

Cosc3430 Wireless Communication Homework 1

P3. Consider an application that transmits data at a steady rate (for example, the sender generates an N-bit unit of data every k time units, where k is small and fixed). Also, when such an application starts, it will continue running for a relatively long period of time. Answer the following questions, briefly justifying your answer:

- a. Would a packet-switched network or a circuit-switched network be more appropriate for this application? Why?

Packet switching would be more appropriate. It is not a bunch of data, and packets will be small and using TCP is fairly reliable.

- b. Suppose that a packet-switched network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed? Why?

No. congestion control is not needed because it is never going to be congested. However it would be wise to put some form of control on it.

P6. This elementary problem begins to explore propagation delay and transmission delay, two central concepts in data networking. Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and suppose the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B.

- a. Express the propagation delay, d_{prop} , in terms of m and s.

$$D_{\text{prop}} = m/s$$

- b. Determine the transmission time of the packet, d_{trans} , in terms of L and R.

$$D_{\text{trans}} = L/R$$

- c. Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.

$$d_{\text{nodal}} = d_{\text{trans}} + d_{\text{prop}}$$

d. Suppose Host A begins to transmit the packet at time $t = 0$. At time $t = d_{\text{trans}}$, where is the last bit of the packet?

It's leaving host A

e. Suppose d_{prop} is greater than d_{trans} . At time $t = d_{\text{trans}}$, where is the first bit of the packet?

It's in the link and hasn't reached Host B yet.

f. Suppose d_{prop} is less than d_{trans} . At time $t = d_{\text{trans}}$, where is the first bit of the packet?

It's already at Host B

g. Suppose $s = 2.5 \cdot 10^8$, $L = 120$ bits, and $R = 56$ kbps. Find the distance m so that d_{prop} equals d_{trans} .

$$m = LR/S = 120 \cdot 56 \cdot 10^3 \times (2.5 \times 10^8) = 536 \text{ km}$$

h. P10. Consider a packet of length L which begins at end system A and travels over three links to a destination end system. These three links are connected by two packet switches. Let d_i , s_i and R_i denote the length, propagation speed, and the transmission rate of link i , for $i = 1, 2, 3$. The packet switch delays each packet by d_{proc} . Assuming no queuing delays, in terms of d_i , s_i , R_i , ($i = 1, 2, 3$), and L , what is the total end-to-end delay for the packet? Suppose now the packet is 1,500 bytes, the propagation speed on all three links is $2.5 \cdot 10^8$ m/s, the transmission rates of all three links are 2 Mbps, the packet switch processing delay is 3 msec, the length of the first link is 5,000 km, the length of the second link is 4,000 km, and the length of the last link is 1,000 km. For these values, what is the end-to-end delay?

$$\text{- Total } d_{\text{end-to-end}} = d_i(m/s + L/R) + s_i(m/s + L/R) + R_i(m/s + L/R)$$

i. P19. (a) Visit the site www.traceroute.org and perform traceroutes from two

different cities in France to the same destination host in the United States. How many links are the same in the two traceroutes? Is the transatlantic link the same?

They're fairly similar, although there are some small variances.

Tracing route to shsu.edu [156.135.1.242]
over a maximum of 30 hops:

1	<1 ms	<1 ms	<1 ms	172.26.131.1
2	<1 ms	<1 ms	<1 ms	. [46.19.176.184]
3	<1 ms	<1 ms	<1 ms	rs-y50-r7a-lal.ine.linkdy.net [217.19.56.32]
4	4 ms	<1 ms	<1 ms	ho.par.francosia.net [37.49.236.18]
5	88 ms	81 ms	153 ms	100ge8-2.core1.snl.be.net [184.185.213.173]
6	89 ms	92 ms	186 ms	100ge8-2.core1.snl.be.net [184.185.213.69]
7	123 ms	122 ms	113 ms	100ge12-1.core1.dal1.be.net [184.185.81.170]
8	116 ms	113 ms	126 ms	learn.gigabitethernet15.core1.dal1.be.net [216.66.73.226]
9	116 ms	117 ms	116 ms	74.209.176.35
10	117 ms	117 ms	117 ms	10.16.0.2
11	117 ms	120 ms	118 ms	www.shsu.edu [156.135.1.242]

a.(b) Repeat (a) but this time choose one city in France and another city in Germany.

Traceroute (v4)

With this tool, you can do a traceroute from our network.

