MODELING AND ANALYSIS OF SPECTRUM HANDOFF DECESION SCHEMES IN COGNITIVE RADIO NETWORKS

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Abstract

Due to the growth and spread of wireless devices in the unlicensed spectrum bands, such as ISM, the bands become more and more crowded and therefore affect the performance of the wireless networks negatively. Thus, the cognitive spectrum access principles are required to utilize the existing spectrum bands more efficiently.

Keywords- ISM, FCC, CRN, PU, FSA.

Introduction

With most of our activities involving some kind of access to network in one way or other, wireless communication has now become extremely important in modern society. This has caused the applications and services, standards, and the total of wireless users, to increase with every passing day, considering that the larger part of the limited available radio spectrum resources have been allocated well and can restrict this growth [1]. Also, finally, the amount of expansion is determined by the existing radio spectrum; the regulatory authorities and government bodies have taken up a stringent procedure/approach toward the distribution and licensing of radio frequency spectrum to disparate organizations (e.g., service providers, military applications, cellular telephony, service providers, and TV), all of these individual entities own absolute transmissions to their assigned frequency channels. By using this strict approach, the main method of accessing a radio spectrum resource is based on a fixed spectrum allocation method, known as Fixed Spectrum Access (FSA). An expansive report compiled by the (SPTF) Spectrum Policy Task Force [2] and issued by (FCC) The Federal Communication Commission, which conclusively proved the fact that a lot of the assigned (licensed) spectrum underwent quite low utilization efficiency, such as those dedicated to a military applications, analogue cellular telephony or TV, which are not completely utilized. The survey has uncovered temporal(time-related) as well as spatial(geographic) variations in the exploitation of radio spectrum, extending from 16-86% in the bands as low as 3GHz and below, while extending lower than this at high frequencies [3]. These temporally unused spectrums, called white spaces or spectrum holes are referred as the “virtual channels” these virtual channels are analytical channels

constructed over the spectrum holes of the licensed PU channels [4]. Because of this, it's mandatory that new regulations and rules are implemented to efficiently utilize the existing spectrum bands.

Problem Definition

There is no denying that there are many advantages of cognitive radio networks, some instances being an improvement in the utilization of the radio spectrum for wireless networks. Even though the boons of cognitive radio technology are many, there does exist some hurdles one necessarily has to overcome, and which need to be explained in briefly:

The cognitive radio technology was devised to work over a diverse (heterogeneous) radio spectrum, consisting of unlicensed spectrum bands and licensed spectrum bands; while a major study has been carried out in licensed spectrum bands, only a small percentage of study has been done in a spectrum environment in the merging licensed and unlicensed spectrum bands for conveyance of data/information which aims at overcoming underuse of the wireless cognitive radio networks. Secondly, considering CRNs the utilization of spectrum will be improved but the impact of several simultaneous and sudden appearances of the PUs in the licensed spectrum band haven't been explored vastly. Higher preference should be given to the handoff SUs (secondary users) over the newly arriving, uninterrupted secondary users to alleviate and hence make up the untoward, unfavorable effects of spectrum handoff.

Methodology

The methodology involves the use of theoretical analysis and the system simulation. For the simulation approach, the event simulator MATLAB package tool need to be used to investigate the delay performance measures, like the cumulative handoff delay, the handoff delay, the total service time, and several others. For the theoretical analysis the queuing theory is used to model the proposed model. The subparts that provide us basic ideas related the theoretical analysis approach is Queuing Theory, Priority Queues and Service Completion of Pre-emptive Priority Queues,

Results

The results are very important for research and development work to prove the problem definition practically. In my research I am using MATLAB tool to simulate the results.

