

The Evolution of Cognitive Radio

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I. ABSTRACT

To heterogeneous cellular networks(HCNs), using the same spectrum resources can cause serious interference problems. But it does not have enough spectrum under a huge amount of mobile equipments, and cognitive radio can be a promising solution to spectrum scarcity problem which use spectrum resources efficiently. In order to maximize the performance of cognitive radio in wireless communications, there are many method has been proposed from different perspective. In this paper, we introduce several effective algorithms that can remedy the dilemma about spectrum scarcity.

II. INTRODUCTION

The fifth generation(5G) wireless systems, which are expected to receive several challenges, such as higher data rates, lower energy consumption, higher spectrum efficiency(SE), have attracted much attention in recent years. Cognitive radio is an active area of research for its potential to trackle, or at least partly address, the above challenges in the 5G cellular networks. It is widely accepted that the capacity of the 5G network system would be 1000 times higher than that of the fourth generation networks. To achieve this goal, we need more bandwidth, higher area capacity and higher SE, among which, improving the channel capacity is an important task since the current spectrum utilization is not quite efficient.

The main advantage of cognitive radio is it allows unlicensed(secondary) systems to operate in licensed frequency bands without causing harmful interference to licensed systems, thus the utilization of spectrum can be significantly improved. In Ref[1], power control problems had been addressed and game theory is used to solve problem. And the interference constraints to ensure promary users' Quality of service(QoS) is considered[2]. Sometimes cognitive radio not only improve the spectral efficiency, but also help system achieve the goal, opportunistic spectrum sharing protocol exploits the situation when the primary system is incapable of supporting its target transmission rate and the secondart system tries to help the primary system to achieve its target goal[3]. To make it possible, the secondary system access to the licensed spectrum of the primary system based on full-duplex cooperative OFDM relaying is proposed in [4]. Joint optimization of subcarriers and power allocation maximize the performance of the whole system[5]. Cooperative spectrum sensing have a good performance in against channel fading and shadowing, [6] consider cooperative spectrum sensing when two secondary users collaborate via the relaying scheme.

[7-10] design algorithms from different perspectives. In Ref[7], author developed a more practical joint pwer control algorithm with multiple primary transmit powers,taking the totla system bandwidth and transmit power of cognitive users

as the most optimal joint goal. Similar to [1], [8] introduced a algorithm also based on game theory, the difference is it's designed for Space-Time Block Coding Multi-Carrier Code Division Multiple Access system. Joint optimizing power and bandwidth of cognitive user of hybrid spectrum shaing can switch between underlay spectrum shaing model and overlay spectrum one according to the location variation of cognitive user[9]. Unpredictable activity of primary users may result in an unconnected network, both centralized and distributed topology control algorithms to ensure bothe K-channel-connected and conflict-free properties is developed in [10].

In recent years, schemes for interference management and power control in heterogeneous cellular networks have been widely investigated. There are many interferences suppression algorithms based on power control, most of the literature got the channel state information needed by organization and control the power of femtocells. However, some of them perceive information with different intervals. [11-12] provided two power allocation algorithms to help heterogeneous cellular networks reduce the interference, but it's worth noting that the purposes and models of two paper are different. A distributed method for relay selection in cooperative cognitive radio networks uses relay help to tranmit to destination[13].

III. CONCLUSION

Because of the advantage of cognitive radio, it has a huge potential to exploit. As the remained useful spectrum is more and more hard to make use of, cognitive radio is a good alternative way to remedy the spectrum scarcity. Different spectrum-sensing techniques can help solve spectrum scarcity in cognitive radio network. But how to balance the primary user and the secondary user is a still need to be considered.

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