ITC19/ Performance Challenges for Efficient Next Generation Networks 1335-1344
LIANG X.J. and XIN Z.H.(Editors)
V.B. IVERSEN and KUO G.S.(Editors)
Beijing University of Posts and Telecommunications Press

Non-preemptive $\sum_i$D-BMAP$_i$/D/1/K queuing system modeling the frame transmission process over wireless channels *

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Abstract. We identify a class of priority queuing systems of G+G/GI/1/K type capable to model the frame transmission process over the wireless channel with correlated losses. To represent arrival process of frames and service process of the wireless channel we use hidden Markov models. Performance evaluation model is then reduced to $\sum_i$D-BMAP$_i$/D/1/K queuing system with non-preemptive priority discipline. The proposed queuing representation allows to capture distributional and autocorrelation properties of the frame service process at the wireless channel. Finally, this model is analyzed for a number of performance parameters of interest.
Keywords: non-preemptive $\sum_i$D-BMAP$_i$/D/1/K queuing system, wireless channels.

1 Introduction

Queuing theory is widely used in performance evaluation of fixed networks. Modeling the information transmission process over the wireless channel is strictly related to its applications. However, early studies did not consider queuing theory as an appropriate tool in wireless domain. We fill this gap proposing a queuing-theoretic model for performance evaluation of frame transmission process over the wireless channel. We identify a set of models that are well-suited for this purpose and outline their properties. We consider $\sum_i$D-BMAP$_i$/D/1/K queuing system with non-preemptive priority discipline as a candidate model and show how it can be used to derive performance parameters of interest.

The rest of the paper is organized as follows. In Section 2 we provide a review of the related work. We introduce our approach in Section 3. Models of the frame arrival and frame error processes are proposed in Sections 4 and 5, respectively. The candidate performance evaluation model of $\sum_i$D-BMAP$_i$/D/1/K type is studied in Section 6. Numerical examples are given in Section 7. Conclusions are drawn in the last section.

2 Related work

To date a number of performance models for frame transmission process over the wireless channel have been proposed. Among others, one have to mention studies of Zorzi and Rao

* This work has been partially supported by E-NEXT project.