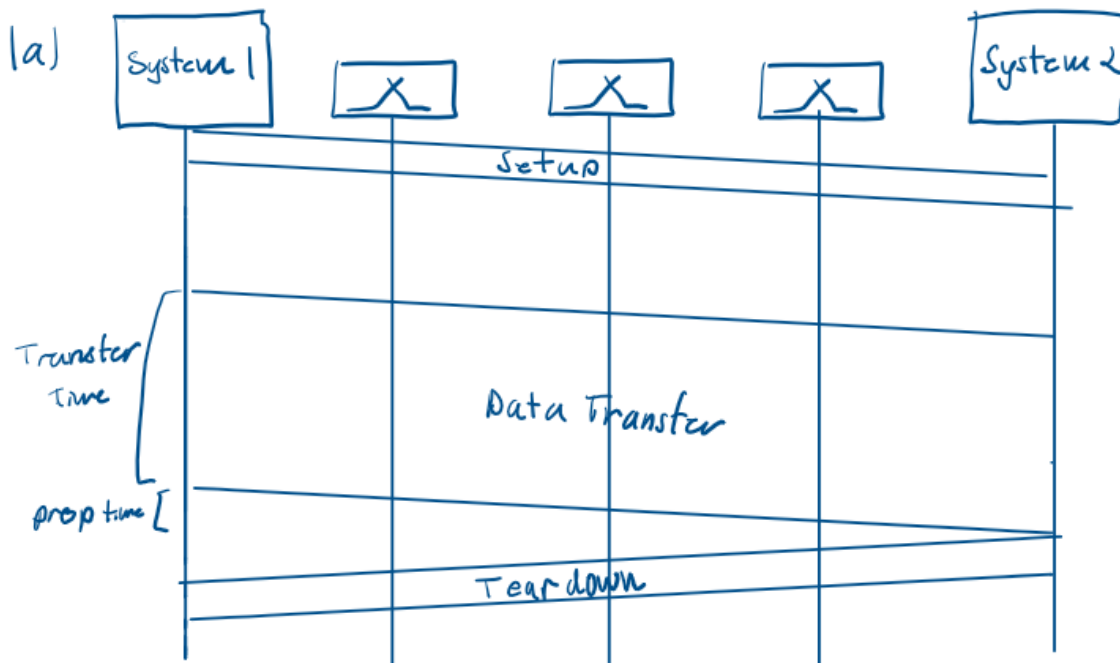


Assignment 3

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COMP 3725

Set: Friday



$$\text{Total delay} = \text{Setup} + \text{Data transfer} + \text{Tear down}$$

$$\text{Data transfer} = \frac{\text{size}}{\text{rate}} + \text{Propagation time}$$

$$\begin{aligned} \text{Propagation time} &= N \cdot D \\ &= 3 \cdot 0.01 \\ &= 0.03s \end{aligned}$$

$$\begin{aligned} \text{Data transfer} &= \frac{1500}{25600} + 0.03 \\ &= 0.08859s \end{aligned}$$

$$\text{Total delay} = 1.5 + 0.08859 + 1$$

$$= 2.589s$$

$$b) \quad \# \text{ of packets} = \frac{\text{message length}}{\text{payload}}$$

packet size = headers + payload, since packet contains header and payload.

