Markov-modulated arrival processes in queueing theory

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Markov-modulated traffic models are fundamental in the quantitative analysis of communication networks, and other stochastic models. They are indeed able to capture a wide variety of features present in today's complex network traffic such as bursts, auto-correlation or the presence of multiple time scales, while retaining the possibility of closed-form solutions and efficient numerical methods. There exist Markov modulated process with discrete arrivals, as well as fluid arrivals.

This talk will review commonly-used models such as the Markov Arrival Process (MAP), Batch MAP (BMAP), Markov Modulated Poisson or Rate Processes (MMPP/MMRP). We will present their basic elements, show and how they can be composed and superimposed. The computation of their statistical properties will be studied, and we will propose generalizations to semi-Markov arrival processes.

In a second part, we will study queueing models fed by Markov-modulated arrival processes, either discrete or fluid. We will show how exploiting the structure of the Markov chain allows to accelerate the computation of performance measures. The concept of *equivalent bandwidth* for Markov-modulated sources of information will be also discussed. In particular, we will see how the analysis of problems with multiple traffic sources can be decomposed into simpler problems with a single source.

References

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