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CSC645 COMPUTER NETWORKS

Homework 1

1. The advantage that a circuit-switched network has over a packet-switched network is that circuit-switched networks provide faster, more steady transfer of data. Since the circuit is dedicated to a single connection, a person's data won't be blocked up by someone else's. Since a router doesn't have to buffer any of the data, there is less delay of the transmission of data. If an application wants to transmit data at a steady rate for a relatively long period of time, then a circuit-switched network would be better. Data would be sent as a whole instead of intermittent packets, so the rate would be steady. Once established, a circuit-switched network would have bandwidth reserved for it, so it doesn't have to worry about the stream.
2. The five layers of the Internet protocol stack are:
    a. Application – this layer contains the supporting network applications that include transfer protocols
    b. Transport – this layer contains transmission protocols
    c. Network – this layer contains routing protocols
    d. Link – this layer facilitates data transfer between network elements through wire or wifi
    e. Physical – this layer contains the bits going through the wire
3.
    a. The maximum number of simultaneous connections that can be in progress at any one time is 16.
    b. If connections must go from A to C, then the maximum is 8.
    c. Yes. Two connections from A->B->C and two connections from A->D->C. Two connections from B->C->D and two connections from B->A->D.
4.
    a. d_prop = m / s sec
    b. d_trans = L / R sec
    c. d_end-to-end = (m/s) + (L/R) sec
    d. Leaving Host A
    e. In the link
    f. Reached Host B
5.
    a. throughput = 500 kbps
    b. time = $(4 * 10^6) * 8 / (500 * 10^3) = 64$ sec
    c.
        i. throughput = 100 kbps
        ii. time = $(4 * 10^6) * 8 / (100 * 10^3) = 320$ sec
6. N = Number of Links
   d_end-to-end = N (d_proc + d_trans + d_prop) = N(d_proc + (L / R_i) + (d_i / s_i))
   Given: N = 3; L = 1500 bytes; s_i = $2.5 * 10^8$ m/; R_i = 2 Mbps; d_proc = 3 msec; D_1 = 5000 km; d_2 = 4000 km; d_3 = 1000 km
   For i = 1
   d_end-to-end = N(d_proc + (L / R_1) + (d_1 / s_1)) = 3(0.003 sec + (1500 * 8 bits / 2000000 bits/sec) + (5,000,000 m / $2.5 * 10^8$ m/sec))

= 0.087 seconds
For i = 2
d_end-to-end = N(d_proc + (L / R_2) + (d_2 / s_2))
= 3(0.003 sec + (1,500 * 8 bits/2000000 bits/sec) + (4000000 m/2.5 * 10^8 m/sec))
= 0.075 sec
For i = 3
d_end-to-end = N(d_proc + (L / R_1) + (d_1 / s_1))
= 3(0.003 sec + (1500 * 8 bits/2000000 bits/sec) + (1000000 m/2.5 * 10^8 m/sec))
= 0.039 sec
0.087 sec + 0.075 sec + 0.039 sec = 0.201 sec
Total end-to-end delay = 0.201 sec.

7. 40 * 10^{12} * 8 / (1 *10^9) = 3200000 seconds = 37 days.

   If speed is a concern, then go with FedEx.

8.
   a.
      i. 8*10^6 / 2*10^6 = 4 sec
      ii. 4 sec× 3 hops = 12 sec
   b.
      i. 1*10^4/2*10^6 = 5 m sec
      ii. 2 × 5m sec = 10 m sec
   c.
      i. 5 m sec× 3 hops = 15 m sec
      ii. 15 m sec + 799 * 5m sec = 4.01 sec
      iii. the delay is less with segmentation

Bonus

(L/R) (N+ P-1)