Network Systems (201300179/201400431), Test 4

April 4, 2016, 13:45–15:15

- This is an open-book exam: you are allowed to use the book by Peterson & Davie and the reader that belongs to this module. Furthermore, use of a dictionary is allowed. Use of a simple (non-graphical) calculator is allowed.
- Other written materials, and laptops, tablets, graphical calculators, mobile phones, etc., are not allowed. ***Please remove any such material and equipment from your desk, now!***
- Although the questions are stated in English, you may answer in English or Dutch, whichever you are more comfortable with.
- You should always explain or motivate your answers, with so much detail that the grader can judge whether you understand the material; so just saying "yes" or giving a formula without explanation is not enough.
- Visiting the toilet without explicit permission of the supervisor is not allowed. During the last 30 minutes of the exam, no toilet visits are allowed.

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1. Congestion Control

Consider a TCP connection between hosts A and B which has been active for a while, with host A sending data to host B. At some point, the `CongestionWindow` = 6 MSS and `SlowstartThreshold` = 8 MSS (see footnote[1]).

2 pt (a) What was the `CongestionWindow` at the time of the most recent packet loss? Explain.

Assume no packets are currently outstanding; thus, host A is allowed to transmit 6 packets next. For simplicity assume MSS = 1 byte. Host A's current sequence number=10.

3 pt (b) Assuming that the first of those six packets is lost, how many RTTs does it take until these 6 packets have been succesfully sent and acknowledged?
Explain your answer by drawing a time-sequence diagram, in which you indicate all packets with their sequence/acknowledgement numbers; also indicate changes of the congestion window, if there are any.

2 pt (c) UDP is used a lot for DNS traffic, but doesn't have congestion control. Why isn't this a problem?

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2. QoS

2 pt (a) Why is overprovisioning, without advanced techniques like fair queueing, differentiated services, etc., usable for some real-time applications and not for others?

3 pt (b) Suppose we would use Fair Queueing, but treat every packet as a separate traffic flow. Is this equivalent to First In First Out queueing? Explain.
(Hint: consider what happens if two big packets arrive, immediately followed by a small one.)

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[1] By `SlowstartThreshold`, we mean the same thing which is called `CongestionThreshold` in the book. The former name is much more common though.

3. Security

2 pt (a) When using PGP for secure e-mail, can the sender be sure about the identity of the receiver, and/or can the receiver be sure about the identity of the sender? Explain.

2 pt (b) A firewall at the border of a company or university network (i.e., at the point where this network is connected to the rest of the Internet) is often configured to drop incoming TCP packets whose destination port is 22, which is the port number for ssh. Why is this useful? Isn't ssh ("secure shell") secure enough?

3 pt (c) To what extent can or cannot IPSec in transport mode help against the following security risks:

(i) traffic analysis; in particular, suppose you're sending an e-mail using SMTP, can an eavesdropper still see that it is mail and/or where it goes? Explain.

(ii) reflected Denial-of-Service attacks. Explain.

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4. Time synchronization and localization

3 pt (a) To determine the position, many positioning algorithms use a mean to determine the distance.

(i) What mechanisms are used to estimate the distance? (mention at least 3)

(ii) What is the difference between RSS and CSI?

(iii) What are the main parameters in the Log Normal Shadowing model that needs calibration?

3 pt (b) The Global Positioning System (GPS) is used in many outdoor applications.

(i) On what type of positioning is GPS based, and what phases (steps) can be identified?

(ii) How many satellites are needed for GPS positioning? Why that number?

(iii) Why does GPS not work well in an indoor environment?

3 pt (c) In time synchronisation all methods rely on message exchange between nodes. However, this causes some message latency uncertainties. What are the reasons behind those uncertainties (mention 5 reasons).

End of this exam.