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CS 438: Communication Networks

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Homework 2

Question 1

1. Caching reduces overall network traffic, decreasing queuing delays for non-cached requests as well.
2. If UIUC has excellent web-caching performance, Parkland College (which is also located in Urbana-Champaign area), WILL NOT benefit.

Caches are local to a specific network domain. Parkland is a separate administrative entity, so its traffic does not route through or access UIUC's internal web cache.

Question 2

1. Fraction of link usage = $L = (90 * 0.01) / 1 = 0.9$
Access time = queuing delay = $1 / (1 - 0.9) = 10$ milliseconds
2. Fraction of link usage = $L = (90 * 0.01) / 5 = 0.18$
Access time = queuing delay = $1 / (1 - 0.18) = 1.22$ milliseconds
3. Fraction of link usage for cache = $L_c = (72 * 0.01) / 10 = 0.072$
Fraction of link usage for server A = $L_s = (18 * 0.01) / 1 = 0.18$
Access time for cache = $1 / (1 - 0.072) = 1.08$
Access time for server A = $1 / (1 - 0.18) = 1.22$
Avg access time = $0.8 * 1.08 + 0.2 * 1.22 = 1.11$ milliseconds

Question 3

FALSE. An overlay network is a logical network built on top of a physical network. The logical links will not dictate the physical topology of the physical network; Node A and Node C could be directly connected or routed through a completely different path that does not involve Node B at all.

Question 4

1. (f) 13-14
2. $RTT / 2 * (2 * 10^8) = (206.567 / 2) * (2 * 10^8) = 20656700000 \text{ m}$
(b) 20000km
3. The server at the subsequent hop returns its ACK in a less-congested path to the source than the previous server.

Question 5

$$T_{\text{transmit}} = 10 / 1000 = 0.01 = 10 \text{ ms}$$

1. $2 * RTT + T_{\text{transmit}} = 2 * 30 + 10 = 70 \text{ milliseconds}$
 $70 * 8 = 560 \text{ milliseconds}$
 $60 \text{ (initial connection)} + 560 = 620 \text{ milliseconds}$
2. $RTT + T_{\text{transmit}} = 30 + 10 = 40 \text{ milliseconds}$
 $40 * 8 = 320 \text{ milliseconds}$
 $60 \text{ (initial connection)} + 320 = 380 \text{ milliseconds}$
3. $T_{\text{transmit}} = 10 \text{ milliseconds}$
 $10 * 8 = 80 \text{ milliseconds}$
 $1 RTT + 80 = 30 + 80 = 110 \text{ milliseconds}$
 $60 \text{ (initial connection)} + 110 = 170 \text{ milliseconds}$

Question 6

1. (2) a network that guarantees an average latency of 1ms.
2. False
3. (a) it fetches the new object only if it has changed.
4. (a), (b)
5. (d)
6. (b)
7. (c)

Question 7

*** See GitHub for iPYNB

