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Collision and Broadcasting Delay Management System in 5G Multimedia Networks

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ABSTRACT: Cognitive networks enable efficient sharing of the radio spectrum. Control signals used to setup a communication and broadcast to the neighbors in their particular channels of operation. This paper deals with broadcasting challengespecially in multi-hop CR ad hoc networks under practical scenario with collision avoidance have been address. Exchanging control information is a critical problem in cognitive radio networks. Selective broadcasting in multi-hop cognitive radio network in which control information is broadcast over pre-selected set of channels. We introduce the idea of neighbor graphs and minimal neighbor graphs to obtain the necessary set of channels for broadcast. Selective broadcasting reduces the delay in disseminate control information and yet assures successful transmission of information to all its neighbors. It is also confirmed that selective broadcasting reduces redundancy in control information and hence reduces network traffic.

KEYWORDS : broadcasting, neighbor graphs and minimal neighbor graphs.

I. INTRODUCTION

The plan of cognitive networks was initiate to enhancethe effectiveness of spectrum utilization. The basic idea ofcognitive networks is to allow other users to utilize thespectrum allocated to licensed users (primary users) when it isnot individualuse by them. These other user who areopportunistic users of the spectrum are called secondary users.Cognitive radio [1] expertise enables secondary users todynamically sense the spectrum for spectrum holes and usethe same for their communication. A group of suchself-sufficient, cognitive users communicating with each other ina multi-hop manner form a multi-hop cognitive radio network(MHCRN).Since the vacant spectrum is shared among a group ofindependent users, there should be a way to control andmanage access to the spectrum. This can be achieve using acentral control or by a cooperative disseminated approach. Ina centralized design, a single entity, called spectrummanager, controls the procedure of the spectrum by secondaryusers [2]. The spectrum manager gathers the informationabout free channels either by sensing its complete domain or byintegrate the information collected by potential secondaryusers in their respective local areas. These users transmitinformation to the spectrum manager through a dedicatedcontrol channel. This approach is not possible for dynamicmulti-hop networks. Moreover, a direct attack such as a Denialof Service attack (DoS) [3] on the spectrum administratorwould debilitate the network. Thus, a distributed approach ischosen over a centralized control.In a disseminated approach, there is no central administrator.As a result, all users should jointly sense and share thefree channel. The information sense by a user should beshared with other users in the network to enable certainnecessary tasks like route detection in a MHCRN. Such controlinformation is broadcast to its neighbours in a traditionalnetwork. Since in a cognitive method, each node has a set ofchannels accessible, a node receives a message only if themessage was send in the channel on which the node waslisten to. So, to make sure that a message is effectively sent toall neighbors of a node, it has to be broadcast in every channel.This is called entire broadcasting of information. In acognitive location, the amount of channels is potentiallylarge. As a result broadcasting in every channel causes a largedelay in transmit the control information.Another solution would be to choose one channel fromamong the free channel for control sign exchange. However,the possibility that a channel is common with all the cognitiveuser is little [4]. As a result, several of the

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nodes may not beavailable using a single channel. So, it is necessary totransmit the control information on more than one channel tomake sure that every neighbour receives a copy [5]. With theraise in number of nodes in the system, it is potential thatthe nodes are scattered over a huge set of channels. As aeffect,cost and delay of communications over all these channelsincreases. A simple, yet efficient solution would be to identifya small separation of channels which cover all the neighbors of anode. Then use this set of channels for exchange the controlinformation. This concept of transmitting the control signalsover a selected group of channels as an alternative of flooding over allchannels is called selective broadcasting and forms the basicdesign of the paper. Neighbor graphs and minimal neighbour graphs are introduced to find the minimal set of channels totransmit the control signals.

