Management and content delivery for smart networks: algorithms and modelling

Lab. 2: Design of rate adaptive routers

The objective of this lab is to apply what was learnt about simulation to a case study of current high interest. The lab focuses on routers' *rate adaptation techniques* to reduce energy consumption. The work consists of the design and implementation of a simulator to investigate the proposed case study, as well as on the use of the simulator to discuss the proposed problem.

System description

In order to reduce energy consumption of routers, a possible solution consists in using rate adaptation (or capacity scaling). Basically, an output link of the router can work at different rates corresponding to different levels of energy consumption (the lower the rate is, the lower the consumption is). Thus, whenever the load is low and the router can afford using lower rates without compromising performance, the router switches to low consuming/ low capacity states. Conversely, as soon as traffic increases, the rate increases also.
We focus on the output port of a router only and make the following assumptions:

- The router can work at two different rates: *high* and *low* rate, with capacity C_H and C_L and consumption P_H and P_L, respectively.
- The time to switch from high capacity state to low capacity state is denoted by T_{HL}; the time for switching from low to high capacity is T_{LH}.
- We assume that, in any moment, the router has an instantaneous exact knowledge of the traffic load.
- The input traffic is generated according to a Markov Modulated Poisson Process (MMPP) with two states: *high* and *low*, with respective packet inter-arrival rates λ_H and λ_L.

Performance evaluation

Evaluate the performance of the proposed rate adaptation scheme, considering also:

- the impact of rate adaptation on the performance (in terms of loss probability and average delay);
- the achieved energy saving;
- the effect of the switching time.

Note

Use confidence intervals for at least one performance indicator of a scenario.