

Mid-Term Grading Rubik

Csci4211 Spring 2019

March 21, 2019

5. (10 points) A station sends a packet via packet switching to another station 4 hops away. Please describe the total delay in terms of all possible component delays. Note that the grading of this question depends on the completeness of your answer.

Answer:

4 Types of delays contribute to the overall delay

$$d_{end-end} = d_{propagation} + d_{transmission} + d_{queueing} + d_{processing}$$

1. $d_{propagation}$: Time for packets to propagate from source to destination at propagation speed of the link
 - (a) Depends on physical medium of the link

$$d_{propagation}[sec] = \frac{d[m]}{s[m/s]} = \frac{d^{sr-s_1} + d^{s_1-s_2} + d^{s_2-s_3} + d^{s_3-dst}}{s}$$

d = distance between source and destination going through all 4 hops.
s = propagation speed of the medium

2. $d_{transmission}$: Time to send out/absorb all of the packet bits

$$d_{transmission}[sec] = \frac{L[bits]}{R[bps]}$$

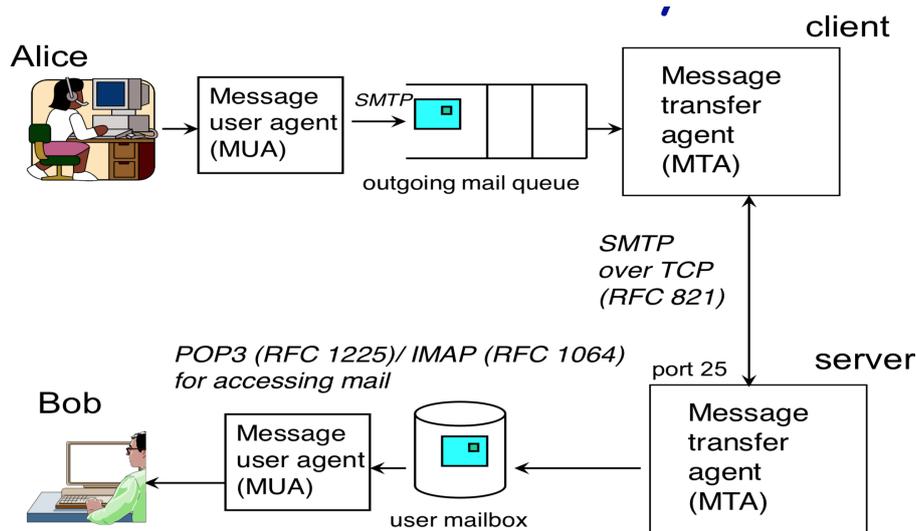
L = packet size
R = Transmission Rate

3. $d_{processing}$: Time required to process a packet - to check for bit errors to determine output links etc. Often negligible.
 - (a) at source prior to sending,
 - (b) at any intermediate router, and
 - (c) at destination prior to delivering to application
4. $d_{queueing}$: time spent waiting in a queue at any point along the route.
 - (a) Often depends on intensity and nature of traffic arriving at queue(s)

Grading:

3 point for transmission and propagation delays and 2 points for processing and queuing delays.
-1 if minor errors
-2 if units are missing
-2 if propagation delay is not calculated for each link.

6. (10 points) When Bob decides to send an email message to Alice at a remote site (i.e., their mail systems are different), describe the processes that this message going through before Alice receives the message. Please also indicate the possible protocols used at each step.



Answer: Suppose Alice with umn.edu email domain sends an email to bob with a gmail.com domain:

1. Alice will log into her computer and use her **Message User Agent(MUA)** to type the email.
2. Once Alice hits send, Alice's MUA sends the email to her **Message Transfer Agent(MTA)** via **SMTP** on port 25
3. Alice's MTA will forward the email to Bob's **Message Transfer Agent(MTA)** via **SMTP** over **TCP** on port 25
4. Bob's MTA will then place the email in **Bob's Mailbox**
5. Bob will then log in to his **Message User Agent(MUA)** and his MUA will access his email in his mailbox via **POP3: Post Office Protocol** or **IMAP: Internet Mail Access Protocol** or **HTTP** over port 143/93.

Grading:

- 1 for each missing bold key term and protocol .
- 5 for wrong description of email flow.
- 4 if protocols are not provided.

7. (10 points) In TCP/IP network, the timeout period is closely related to the estimated RTT. Describe how the RTT and timeout is determined in TCP/IP network.

Answer:

1. $EstimatedRTT = (1 - a)EstimatedRTT + a(SampleRTT)$
where $a = 0.125$ and
SampleRTT is the time from segment transmission until ACK is received.
2. $TimeoutInterval = EstimatedRTT + 4(DevRTT)$
where $DevRTT = (1 - b)DevRTT + b(|SampleRTT - EstimatedRTT|)$
typically, $b = 0.25$

Grading:

- 4 points for correct EstimatedRTT formula, 4 points for correct DevRTT formula and 2 points for correct TimeoutInterval formula
- 1 per error in each formula.
- 8 if no formula is given.

8. (10 points) Suppose TCP Tahoe is used over a lossy link that loses one segment in every 6th RTT (for example, starting from RTT #0, one segment will be lost during RTT #5, and the congestion window and threshold should be adjusted accordingly at RTT #5. The loss will repeat during RTT #11, RTT #17,...). Show how congestion window varies over time by filling in the following table. Assume that initially the congestion window is 1 segment and the threshold is 10. Also, while computing threshold, round it up to the nearest integer.

To simply(simplify) this question, we assume after a burst is sent, the sender will wait for ACKs to all the segments before the congestion window is adjusted. In addition, we assume the ACKs will return to the sender every RTT time, if not lost (and not lost).

Answer:

| | | | | | | | | | | | | | | | | | |
|------------------|----|----|----|----|----|---|---|---|---|---|----|----|----|----|----|----|----|
| RTT # | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Congwin | 1 | 2 | 4 | 8 | 10 | 1 | 2 | 4 | 5 | 6 | 7 | 1 | 2 | 4 | 5 | 6 | 7 |
| Threshold | 10 | 10 | 10 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |

| | | | | | | | | | | | | | | |
|------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| RTT # | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Congwin | 1 | 2 | 4 | 5 | 6 | 7 | 1 | 2 | 4 | 5 | 6 | 7 | 1 | 2 |
| Threshold | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

Grading:

-1 or -2 if minor mistakes

-5 if CongWin and Threshold are not adjusted at RTT 5, 11, 17, 23 and 29

-8 is not correctly showing the idea of TCP Tahoe (late recovery etc...)