II. EXISTING SYSTEM

Broadcast is an important process in ad hoc networks, especially in distributed multi-hop multi-channel networks. In CR ad hoc networks, different SUs may obtain different sets of accessible channels. This non-uniform channel availability impose special plan challenges for broadcasting in CR ad hoc networks. So we introduce fully-distributed broadcast protocol in a multi-hop CR ad hoc network. In this protocol, control information exchange among nodes, such as channel accessibility and routing information, is critical for the realization of most networking protocols in an ad hoc network. In cognitive network, each node has a set of channels available; a node receives a message only if the message was send in the channel on which the node was listen to. So, to make sure that a message is successfully sent to all neighbors of a node, it has to be broadcast in every channel. In a cognitive environment, the number of channels is potentially large. As a result broadcasting in each channel causes a large delay in transmitting the control information. problem defined in this project1)Broadcasting delay is high.2)Redundancy Occur.3)Sent control information to all nodes.4)High congestion.5)Network traffic is high.

III. PROPOSED SYSTEM

Broadcasting control information overall channel will origin a large delay in setting up the communication. Thus, exchange control information is a mainproblem in cognitive radio networks. In our proposed work, we deals with selective broadcasting in multi-hop cognitive radio network in which, control information is transmit over pre-selected set of channels. We establish the concept of neighbor graphs and minimal neighbor graphs to derive the essential set of channels for transmission. Neighbor graphs and minimal neighbor graphs are introduced to find the minimal set of channels to transmit the control signals. A neighbor graph of a node represents its neighbors and the channels over which they can communicate. A minimal neighbor graph of a node represent its neighbors and the minimum set of channels through which it can reach all its neighbors. Advantages of proposed system.1)Control information is transmitted over pre-selected set of channels.2)Network traffic is reduced3)Low Broadcasting delay4)Less congestion, contention5)No common control channel6)Redundancy reduced.

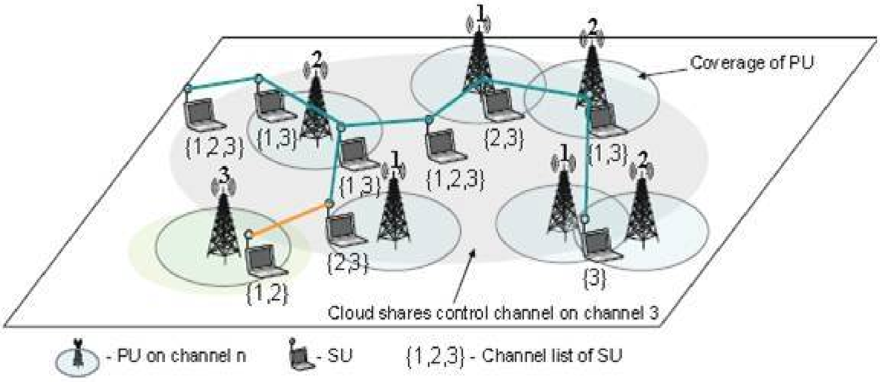

Figure 1.Architecture Diagram

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IV. SELECTIVE BROADCASTING

In a MHCRN, each node has a set of channels presentedwhen it enters a network. In order to become a part of thenetwork and start communicate with other nodes, it has toinitial know its neighbors and their channel information. Also, ithas to let other nodes know its occurrence and its accessiblechannel information. So it broadcasts such information over allchannels to make sure that all neighbors obtain the message.Similarly, when a node wants to start a communication itshould replace certain control information useful, forexample, in route discovery. However, a cognitive networklocation is dynamic due to the primary user's traffic.The number of available channels at each node keeps changingwith time and location. To keep all nodes efficient, theinformation change has to be transmitted over all channels asquickly as possible. So, for successful and efficient coordination,fast dissemination of control traffic between neighboring usersis required. So, minimal delay is aimportant factor in promptlydisseminating control information. Hence, the goal is to decreasethe broadcast delay of each node.

Now, consider that a node has M available channels. LetTb be the minimum time required to broadcast a controlmessage. Then, total broadcast delay = M ×Tb.So, in order to have lower broadcast delay we need toreduceM. The value of Tb is dictated by the particularhardware used and hence is fixed. M can be reduced bydiscovering the minimum number of channels, M ' to broadcast,but still making sure that all nodes obtain the message. Thus,communications over carefully selected M' channels instead ofblindly broadcasting over M (presented) channels is calledSelective Broadcasting. Finding the minimum number ofchannels M ' is accomplished by using neighbor graphs anddiscovering the minimal neighbor graphs.Before explaining the idea of neighbor graph and minimalneighbor graph it is essential to understand the state of thenetwork when selective broadcasting occurs and the differenceamong multicasting and selective broadcasting.

