும் → ARQ

2 byte 4 byte

* Cyclic redundancy check. Retrieved January 19, 2017, from wikipedia Web site: https://en.wikipedia.org/wiki/Cyclic_redundancy_check

I-frame control field

- 1st bit: '0' : defined type of frame (I-Frame)
- N(S) (3 bits): Transmitting Frame number (0-7)
 - Can extend to 7 bits
- N(R) (3 bits): ACK or NAK Frame number (0-7)
 - When piggybacking is used
 - Can extend to 7 bits
- P/F bit
 - P bit (Poll bit) : Poll Frame from Primary
 - '1': Poll Frame from Primary
 - '0': otherwise
 - F bit (Final bit) : Frame from Secondary
 - '1': Last I-frame from Secondary
 - '0': otherwise



S-frame control field

- Code

von der Lerngruppe

- 00: RR (Receive Ready)

- N(R) = ACK no.

- 01: REJ (REject)

→ NAK for Go-back-N

- N(R) = NAK no.

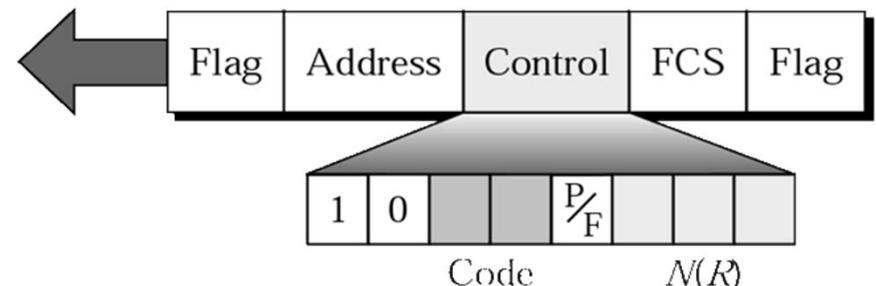
- 10: RNR (Receive Not Ready) : receiver announces that receiver is busy and cannot receive more frame (acts as kind of congestion control mechanism by asking sender to slow down)

- N(R) = ACK no.

- 11: SREJ (Selective-REject) → NAK for Selective-reject (N(R) = NAK no.)

