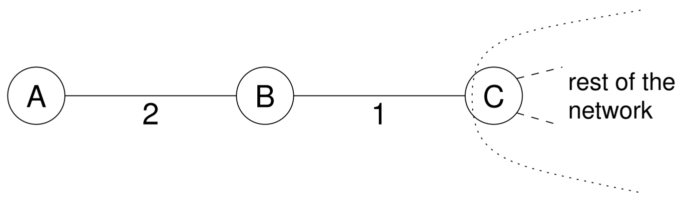
Network Systems (201300179/201400431), Test 3

March 18, 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.

1. Distance-vector routing



Consider a network consisting of six nodes labelled A—F. A small part of the network is shown in the figure; the rest of the network lies beyond node C and no details about it are given. The network uses a simple distance-vector based routing algorithm, without enhancements like split horizon; all nodes simultaneously send a distance vector to their neighbours once per minute.

We focus on what node B does.

Let us assume that initially there is no link between nodes B and C, but A and B are already connected for a couple of minutes. Then B and C get connected.

2 pt (a) What is the distance vector that node B sends to node C?

Node C sends to node B the following distance vector:

destination	cost
D	1
E	8
F	4

2 pt (b) How many minutes (i.e., iterations of the algorithm) does it take before also node A knows about destinations D, E and F? Explain.

Some time later, after everything has converged, node B gets a different distance vector from node C:

destination	cost
D	1
E	30
F	4

3 pt (c) Describe what will happen next in the network. How long will it take before nodes A and B have correct paths to node E again?

2 pt (d) Split horizon could have prevented the slow convergence you saw in the previous question. In order to achieve that, would it be sufficient if *only* node A does split horizon?
(Of course, in general it's safest to have all nodes do split horizon; but the question here is whether in this specific case, it would have been enough if only A does it.)

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2. Addressing and routing in the Internet

2 pt (a) Does it make sense to apply the HD ratio to MAC addresses? Explain.

The IPv6 address block `ff00::/8` is reserved for multicast.

2 pt (b) What does this notation mean? Explain the `ff00`, the `::` and the `/8` parts.

2 pt (c) Why does multicast need a separate address block? After all, the packets are going to be sent to the same computers that already have unicast addresses.

Assume a certain address block, let's say 12.1.2.3/24, is advertised using BGP at two totally different places in the Internet, let's say in Amsterdam and in Madrid.

2 pt (d) What happens if a packet is sent to this address from say Paris? Where will it go, and what determines this?

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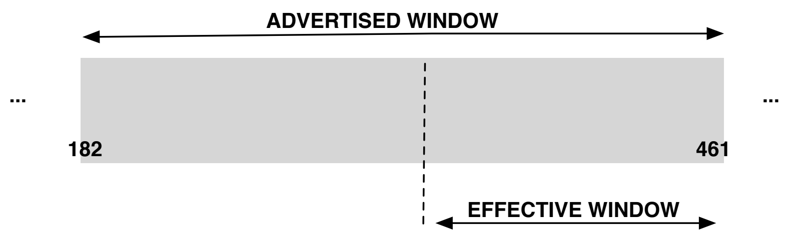
3. TCP If possible, please answer this problem in English



Consider the state of the sliding window at the sender side of a TCP connection, as depicted in the above figure. The gray area indicates which segments fall into the advertised window. The first byte in the Advertised Window is byte number 182. The last byte is byte number 461. The MSS is 40 bytes and the initial sequence number (used by the SYN packet initiating the connection) is 101.

2 pt (a) Explain the difference between the advertised window and the effective window.

2 pt (b) Four segments of size MSS are currently in-flight. How many more segments can be transmitted in the shown state?

2 pt (c) Starting with the state shown in the figure, how do the advertised window and the effective window change when a segment with AcknowledgementNumber = 302 and WindowSize = 280 is received?

2 pt (d) So far we've (silently) assumed the window scaling option was not used. Suppose it was in fact used, with a factor of 16. What change, if any, would this make to the answer to the previous question?

3 pt (e) Consider a regular teardown of a TCP session. Draw the timing diagram of the TCP teardown. In the diagram indicate which segments are sent and, for both the sender and the receiver, which states of the TCP state-transition diagram they traverse (see Figure 5.7 of Peterson & Davie). When drawing the diagram, assume that the host to the left initiates the teardown.

End of this exam.