

## Master Course Computer Networks

### Homework 3

(submission until December 3rd into INBOX located in front of 03.05.052)

**Note:** Subproblems marked by \* can be solved without preceding results.

### SYN Cookies

The lecture introduced a DoS attack referred to as SYN flooding. Without additional precautions, TCP is especially susceptible to this form of attack. In this exercise you will investigate a countermeasure against SYN flooding for TCP, called *SYN Cookies*. A reference to start with for this homework is RFC 4987.

- a)\* Briefly describe the problem of SYN flooding and argue whether UDP can be affected as well.
- b)\* Describe the concept of TCP SYN cookies in your own words. Sketching the TCP handshake and explaining the values being exchanged might be helpful.
- c)\* Have a look at RFC 2960 and sketch the SCTP handshake and describe the cookie mechanism used by SCTP.

### TCP Congestion Avoidance

In contrast to UDP, TCP offers a congestion avoidance algorithm that tries to dynamically adapt the sender's rate to the available capacity on the link. Furthermore, TCP allows a receiver to throttle the sender's rate if necessary. Read RFC 2581 and answer the following short questions.

- a)\* What is the difference between congestion control and flow control?
- b)\* Sketch a typical development of the TCP sender window for both variants Tahoe and Reno over time, starting at the time when the TCP connection is established. Mark and name the different phases.

Now assume a TCP connection over a satellite link. The average RTT is 800 ms and the link's available bandwidth is 24 Mbit/s. Assume that there is no packet loss before the link's bandwidth is achieved by the TCP connection.

- c) Estimate the minimum amount of time necessary until an ordinary TCP connections fully utilizes the available bandwidth.
- d) Describe how TCP window scaling can help to mitigate the problem.