- P/F bit

- Depend on the condition of Code field



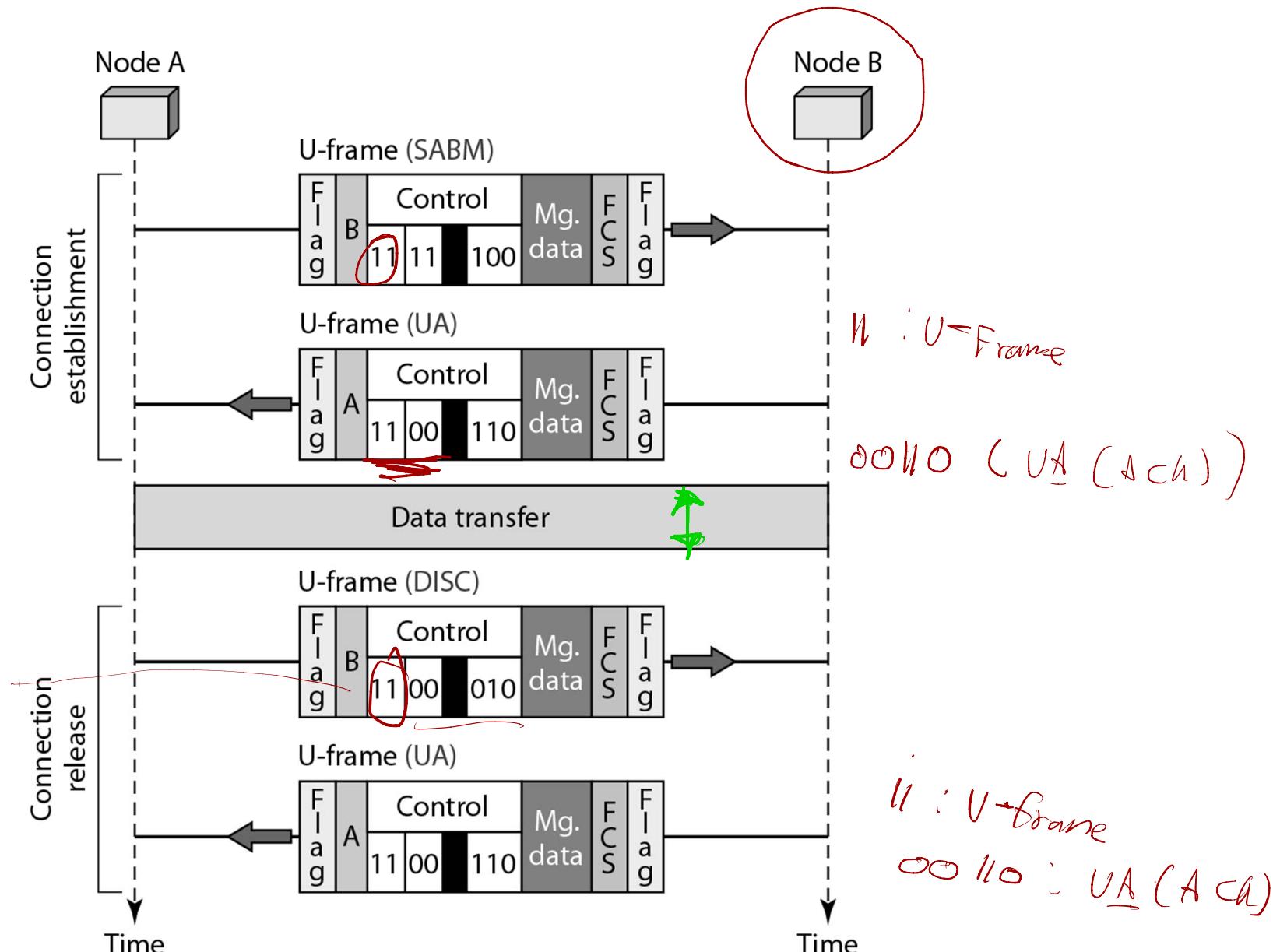
U-frame control command and response

<i>Code</i>	<i>Command</i>	<i>Response</i>	<i>Meaning</i>
00 001	SNRM		Set normal response mode
11 011	SNRME		Set normal response mode, extended
11 100	SABM	DM	Set asynchronous balanced mode or disconnect mode
11 110	SABME		Set asynchronous balanced mode, extended
00 000	UI	UI	Unnumbered information
00 110		UA	Unnumbered acknowledgment
00 010	DISC	RD	Disconnect or request disconnect
10 000	SIM	RIM	Set initialization mode or request information mode
00 100	UP		Unnumbered poll
11 001	RSET		Reset
11 101	XID	XID	Exchange ID
10 001	FRMR	FRMR	Frame reject

