Topic: TCP performance

Exercise n. 1

A and B are two TCP Reno entities, with A aimed at transmitting 13 segments to B.

The maximum value of congestion window is 800 bytes, the initial value of slow start threshold *ssth* is 400 bytes, RTT = 10 ms and RTO=RTT + e, SMSS=100 bytes. Segments 4 and 9 are lost.

By assuming processing and transmission time as negligible

- draw the exchange of segments/acks as a function of time
- evaluate the instant T when the ack for segment 13 is received by the the sender.

Exercise n. 2

A and B are two TCP Reno entities, with A aimed at transmitting 13 segments to B.

The maximum value of congestion window is 800 bytes, the initial value of slow start threshold *ssth* is 400 bytes, RTT = 100 ms and RTO=250 ms, SMSS=100 bytes. Segment 8 is lost during two consecutive transmissions and segment 12 is lost once.

By assuming processing and transmission time as negligible

- draw the exchange of segments/acks as a function of time
- evaluate the instant T when the ack for segment 13 is received by the the sender.

Exercise n. 3

A and B are two TCP Reno entities, with A aimed at transmitting 10 segments to B.

The maximum value of congestion window is 400 bytes, the initial value of slow start threshold *ssth* is 400 bytes, RTT = 100 ms, SMSS=100 bytes. Segment 4 is lost.

By assuming processing and transmission time as negligible

- draw the exchange of segments/acks as a function of time
- evaluate the instant T when the ack for segment 10 is received by the the sender.

Exercise n. 4

A and B are two TCP Reno entities, with A aimed at transmitting 16 segments to B.

The maximum value of congestion window is 700 bytes, the initial value of slow start threshold *ssth* is 700 bytes, RTT = 100 ms, RTO=400 ms, SMSS=100 bytes. Segments 8 and 9 are lost.

By assuming processing and transmission time as negligible

- draw the exchange of segments/acks as a function of time
- evaluate the instant T when the ack for segment 16 is received by the the sender.

Exercise n. 5

A and B are two TCP Reno entities, with A aimed at transmitting 12 segments to B.

The maximum value of congestion window is 800 bytes, the initial value of slow start threshold *ssth* is 800 bytes, RTT = 100 ms, RTO=500 ms, SMSS=100 bytes. Segments 8 is lost.

By assuming processing and transmission time as negligible

- draw the exchange of segments/acks as a function of time
- evaluate the instant T when the ack for segment 12 is received by the the sender.

Exercise n. 6

A and B are two TCP Reno entities, with A aimed at transmitting 10 segments to B.

The maximum value of congestion window is 800 bytes, the initial value of slow start threshold *ssth* is 800 bytes, RTT = 100 ms, RTO=500 ms, SMSS=100 bytes. Segments 4 is lost twice.

By assuming processing and transmission time as negligible

- draw the exchange of segments/acks as a function of time
- evaluate the instant T when the ack for segment 10 is received by the the sender.

Exercise n. 7

Consider a TCP connection operating in congestion avoidance. By adopting a periodic loss model, calculate the duration of the period T in seconds and the value of throughput S in Kbit/s, assuming that RTT starts from RTT_0 = 100 ms at the first round of the period T and increases by 10 ms at each round, and that the value of the congestion window starts at 10 SMSS, with SMSS=200 bytes.

Exercise n. 8

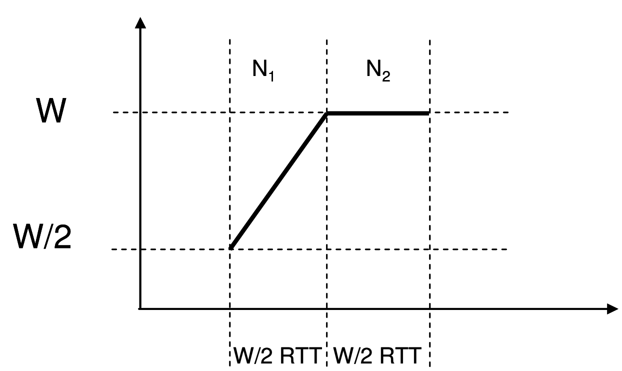
Consider a TCP connection operating in congestion avoidance. By adopting a periodic loss model, calculate the value of throughput S in Kbit/s, assuming that RTT= 120 ms and that the congestion window reaches its maximum value during the period T at T/2 with p=0.001 and SMSS=200 bytes.

$N_1 = \frac{3}{8}W^2$

$N_2 = \frac{W^2}{2}$

$N = N_1 + N_2 = 7/8\ W^2 \rightarrow W=33.8$

S=(1/p)*200*8/(RTT W)=394 Kbit/s



Exercise n. 9

Calculate the latency time for an object O=100Kbyte on a link with R=100 Kbit/s and RTT=200 ms in the first round and 250 ms in the following rounds.

SMSS=200 bytes.

S/R=0.016 s; O/S=500

$K=\left\lceil \log_2\left(1+\frac{O}{S}\right)\right\rceil=9$

Q= $\left\lfloor \log_2\left(1+\frac{RTT_2}{S/R}\right)\right\rfloor + 1$ =5

P=min (K-1,Q)=5

L_D= $RTT_1 + RTT_2 + O/R + P(RTT_2 + S/R) - (2^P - 1)S/R = 9{,}28s$

Exercise n. 10

Calculate the latency time for an object O=20 Kbyte on a link with R=1 Mbit/s. RTT=100 ms during the first and second rounds and 150 ms in further rounds.

SMSS=100 bytes.

S/R=0.0008 s; O/R=0.16 s; O/S=200

K= $\left\lceil \log_2\left(1+\frac{O}{S}\right)\right\rceil$ =8

Q= $\left\lfloor \log_2\left(1+\frac{RTT_2}{S/R}\right)\right\rfloor + 1$ =8

P=min (K-1,Q)=7

L_D= 2 $RTT_1 + O/R + P(RTT_2 + S/R) - (2^P - 1)S/R = 1{,}314s$

Exercise n. 11

Calculate the latency time for an object O=15Kbyte on a link with R=90 Kbit/s. RTT=100 ms during TCP connection establishment and in the first transmission round. After then RTT increases of 10% at each round. SMSS=500 bytes.

S/R= 44,4 ms ; O/R= 1,33 s

L_D= 2 * 100+ 1330+100+ (110-44.4) + 0 + 0 = 1,69 s

K= $\left\lceil \log_2\left(1+\frac{O}{S}\right)\right\rceil$ =5

Exercise n. 12

Calculate the latency time for an object O=100Kbyte on a link with R=10 Mbit/s. RTT=150 ms and SMSS=100 bytes.

O/R= 0.08 s ; S/R 80 µs; O/S= 1000

K= $\left\lceil \log_2\left(1+\frac{O}{S}\right)\right\rceil$ = 10

Q= $\left\lfloor \log_2\left(1+\frac{RTT}{S/R}\right)\right\rfloor + 1$ =11

P=min (K-1,Q)=9

L_D= 2 $RTT + O/R + P(RTT + S/R) - (2^P - 1)S/R = 1{,}689s$