Comp 2322 Computer Networking

Homework Three

Due time: 11:59pm, March 11, 2024, Monday

Total marks: 10 points

Submission Requirements:

You need to submit the homework to the blackboard via Learn@PolyU on or before the due time. Late submission will cause the marks to be deducted 25% per day.

Questions:

1) (4 points) Consider transferring an enormous file of *L* bytes from Host A to Host B. Answer the following questions:

a) Assume an MSS of 880 bytes and the TCP sequence number field has 4 bytes. What is the maximum value of *L* such that TCP sequence numbers are not exhausted? (2 points)

b) Assume that a total of 56 bytes of transport, network, and data-link header are added to each segment before the resulting packet is sent out over a 200 Mbps link. Ignore flow control and congestion control so A can pump out the segments back to back and continuously. For the *L* you obtain in (a), find how long it takes to transmit the file. (2 points)

Answer:

a)

The maximum value of L can be calculated as:

L/MSS <= (2^32)-1

Simplifying the inequality:

L <= (2^32-1) * MSS

L <= (2^32-1) * 880

L <= 3,805,800,704

Therefore, the maximum value of L such that TCP sequence numbers are not exhausted is 3,805,800,704 bytes.

b)

L obtained in (a)= 3,805,800,704 bits

The total transmission time can be calculated using the formula:

Transmission time = (L + (L/MSS) * 56) / link speed

The link speed is given as 200 Mbps, which means 200 Megabits per second.

Converting L to bits:

L_bits = L * 8= 3,805,800,704*8=30,446,405,632 bits

Transmission time

= (L_bits + (L/MSS) * 56 * 8) / (200 * 10^6)

=(30,446,405,632+(30,446,405,632/880) * 56 * 8) / (200 * 10^6)

=160.3749 seconds

The final result of transmission time is 160.3749 seconds.

2) (6 points) Consider the TCP timer management that TCP estimates the round-trip time and retransmission timeout interval. The formulas used to compute the round-trip time and retransmission time interval are given:

$$EstimatedRTT_n = \alpha \cdot SampleRTT_n + (1-\alpha) \cdot EstimatedRTT_{n-1}$$

$$DevRTT_n = \beta \cdot |SampleRTT_n - EstimatedRTT_{n-1}| + (1-\beta) \cdot DevRTT_{n-1}$$

$$TimeoutInterval_n = EstimatedRTT_n + 4 \times DevRTT_n$$

Suppose that the two measured *SampleRTT* values are 108 ms and 110 ms. Compute the *EstimatedRTT* after each of these *SampleRTT* values is obtained, using a value of α = 0.15 and assuming that the value of *EstimatedRTT* was 100 ms just before the first of these samples were obtained. Compute also the *DevRTT* after each sample is obtained, assuming a value of β = 0.25 and assuming the value of *DevRTT* was 6 ms just before the first of these samples was obtained. Last, compute the TCP *TimeoutInterval* after each of these samples is obtained.

Answer:

Assume

SampleRTT1=108ms

SampleRTT2=110ms

α = 0.15

β = 0.25

EstimatedRTT0=100ms

DevRTT=6ms

First SampleRTT:

$$EstimatedRTT_n = \alpha \cdot SampleRTT_n + (1-\alpha) \cdot EstimatedRTT_{n-1}$$

= 0.15 * 108 ms + (1 - 0.15) * 100 ms

=16.2 ms + 85 ms

=101.2 ms

$$DevRTT_n = \beta \cdot |SampleRTT_n - EstimatedRTT_{n-1}| + (1-\beta) \cdot DevRTT_{n-1}$$

=0.25 * |108 ms - 100 ms| + (1 - 0.25) * 6 ms

=0.25 * 8 ms + 0.75 * 6 ms

=6.5 ms

$$TimeoutInterval_n = EstimatedRTT_n + 4 \times DevRTT_n$$

=101.2 ms + 4 * 6.5 ms

=127.2 ms

Second SampleRTT:

$$EstimatedRTT_n = \alpha \cdot SampleRTT_n + (1-\alpha) \cdot EstimatedRTT_{n-1}$$

= 0.15 * 110 ms + (1 - 0.15) * 101.2 ms

=16.5 ms + 85.92 ms

=102.42 ms

$$DevRTT_n = \beta \cdot |SampleRTT_n - EstimatedRTT_{n-1}| + (1-\beta) \cdot DevRTT_{n-1}$$

=0.25 * |110 ms - 101.2 ms| + (1 - 0.25) * 6.5 ms

=0.25 * 8.8 ms + 0.75 * 6.5 ms

=7.08 ms

$$TimeoutInterval_n = EstimatedRTT_n + 4 \times DevRTT_n$$

=102.42 ms + 4 * 7.08 ms

=130.74 ms

Therefore, final result :

EstimatedRTT1 = 101.2 ms

DevRTT1 = 6.5 ms

TimeoutInterval1 = 127.2 ms

EstimatedRTT2 = 102.42 ms

DevRTT2 = 7.08 ms

TimeoutInterval2 = 130.74 ms