

NS Lab 4 Answer Sheet

NS3 simulator - TCP Performance Monitoring

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Hand-in time (submit to blackboard) by Sep 30, 2013 13:00CEST

Total points: 20 pts

Please provide your answer in the appropriate space for each question

Task 1 - Throughput of TCP client-server connection

1. See the text files *output-task1-64-16k.txt*, *output-task1-96-16k.txt* and *output-task1-128-16k.txt*.

Latency	Measured Throughput	Calculated Throughput	Calculation
64ms	1.03Mbps	1.02 Mbps	$(16384 * 8 / 10^6) / (0,064 * 2)$
96ms	0.68 Mbps	0.68 Mbps	$(16384 * 8 / 10^6) / (0,096 * 2)$
128ms	0.51 Mbps	0.51 Mbps	$(16384 * 8 / 10^6) / (0,128 * 2)$

Here, an Mbit is (apparently) a million bits, as opposed to a 1024^2 bits.

2. Yes, it inversely affects throughput. The TCP client waits to submit more than RWIN bytes until it receives an ACK; the client has to wait longer if the latency is bigger.

3. Optimal RWIN value: 51200 bytes
Calculation: $((3.2 * 10^6) * (0.064 * 2)) / 8$
4. 3.10 Mbps. See *output-task1-optimal.txt*.

Task 2 – Monitoring TCP congestion window

1. From 1s to 1.5s, we have the slow start phase where cwnd grows exponentially. After that, TCP enters the congestion avoidance phase where cwnd grows much more slowly. See *cwnd-part1.log* and *cwnd-part1.png* (Figure 1).

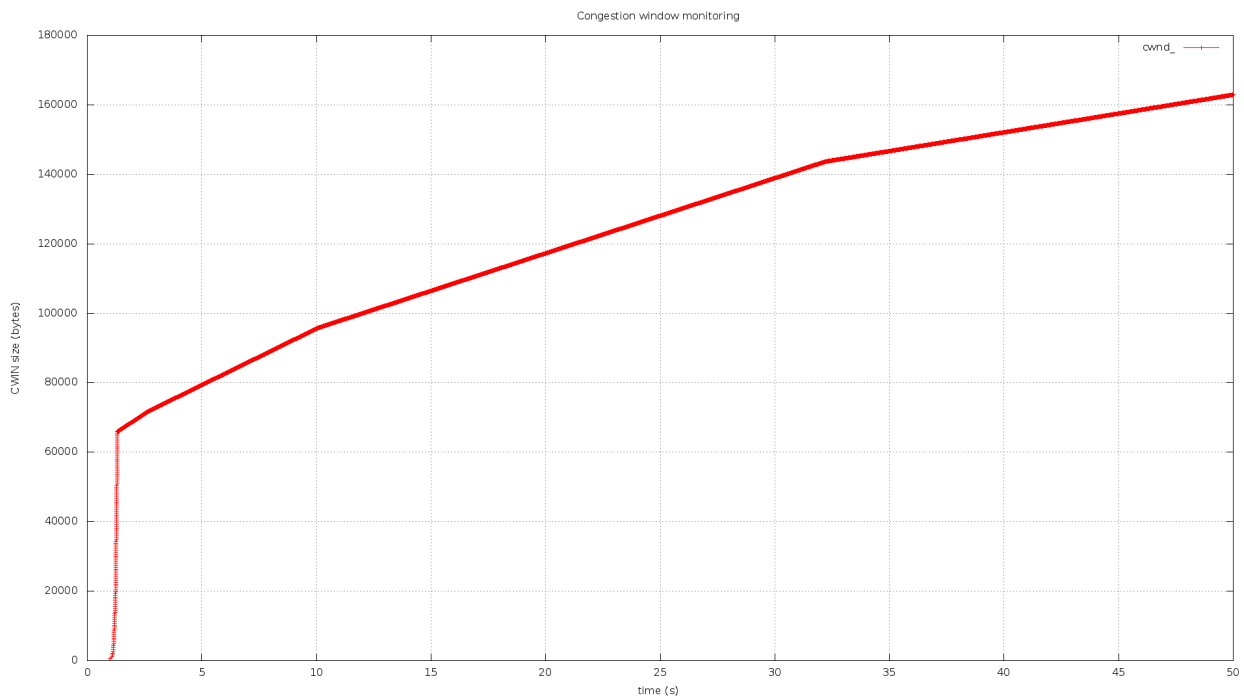


Figure 1: Tahoe – droptail queue = 100

2.a. See *cwnd-part2.log* and *cwnd-part2a.png* (Figure 2).

