**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:
   1. 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)
   2. 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.

The maximum possible sequence numbers are .

For TCP, the sequence number does not increment by one with each segment. Rather, it increments by the number of bytes of data which have been sent. So the maximum size of the file is irrelevant to the value of an MSS, i.e., the maximum size file that can be sent from A to B is the number of bytes representable by maximum possible sequence number .

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.

The total numbers of segments required to send the file are .

For each segment, 56 bytes of header need to be added, resulting a total of bytes of header.

The total number of bytes transmitted is .

Thus, the time to transmit the file over a 200 Mbps link is seconds.

1. (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:

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:

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

=16.2 ms + 85 ms

=101.2 ms

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

=0.25 \* 8 ms + 0.75 \* 6 ms

=6.5 ms

=101.2 ms + 4 \* 6.5 ms

=127.2 ms

Second SampleRTT:

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

=16.5 ms + 85.92 ms

=102.42 ms

=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

=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