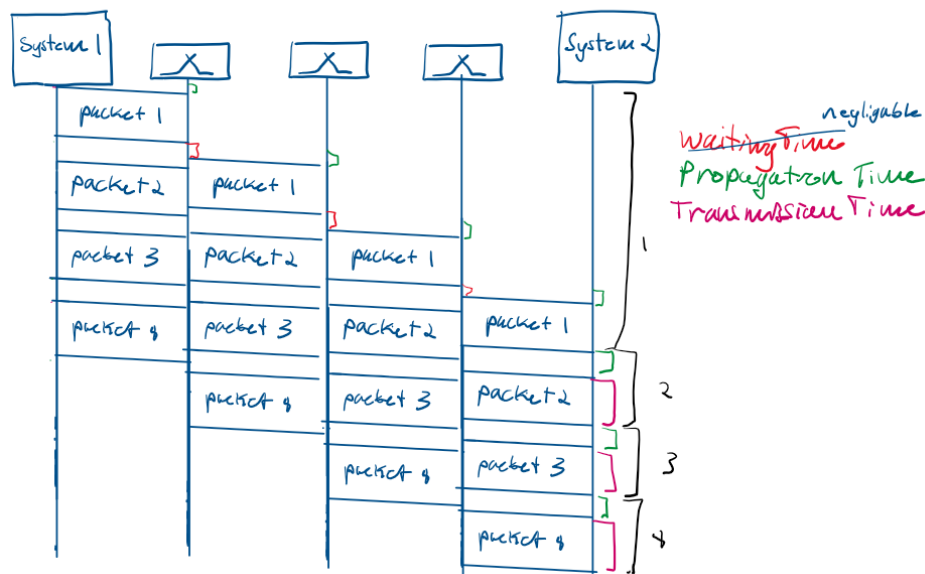
$$= 64 + \text{payload}$$

$$512 = 64 + \text{payload}$$

$$\text{payload} = 448$$

$$\begin{aligned} \# \text{ of packets} &= \frac{1500}{448}, \text{ so each packet is 64 bits header and } \\ &= 3.34 \text{ 448 bits of data, with padding on the last one.} \\ &= 4 \text{ total packets} \end{aligned}$$

Since message length (L) is data only and no headers



$$\text{Total Delay} = 7 \cdot \text{Transmission} + 7 \cdot \text{Propagation Time}$$