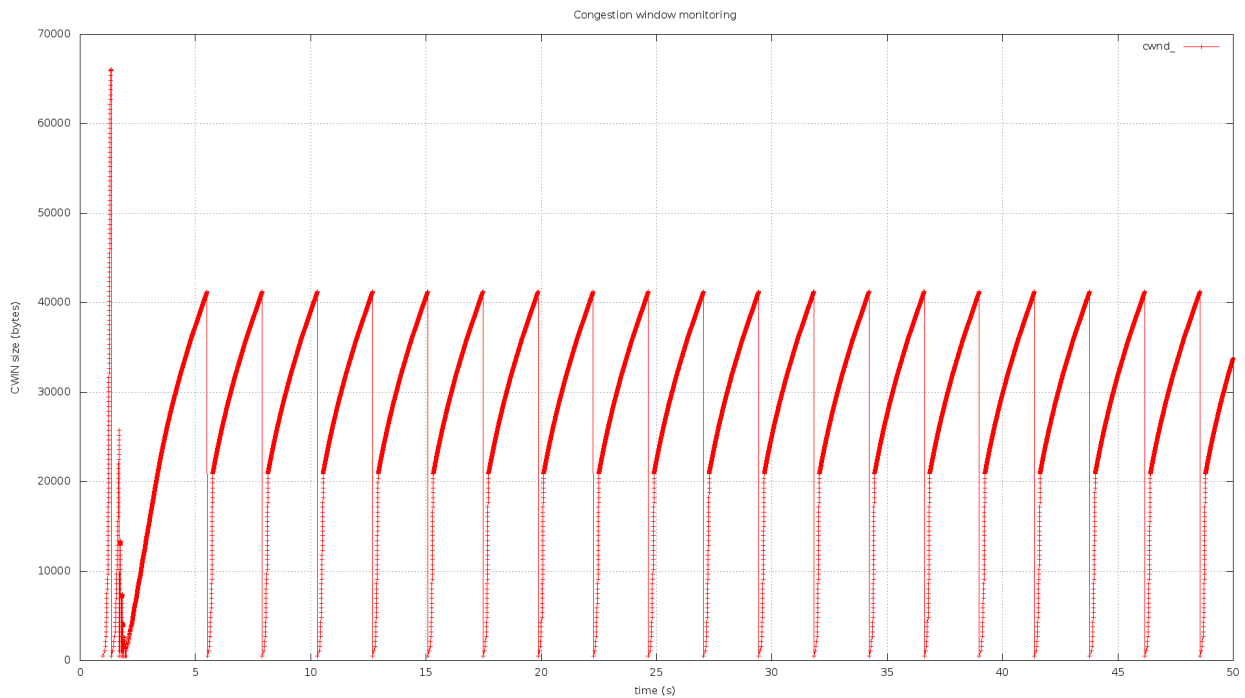


Figure 2: Tahoe, droptail queue = 40

2.b See *cwnd-part2-1s-185s.log* and *cwnd-part2b.png* (Figure 3).

