# HW2 Wireless & Mobile Computing

Thursday, September 9, 2021 10:00 PM

1. a) end to end circuit switching

$$(\text{message delivery time}) = \left(N \times D + \left(\frac{L}{B}\right)\right)$$

$$= \left(4 \times .001 + \left(\frac{3200}{9600}\right)\right) = (.004 + (0.3333)) = \boxed{0.3373}$$

$$(\text{end to end delay}) = (.2 + .3373 + .02) = \boxed{.5573 \text{ seconds}}$$

datagram packet switching

number of data bits per packet $= (P - H)$
$= 1024 - 16 = \boxed{1008}$

$$\text{num of packets} = \left(\frac{L}{\text{num of data bit}}\right) = \frac{3200}{1008} = 3.1746$$

$D1 = \text{num of packets} \times \left(\frac{P}{B}\right) + D$
$D2..D4 = \left(\frac{P}{B}\right) + D$

$$D1 = 3.1746 \times \left(\frac{1024}{9600}\right) + .001$$
$$= .3386 + .001$$
$$= \boxed{.3396}$$

$$D2 = \left(\frac{1024}{9600}\right) + .001$$
$$= .1066 + .001$$
$$= .1076$$

$$\text{end to end delay} = .3396 + .1076 + .1076 + .1076 = \boxed{.6624}$$

virtual circuit switching

end to end delay in VCS $=$ (call setup time + datagram packet switching time + call breakdown time)
$= .2 + .6624 + .02$
$= \boxed{0.8824 \text{ seconds}}$

b) Circuit switching

$$S + N \times D + \frac{L}{B} + T = \left(\frac{L}{P-H}\right) + \frac{P}{B} + N \times D$$
$$= S + \frac{L}{B} + T = \left(\frac{L}{P-H}\right) + \frac{P}{B}$$
$$= \boxed{S + \frac{L}{B} + T = \left(\frac{L}{P-H}\right) + \frac{P}{B}}$$

virtual circuit switching

$$S + N \times D + \frac{L}{B} + T = S + T_D + T$$
$$= S + N \times D + \frac{L}{B} + T = S + \left(\frac{L}{P-H}\right) + \frac{P}{B} + N \times D + T$$
$$= \left(\frac{L}{B}\right) = \left(\frac{L}{P-H}\right) + \frac{P}{B}$$
$$= \boxed{\frac{L}{B} = \left(\frac{L}{P-H}\right) + \frac{P}{B}}$$

datagram packet

$$T_D = S + T_D + T$$
$$= \boxed{T_D = S + T_D + T}$$

2. $T_d = (N_p + N - 1)\left(\frac{P}{B}\right) + (N \times D)$ ; $\left(\frac{L}{P-H}\right) = N_p$ ; $0 = D$

$$T_d = \left(\left(\frac{L}{P-H}\right) + N - 1\right)\left(\frac{P}{B}\right) + (N \times 0)$$

$$= \boxed{\left(\left(\frac{L}{P-H}\right) + N - 1\right)\left(\frac{P}{B}\right) = T_d}$$

$$\frac{dT_d}{(dP)} = 0$$

$$\frac{d\left(\left(\left(\frac{L}{P-H}\right) + N - 1\right)\left(\frac{P}{B}\right)\right)}{(dP)} = 0$$

$$\left(\frac{1}{B}\right)\left(\frac{L}{P-H} + N - 1\right) - \left(\frac{P}{B}\right)\left(\frac{L}{(P-H)^2}\right) = 0$$

$$L(P-H) + (N-1)(P-H)^2 - LP = 0$$
$$LP - LH + (N-1)(P-H)^2 - LP = 0$$
$$= -LH + (N-1)(P-H)^2 = 0$$
$$= (N-1)(P-H)^2 = LH$$
$$= (P-H)^2 = \frac{LH}{(N-1)}$$

$$= P - H = \sqrt{\frac{LH}{(N-1)}}$$

$$= \boxed{P = H + \sqrt{\frac{LH}{(N-1)}}}$$

3. $(\text{max num of phones}) = \left(\frac{\text{freq of trunk}}{\text{freq of channel}}\right) \times$ num of phones per channel

$$= \left(\left(\frac{1\,MHz}{4\,kHz}\right) \times (200)\right) = \left(\left(\frac{1 \times 10^6\,Hz}{4 \times 10^3\,Hz}\right) \times (200)\right)$$

$$= ((.25 \times 10^3) \times (200))$$
$$= 250 \times 200$$
$$= \boxed{50{,}000}$$

4. The flaws are as follows:
↳ The overhead of the inital circuit set up in the circuit switching is not considered.
↳ The overhead of the circuit teardown in the circuit switching is also not considered.

5. Yes, a packet can be delivered to the wrong location. Reason being is because a large noise can produce an undetected error in the packet and then it will modify the virtual circuit identifier or destination address field, therefore, the packet would be delivered to the wrong location.