Discrete event traffic simulation

Part 2

Traffic simulation of packet-oriented loss and waiting systems
Completion date: lesson 8

a) Loss system: Erlang-B distribution

Consider a packet-oriented loss system with *N* channels running at 1 Gbit/s each. Assume that the activity of all users who access the system is represented by a source that generates packets with an arrival rate lambda = 200 packets/ms (Poisson process) and that each packet transmission has an average duration dm = 0.008 ms, with exponential distribution (Erlang-B model).

Based on the event-driven simulation method, develop a simulation program of this system, enabling you to obtain, for a given *N*, the estimator of the blocking probability B (equal to the packet loss probability).

Compare the results of the blocking probability B with theoretical predictions (you may use, for example, the online traffic calculator available here).

b) Waiting system with infinite length queue: Erlang-C distribution

Adapt the previous program, considering that the packets that do not have available resources are placed in a queue with infinite length.
In this case, assuming that A is the packet delay, calculate:

- the estimator of the probability that a packet is delayed P(A>0);
- the estimator of the average delay Am of all packets;
- the histogram of the delay of the packets that suffer delay (A>0);
- the estimator of the probability that a packet is delayed more than Ax P(A>Ax).

Compare the results of the **estimator of the probability that a packet is delayed** P(A>0) and **the estimator of the average delay Am of all packets** with theoretical predictions (you may use, for example, the online traffic calculator available here).

c) General case – waiting system with finite length queue

Adapt the previous program, considering that the packets that do not have available resources are placed in a queue with finite length L.

Show that in this case, the previous results of the Erlang-B and Erlang-C distributions can be obtained by making L=0 and L arbitrarily large, respectively. Compute the queue length L, which leads to a packet loss probability of 1%.

Compare your simulation results with theoretical predictions (you may use, for example, the online traffic calculator available here).