Traceroute (v4)

1	webindex.adv.fr	212.95.66.126	0.459 ms
2	border-gateway2.sdv.fr	212.95.69.227	1.309 ms
3	decix.net.mall.ru	80.81.194.112	4.112 ms
8	ip167.156.odnoklassniki.ru	217.20.156.167	50.474 ms

1	webindex.adv.fr	212.95.66.126	0.192 ms
2	border-gateway2.sdv.fr	212.95.69.227	1.1 ms
3	core1.ams.edgcastcdn.net	80.249.209.162	14.242 ms
4	93.184.220.20	93.184.220.20	13.64 ms

b.(c) Pick a city in the United States, and perform traceroutes to two hosts, each in a different city in China. How many links are common in the two traceroutes? Do the two traceroutes diverge before reaching China?

There were a lot of common links until they diverged after going across the “china169-backbone-as4837.10gigabitethernet10-9.core1.sjc2.he.net” line.

<pre> 1 10.0.0.1 [10.0.0.1] 0.000 ms 2 10.0.0.2 [10.0.0.2] 0.000 ms 3 10.0.0.3 [10.0.0.3] 0.000 ms 4 10.0.0.4 [10.0.0.4] 0.000 ms 5 10.0.0.5 [10.0.0.5] 0.000 ms 6 10.0.0.6 [10.0.0.6] 0.000 ms 7 10.0.0.7 [10.0.0.7] 0.000 ms 8 10.0.0.8 [10.0.0.8] 0.000 ms 9 10.0.0.9 [10.0.0.9] 0.000 ms 10 10.0.0.10 [10.0.0.10] 0.000 ms 11 10.0.0.11 [10.0.0.11] 0.000 ms 12 10.0.0.12 [10.0.0.12] 0.000 ms 13 10.0.0.13 [10.0.0.13] 0.000 ms 14 10.0.0.14 [10.0.0.14] 0.000 ms 15 10.0.0.15 [10.0.0.15] 0.000 ms 16 10.0.0.16 [10.0.0.16] 0.000 ms 17 10.0.0.17 [10.0.0.17] 0.000 ms 18 10.0.0.18 [10.0.0.18] 0.000 ms 19 10.0.0.19 [10.0.0.19] 0.000 ms 20 10.0.0.20 [10.0.0.20] 0.000 ms 21 10.0.0.21 [10.0.0.21] 0.000 ms 22 10.0.0.22 [10.0.0.22] 0.000 ms 23 10.0.0.23 [10.0.0.23] 0.000 ms 24 10.0.0.24 [10.0.0.24] 0.000 ms 25 10.0.0.25 [10.0.0.25] 0.000 ms 26 10.0.0.26 [10.0.0.26] 0.000 ms 27 10.0.0.27 [10.0.0.27] 0.000 ms 28 10.0.0.28 [10.0.0.28] 0.000 ms 29 10.0.0.29 [10.0.0.29] 0.000 ms 30 10.0.0.30 [10.0.0.30] 0.000 ms 31 10.0.0.31 [10.0.0.31] 0.000 ms 32 10.0.0.32 [10.0.0.32] 0.000 ms 33 10.0.0.33 [10.0.0.33] 0.000 ms 34 10.0.0.34 [10.0.0.34] 0.000 ms 35 10.0.0.35 [10.0.0.35] 0.000 ms 36 10.0.0.36 [10.0.0.36] 0.000 ms 37 10.0.0.37 [10.0.0.37] 0.000 ms 38 10.0.0.38 [10.0.0.38] 0.000 ms 39 10.0.0.39 [10.0.0.39] 0.000 ms 40 10.0.0.40 [10.0.0.40] 0.000 ms 41 10.0.0.41 [10.0.0.41] 0.000 ms 42 10.0.0.42 [10.0.0.42] 0.000 ms 43 10.0.0.43 [10.0.0.43] 0.000 ms 44 10.0.0.44 [10.0.0.44] 0.000 ms 45 10.0.0.45 [10.0.0.45] 0.000 ms 46 10.0.0.46 [10.0.0.46] 0.000 ms 47 10.0.0.47 [10.0.0.47] 0.000 ms 48 10.0.0.48 [10.0.0.48] 0.000 ms 49 10.0.0.49 [10.0.0.49] 0.000 ms 50 10.0.0.50 [10.0.0.50] 0.000 ms 51 10.0.0.51 [10.0.0.51] 0.000 ms 52 10.0.0.52 [10.0.0.52] 0.000 ms 53 10.0.0.53 [10.0.0.53] 0.000 ms 54 10.0.0.54 [10.0.0.54] 0.000 ms 55 10.0.0.55 [10.0.0.55] 0.000 ms 56 10.0.0.56 [10.0.0.56] 0.000 ms 57 10.0.0.57 [10.0.0.57] 0.000 ms 58 10.0.0.58 [10.0.0.58] 0.000 ms 59 10.0.0.59 [10.0.0.59] 0.000 ms 60 10.0.0.60 [10.0.0.60] 0.000 ms 61 10.0.0.61 [10.0.0.61] 0.000 ms 62 10.0.0.62 [10.0.0.62] 0.000 ms 63 10.0.0.63 [10.0.0.63] 0.000 ms 64 10.0.0.64 [10.0.0.64] 0.000 ms 65 10.0.0.65 [10.0.0.65] 0.000 ms 66 10.0.0.66 [10.0.0.66] 0.000 ms 67 10.0.0.67 [10.0.0.67] 0.000 ms 68 10.0.0.68 [10.0.0.68] 0.000 ms 69 10.0.0.69 [10.0.0.69] 0.000 ms 70 10.0.0.70 [10.0.0.70] 0.000 ms 71 10.0.0.71 [10.0.0.71] 0.000 ms 72 10.0.0.72 [10.0.0.72] 0.000 ms 73 10.0.0.73 [10.0.0.73] 0.000 ms 74 10.0.0.74 [10.0.0.74] 0.000 ms 75 10.0.0.75 [10.0.0.75] 0.000 ms 76 10.0.0.76 [10.0.0.76] 0.000 ms 77 10.0.0.77 [10.0.0.77] 0.000 ms 78 10.0.0.78 [10.0.0.78] 0.000 ms 79 10.0.0.79 [10.0.0.79] 0.000 ms 80 10.0.0.80 [10.0.0.80] 0.000 ms 81 10.0.0.81 [10.0.0.81] 0.000 ms 82 10.0.0.82 [10.0.0.82] 0.000 ms 83 10.0.0.83 [10.0.0.83] 0.000 ms 84 10.0.0.84 [10.0.0.84] 0.000 ms 85 10.0.0.85 [10.0.0.85] 0.000 ms 86 10.0.0.86 [10.0.0.86] 0.000 ms 87 10.0.0.87 [10.0.0.87] 0.000 ms 88 10.0.0.88 [10.0.0.88] 0.000 ms 89 10.0.0.89 [10.0.0.89] 0.000 ms 90 10.0.0.90 [10.0.0.90] 0.000 ms 91 10.0.0.91 [10.0.0.91] 0.000 ms 92 10.0.0.92 [10.0.0.92] 0.000 ms 93 10.0.0.93 [10.0.0.93] 0.000 ms 94 10.0.0.94 [10.0.0.94] 0.000 ms 95 10.0.0.95 [10.0.0.95] 0.000 ms 96 10.0.0.96 [10.0.0.96] 0.000 ms 97 10.0.0.97 [10.0.0.97] 0.000 ms 98 10.0.0.98 [10.0.0.98] 0.000 ms 99 10.0.0.99 [10.0.0.99] 0.000 ms 100 10.0.0.100 [10.0.0.100] 0.000 ms </pre>	<pre> 1 10.0.0.1 [10.0.0.1] 0.000 ms 2 10.0.0.2 [10.0.0.2] 0.000 ms 3 10.0.0.3 [10.0.0.3] 0.000 ms 4 10.0.0.4 [10.0.0.4] 0.000 ms 5 10.0.0.5 [10.0.0.5] 0.000 ms 6 10.0.0.6 [10.0.0.6] 0.000 ms 7 10.0.0.7 [10.0.0.7] 0.000 ms 8 10.0.0.8 [10.0.0.8] 0.000 ms 9 10.0.0.9 [10.0.0.9] 0.000 ms 10 10.0.0.10 [10.0.0.10] 0.000 ms 11 10.0.0.11 [10.0.0.11] 0.000 ms 12 10.0.0.12 [10.0.0.12] 0.000 ms 13 10.0.0.13 [10.0.0.13] 0.000 ms 14 10.0.0.14 [10.0.0.14] 0.000 ms 15 10.0.0.15 [10.0.0.15] 0.000 ms 16 10.0.0.16 [10.0.0.16] 0.000 ms 17 10.0.0.17 [10.0.0.17] 0.000 ms 18 10.0.0.18 [10.0.0.18] 0.000 ms 19 10.0.0.19 [10.0.0.19] 0.000 ms 20 10.0.0.20 [10.0.0.20] 0.000 ms 21 10.0.0.21 [10.0.0.21] 0.000 ms 22 10.0.0.22 [10.0.0.22] 0.000 ms 23 10.0.0.23 [10.0.0.23] 0.000 ms 24 10.0.0.24 [10.0.0.24] 0.000 ms 25 10.0.0.25 [10.0.0.25] 0.000 ms 26 10.0.0.26 [10.0.0.26] 0.000 ms 27 10.0.0.27 [10.0.0.27] 