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High Energy And Spectral Efficiency Analysis For Cognitive Radio Ad-Hoc Network Based Spectrum Aggregation

T.R.Arulselvi[1], T.Senthil Kumar[2], D.Devarajan[3], R.Lakshmi Rekha[4]

[1]P.G Scholar, E.G.S.Pillay Engineering College, Nagapattinam, Tamilnadu.
[2]Assistant Professor, E.G.S.Pillay Engineering College, Nagapattinam, Tamilnadu.
[3]Assistant Professor, E.G.S.Pillay Engineering College, Nagapattinam, Tamilnadu.
[4]Head of Department, E.G.S.Pillay Engineering College, Nagapattinam, Tamilnadu.

Abstract—Cooperative routing and spectrum aggregation are two promising techniques for Cognitive Radio Ad-hoc Networks (CRAHNs). In this paper, we propose a spectrum aggregation based cooperative routing protocol, termed as SACRP, for CRAHNs. This is the first contribution on spectrum aggregation-based cooperative routing for CRAHNs. The essential target of SACRP is to provide higher energy efficiency, improve throughput, and reduce network delay for CRAHNs. In this regard, we design the MAC and physical layer, and proposed different spectrum aggregation algorithms for cognitive radio (CR) users. We propose two different classes of routing protocols; class A for achieving higher energy efficiency and throughput, and class B for reducing end-to-end latency. Performance evaluation demonstrates the effectiveness of SACRP in terms of energy efficiency, throughput, and end-to-end delay

Keywords: Cognitive radio networks, cooperative routing, spectrum aggregation.

I. INTRODUCTION

Spectrum shortage is one of the essential bottlenecks for the advancement of future remote correspondence frameworks. Under current range distribution arrangements, the range usage effectiveness in authorized range at a specific time and area is low.

The Federal Communications Commission (FCC) gauges the use of relegated range to be somewhere around 15% and 85%. To address such wastefulness given constrained range accessibility, the FCC has endorsed arrangements, for example, deft utilization of authorized range, for example, TV white spaces. Such arrangements will be in the long run acknowledged through the appropriation of Cognitive Radio (CR), innovation, which is imagined to build range use through element range access (DSA) method, wherein unlicensed (CR) clients shrewdly utilize authorized bands when not possessed. Hence, the usage of range can be extraordinarily upgraded by sharp correspondence on authorized range.

The conventional wireless techniques can just backing the usage of ceaseless range assets. Be that as it may, wide constant range groups are once in a while accessible under the present circumstance of range assets and the approach of stable authorized range usage.

In such manner, range accumulation system has been proposed to fulfill the expanding data transfer capacity requests. As of late, various studies have concentrated on diverse range total calculations for CR systems for expanding range proficiency and throughputs.

Our goal is to achieve higher energy efficiency, improve throughput, and reduce network delay for CRAHNs.

II. EXISTING SYSTEM

Cognitive Radio (CR) is an intelligent radio that senses the environment and adapts its transmission parameters to efficiently utilize the scarce radio spectrum. One of the promising applications of the CR technology is hierarchical spectrum sharing, where primary users (PUs), which are licensed to use certain spectrum bands, allow secondary users (SUs) to access the spectrum as long as the interference does not degrade the communication quality of the PU links.

In existing system, they have only used in spectrum sensing and spectrum sharing method. The spectrum allocation is design either MAC layer or PHY layer. A distributed CR routing protocol is to specifically address the problems of PU receiver protection, service differentiation in CR routes, and joint spectrum-route selection.

A cooperative routing protocol has been considered for achieving higher channel capacity gain. Due to spectrum heterogeneity characteristics, the channel which provides maximum capacity is selected for transmission in each direct link, and the node that can provide the maximum capacity gain is selected as the relay node for cooperative routing. The ad-hoc network used in static spectrum allocation. The spectrum channel is allocated by heterogeneous method.

III. PROPOSED SYSTEM

Wireless networks are based on a fixed spectrum assignment policy that is regulated by governmental agencies. Although spectrum is licensed on a long-term basis over vast geographical regions, recent research has shown that significant portions of the assigned spectrum are utilized, leading to waste of valuable frequency resources.

To address this critical problem, the FCC recently approved the use of unlicensed devices in licensed bands. Toward this end, cognitive radio (CR) technology is envisaged that enables the identification and use of vacant spectrum, known as spectrum hole or white space.

In this article we focus on the challenges faced in CR ad hoc networks (CRAHNs), which do not have infrastructure support and must rely on local coordination for different CR functionalities.

Since most of the spectrum is already assigned, a key challenge is to share the licensed spectrum without interfering with the transmission of other licensed users (also known as primary users or PUs). If this band is found to be occupied by a licensed user, the CR user moves to another spectrum hole to avoid interference. In CRAHNs the distributed multi hop architecture, dynamic network topology, diverse quality of service (QoS) requirements, and time and location varying spectrum.

