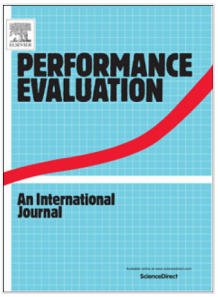

A comprehensive study on the queue-size distribution in a finite-buffer system with a general independent input flow

Wojciech M. Kempa

PII: S0166-5316(16)30261-9
DOI: http://dx.doi.org/10.1016/j.peva.2016.11.002
Reference: PEVA 1885

To appear in: *Performance Evaluation*

Received date: 22 November 2013
Revised date: 25 October 2016
Accepted date: 10 November 2016

Please cite this article as: W.M. Kempa, A comprehensive study on the queue-size distribution in a finite-buffer system with a general independent input flow, *Performance Evaluation* (2016), http://dx.doi.org/10.1016/j.peva.2016.11.002

A comprehensive study on the queue-size distribution in a finite-buffer system with a general independent input flow

Wojciech M. Kempa

Silesian University of Technology, Institute of Mathematics, ul. Kaszubska 23, 44-100 Gliwice, Poland, phone/fax: + 48 32 2372864, e-mail: wojciech.kempa@polsl.pl

Abstract

A finite-buffer $GI/M/1/N-$type queueing model is considered. The explicit formula for the Laplace transform of the transient queue-size distribution, conditioned by the number of packets present in the system at the starting time, is derived. The shape of the formula allows for finding the stationary distribution by applying the key renewal theorem. Moreover, the convergence rate of the transient queue-size distribution to the stationary one is determined with the constant value given explicitly. Numerical example is attached as well.

Keywords: Convergence rate, finite buffer, queue-size distribution, renewal theory
2010 MSC: 60K25, 68M20, 90B22

1. Preliminary

Applications of queueing models with finite buffer capacities in modeling of telecommunication and computer networks are common. Optimization of the network and prevention of different negative phenomena occurring during the operation of the network, such as losses of data packets due to buffer overflow, or too long queueing delay require not only a long-term observation of the network at different load, but also the knowledge of certain stochastic characteristics describing the evolution of the system. Among them, probably the most important, is the queue-size distribution.

As it is easy to observe, in the literature, most works devoted to the queue-size distribution in finite-buffer models deal with one of Markovian