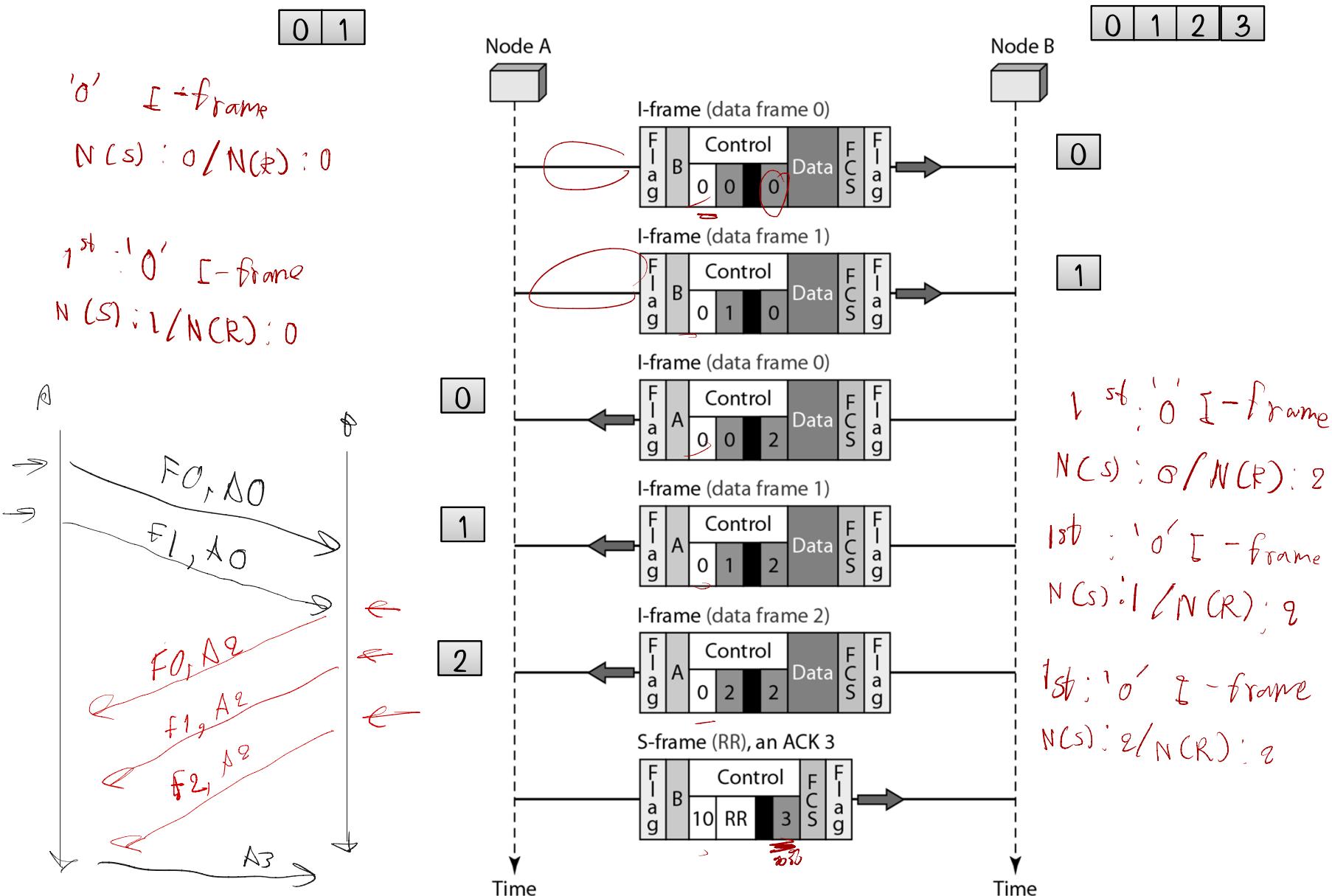
Example of connection and disconnection

11 : U-frame

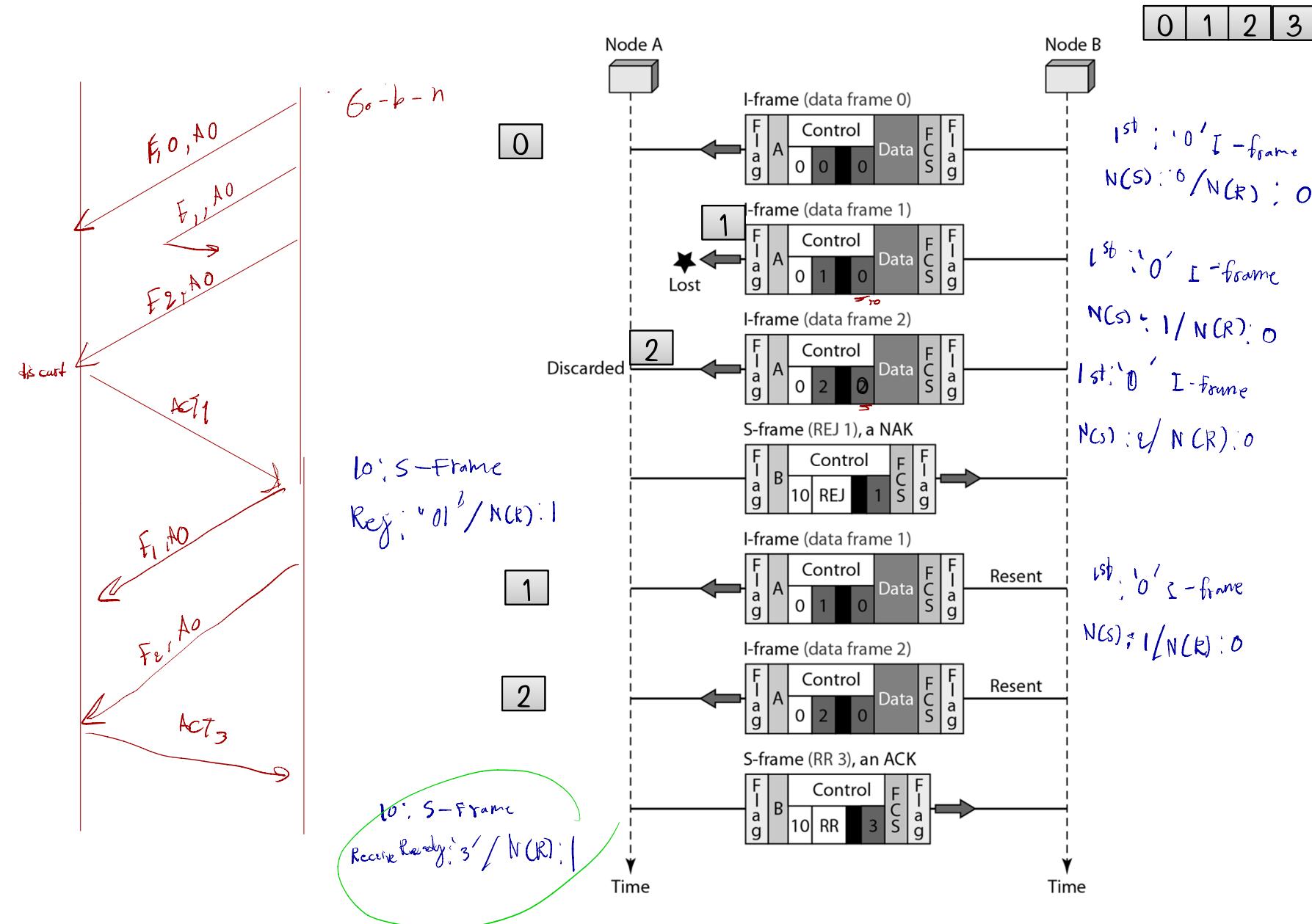
11 100 : SABM



Example of piggybacking without error



