SMU Course #: EETS 7315

Data Communications

Week #4 -- Dr. Baker

Review: Summary of Example

- We were given a data stream:
  $X^5 + X^2 + 1$
- For a required N = 3, we let GP be
  $X^3 + X^2 + 1$
- We divided (MP)X^3 by GP and obtained a remainder of X^2
- The CRC is 1 0 0

The Message as Sent

- The original message:

  1 0 0 1 0 1

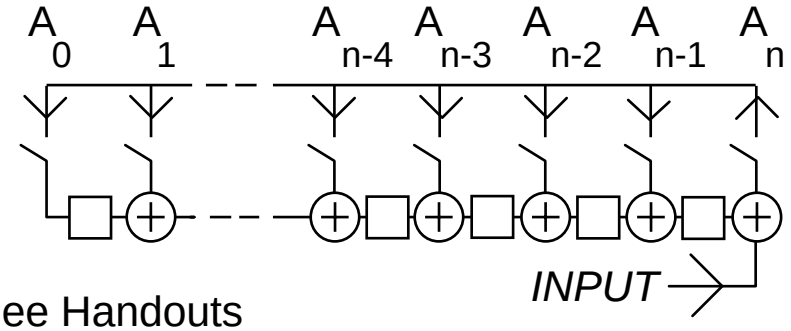
  (First) (Last)
- The total message with CRC:

  1 0 0 1 0 1 1 0 0
- Expressed LSB on right:

  0 0 1 1 0 1 0 0 1

The Hardware Method*

- That's the theory; now for the hardware method ...
- Construct a right-shift register with switchable linear feedback taps:



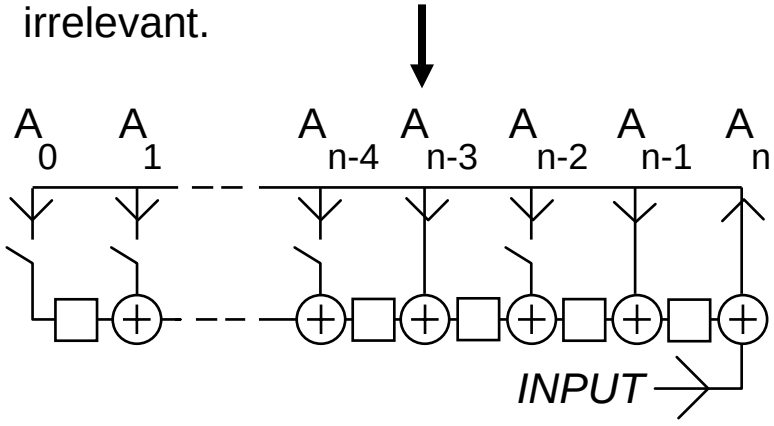
*See Handouts

The Hardware Method

1. Close the switches to represent the coefficients of the GP, the input end of the register representing the highest-order coefficient.
2. Pre-set the register contents to 0.
3. Let a copy of the data stream flow into the register as it leaves the terminal.
4. The final contents of the register are the error checking bits.

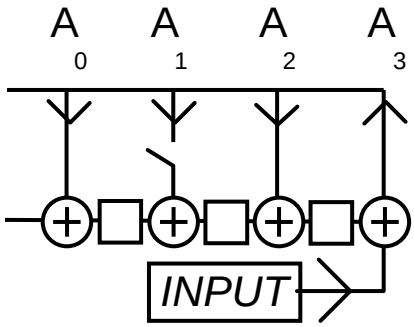
For our example:

- Our GP has $A_3 = 1$, $A_2 = 1$, and $A_0 = 1$; all other A's are 0.
- Everything to the left of the arrow is irrelevant.



Simplifying:

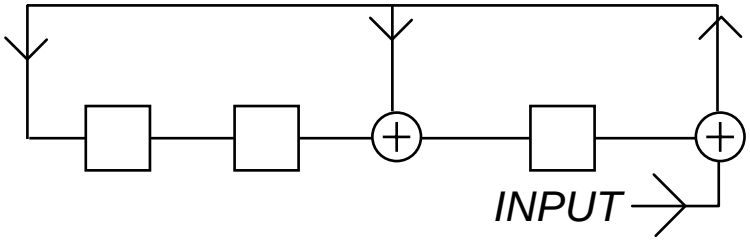
- Note that everything to the left of A_0 is irrelevant.



