Performance Evaluation of Finite-Source Cognitive Networks with Non-reliable Services Using Simulation*

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Abstract

As the evolution of wireless communication technology, the available spectrum resources become scarce. The cognitive radio (CR) is a dynamic spectrum access technique which provides the capability to share a wireless channel between licensed and unlicensed users opportunistically (also called Primary Users - PU and Secondary Users - SU).

In this paper stochastic simulation is used for performance evaluation of cognitive radio network. A finite-source retrial queuing model with two service units is proposed. A priority queue and an orbit are assigned to the PUs and SUs respectively. The proposed queueing system contains two interconnected, not independent sub-systems. The Primary Channel Service (PCS) and the Secondary Channel Service (SCS) are not reliable and the services are assumed to be subject to a random failure with probability p_1 and p_2 for the PCS and SCS, respectively. The failure of the service may block the servers and the request retransmission process starts immediately. The novelty of this work is to analyze the effect of the failure probability on the mean and the variance of the response time of the PUs and SUs, and on the Utilization of the PCS and SCS. The inter-event times are supposed to be exponentially, hypo-exponentially, hyper-exponentially and lognormally distributed random variables, depending on different cases during simulation.

By the help of simulation we compare the effect of the non-reliability of the servers in different combination of distributions on the first and second moments of the response times of the requests, and the utilization of the system by illustrating on different figures.

Keywords: Retrial queueing systems, simulation, cognitive radio networks, non-reliable servers, performance and reliability measures.

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