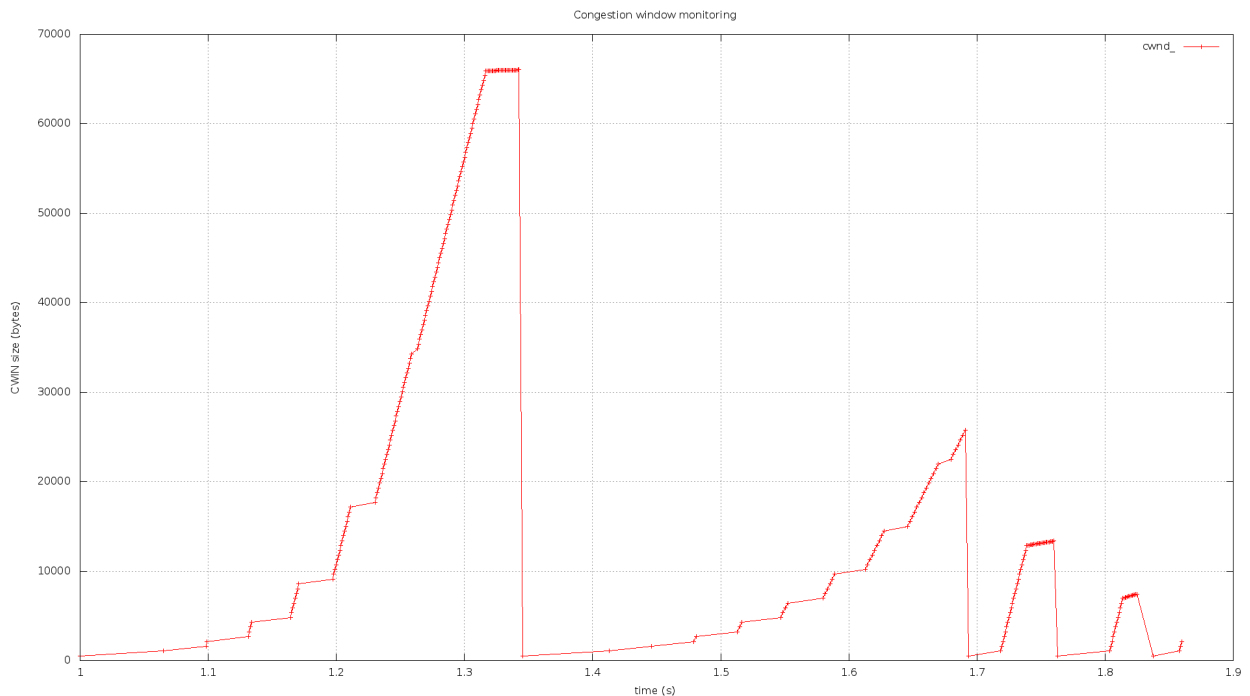


Figure 3: Tahoe, droptail queue = 40 (from 1 until 1.85 secs)

State changes, Tahoe - from 1 until 1.85 secs		
Time accuracy (sec, 3 decimal)	cwnd (bytes)	New state
1.000	1	<i>Initial state: Slow start</i>
1.316	65928	Congestion avoidance
1.345	536	Slow start
1.738	12864	Congestion avoidance
1.762	536	Slow start
1.813	6968	Congestion avoidance
1.837	536	Slow start

(Note that another drop happens at 1.693, but this was still in the slow start phase, so no state change occurred.)

2.c See *cwnd-part2-4s-6s.log* and *cwnd-part2c.png* (Figure 4).

