



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich
Spring Term 2014

Operating Systems and Networks

Assignment 9

Assigned on: **17th April 2014**
Due by: **24th April 2014**

1 UDP

Why is UDP used if applications do not want to have connection-oriented communications? Would it not have been enough to just let user processes send raw IP packets?

2 TCP Three-Way Handshake

In the lecture you learned how TCP uses three-way handshake to establish a session.

Imagine that a two-way handshake rather than a three-way handshake were used to set up connections. In other words, the third message was not required. Could there be any problem? If so, please illustrate with an example.

3 Sliding Windows

- Using 5-bit sequence numbers, what is the maximum size of the send and receive windows for the Go-Back-N and Selective-Repeat algorithms?
- Frames of 1000 bits are sent over a 1 Mbps satellite channel - propagation delay of 270 msec. Acknowledgements are always piggybacked. Headers are very short. Three bit sequence numbers are used. What is the maximum achievable channel utilization in frames per second for (a) protocol with Go-Back-N and (b) protocol with Selective-Repeat ?

4 Maximum Throughput Computation

We assume that packet sequence number increases for each packet from a source to a destination and the maximum packet size is 1500 bytes. The packet sequence number for a flow starts from 0x0, and wraps around to 0x0 after the flow generates 2^x packets, where x is the length of packet sequence number. To get around the problem of sequence numbers wrapping around while old packets still exist one could use 64 bits to indicate sequence numbers.

- Theoretically, an optical fiber running at 75 Tbps. What maximum packet lifetime is required to make sure that future 75 Tbps networks do not have wraparound problems even with 64-bit sequence numbers? Assume that each byte has its own sequence number, as TCP does.

- b) In practice, maximum packet lifetime is set to 2 minutes, and packets use 16-bit sequence numbers. What is the real throughput?

5 UDP Socket Programming

Implement UDP client/server programs. The UDP client program sends a sentence (i.e. a character string which is entered by the user) to the UDP server program via UDP sockets. The UDP server displays the string, and sends it back to the UDP client that then displays the result.