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A Survey on Cognitive Radio Networks Using Geographical Routing Load Balancing Scheme Based On Rainbow Method

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ABSTRACT: In Cognitive Radio (CR) ad hoc networks, different unlicensed users may acquire different available channel sets with the licensed users. This non-uniform spectrum availability imposes special design challenges for broadcasting in CR ad hoc networks. A fully-distributed broadcast protocol in multi-hop Cognitive Radio ad hoc networks with collision avoidance may enhance the throughput in the cognitive radio networks using various scheduling scheme. Hence we proposed a BRACER protocol to increase the broadcasting ratio and reduce broadcast delay in the cognitive radio. BRACER protocol is proposed in multi-hop CR ad hoc networks for broadcast scenarios without a common control channel By intelligently reducing the original available channel set and manipulating the broadcasting sequences and scheduling schemes and proposed broadcast protocol can give very elevated successful broadcast ratio although achieving very short average broadcast delay. It can also avoid broadcast collisions by using a scheduling scheme as Time Division Multiple Access (TDMA).

KEYWORDS: Cognitive Radio ad hoc networks, multi-hop Cognitive, Fully-distributed broadcast protocol, BRACER, Time Division Multiple Access

I. INTRODUCTION

The cognitive radio is an intelligent radio that can be programmed and configured dynamically. Its transceiver is designed to use the best wireless channels in its vicinity. Such a radio automatically detects available channels in wireless spectrum, then accordingly changes its transmission or reception parameters to allow more concurrent wireless communications in a given spectrum band at one location. This process is a form of dynamic spectrum management.

The propose TDMA modulation scheme to avoid collision. Because of, each data is assigned to particular time slot. TDMA signalling is similar to FDMA signalling, except for the time alignment of the data. TDMA signals also appear to perform better than FDMA in the presence of phase jitter. This may make us a suspect to non-linearity's, which may be prevented using linear amplifiers. But, they are much expensive and power consuming. In TDMA, modulation and demodulation reduce the BER (bit error rate).

Time priority mechanisms control the transmission sequences of buffered packets while space priority mechanisms control the access to buffer. Chipalkatti et al. studied the performance of time priority mechanisms including Minimum Laxity Threshold (MLT) and Queue Length Threshold (QLT) under mixed traffic of real-time and non-real-time packets. Their results show that the First In First Out (no special priority) policy causes relatively high losses for real-time traffic while providing low delays for non-real-time traffic. The converse holds true when priority is given to real-time traffic unconditionally. Space (or loss) priorities propose to provide several grades of services through the selectively discarding low priority packets. This type of priority mechanisms exploit the fact that low priority packets may be discarded in case of congestion, without significantly compromising the source‟s QoS requirements. Space priority mechanisms that have been investigated are primarily the Pushout mechanisms and Partial Buffer Sharing (PBS). In both the mechanisms, each source marks every packet with a priority level, indicating high priority and low priority packet. A description of several space priority mechanisms are given below, In the Pushout mechanism, high priority packet may enter the queue even when it is full, by replacing a low priority packet already in queue.

If a low priority packet arrives at the queue when it is full, then it will be discarded. With this mechanism, vital packets will only be lost when the queue is full and there are no ordinary packets waiting for service in the queue. Multi-queue based Push-out policy can achieve highest buffer sharing as well as service.

II. RELATED WORK

Two auction mechanisms such as SNR auction and power auction proposed by [1] which determines relay selection and relay power allocation in a distributed manner. When maximizing the total rate, the power auction achieves the efficient allocation. SNR auction so flexible compared with power auction. User achieves Nash equilibrium in asynchronous and distributed manner. These two auctions are applied in multiple relay networks [1]. The efficiency of Nash equilibrium was proved by Non-negative matrix theory.