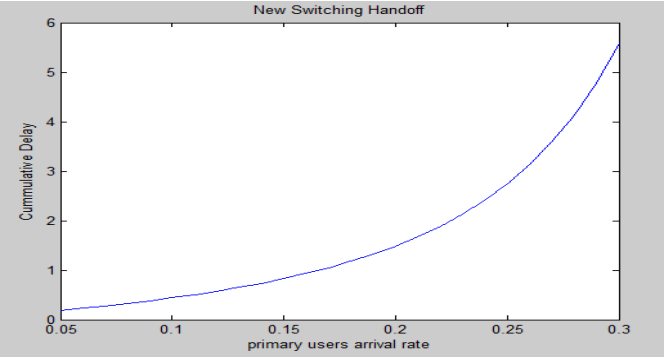

Figure 1: New switching-handoff scheme cumulative handoff delay

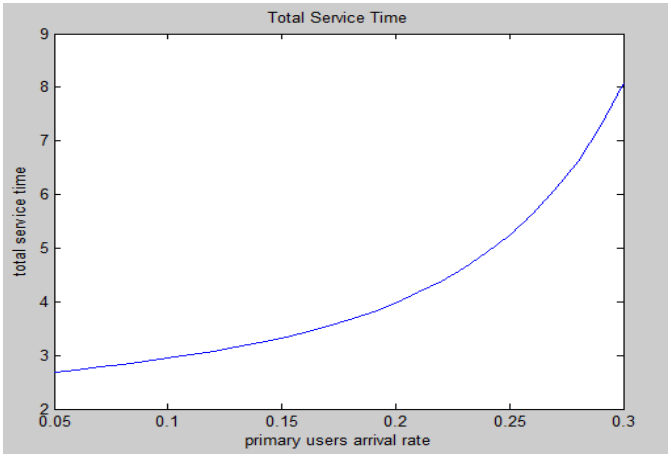

Figure 2: New switching-handoff schemes total service time

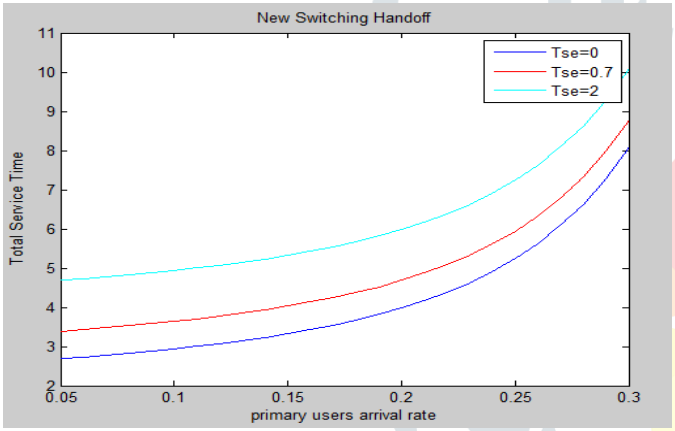

Figure 3: New switching-handoff schemes total service time for different values of T_{se}.

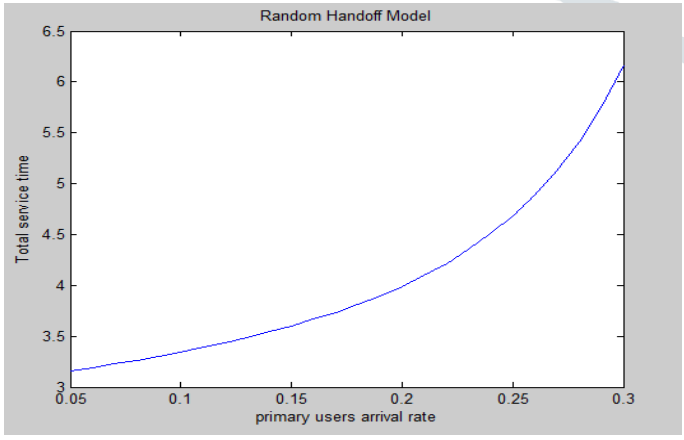

Figure 4: Random handoff scheme total service time

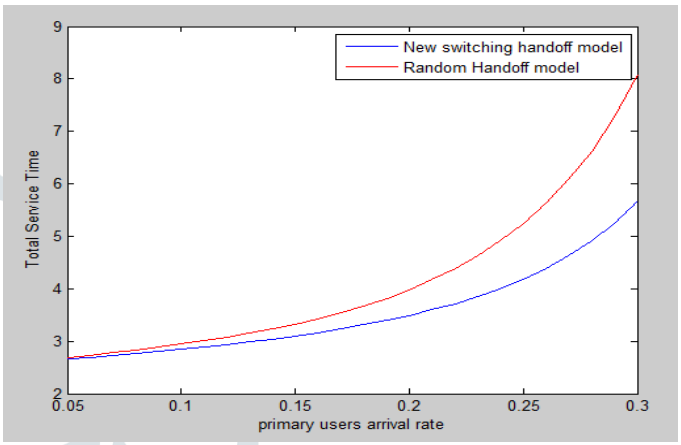

Figure 5: Comparison of Random and New switching handoff scheme.

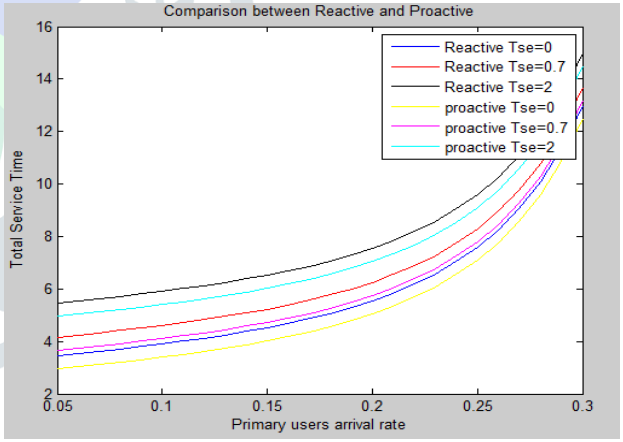

Figure 6: Comparison of Proactive and Reactive handoff scheme.

Conclusion

The research paper presents cognitive radio networks and use of radio spectrum for wireless networks. The paper focus on modeling of different spectrum handoff schemes and the total service time. The paper also presents comparison between random and new switching handoff models and between proactive and reactive handoff schemes.

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