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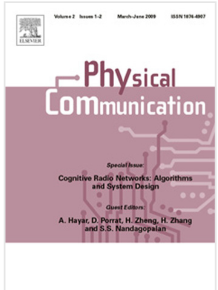

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Spectrum Mobility in Cognitive Radio Network using Spectrum Prediction and Monitoring Techniques

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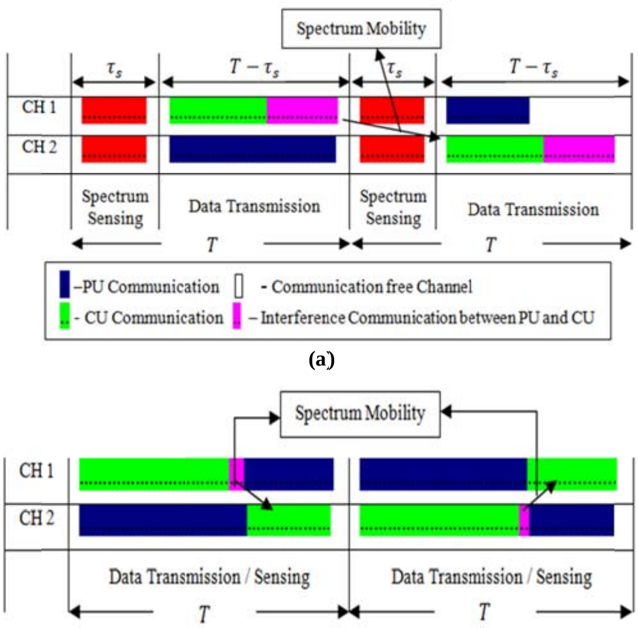
***Abstract*— The spectrum mobility during data transmission is an integral part of the cognitive radio network (CRN) which is conventionally two types for instance reactive and proactive. In the reactive approach, the cognitive user (CU) switches its communication after the emergence of the primary user (PU), where the detection of emergence of PU relies either on spectrum sensing and/or monitoring. Due to certain limitations of the reactive approach such as: 1) loss at least one packet on the emergence of PU and 2) resource (bandwidth) wastage if the periodic sensing is used for mobility, the researchers have introduced the concept of proactive spectrum mobility. In this approach, the emergence of PU is predicted on the bases of pre-available spectrum information, and switching is performed before true emergence of the PU, in order to avoid even the single packet loss. However, the imperfect spectrum prediction is a major milestone for the proactive spectrum mobility. Recently, due to introduction of the spectrum monitoring simultaneous to the data transmission, the reactive approach has come into lime-light again, however, it suffers from the 'single packet loss' and 'imperfect spectrum monitoring' issues. Therefore in this paper, we have exploited the spectrum monitoring and prediction techniques, simultaneously for the spectrum mobility, in order to enhance the performance of cognitive radio network (CRN). In the proposed strategy, the decision results of the spectrum prediction and monitoring techniques are fused using AND and OR fusion rules, for the detection of emergence of PU during the data transmission. Further, the closed-form expressions of the resource wastage, achieved throughput, interference power at PU and data-loss for the proposed approaches as well as for the prediction and monitoring approaches are derived. Moreover, the simulation results for the proposed approaches are presented and validation is performed by comparing the results with prediction and monitoring approach. In a special case, when the prediction error is zero, the graphs of all metric values overlies the spectrum monitoring approach, which further validates the proposed approach.**

Index Terms*— Cognitive Radio, Interweave, Spectrum Prediction, Spectrum Monitoring, Throughput,

I. Introduction

Recently, the explosively increasing demands of the radio spectrum for high-speed internet and multimedia services as well as its fixed spectrum allocation policy have led to a challenging problem of spectrum scarcity [1]. The possible solution to resolve this problem is the cognitive radio (CR), which is an emerging intelligent technology in the field of wireless communication [2-5]. In this technology, the unlicensed/cognitive user (CU) is allowed to exploit the spectrum which is already allocated to the licensed/primary user (PU) in such a way that the PU communication remains impervious. Initially, the CU senses its radio-frequency environment to perceive the unutilized bands of the PU, then accesses these bands using spectrum accessing techniques and finally, establishes communication on these bands. However, the protection of PU communication is the key function of spectrum accessing techniques. The spectrum sensing acts as the backbone for the complete framework of the CRN, as it detects the idle/unused bands of the spectrum, therefore its performance must be reliable. The performance metrics of the spectrum sensing technique are the probability of false-alarm (P_f) and probability of detection (P_d), in which the value of P_f and P_d must be low and high, respectively for the better sensing performance [6]. The CU needs to vacant the spectrum on the emergence of PU during the data transmission, however to continue the CU communication, the CU needs to switch on another idle channel and this process is known as spectrum-handoff or mobility [7]. The spectrum mobility techniques are generally two types, namely, the reactive and proactive. In the reactive technique, the CU switches its communication after the emergence of PU, however the CU switches its communication before the emergence of PU in case of the proactive technique. The detailed discussion of both the techniques is presented as follows.



(a)

(b)

Fig. 1 The spectrum mobility in cognitive radio networks using **(a)** periodic sensing and (**b)** spectrum monitoring with two transceivers at CU.