Paper [2] discussed about subcarrier and power allocation problem for orthogonal frequency division multiple access based on relay. The joint optimized problem is defined in terms of power allocation, subcarrier assignment and relay selection. The above problem is solved by two techniques such as sub gradient method and dual decomposition. The objective of technique is to improve the throughput. Two low-complexity suboptimal schemes are introduced for reducing the computational cost. The above schemes are tested by computer simulations which are based on LTE-A network. The proposed schemes also support heterogeneous services which meets the Qos. Relay selection and resource allocation supports GBR and AMBR traffic in a multi-user cooperative OFDMA-based uplink system. Three schemes are proposed such as QoS aware optimal joint relay selection, subcarrier assignment and power allocation which are under a total power constraint. A joint optimization problem has been investigated in order to achieve the maximum throughput by satisfying QoS requirements of individual user for relay selection and resource allocation. The computational complexity was reduced with the help of suboptimal schemes. Advantages of paper [2] are it maximizes the system throughput. But doesn't meet the Qos requirement.

Cooperative spectrum sharing scheme increase the spectrum usage effectively by permitting secondary users(SUs) to share the licensed bands with primary users(Pus) in dynamic and opportunistic manner. This paper discussed about how one PU and one SU realize an efficient spectrum sharing scheme via dynamic non-cooperative bargaining. The PU does not have the complete information about SU's energy cost which is one of the key challenges in this paper [3]. Advantage of this paper [3] is, it has higher data rate but increases bargaining power consumption. Sensing based spectrum sharing technique combines the benefits of both spectrum overlay and spectrum underlay to improve the throughput of the secondary user, without generating harmful interference to the primary user.

Transmit diversity needs more antenna at transmitter side. Many wireless devices are small in size. Cooperative communication enables a single antenna mobile user to share their antenna in multi-user environment. It also creates a virtual multi-antenna transmitter which allow the user to achieve the transmit diversity [4]. In cooperative wireless communication, we call the wireless agents as users which increase their effective of Qos through cooperation. It also acts as a cooperative agent for another agent. The wireless users are used to transmit data.

Paper [5] discussed about orthogonal frequency division multiple-access two-way relay network. In multi-user two-way relay network, multiple mobile stations (MSs) can communicate with a common base station (BS) with the help of multiple relay stations (RSs). We also investigate the joint optimization problem which occurs during relay selection, subcarrier assignment and subcarrier-pairing based relay-power allocation process. The above problem is considered as a mixed integer programming problem. We introduce an efficient algorithm with the help of dual method for solving the joint optimization problem. This method improves the system performance compared with other methods.

III. PROPOSED SYSTEM

A. *Overview of the system*

Considering a cooperative wireless cognitive radio network, where a source node (primary user) transmits a message from primary network to the destination node (secondary user) in secondary network with the help of a multiple relay nodes. In cognitive radio networks, wireless nodes change their parameters to communicate efficiently, avoiding collision with licensed or unlicensed users. The cognitive capability of a cognitive radio enables real time interaction with the given environment to determine suitable communication parameters and adjust to the dynamic radio environment.

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In cognitive Radio network, for reducing traffic due to broadcasting scheme is rectified by making the **Mesh Topology.** It can reduce the traffic by using a dedicated link for each sensor to communicate. In broadcasting scheme multiple source can transmitting a message to a destination via a single channel. So all the source will try to transmit a message to the destination at simultaneously by using the same single channel. The channel may be available or unavailable for a particular time by another sensor, so there is a heavy competition for using the channel. Here, we are proposing a **Distributed Broadcast Scheduling Scheme** for efficient usage of channel as well as avoiding Collision.

BRACER protocol is particularly designed for broadcast scenarios in multi-hop CR ad hoc networks without a common control channel. Construction of the broadcasting sequences and distributed broadcast scheduling scheme and broadcast collision avoidance scheme. Construction of the Broadcasting Sequences: The broadcasting sequences are the sequences of channels by which a sender and its receivers hop for successful broadcasts.

To prevent collision in the network while broadcasting, a scheduling scheme is used. Time Division Multiple Access scheme is used to allocate the channel to different sensors for the particular time by using different time slots. In Three Stage Relaying (TSR) scheme, optimal relay selection is a major problem. The problem of choosing proper relay is major problem in dual-hop cooperation scheme, in both clustered and centered network topologies.

