

CSE-160: HW1-5

1.17; c) $= 2 \mu\text{s}$

(
Delay time

$$\begin{aligned} \text{Total time} &= \text{Delay time} + 1 \cdot \text{Transmission time} + 1 \cdot \text{Propagation delay} \\ &= 2 \mu\text{s} + 1 \cdot 120 \mu\text{s} + 20 \mu\text{s} \\ &= 142 \mu\text{s} + 1 \end{aligned}$$

1.19; a) The bandwidth for this channel is 100-Mbps

b)

$$\text{time} = \frac{\text{size}}{\text{bandwidth}} = \frac{12,000 \text{ bits}}{100 \text{ Mbps}} = \frac{12 \cdot 10^3 \text{ bits}}{100 \cdot 10^6 \text{ bps}} = 0.12 \cdot 10^{-3} \text{ s}$$

$$= \frac{0.12 \cdot 10^{-3} \cdot 10^3}{10^3} \Rightarrow 10^3 \cdot 0.12 \cdot 10^{-3} \cdot 10^{-3} = 120 \cdot 10^{-6} = 120 \mu\text{s}$$

3 links: $(4 \cdot \text{Transmission time}) + (4 \cdot \text{Propagation delay}) = (4 \cdot 120) + (4 \cdot 10) = 520 \mu\text{s}$

L 50 byte (400 bits) of ACK will take transmission time of 4 μs

L Since bandwidth is 100 mbps and data sent as an ACK is 400 bits

$$\text{time} = \frac{\text{size}}{\text{bandwidth}} = \frac{400 \text{ bits}}{100 \text{ mbps}} = \frac{4 \text{ bits}}{10^6 \text{ bps}} = 4 \cdot 10^{-6} = 4 \mu\text{s}$$

$$\begin{aligned} (4 \cdot \text{Transmission time}) + (4 \cdot \text{Propagation delay}) &= (4 \cdot 4) + (4 \cdot 10) \\ &= 56 \mu\text{s} \end{aligned}$$

$\nwarrow \swarrow$

$$520 \mu\text{s} + 56 \mu\text{s} = 576 \mu\text{s} \Rightarrow \frac{12000 \text{ bits}}{576 \mu\text{s}}$$

$$\Rightarrow \frac{12000}{576 \cdot 10^{-6}} \Rightarrow \frac{12000 \cdot 10^6}{576} = 20.833 \cdot 10^6$$

$= 20.83 \mu\text{bps}$



c) $\text{time} = \frac{100 \cdot 6.5 \cdot 10^8}{12 \cdot 3600 \text{ s}} \Rightarrow \frac{650 \cdot 10^8}{43200} = 0.01504629 \cdot 10^8$

$\frac{10^2 \cdot 10^6 \text{ bps}}{= 1.50463 \text{ MBPS}}$