Netwerken, Spring 2018 Assignment 1: Go-back-N ARQ implementation

Deadline: Tuesday March 27, 2018

The purpose of this assignment is to extend a Stop-and-wait ARQ implementation from sender A to receiver B, to a Go-back-N sliding window ARQ mechanism from A to B. Notice that in both cases we have a half-duplex connection, so data transfer is going only in a single direction from A to B. The parameters that control the Stop-and-wait protocol are (see header file `variables.h`):

- Packet delay A, in milliseconds (`PACKET_DELAY_TIME_A`).
- Packet delay B, in milliseconds (`PACKET_DELAY_TIME_B`).
- Packet loss ratio, in % (`PACKET_LOSS_PERC`).
- Packet damage ratio, in % (`PACKET_DAMAGED_PERC`).
- Expiration time, in milliseconds (`ARQ_TIMEOUT`).

For the implementation of Go-Back-N ARQ you will have to define an additional parameter `WINDOW_SIZE`, see also the hints below. Note that in the Stop-N-Wait implementation we have chosen to have the number of sent packets to be equal to 1000. This parameter is chosen such that it allows the achieved bandwidth to be "measured" (see `SR_N_PACKETS`). For the Go-Back-N implementation this parameter should not be changed. The other five parameters and the window size have to be varied.

As an outcome of this project we expect you to investigate the trade-offs of the different parameter settings. More specifically, we ask you to produce eight plots in which each time the bandwidth is plotted against the following parameters:

1. Packet delay A vs. packet delay B.
2. Packet loss ratio vs. packet damage ratio.
3. Window size vs. packet loss ratio.
4. Window size vs. packet damage ratio.
5. Window size vs. packet delay A.
6. Window size vs. packet delay B.
7. Expiration time vs. packet delay A.
8. Expiration time vs. packet delay B.

These plots should be 3D surface plots (the two parameters on the x and y-axis and the bandwidth on the z-axis). Use the following values for the parameters in your investigation:

- Packet delay A: 1, 2, 5, 10, 20 ms.
- Packet delay B: 1, 2, 5, 10, 20 ms.
- Packet loss ratio: 0.1, 1, 2, 5, 10 %.
- Packet damage ratio: 0.1, 0.2, 0.5, 0.8, 1.0 %.
- Expiration time: 200, 400, 600, 800, 1000 ms.
- Number of sequence numbers: 8, 64, 128, 256.

Submission

By March 27, we ask you to send a working version of your implementation written in C together with a Makefile and a PDF file containing the eight plots corresponding to the parameter settings and an explanation of what each plot shows. **The assignment must be done individually.** Plagiarism in your submission will lead to a grade 0 immediately if detected. Ensure that you mention your name and student number in your source code and PDF file. Submit your work by e-mail to *netwerken2018@gmail.com*, make sure the subject **is equal to** "Netwerken 2018 assignment 1" and include your name and student ID in the e-mail.

For this assignment, a maximum of 10 points can be obtained. The points are distributed as follows: Code compiles & executes (2.0 / 10) Code Layout & Quality, Makefile (2.0 / 10), Correct implementation of Go-back-N sliding window ARQ (3.0 / 10), Report (3.0 / 10).

Hints

- Note that the range of sequence numbers should be a power of two. However the window size should be less than the sequence number range.
- When debugging the code it is recommended that you set the packet delay times A and B to 500 milliseconds or more. Additionally, it is recommended to first get your implementation to work with 0% packet loss and 0% packet damage, representing a perfect connection. You can use the `PERFECT_CONNECTION` define in `variables.h` to enable this.
- When investigating parameter settings 7 and 8, the expiration time should not be smaller than the packet delay time.