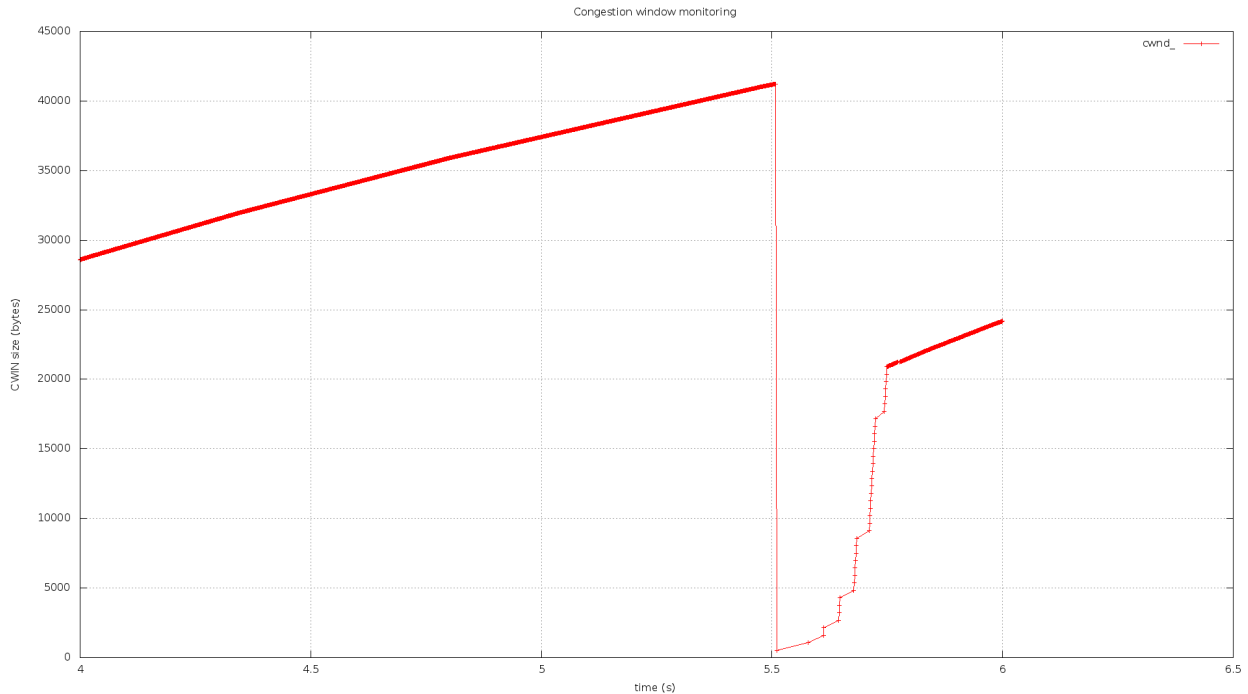


Figure 4: Tahoe, droptail queue = 40 (from 4 until 6 secs)

State changes, Tahoe - from 4 until 6 secs		
Time accuracy (sec, 3 decimal)	cwnd (bytes)	New state
4.000	28594	<i>Initial state: Congestion av.</i>
5.511	536	Slow start
5.749	20904	Congestion avoidance

3.a See *cwnd-part3.log* and *cwnd-part3a.png* (Figure 5).

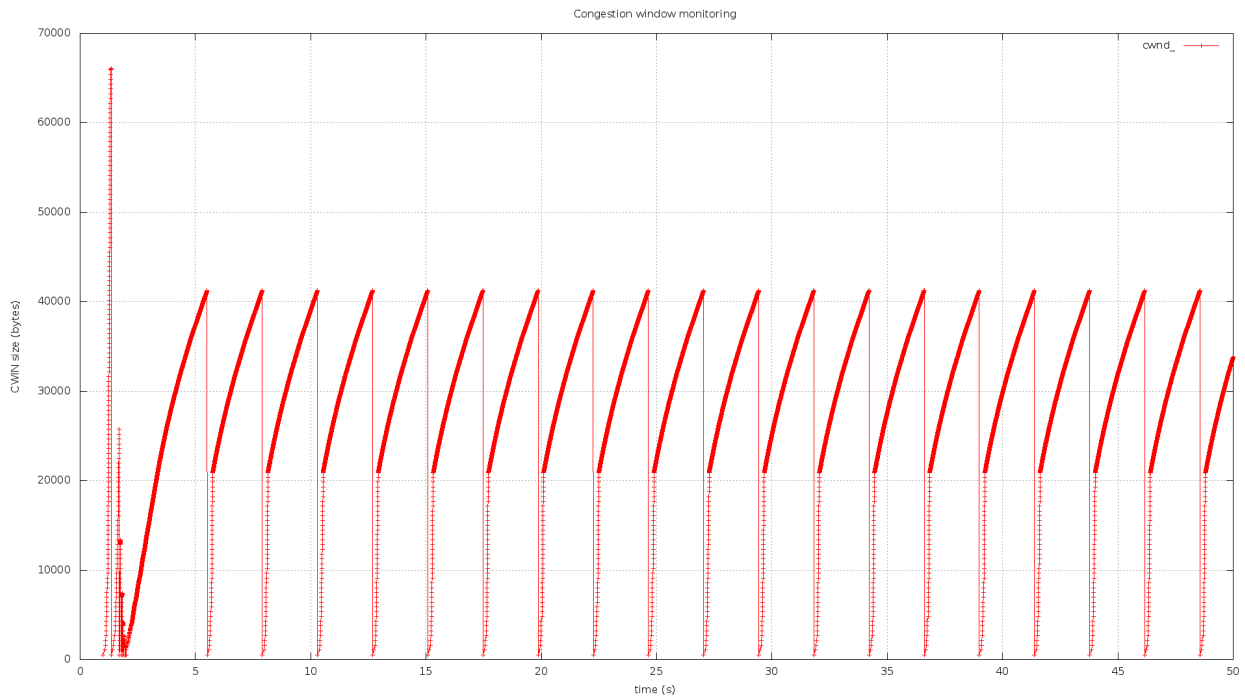


Figure 5: Reno, droptail queue = 40

3.b See *cwnd-part3-4s-6s.log* and *cwnd-part3b.png* (Figure 6).

