

SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Spring 2020

ENSC 427: COMMUNICATION NETWORKS
ENSC 894: SPECIAL TOPICS II COMMUNICATION NETWORKS

Midterm No. 1

Wednesday, February 26, 2020

Duration: 110 minutes. Attempt all problems. Questions are not equally weighted. Please provide detailed answers and include diagrams, graphs, and tables, as needed. Expand all acronyms. Closed book and closed notes. Simple calculators (with no graphing/programming functions) are permitted. PDAs, laptops, and wireless phones are not permitted. Please write legibly. Illegible text will not be graded. Please use a pen (no pencils, please).

1. Chapter 1 Computer Networks and the Internet (25 points):

- (a) List four types of delays in packet-switched networks.
- (b) Describe each type and include their typical order of magnitude.
- (c) What is the total nodal delay?
- (d) What is the end-to-end delay in a network with $N - 1$ routers. Assume that the network is uncongested.
- (e) Describe the trade-off between queuing delay and packet loss.

2. Chapter 3 Transport Layer (25 points):

- (a) What is round trip time and how is it estimated?
- (b) What is timeout? How is its value set in TCP?
- (c) What are typical value of the parameters used?
- (d) Suppose that TCP's current estimated values for the round trip time and deviation in the RTT are 200 ms and 20 ms, respectively. Suppose that the next three measured values of the RTT are 400 ms, 300 ms, and 500 ms. Compute TCP's new value of the round trip time, deviation in the RTT, and timeout after each of these three measured RTT values is obtained.

3. Chapter 3 Transport Layer (30 points):

Consider Fig. 1. Assume that TCP Reno is the protocol experiencing the shown behavior. In all cases, provide a short discussion justifying your answer. The initial value of *cwnd* (congestion window) is 1 and the initial value of *ssthresh* (slow start threshold) is 8.

- (a) What are the main phases of the TCP congestion control algorithm?
- (b) Identify the intervals of time when each phase operates.

- (c) What happens after the 6th, 27th, 32th, 36th, and 39th time unit.
- (d) Identify the intervals of time at which the value of *ssthresh* changes and give the new value of *ssthresh*.
- (e) Why TCP Reno does not employ the slow start phase when a triple duplicate ACK is received?

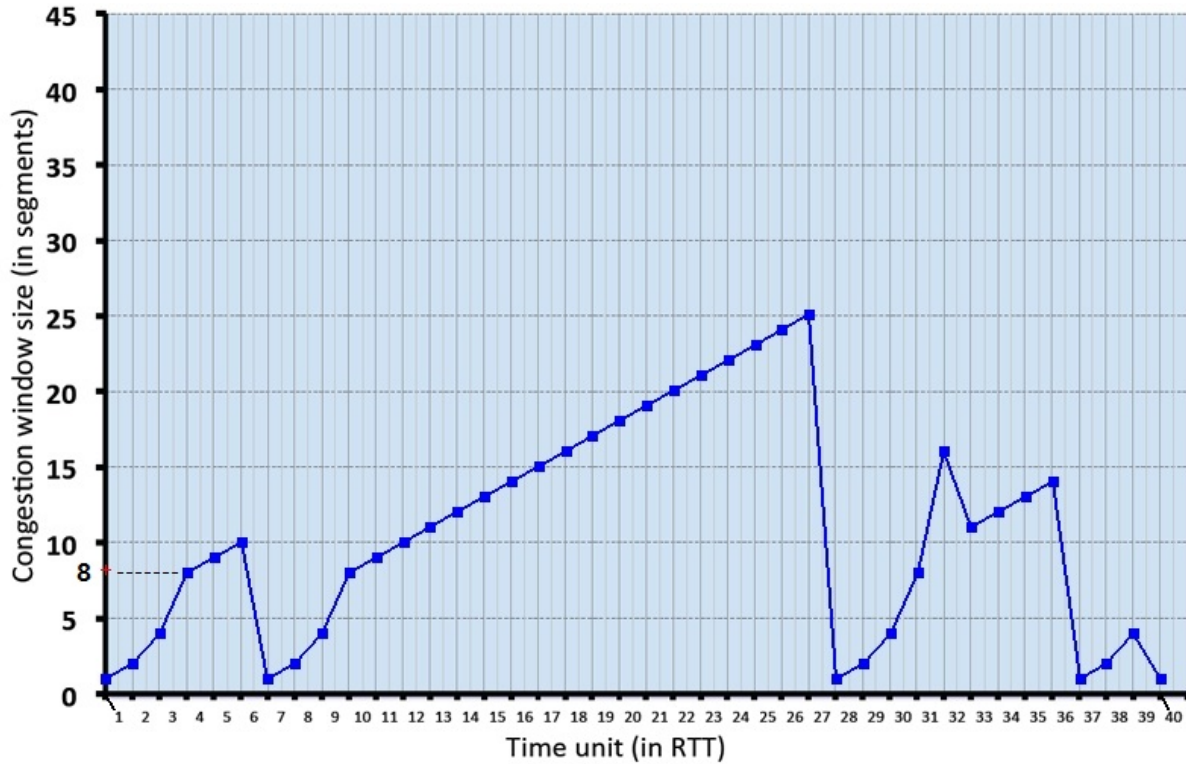


Figure 1: TCP window size as a function of time.

4. Chapter 2 Application Layer and Case Study: Simulation of Gnutella Network (20 points):

- (a) List main characteristics of P2P networks.
- (b) Provide examples of P2P architecture.
- (c) What is the “topology mismatch” in P2P networks?
- (d) List the proposed improvements to solve the mismatch.
- (e) Describe the simulation scenario.
- (f) Summarize main simulation results.