

# Assignment 3

March 30, 2016 7:00 PM

①  $LT_{Avg} = 200 \text{ Mbps} = 200 \cdot 10^6 \text{ bps} \rightarrow r$   
 $Back-To-Back = 10 \text{ ms} = 0.01 \text{ s} \rightarrow s$   
 $Link \text{ Rate} = 1 \text{ Gbps} = 1 \cdot 10^9 \text{ bps} \rightarrow M$

$$\frac{b}{M-r} = s \rightarrow b = s(M-r)$$

$$b = 0.01(1 \cdot 10^9 - 200 \cdot 10^6) \text{ bits}$$

$b = 8 \text{ Mb} = 1 \text{ MB}$

②  $SRTT = 150 \text{ ms}$        $\alpha = 0.875$   
 $new \text{ RTT} = 75 \text{ ms}$        $R = 75$

Its	SRTT	$\rightarrow \alpha SRTT + (1-\alpha)R$
1	150	140.65
2	140.65	132.44
3	132.44	125.26
4	125.26	119.33
5	119.33	113.79
6	113.79	108.94
7	108.94	104.69
8	104.69	100.98
9	100.98	97.73

On the 9th Iteration  
we drop below 100ms

③  $\alpha = 0.875$        $SRTT \leftarrow \alpha SRTT + (1-\alpha)R$   
 $\beta = 0.75$        $RTTVAR \leftarrow \beta RTTVAR + (1-\beta) |SRTT - R|$   
 $R = 250 \text{ or } 500$        $RTO \leftarrow SRTT + 4 \times RTTVAR$

Used Excel to calculate

SRTT	n=4	RTTVAR	Timeout	SRTT	n=5	RTTVAR	Timeout
200	500	200	1000	200	500	200	1000
237.5	250	219	1113.5	237.5	250	219	1113.5
239.0625	250	160.805	882.2825	239.0625	250	160.805	882.2825
240.4296875	250	118.513975	714.4855875	240.4296875	250	118.513975	714.4855875
241.6259766	500	87.72264013	592.5165371	241.6259766	250	87.72264013	592.5165371
273.9227295	250	127.7538067	784.9379565	242.6727295	500	65.25380675	503.6879565
270.9323883	250	97.96342323	662.7860812	274.8386383	250	111.3145585	720.0968723
268.3158398	250	75.7667618	571.382887	271.7338085	250	86.35614169	617.1583753
266.0263598	500	59.13102844	502.5504736	269.0170825	250	67.60987414	539.456579
295.2730648	250	101.0677505	699.5440669	266.6399471	250	53.43338	480.3734671
289.6139317	250	84.08704659	625.9621181	264.5599538	500	42.63202038	435.0880353
284.6621903	250	70.44615647	566.4468161	293.9899595	250	89.55506624	652.2102245
280.3294165	500	59.38678022	517.8765374	288.4912146	250	75.47713758	590.3997649
307.7882394	250	97.67612764	698.49275	283.6798128	250	63.9663427	539.5451836
300.5647095	250	84.77387176	639.6601965	279.4698362	250	54.47571994	497.3727159
294.2441208	250	73.67836504	588.9575809	275.7861067	500	46.5899774	462.1460162
288.7136057	500	64.10945303	545.1514178	303.8128433	250	89.59825706	662.2058716
315.124405	250	98.98040475	711.046024	297.0862379	250	77.96395592	608.9420616
306.9838544	250	87.54699267	657.171825	291.2004582	250	67.90560774	562.8228891
299.8608726	250	77.27979831	608.9800658	286.0504009	250	59.19215211	522.8190093
293.6282635	500	68.10667293	566.0549552	281.5441008	500	51.63094974	488.0678998
319.4247306	250	100.6297386	721.9436851	308.8510882	250	91.78825862	676.0041227
310.7466392	250	89.80959446	669.9850171	301.4947022	250	80.80031825	624.6959752
303.1533093	250	79.84956782	622.5515806	295.0578644	250	71.04990468	579.2574831
296.5091457	500	70.78001616	579.6292103	289.4256313	250	62.42039747	539.1072212
321.9455025	250	101.8343252	729.2828033	284.4974274	500	54.79909401	503.6938035
312.9523147	250	91.30708977	678.1806737	311.435249	250	93.33099083	684.7592123
305.0832753	250	81.4791833	631.0000085	303.7558429	250	82.55712565	633.9843455
298.1978659	500	72.43583081	587.9411891	297.0363625	250	72.88009119	588.5567273
323.4231327	250	102.6043317	733.8404595	291.1568172	250	64.23275628	548.0878423
314.2452411	250	92.23090199	683.1688491	286.012215	500	56.53678882	512.1593703
306.2145859	250	82.46755971	636.0848248	312.7606882	250	94.20343419	689.5744249

← drops below 500ms at n=5

so longest is n=4

④ a) Round 1  
Round 22

b) Triple duplicate Ack - hiccup

c) Timeout - Completely dies

$$\begin{aligned} d) \text{ ssthresh} &= \text{cwnd} \times 2 \\ &= 1 \times 2 \\ &= 2 \end{aligned} \quad \left. \vphantom{\begin{aligned} d) \text{ ssthresh} &= \text{cwnd} \times 2 \\ &= 1 \times 2 \\ &= 2 \end{aligned}} \right\} \text{Slow start}$$

$$\begin{aligned} e) \text{ ssthresh} &= \text{cwnd} + 1 \\ &= 39 + 1 \\ &= 40 \end{aligned} \quad \left. \vphantom{\begin{aligned} e) \text{ ssthresh} &= \text{cwnd} + 1 \\ &= 39 + 1 \\ &= 40 \end{aligned}} \right\} \text{Stable Increase}$$

$$\begin{aligned} f) \text{ ssthresh} &= \text{cwnd} \cdot 2 \\ &= 8 \cdot 2 \\ &= 16 \end{aligned} \quad \left. \vphantom{\begin{aligned} f) \text{ ssthresh} &= \text{cwnd} \cdot 2 \\ &= 8 \cdot 2 \\ &= 16 \end{aligned}} \right\} \text{Slow start}$$

$$\begin{aligned} g) \text{ ssthresh} &= \text{cwnd} / 2 \\ &= 16 / 2 \\ &= 8 \end{aligned} \quad \left. \vphantom{\begin{aligned} g) \text{ ssthresh} &= \text{cwnd} / 2 \\ &= 16 / 2 \\ &= 8 \end{aligned}} \right\} \begin{array}{l} \text{Because of Triple} \\ \text{Duplicate ACK} \end{array}$$

cwnd = 16