Modelling and Performance Analysis of Some Communication Related Queuing Systems

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by

Sweta Dey

Department of Mathematics

Indian Institute of Space Science and Technology

Thiruvananthapuram, India

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Abstract

A queuing system can be described as arrival of customers for service; if the service is not immediate, then waiting for service and leaving the system after being served. The models that we consider here are intended for studying dynamics and performance characteristics of some queueing systems that are related to communication, specifically some wireless network and two-way communication (call centre situation) models.

In the first half of the thesis, we mainly deal with two wireless network models. The first model is developed to study the queueing characteristics of nodes in a wireless network, where the channel access is governed by binary exponential back off (BEB) rule based on CSMA/CA protocol. In the second model, apart from the assumptions put forth in the first model, we take into consider data packets that are of emergency in nature. The speciality here is that these packets have to be transmitted within a random amount of time after they are being generated. Otherwise, their relevance will be lost and hence such packets are assumed to be dropped.

The second half of the thesis deals with some models related to two-way communication, especially some call centre models. Some works have already been reported in this direction earlier. Here, we consider some variants of the said models by incorporating multi-class incoming calls with or without outgoing calls. A detailed analysis by regenerative approach has been carried out under general distribution assumptions for call processing times. Further, these models have been extended to multi-class orbital calls under balking set up and we have offered some rigorous mathematical treatment to derive some important system performance measures that are helpful for system design. In the final chapter, another variant of these models comprising server vacation is analysed and steady state distribution and some measures of effectiveness are computed by combining matrix analytic and regenerative approaches in Markovian set up.