$$\text{Transmission Time} = \frac{\text{message size}}{\text{Bandwidth}}$$

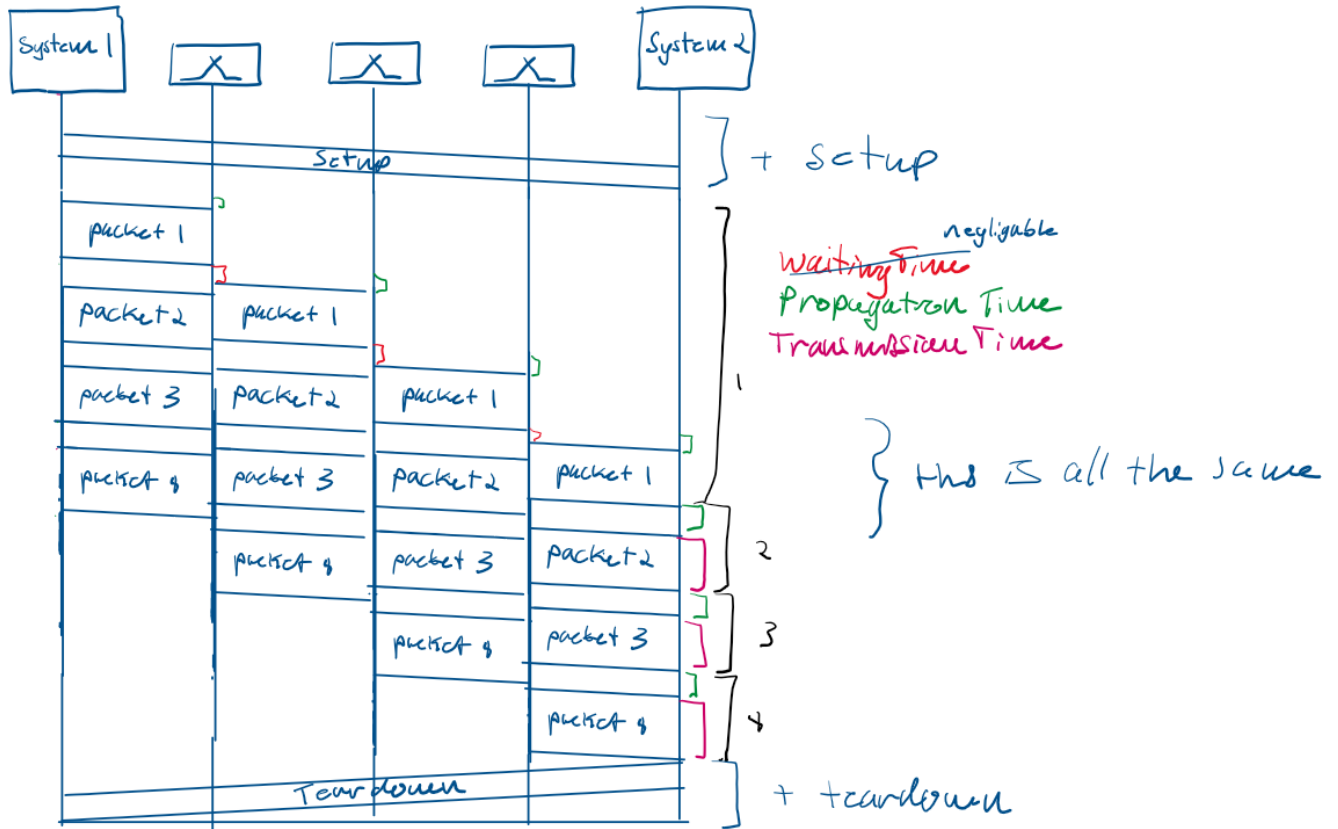
$$= \frac{512}{25600}$$

$$= 0.02 \text{ s}$$

$$\text{Total Delay per packet} = 7 \cdot 0.02 + 7 \cdot 0.01$$

$$= 0.21 \text{ s}$$

c)



$$\begin{aligned}
 \text{Transmission Time} &= \text{Setup} + 7 \cdot \text{Transmission} + 7 \cdot \text{Propagation Time} + \text{Teardown} \\
 &= 1.5 + 0.21 + 1 \\
 &= 2.71 \text{ s}
 \end{aligned}$$

2)

$$g(x) = x^4 + x^2 + 1 = 10101$$

$$\text{dataword} = 001101011110$$

a)

$$\begin{array}{r}
 10101 \overline{) 0011010111100000} \\
 \underline{00000} \downarrow \\
 01101 \downarrow \\
 \underline{00000} \downarrow \\
 11010 \downarrow \\
 \underline{10101} \downarrow \\
 11111 \downarrow \\
 \underline{10101} \downarrow \\
 10101 \downarrow \\
 \underline{10101} \downarrow \\
 00001 \downarrow \\
 \underline{00000} \downarrow \\
 00011 \downarrow \\
 \underline{00000} \downarrow \\
 00110 \downarrow \\
 \underline{00000} \downarrow \\
 01100 \downarrow \\
 \underline{00000} \downarrow \\
 11000 \downarrow \\
 \underline{10101} \downarrow \\
 11010 \downarrow \\
 \underline{10101} \downarrow \\
 11110 \downarrow \\
 \underline{10101} \downarrow \\
 1011 \leftarrow \text{remainder}
 \end{array}$$

so codeword is : 001101011110 1011

$$\begin{array}{ccccccc}
 \text{b)} & 0011 & 0101 & 1110 & 1011 & & \\
 & \uparrow\uparrow & & & \uparrow\uparrow & & \\
 & = 1111 & 0101 & 1110 & 1000 & &
 \end{array}$$

$$\begin{array}{r}
 110010111011 \\
 10101 \overline{) 1111010111101000} \\
 \underline{10101} \\
 10111 \\
 \underline{10101} \\
 00100 \\
 \underline{00000} \\
 01001 \\
 \underline{00000} \\
 10011 \\
 \underline{10101} \\
 01101 \\
 \underline{00000} \\
 11011 \\
 \underline{10101} \\
 11100 \\
 \underline{10101} \\
 10011 \\
 \underline{10101} \\
 01100 \\
 \underline{00000} \\
 11000 \\
 \underline{10101} \\
 11010 \\
 \underline{10101} \\
 1111 \leftarrow \text{remainder is not all 0s}
 \end{array}$$

∴ the error was detected.

$$\begin{array}{r} 2012 = 0010 \ 0000 \ 0001 \ 0010 \\ 0010 \ \underline{0000} \ \underline{0001} \ \underline{0010} = 1101 \ 1111 \ 1110 \ 1101 \end{array}$$

15 = 0011 1111 0000 0001

$$15 = 1111\ 1110\ 1110\ 1011$$

$$15 = 0101\ 0110\ 1111\ 1000$$

$$= 1010101100100110$$

$$\begin{array}{r} 0001 \ 1111 \ 1111 \ 0111 \\ + \ 11 \\ \hline 0001 \ 1111 \ 1111 \ 1010 \end{array}$$

$= E005_{16} \neq \text{all } 0s$ \therefore the error is detected and the message is rejected

$$A = (1, 2, 3, 4)$$
$$C = (3, 1, 2, 4)$$
$$D = (1, 1, 2, 3)$$

User A at slot 9

User B at slot 12

User C at slot 6

User D at slot 14