Computer Network 資工三 B03902125 林映廷

1.

a. A circuit-switched network would be well suited to the application described, because the application involves long sessions with predictable smooth bandwitch requirement. Since the transmission rate is known and not bursty, bandwidth can be reserved for each application session circuit with no significant waste. In addition, we need not worry greatly about the overhead costs of setting up and tearing down a circuit connection, which are amortized over the lengthy duration of a typical application session.

b. Given such generous link capacities, the network needs no congestion control mechanism. In the worst (most potentially congested) case, all the applications simultaneously transmit over one or more particular network links. However, since each link offers sufficient bandwitch to handle the sum of all of the applications' data rates, no congestion (very little queuing) will occur.

2.

a. $\frac{3\text{ Mbps}}{150\text{ kbps/人}} = \underline{20\text{人}}$ #

b. $\underline{p = 0.1}$ #

c. $\underline{C^{120}_{n}(0.1)^{n}(0.9)^{120-n}}$ #

d. $1 - \sum_{n=1}^{20} C^{120}_{n}(0.1)^{n}(0.9)^{120-n} = \underline{0.008}$ #

By the central limit theorem to approximate this probability. Let X_j be independent random variables s.t. $P(X_j = 1) = P$.

$$P(21 \text{ or more users}) = 1 - P\left(\sum_{j=1}^{120} X_j \le 20\right)$$

$$P\left(\sum_{j=1}^{120} X_j \le 20\right) = P\left(\frac{\sum_{j=1}^{120} X_j - 12}{\sqrt{120 \times 0.1 \times 0.9}} \le \frac{8}{\sqrt{120 \times 0.1 \times 0.9}}\right)$$

$$\approx P\left(Z \le \frac{8}{3.286}\right) = P(Z \le 2.43)$$

$$= 0.992$$

when Z is a standard normal r.v. Thus, P (21 or more users) ≈ 0.008 #

3.

a. $d_{prop} = \frac{m}{s}$ (sec)

b. $d_{trans} = \frac{L}{R}$ (sec)

c. $d_{end\text{-}to\text{-}end} = d_{trans} + d_{prop} = \frac{L}{R} + \frac{m}{s}$ (sec)

d. The bit is just leaving Host A.

e. The first bit is in the link.

f. Host B

g. $d_{prop} = d_{trans}$

$$\frac{m}{2.5 \times 10^8} = \frac{120 \text{(bits)}}{60 \text{ (kbps)}} = 0.002$$

$$m = 5 \times 10^5 \text{ (m)}$$

4. a. Routers process layers 1 through 3. (maye including layer 4 in the modern routes)

b. Link layer switches process layers 1 through 2.

c. Host process all five layers.

d. $2 \times RTT$ + total file transfer time $= 2 \times 5 + 4 = 14$ (sec)