A.MAC AND PHY LAYER STRUCTURE FOR SPECTRUM AGGREGATION

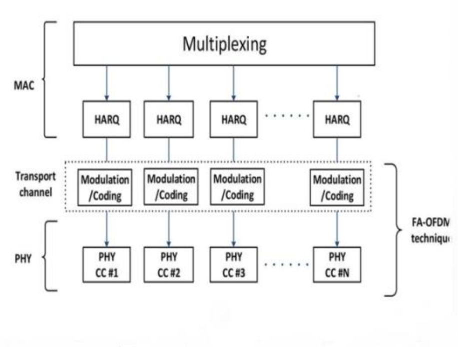

Fig 1: Block diagram of MAC and PHY layer

Multiple analog signal or digital data streams are combined into one signal over a shared medium. HARQ (Hybrid Automatic Repeat Request) it is combination of high rate forward error-correcting code and ARQ error control.

In standard ARQ, redundant bit as added to data to be transmitted using error detecting code such as a cyclic redundancy. The PHY layer deals with bit-level transmission.

DSA (Dynamic Spectrum Allocation) is a new spectrum sharing paradigm that allows secondary user to access the abundant spectrum holes or white spaces in the licensed spectrum band. DSA is a promising technology to alleviate the spectrum scarcity problems and increase spectrum utilization.

B. SPECTRUM ALLOCATION

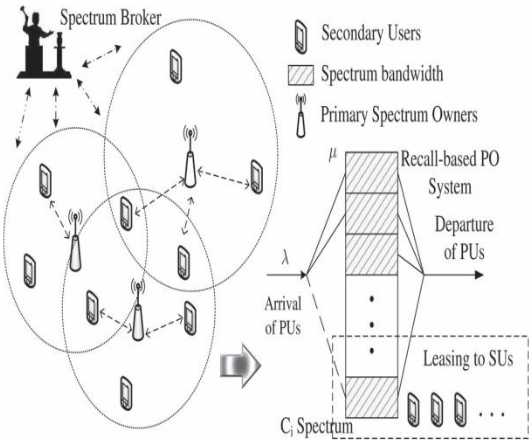

Fig 2: Block diagram of spectrum allocation

The spectrum allocation should monitoring the available spectrum band capture their information and then detect spectrum holes. In this section the allocated nodes of the secondary channel is allocated depending based on the priority (based on data size). This allocation is not static, so the allocation and priority of node change.

IV. REQUIREMENTS

Hardware used:
Processor: Intel i5 Processor with frequency 2.2 GHz
RAM : 4GB and above
Software used:
Operating System : Windows 2008
Tool : MATLAB R2012a

V. RESULTS

We calculate the performance of the proposed method in the following applications: to improve the higher energy efficiency, improve throughput, and reduce network delay for CRAHNs.

CASE 1: Network Creation

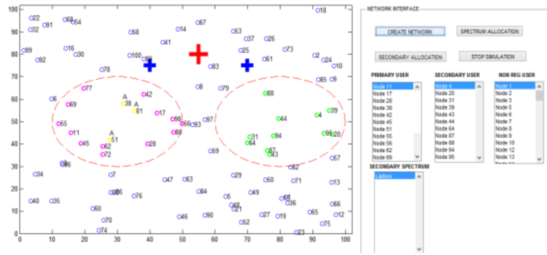

Fig 3: network creation

To create a cognitive radio for a spectrum allocation. To create two kind of network.

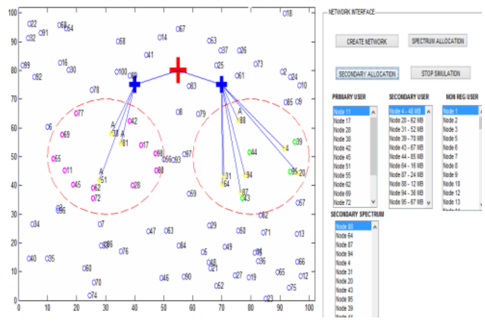

Fig 4: spectrum allocation

The spectrum allocation it should be monitor the available spectrum band capture their information and then detect spectrum holes. The secondary spectrum allocation to allocated nodes of the secondary channel. This allocation depending based on the priority(based on data size).