These arise the problem of collision while transmitting data to different sensor in the network. The selection of relay should maximize the SNR ratio. Relay selection problem should find a optimal set of transmitting and receiving relays that should maximize the received SNR at destination.

B. *Proposed system*

In the existing system doesn’t concentrate the outside of the cluster so the transmission of message is lost at any time. And also it consumes more time. Because only one relay is allowed to transmit at each time slot. To overcome this problem we propose a technique called rainbow method. This Proposed method is to select the cluster head(Master)for each cluster then we distributes the load of relay nodes to the subset nodes in the cluster and Cluster head is selected dynamically.

It will be help to balance the load. Rainbow method is a scheme which allow the master node to set the type of network, frequency , message rate and channel ID. Master node enables the channel by transmitting channel ID with data at given time interval. after receiving the message the Slave is open. Rainbow method reduces the delay of the data transmission.

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C. *Algorithm and techniques*

1. *Recursive algorithm*

A recursive algorithm is an algorithm which calls itself with "smaller or simpler" input values, and which obtains the result for the current input by applying simple operations to the returned value for the smaller (or simpler) input. More generally if a problem can be solved utilizing solutions to smaller versions of the same problem, and the smaller versions reduce to easily solvable cases, then one can use a recursive algorithm to solve that problem. For example, the elements of a recursively defined set, or the value of a recursively defined function can be obtained by a recursive algorithm. Priority mechanisms are used to optimize the network utilization, while meeting the requirements of each type of traffic. The user may generate different priority traffic flows by using the loss priority bit capability and when buffer overflow occurs, packets from the low priority flow can be selectively discarded by network elements. Priority mechanisms can be classified into two categories:

A. time priority.
B. space priority.

Time priority mechanisms control the transmission sequences of buffered packets while space priority mechanisms control the access to buffer. Studied the performance of time priority mechanisms including Minimum Laxity Threshold (MLT) and Queue Length Threshold (QLT) under mixed traffic of real-time and non-real-time packets. Their results show that the First In First Out (no special priority) policy causes relatively high losses for real-time traffic while providing low delays for non-real-time traffic. The converse holds true when priority is given to real-time traffic unconditionally. Space (or loss) priorities propose to provide several grades of services through the selectively discarding low priority packets. This type of priority mechanisms exploit the fact that low priority packets may be discarded in case of congestion, without significantly compromising the sources QoS requirements.

Space priority mechanisms that have been investigated are primarily the Push out mechanisms and Partial Buffer Sharing (PBS). In both the mechanisms, each source marks every packet with a priority level, indicating high priority and low priority packet. A description of several space priority mechanisms are given below: In the Push out mechanism, if high priority packet enter the queue even when it is full, then it replacing a low priority packet already in queue. If a low priority packet arrives at the queue when it is full, then it will be discarded. With this mechanism, vital packets will only be lost when the queue is full and there are no ordinary packets waiting for service in the queue.

Multi-queue based Push-out policy can realize highest buffer sharing as well as service differentiation and fairness assurance. A Proportional Loss Rate dropper to support the proportional differentiated services. With the PBS mechanism, both high priority packets and low priority packets are accepted by the queue until it reaches a threshold level. When this threshold has been filled only high priority packets will be accepted, provided that queue is not full.

The threshold in all the existing PBS schemes are constants and do not change during operation. Their results show that the independent theory underestimates the consecutive packet loss probabilities. They also conclude that high correlation between consecutive packet losses may restrict the efficiency of forward error correction.

