

DESCRIPTION FOR THE GENERAL PUBLIC

A negative phenomenon called bufferbloat can be today observed in Internet devices (routers). Namely, very long queues of packets (small data chunks) occur frequently in buffers of routers located on paths from senders to receivers.

This phenomenon induces significant increase of the latency in packets delivery. For the Internet users, it manifests itself as "slow" Internet. For example, web browsing is burdensome because the loading of pages is delayed, the voice communication is unpleasantly delayed or echoing, the lag in networking games is intolerable, etc.

The solution to this problem is dropping packets at routers, before the queues become too long. The purpose of such preventive dropping is to inform the data senders about the necessity to reduce their sending rate. Typically, the packets are dropped randomly, with the probability that depends of the length of the queue of packets in the buffer. This dependence is called the dropping function.

To figure out, what exactly form the dropping function should have, we have to solve mathematical models of queues of packets with the dropping function in the general form. Knowing the solution in the general case, we can design functions that realize particular performance goals, e.g maintain the average queue of 100, instead of 1000, packets.

In recent years, the scientists managed to solve the models of queues with dropping functions, but only in the case of very small buffers – far too small, taking into account the real buffers in real routers.

The main subject of this project is to derive formulas and theorems describing the performance of queues of packets with dropping functions and large buffers. Using the obtained formulas, it will be possible to write a computer program able to automatically design and parameterize the dropping function, which can provide the needed performance goals (eg. to keep the average queue size of 100 packets).

Queues of packets may be stable or instable, depending on their design and parameters. Therefore, it is necessary to find and prove sufficient and necessary conditions for the stability of the considered queues. These conditions have to be easy to check, so that we could decide easily, whether the queueing mechanism we are going to use will be stable, or not. So far, such conditions have not been found for the queues with dropping functions and large buffers. Finding these conditions is certainly a task of importance, both from theoretical and practical point of view.

The final goal of the project is to implement the packet dropping mechanisms (obtained through mathematical modeling) in a prototype device, and then test it for the compliance with the design goals, against a real, high-volume traffic.