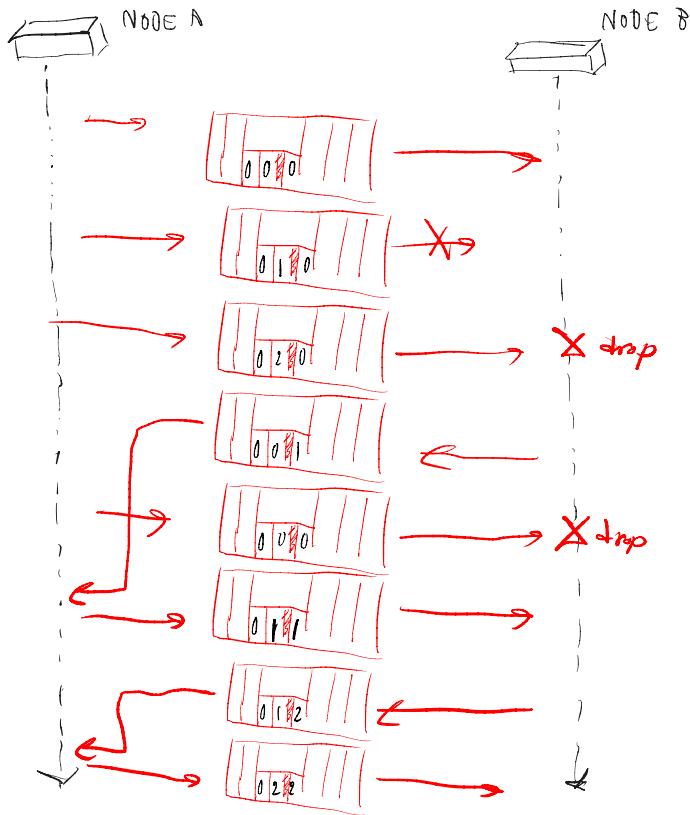
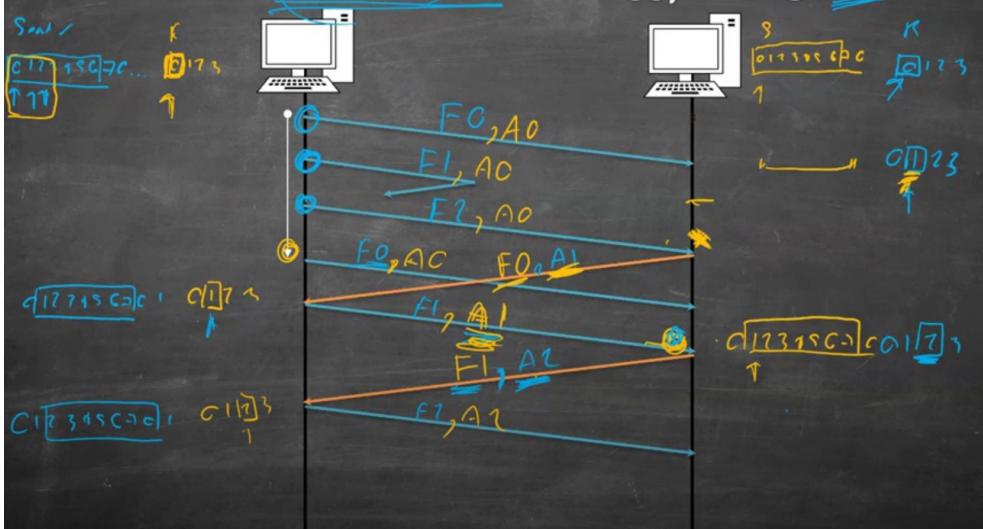
Example of piggybacking with error



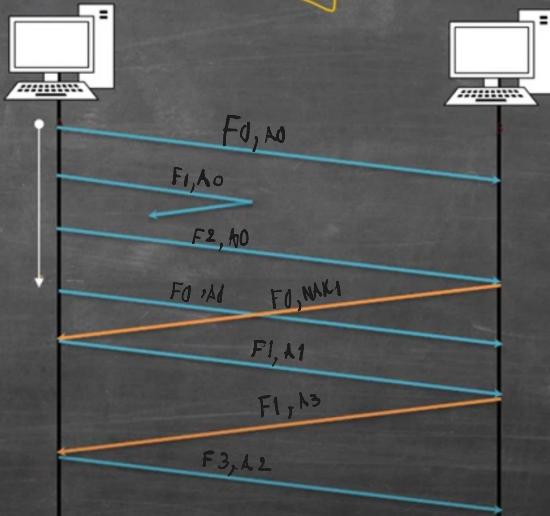
$$z^m - 1 = \Sigma$$

HDLC (Activity)

- A : A<->B Go-Back-N ARQ & Piggybacking ($m=3$)



- B : A<->B **Selective Repeat & Piggybacking (m=3)**



- C : A \leftrightarrow B Go-Back-N ARQ & Piggybacking ($m=3$)