2. *Algorithm of recursive process*

If a set of function is defined recursively, then a recursive algorithm to compute its members or values mirrors the definition. Initial steps in recursive algorithm correspond to the basis clause of the recursive definition and they identify the basic elements. They are then followed by steps corresponding to the inductive clause, which reduce the computation for an element of one generation which immediately preceding generation element.

```
int i, even;
 i := 1;
 even := 0;
  while( i<k ){
  even := even + 2;
  i := i + 1;}
return even .
```

3. *TDMA modulation*

The propose TDMA modulation scheme to avoid collision. Because of, each data is assigned to particular time slot. TDMA signalling is similar to FDMA signalling, except for the time alignment of the data .TDMA signals also appear to perform better than FDMA in the presence of phase jitter. This may make us a suspect to non-linearity’s, which may be prevented using linear amplifiers. But, they are much expensive and power consuming. In TDMA, modulation and demodulation reduce the BER (bit error rate).

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4. Cooperative communication

Cooperative communication is essential role in cognitive radio network by providing low power wireless devices to achieve high throughput. The advantages of cooperative communication in CRN include low transmission power, higher energy efficiency, high throughput, low interference to primary network and better network coverage. Cooperation in CRN also introduces some drawbacks for example, extra relay traffic and increase in end-to-end latency. Recent year research for cognitive radio network focused on two types of cooperation that are dedicated and dynamic cooperation. In dedicated cooperation, there are secondary devices that can only operate as relay. In dynamic cooperation, any secondary users can cooperate with primary or secondary network. The main goal for cooperation is to maximize the throughput with the help of user cooperation, power allocation. The proposal cooperation is dynamic cooperation process. The distributed power allocation is proposed to maximize the coverage of the cognitive radio network. The performance of a cooperative communication system can be improved by using multiple relays, rather than a single relay, which convey the same information to the destination. The multiple relay selection gives more freedom to select best path between primary users (source) to select multiple relay and selected multiple relay to secondary users (destination).

5. Relay selection with multi-hop

The target of relay selection is followed by, source node which wants to send a message to a destination. Hereby, source node is in primary network and destination node is in secondary network. There are several adjacent nodes between source and destination which are coordinates to become a cooperative multiple relay nodes. Relay selection determines the node that is the best suitable path to act as a relay node. The selection process is done in a distributaries manner and introducing only a reasonable overhead in terms of message complexity and delay. The operation of multi-hop adaptive relay selection approaches the determined capable of taking action relays access routing information creating a limited image of the network beyond the adjacent wireless links. Therefore, this typically two hop communication between sources to destination. If the quality of received signal is below that of the threshold, and then the relay selection process is triggered. Adaptive schemes should address the transmission collision problem and should take more advantages of spatial diversity.

D. Advantages

A. To prevent the more interference occurrence between the cluster.
B. Multiple relay can be used. So, more number of packets can be send at a given time.
C. To achieve a very high successful broadcast ratio and reduce the broadcast delay.
D. To avoid collision while broadcasting by using TDMA mechanism.

IV. IMPLEMENTATION

A. MODULES DESCRIPTION

I. Creation of basic Mesh topology

Create a simulation environment on wireless network topology using a Mesh topology. In a mesh topology, every sensor has a dedicated point-to-point link to every other sensor.

II. Construction of broadcasting Scheme

Non-uniform channel availability imposes special design challenges for broadcasting in ad hoc networks.

III. Distributed Broadcast Scheduling Scheme by BRACER Protocol

BRACER protocol is proposed in multi-hop CR ad hoc networks for broadcast scenarios without a common control channel. Construction of the broadcasting sequences and distributed broadcast scheduling scheme and broadcast collision avoidance scheme.

IV. Collision Avoidance

The proposed broadcast scheduling scheme also contributes to the broadcast collision avoidance.

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V. CONCLUSION AND FUTURE WORK

A fully-distributed broadcast protocol in multi-hop Cognitive Radio ad hoc networks with collision avoidance may enhance the throughput in the cognitive radio networks using various scheduling scheme. Hence we proposed a BRACER protocol to increase the broadcasting ratio and reduce broadcast delay in the cognitive radio. The proposed broadcast protocol can provide very high successful broadcast ratio while achieving very short average broadcast delay. It can also avoid broadcast collisions by using a scheduling scheme as Time Division Multiple Access (TDMA).The proposed system increases throughput as well as decreases the delay.

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