Network Systems (201300179/201400431), Test 3

March 20, 2015, 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, and the handout about peer-to-peer communication (i.e., the part of the Kurose&Ross book distributed via Blackboard). 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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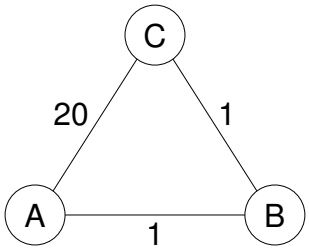
1. Distance-vector routing



Consider a simple network consisting of three nodes in a row, labeled A through C, with link costs as indicated in the figure.

In this network, a distance-vector routing algorithm is used, in which all nodes *simultaneously* send a distance vector to their neighbours *once per minute*.

Initially, each node only knows itself.

2 pt (a) How many minutes (i.e., iterations of the algorithm) does it take before all nodes have found *a* path to all other nodes? Explain.

2 pt (b) How many minutes (i.e., iterations of the algorithm) does it take before all nodes have found the *optimal* path to all other nodes? Explain.

2 pt (c) After convergence, what does the distance vector that node A sends to each of its neighbours look like, if *no* split horizon or poisoned reverse is used?

2 pt (d) After convergence, what does the distance vector that node A sends to each of its neighbours look like, if *split horizon* is used?

At some moment, the link between B and C breaks. B and C notice this at the next moment at which distance vectors are exchanged, because they no longer hear each other's transmission.

3 pt (e) How many minutes (iterations) does it take for the network to converge again, *with* split horizon? Explain.

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2. Addressing and routing in the internet

3 pt (a) Assume that we expect the earth's population to grow to 10 billion people, and that we expect each of them to need 1000 IP addresses.
Use the HD ratio to estimate how long the addresses would need to be for comfortable assignment.

2 pt (b) Network Address Translators (NATs) do not just change the IP address, but also the (TCP or UDP) portnumber. Why is this necessary?

2 pt (c) We've seen that in Mobile IP, the "foreign agent" can be integrated in the mobile host. Would it also be possible to integrate the "home agent" into either the mobile host, or the fixed host which is talking to the mobile host? Explain.

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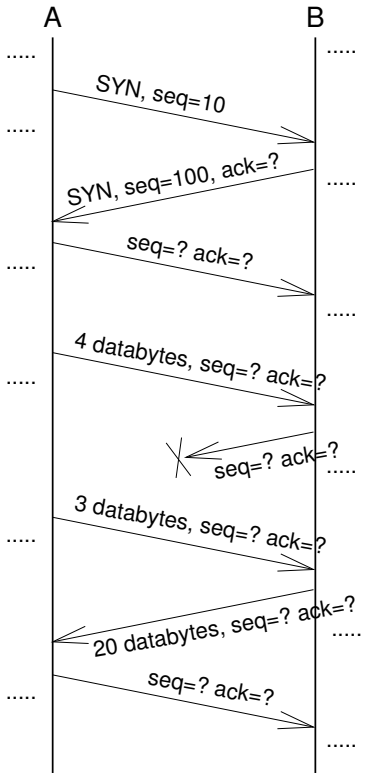
3. TCP

Consider a TCP connection, as represented by the shown time-sequence diagram.



4 pt (a) Many sequence and acknowledgement numbers are missing (the questionmarks in the diagram). Give their values.

Notes: The segment with 3 databytes is *not* a retransmission of the 4 databytes from the previous segment. The ACK flag is not explicitly indicated in the diagram. Segments contain 0 databytes unless indicated otherwise.

2 pt (b) After the above exchange of packets, has all data been acknowledged, or are host A and/or host B still waiting for an acknowledgement? Explain.

3 pt (c) Indicate in which TCP state host A and B are initially and after each packet transmission (the dots in the diagram).

(Note: you need the TCP state transition diagram for this, which is figure 5.7 in the book. If you did not bring the book, please raise your hand; the lecturer may have brought a few spare copies of this diagram.)

3 pt (d) Would the use of the *timestamp*, the *window scaling*, or the *selective acknowledgement* TCP extensions make any difference in this example? Explain.

End of this exam.