0.000 ms 28 10.0.0.28 [10.0.0.28] 0.000 ms 29 10.0.0.29 [10.0.0.29] 0.000 ms 30 10.0.0.30 [10.0.0.30] 0.000 ms 31 10.0.0.31 [10.0.0.31] 0.000 ms 32 10.0.0.32 [10.0.0.32] 0.000 ms 33 10.0.0.33 [10.0.0.33] 0.000 ms 34 10.0.0.34 [10.0.0.34] 0.000 ms 35 10.0.0.35 [10.0.0.35] 0.000 ms 36 10.0.0.36 [10.0.0.36] 0.000 ms 37 10.0.0.37 [10.0.0.37] 0.000 ms 38 10.0.0.38 [10.0.0.38] 0.000 ms 39 10.0.0.39 [10.0.0.39] 0.000 ms 40 10.0.0.40 [10.0.0.40] 0.000 ms 41 10.0.0.41 [10.0.0.41] 0.000 ms 42 10.0.0.42 [10.0.0.42] 0.000 ms 43 10.0.0.43 [10.0.0.43] 0.000 ms 44 10.0.0.44 [10.0.0.44] 0.000 ms 45 10.0.0.45 [10.0.0.45] 0.000 ms 46 10.0.0.46 [10.0.0.46] 0.000 ms 47 10.0.0.47 [10.0.0.47] 0.000 ms 48 10.0.0.48 [10.0.0.48] 0.000 ms 49 10.0.0.49 [10.0.0.49] 0.000 ms 50 10.0.0.50 [10.0.0.50] 0.000 ms 51 10.0.0.51 [10.0.0.51] 0.000 ms 52 10.0.0.52 [10.0.0.52] 0.000 ms 53 10.0.0.53 [10.0.0.53] 0.000 ms 54 10.0.0.54 [10.0.0.54] 0.000 ms 55 10.0.0.55 [10.0.0.55] 0.000 ms 56 10.0.0.56 [10.0.0.56] 0.000 ms 57 10.0.0.57 [10.0.0.57] 0.000 ms 58 10.0.0.58 [10.0.0.58] 0.000 ms 59 10.0.0.59 [10.0.0.59] 0.000 ms 60 10.0.0.60 [10.0.0.60] 0.000 ms 61 10.0.0.61 [10.0.0.61] 0.000 ms 62 10.0.0.62 [10.0.0.62] 0.000 ms 63 10.0.0.63 [10.0.0.63] 0.000 ms 64 10.0.0.64 [10.0.0.64] 0.000 ms 65 10.0.0.65 [10.0.0.65] 0.000 ms 66 10.0.0.66 [10.0.0.66] 0.000 ms 67 10.0.0.67 [10.0.0.67] 0.000 ms 68 10.0.0.68 [10.0.0.68] 0.000 ms 69 10.0.0.69 [10.0.0.69] 0.000 ms 70 10.0.0.70 [10.0.0.70] 0.000 ms 71 10.0.0.71 [10.0.0.71] 0.000 ms 72 10.0.0.72 [10.0.0.72] 0.000 ms 73 10.0.0.73 [10.0.0.73] 0.000 ms 74 10.0.0.74 [10.0.0.74] 0.000 ms 75 10.0.0.75 [10.0.0.75] 0.000 ms 76 10.0.0.76 [10.0.0.76] 0.000 ms 77 10.0.0.77 [10.0.0.77] 0.000 ms 78 10.0.0.78 [10.0.0.78] 0.000 ms 79 10.0.0.79 [10.0.0.79] 0.000 ms 80 10.0.0.80 [10.0.0.80] 0.000 ms 81 10.0.0.81 [10.0.0.81] 0.000 ms 82 10.0.0.82 [10.0.0.82] 0.000 ms 83 10.0.0.83 [10.0.0.83] 0.000 ms 84 10.0.0.84 [10.0.0.84] 0.000 ms 85 10.0.0.85 [10.0.0.85] 0.000 ms 86 10.0.0.86 [10.0.0.86] 0.000 ms 87 10.0.0.87 [10.0.0.87] 0.000 ms 88 10.0.0.88 [10.0.0.88] 0.000 ms 89 10.0.0.89 [10.0.0.89] 0.000 ms 90 10.0.0.90 [10.0.0.90] 0.000 ms 91 10.0.0.91 [10.0.0.91] 0.000 ms 92 10.0.0.92 [10.0.0.92] 0.000 ms 93 10.0.0.93 [10.0.0.93] 0.000 ms 94 10.0.0.94 [10.0.0.94] 0.000 ms 95 10.0.0.95 [10.0.0.95] 0.000 ms 96 10.0.0.96 [10.0.0.96] 0.000 ms 97 10.0.0.97 [10.0.0.97] 0.000 ms 98 10.0.0.98 [10.0.0.98] 0.000 ms 99 10.0.0.99 [10.0.0.99] 0.000 ms 100 10.0.0.100 [10.0.0.100] 0.000 ms </pre>
--	--