Finally:

- Hardware representation of the GP

$X^3 + X^2 + 1$

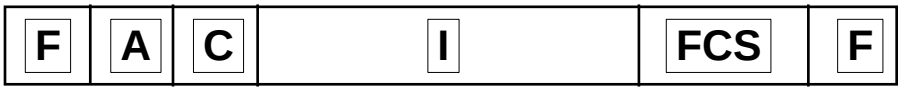


Note and compare with book. Although book's method will give the same answer, that's not the way the chips are built.

Repertoire of HDLC Commands and Responses

- See P. 6 of IS 7809 in tchandouts.com
- The top 3 boxes contain specific minimum requirements for the 3 connection-oriented classes.
- The lower 14 boxes are options, some connection and some connectionless.
- Arrows to the left refer to commands; to the right refer to responses.

Review: HDLC Addressing



- The address field in "pure" HDLC is always that of a response terminal (or node) on the link
- This implies that the A field of a command always contains the address of the commanded TE
- Similarly, a response always contains the address of the responding TE

Formats of the Control Field

Control field format for	Control field bits							
	1	2	3	4	5	6	7	8
Information transfer command/response (I format)	0	N(S)			P F	N(R)		
Supervisory commands/ responses (S format)	1	0	S	S	P F	N(R)		
Unnumbered commands/ responses (U format)	1	1	M	M	P F	M	M	M

Meaning of the P & F Bits

- Every HDLC frame has either a P bit or an F bit
- Commands have only P bits
- Responses have only F bits
- P = 1 compels a response
- Question: How do you tell which frames are commands and which are responses?

Connectionless Operation of HDLC

- The simplest form of operation is connectionless.
- It may involve as little as option 4, but it likely will include options 1 and 12.
- Since a poll compels a response, set- ting P=1 in a UI command will, at a minimum, cause a DM response with F=1. (Some systems respond with UI.)

Formats of the Control Field

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Unnumbered commands/ responses (U format)	1	1	M	M	P F	M	M	M

The Common Unnumbered Commands & Responses

Command/ Response	M Values (Bits 3-8)	Command/ Response	M Values (Bits 3-8)
SNRM/	0 0 0 0 1	UI/UI	0 0 0 0 0
SABM/	1 1 1 0 0	XID/XID	1 1 1 0 1
DISC/	0 0 0 1 0	TEST/TEST	0 0 1 1 1
SNRME/	1 1 0 1 1	SIM/RIM	1 0 0 0 0
SABME/	1 1 1 1 0	/UP	0 0 1 0 0
/UA	0 0 1 1 0	/DM	1 1 0 0 0
/FRMR	1 0 0 0 1	/RD	0 0 0 1 0

Example of a Connectionless Data Session (A sends to B)

- See Nomenclature, Handouts p. 20

A: B, UI

B: *(No transmission)*

Name of sending TE

Content of frame sent

Example of a More Complex Connectionless Data Session

A: B, UI,P

B: ?

Example of a More Complex Connectionless Data Session

A: B, UI,P

B: B, UI,F

(A TWA exchange of data)

The Connection Classes
1. Meanings of U & B

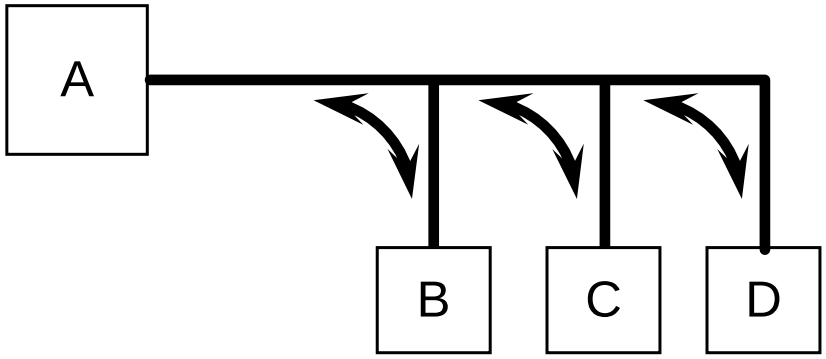
- Unbalanced - There is one command TE and one or more response TEs. The two types do not have equal authority.
- Balanced - There are two and only two TEs in the link. They have equal authority. They can each send commands and responses.

The Connection Classes
2. Meanings of N & A

- Normal - A response TE cannot initiate response to a command unless polled. Last frame of response contains F=1.
- Asynchronous* - A response TE may respond to any command. If polled, it responds with F=1 at its earliest convenience.

*Note that this use of the word "asynchronous" has nothing to do with bit timing.

Example Configuration for UN Class of HDLC



In this case, "A" would be the primary station; the other TEs would be secondaries.