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Fakultät IV – Elektrotechnik und Informatik
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4th Assignment: Network Protocols and Architectures, WS 11/12

Question 1: (30 points) *TCP Traffic Analysis*

This exercise will introduce you to traffic analysis techniques by examining TCP using a real connection. In order to complete the exercise, download a copy of Wireshark for your operating system from `http://www.wireshark.org/` and familiarize yourself with the tool. Read about display filters and how to set them.

Let us come to the experiment itself. Start the traffic capturing in Wireshark and download a web page using your browser, then stop the capturing. You will probably have captured packets that do not belong to the transfer of the website itself, so configure a display filter to display only packets that belong to the HTTP connection you have just requested. An easy way to accomplish this is to filter by the IP address of the remote web server and the HTTP protocol.

Analyse the obtained data by marking packets belonging to i) the TCP connection setup, ii) the transmission of the HTTP request, iii) the transmission of the HTTP response, and iv) tear-down of the connection. Include a marked screenshot of Wireshark in your solution. Also include the host name of the remote web server, its IP address, and the used display filter.

Question 2: ($10 \cdot 4 = 40$ points) *TCP congestion window size*

Assuming TCP Reno is the protocol experiencing the behaviour shown in Figure 1. Answer the following questions. In all cases, you should provide a short discussion justifying your answer. Stating a simple number is not sufficient, it should be clear where that number stems from. Remember that `Threshold` is the limit after which TCP switches from slow start to congestion avoidance.

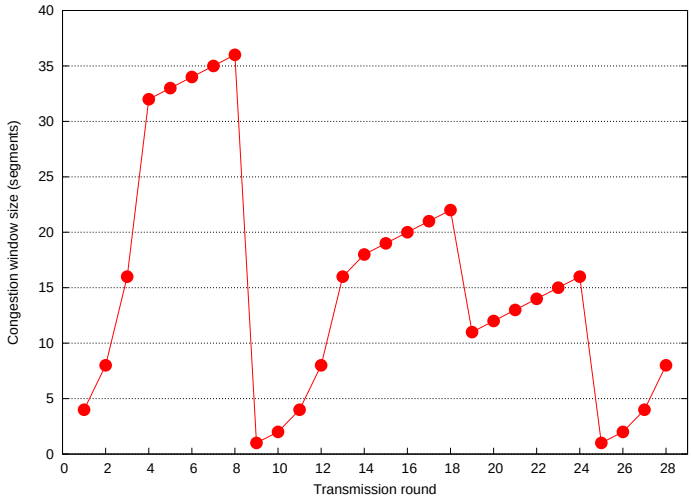


Figure 1: TCP window size as a function of time.

(a) What is the size of the inital window?

(b) Identify the intervals of time when TCP slow start is operating.

(c) Identify the intervals of time when TCP congestion avoidance is used.

(d) After the 8th transmission round, is the segment loss detected by a triple duplicate acknowledgment or by a timeout?

(e) After the 18th transmission round, is the segment loss detected by a triple duplicate acknowledgment or by a timeout?

(f) What is the initial value of `Threshold` at the first transmission round?

(g) What is the value of `Threshold` at the 10th transmission round?

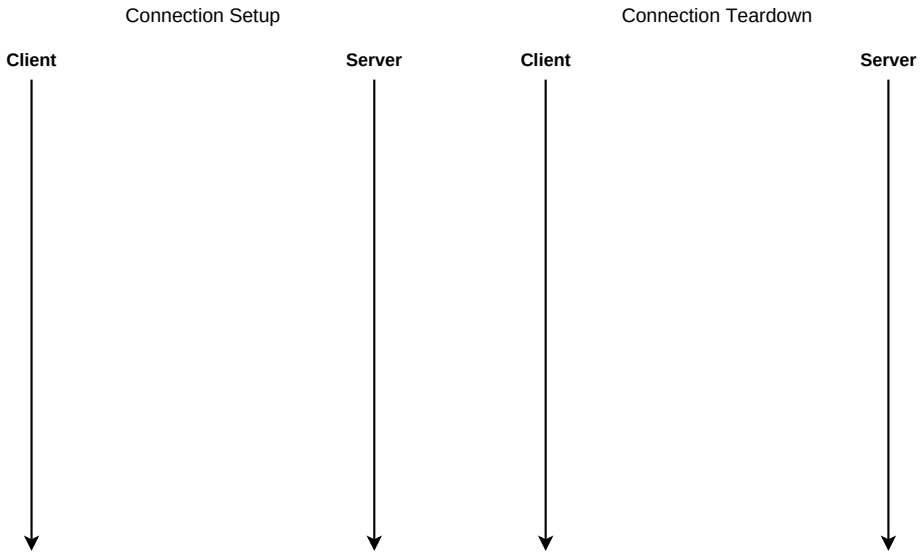
(h) What is the value of `Threshold` at the 20th transmission round?

(i) During which transmission round is the 100th segment send?

(j) Assuming a packet loss is detected after the 28th round by the receipt of a triple duplicate acknowledgement, what will be the values of the congestion window size and of `Threshold`?

Question 3: $(15 + 15 = 30$ points) *TCP Handshake and Teardown*

TCP is the number one example for connection-oriented services. In this problem we will have a closer look at TCP's connection management.



(a) Enter a successful connection setup into a diagram (see above on the left). Label the arrows with the relevant parts of the TCP header (flags, sequence number, acknowledgment number). The initial (randomly chosen) sequence numbers of client and server are: 2500 (Client) and 10030 (Server).

(b) Enter the successful connection teardown into another diagram (see above on the right). Again label the arrows with the relevant parts of the TCP header (flags, sequence number, acknowledgement number). Assume that after the connection setup from part (a) some data was transferred: 500 bytes from client to server, and 10000 bytes from server to client. Consider these values when determining sequence and acknowledgment numbers.

Due Date: Thursday, November, 24th 2011 only until 13:55 h s. t.

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- **On paper:** Postbox in the Telefunkenhochhaus (basement, behind the doorman right)
- Put your name, StudentID number (Matrikelnummer) **and** the name of your tutor on your solution.