CASE 2: Analytical Result

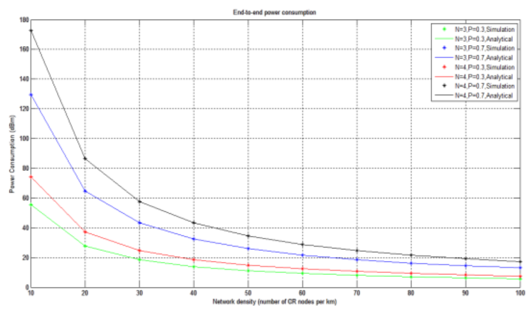

Fig 5: end to end power consumption against network density in SACRP

The transmission power decreases when the network density increases. The power consumption is reduced when the number of aggregated channels increases due to the infamous bandwidth-power inverse relationship.

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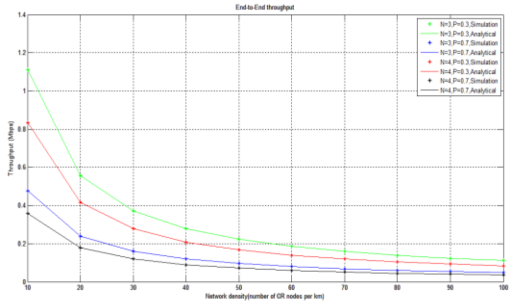

Fig 6: end to end throughput against network density

That the throughput initially increases and then decreases with the network density. The increases with the number of aggregated channels. Furthermore, the end to end throughput decreases with higher PU activity.

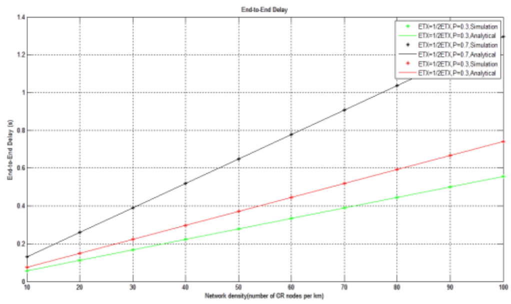

Fig 7: end to end delay against network density

To provides lower end to end delay in good channel condition. Moreover, the end to end delay initially decreases and then increases as the network density increases. The end to end delay increases with higher PU activity.

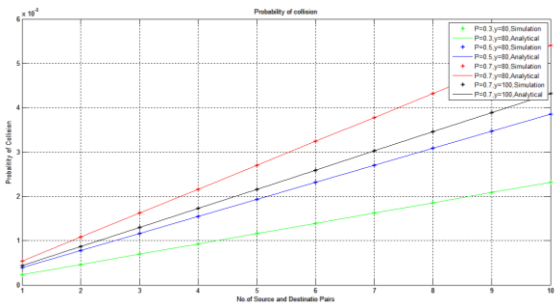

Fig 8: the probability of collision against the number of source and destination pairs.

The probability of collision increases with the number of source and destination pairs. For a give network density , the probability of collision increases with higher PU activity.

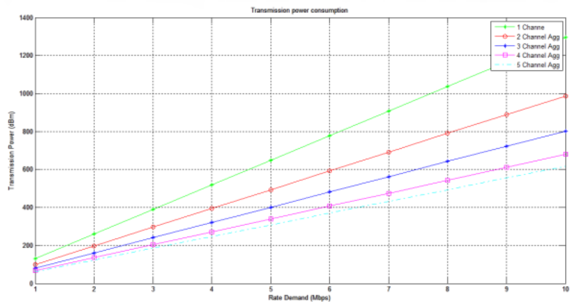

Fig 9: transmission power consumption against the rate demand in SACRP

The transmit power as a function of the rate demand between the source and destination. As the rate demand increases, the power consumption also increases. However, as the number of aggregated channels increases, the transmit power gain is decreased.

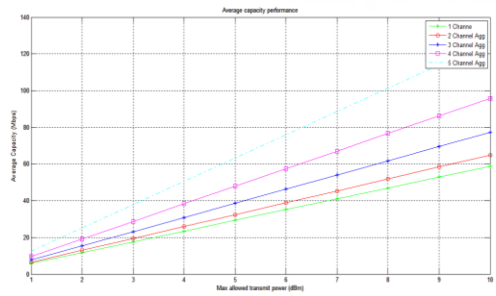

Fig 10: average capacity performance against the maximum allowed transmit power of each channel in SACRP.

The maximum allowed transmit power should be increase the capacity of performance increases. The capacity performance reaches a saturation point as soon as the total transmission power reaches the constraint.

VI. CONCLUTION

In this paper, we proposed SACRP (spectrum aggregation-based cooperative routing protocol for CRAHNs). SACRP is given into two classes of cooperative routing protocols: *Class A* for reduced power consumption and throughput maximization, *Class B* for reducing the end-to-end delay. We have also conducted a performance comparison of SACRP with other relevant protocols in literature. This method shows a great improvement while comparing with existing system.

In future work Stacel burg gamming theory will implemented. This technique will improve the performance efficiency and also improves the spectral and Energy Efficiency. This implementation will be done in MATLAB Simulink Tool.

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