

IM Ds Com I p593 2003  
Digital Communication I

a) capacity - rate at which symbols can be placed into channel

latency - time from insertion of symbol to reception.

b) i) XON/XOFF - requires bound on channel latency so if variation unbounded it doesn't work.

ii) Stream media - need to buffer expected variance of single direction.  
- if two way then can cause problems for participants

iii) protocol timers - need time out a duration to be above expected variance, makes timeout later than just average channel delay  $\Rightarrow$  channel will go idle.

c) Rx acknowledges each Tx packet, Tx sends next on ack. Tx timeouts if no ack and resends

d) i)

2) 10 ms - miss 20% of packets  
~~- 10 ms~~

expect time per packet (in ms):

$$\begin{aligned} & (.8)(2) + (.2)(.8)(12) + (.2)^2(.8)(22) + \dots \\ & = 2 + (.8)(0) + (.2)(.8)(10) + (.2)^2(.8)(20) + \dots \\ & = 2 + (.8)(10) \sum_{i=0}^{\infty} i (.2)^i \end{aligned}$$

$$= 2 + (.8)(10) \frac{.2}{(.8)^2} = 4.5 \text{ or } \frac{1000}{4.5} \text{ packets/sec} \approx 222 \text{ packets/sec}$$

Similarly for 12ms, miss 10% so

$$2 + (.9)(12) \frac{.1}{(.9)^2} = 3.3 \text{ ms per packet or } 300 \text{ packets/sec}$$