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Modele kolejkowe z opóźnionym wybudzaniem serwera

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Abstract

The subject of the dissertation refers to studies over concepts derived from queuing theory. In particular, presented research results are related with analysis of queuing models, which can be applied in computer networks and telecommunication. Nowadays, queuing theory is utilized for ensuring the relevant quality of service in various areas of telecommunication. Precise modelling of network traffic has important impact in designing of a network devices in terms of their performance or costs of production. As an example, we can consider a spatially distributed autonomous sensors, which work together and form a network (wireless sensor network). Applications of wireless sensor networks in monitoring of different real-life phenomena, like air and water pollution, fire risk, road traffic, military operations and many others are common nowadays. Sensors (nodes), typically equipped with a non-rechargable battery, are often located in hardly accessible places in which their eventual replacement with new ones can be difficult. In the context of queuing theory, the problem of power saving in wireless sensor networks is intensively explored.

This doctoral thesis contains stochastic analysis of queuing models with wake up mechanisms of the server such as threshold policy and setup times. Presented research results concern of effective and precise modelling of network traffic in network devices with limited access to server arising from applied power saving mechanism or physical features of servers. In particular, detailed transient characterizations of queue size, virtual waiting time and departure process in a single-server finite-buffer models with N-policy and generally distributed server setup times was described. Presented results concern of simple and compound Poisson arrival process.

In the considered queueing models, utilizing analytical approach based on the technique of embedded Markov chains, potential of random walks, continuous total probability law, renewal theory and linear algebra, compact-forms of representation for the Laplace transform and generating function of Laplace transform of transient distributions was found. Applied research methodology allows to determining a transient behaviour and a steady state of considered systems. Numerical tractability of the formulas is visualized in network-motivated numerical examples.