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Adaptive active queue management mechanism to congestion control in Internet network.

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Abstract

This dissertation presents the knowledge of adaptive Active Queue Management mechanisms in computer networks. Implementation of the presented solutions optimizes the transmission efficiency on the Internet. This allows for optimizing the queue occupancy level and the average packet waiting time in the transmission buffer. This dissertation is a collection of five published research peer-reviewed articles. They present the proposed models of adaptive Active Queue Management mechanisms and contain the results from research work.

The scope of this dissertation is as follows: first, there is a list containing published articles that are the main scientific achievements of this dissertation is presented. Then a list containing other publications and a summary of all scientific achievements are described.

Chapter 1 refers to the topic of computer networks and Active Queue Management mechanisms. It discusses the dissertation's purpose and thesis.

Section 2 presents the main theoretical issues of data transmission in the Internet network. The following subsections are discussed: principles of cooperation between TCP protocol and Active Queue Management mechanism (subsection 2.1), methods of congestion control in TCP protocol (subsection 2.2), Fluid-Flow approximation model used to evaluate cooperation of AQM mechanisms with TCP protocol (subsection 2.3), self-similarity characteristics of network traffic (subsection 2.4) and the current State Of The Art related to Active Queue Management mechanisms (subsection 2.5).

Subsection 3 presents a collection of five peer-reviewed research articles that propose novel adaptive Active Queue Management mechanisms. This chapter also describes obtained results and explains in detail the author's own contributions.

The paper presented in chapter 4 proposes a model of the Active Queue Management mechanism that uses the response from three different PI^{α} controllers to calculate the packet loss probability.

The paper described in chapter 5 focuses on selecting the Active Queue Ma-

nagement mechanism parameters based on Machine Learning and Reinforcement Learning.

The article in section 6 presents an adaptive AQM mechanism that adapts to the traffic intensity and the degree of self-similarity. The proposed solution is also based on Neural Networks and Reinforcement Learning.

The chapter 7 refers to the article that proposes an adaptive Active Queue Management mechanism based on supervised learning methods.

The chapter 8 presents a paper that focuses on the model of Active Queue Management, dedicated to the transmission for Internet of Things devices, especially for protecting its priority data.

The results presented in chapters 4 - 8 proves thesis stated in this dissertation. Creating adaptive Active Queue Management mechanisms that adjust not only to network traffic intensity but also to Long-Range traffic dependencies can significantly increase the computer network transmission efficiency.

The final conclusions from the research, the thesis summary and possible directions for further research are described in section 9.