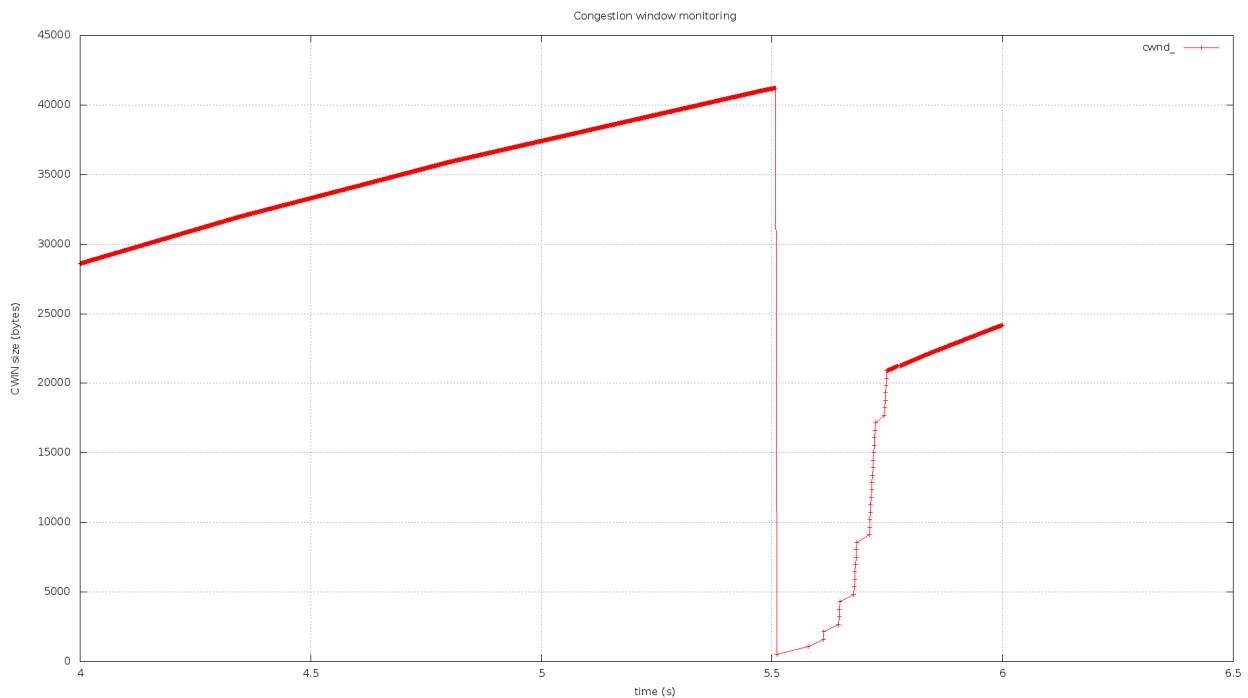


Figure 6: Reno, droptail queue = 40 (from 4 until 6 secs)

<i>State changes, Reno - from 4 until 6 secs</i>				
Time (sec, accuracy 3 decimal)	Current cwnd (bytes)	New cwnd (bytes)	New state	Event
4.000	28594	---	<i>i.s.: Cong. av.</i>	---
5.511	41230	536	Slow start	Timeout; packet(s) lost.
5.750	20904	20917	Congestion av.	Threshold reached.

Submission

You have to submit:

- Your answers to all the questions. Use this provided **answer sheet** for you answers and graphs. Provide your answers in the appropriate answer field for each question
- The source codes of the two tasks.
- The graphs and the produced data.

Attention: You have to submit one PDF file that contains all the answers and graphs; the name of the file should be lab4-<lastname_firstletter>.pdf (example: lab1-vanderveldt_k.pdf, or lab1-pittaras_c.pdf). Additionally you have to submit one zip (or rar) file containing the source codes, the graphs and the data. The name of the file should be: lab4-source-<lastname_firstletter>.zip

Any other kind of submission will not be taken into account. You must also put your full name and your student number at the top of the answer sheet.