The impact of server reliability on the characteristics of cognitive radio systems[*]

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The present paper deals with a finite-source retrial queuing system, which has two service channels that use the cognitive technology. For more details on the system model, see [1], [6], [8], [7], [4].

In this paper, finite-source retrial queueing cognitive radio system is analyzed with the following assumptions. Consider two interconnected subsystems, where the licensed requests are generated by finite number of sources N_1. These sources generate primary calls corresponding to an exponentially distributed time with an average value of $1/\lambda_1$ which are sent to the primary service unit. If the server is idle, the service starts immediately. If the server is busy, the call joins a preemtive priority queue. The primary service time is supposed to be exponentially distributed random variable with a mean $1/\mu_1$. For the secondary part, the number of sources is denoted by N_2. Each source generates low priority calls according to an exponentially distributed time with mean value of $1/\lambda_2$. The secondary service time is exponentially distributed with a parameter μ_2. We assume that the secondary service unit is non-reliable, which means that the server is subject to random failures depending on whether it is busy or idle. The secondary service unit may fail after a time, which is generally distributed with a rate θ_2 when it is idle, and γ_2 when it is busy. The operating time (or inter-failure time) during busy or idle state is supposed to be hyper-exponential, hypo-exponential, gamma, lognormal and Pareto distributed random variables. Similarly, the same holds for repair times with rate σ_2. The retrial time of the secondary customers is supposed to be exponentially distributed random variable with a parameter ν.

In [2], [5], [3], the authors applied a tool-supported approach to determine the most important operating characteristics of the system. They examined several scenarios of server unreliability in a system as complex as this, which allows an exponential distribution of operation and repair time.

The aim of this paper is to investigate the impact of the various distributions on the performance measures of the secondary part of the system. Using stochastic simulation,

several scenarios of the servers unreliability are treated.

Keywords: finite-source retrial queueing systems, cognitive radio networks, non-reliable servers, performance and reliability analysis, simulation modeling.

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