

## Abstract

# Mathematical Analysis of Multifractal Nature of Network Traffic

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This work is dedicated to the multifractal analysis of network traffic. It has been proved that the congestion control mechanism of the Internet transport protocol, i.e., the mechanism of TCP can generate multifractal traffic properties and burstiness which causes the network traffic being easily congested in the network and the flow of information being far from optimal.

In this thesis we provided the underlying basis of the multifractal analysis of a linear TCP traffic model with Markov-modulated Poisson process. We considered TCP Reno as this is the canonical TCP version. This work is the first step towards capturing the multifractal spectra of the TCP traffic model where instead of Poisson process we have Markov-modulated Poisson process for modeling packet loss events. Using Markov-modulated Poisson process as a loss-event model is more realistic because packet losses occur in bursts and a time-dependent Poisson process can capture its varying nature.

In this work we prove in a special case that this change in the model may not cause huge differences in the multifractal nature. Still, it would be an important step, because this way a more realistic model could be used in teletraffic modeling without implying a more bursty behavior.

This study gives the basic foundations for a more general analysis. We used a conjecture which has been analytically verified in analogous cases. We believe that the assumptions which we made would not affect the result, however, since this is an ongoing research, the next step will be to verify our results in the general case.

BME  
2019