A. State Of The Network

When a node enter in the network forthe first time, it has no information about its neighbors. So,initially, it has to broadcast over all the feasible channels toreach its neighbors. This is called the initial state of thenetwork. From then on, it can begin broadcasting selectively.Network steady state is reached when all nodes know theirneighbors and their channel information of each node. Since selectivebroadcasting starts in the steady state, all nodes are assumed tobe in steady state during the rest of the conversation.

B. *Multicasting And Selective Broadcasting*

Broadcasting isthe environment of wireless communication. As a result, Multicastingand Selective broadcasting might appear related, but they changein basic idea itself. Multicasting is used to send a message to aspecific group of nodes in a particular channel. In a multichannelenvironment where the nodes are listening to differentchannels, Selective broadcasting is an essential way totransmit a message to all its neighbors. It uses a selected set ofchannels to transmit the information instead of broadcastingin all the channels

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V. NEIGHBOR GRAPH AND MINIMAL NEIGHBOR GRAPH FORMATION

In this section, the design of neighbor graph and minimal neighbor graph is introduced and the construction of the same is explain. A neighbor graph of a node represent its neighbors and the channels over which they can communicate. A minimal neighbor graph of a node represents its neighbours and the minimum set of channels through which it can reach all its neighbors. The complete construction of both such graphs is explained below.

A. Construction Of Neighbor Graph

Each node maintains a neighbor graph. In a neighbour graph, each user is represented as a node in the graph. Each channel is represent by an edge. Let graph G denote the neighbor graph, with N and C representing the set of nodes and all possible channels, correspondingly. An edge is added between a pair of nodes if they can communicate through a channel. So aeach nodes can have 2 edges if they can use two different frequencies (channels). For example, if nodes A and B have two channels to communicate with each other, then it is represented as shown in Fig. 1a. A and B can communicate through channels 1 and 2. hence, nodes A and B are connected by two edges.

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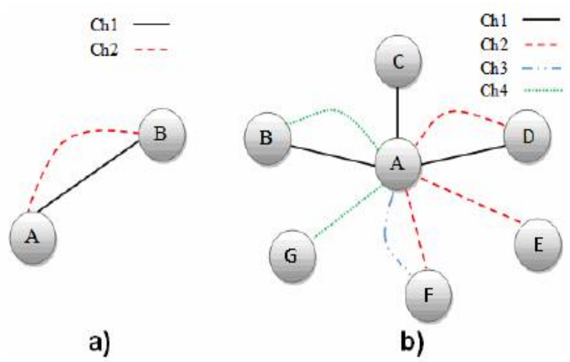

Figure 2. a) Nodes A and B linked by 2 edges. b) Representation of node A with 6 neighbors

consider a graph with 7 nodes from A to G and 4 different channels as shown in Fig. 1b. Node A is considered the source node. It has 6 neighboring node, B through G. The edges signify the channels through which A can communicate with its neighbors. For example, A and D node can communicate through thechannels 1 and 2. It means that they are neighbors to each other in channels 1 and 2. So this graph is called the neighbor graph of node A. Similarly every node maintains its neighbor graph.

B. Construction Of Minimal Neighbor Graph

To decrease the number of broadcasts, the minimum number of channels through which a node can reach all its neighbours has to be chosen. A minimal neighbor graph contain set of channels. Let DC be a set whose elements represent the degree of each channel in the neighbor graph. So, DCi represents the number of edges corresponding to channel Ci . For example, the set DC of the graph in Fig. 1b is: DC ={3,3,1,2}. To build the minimal neighbor graph, the channel with the highest degree in DC node is chosen. All edges corresponding to this channel, as well as all nodes other than the source node that are associated to these edges in the neighbor graph, are removed. This channel is added to a set called 'Essential Channel Set', ECS which as the name imply, is the set of required channels to reach all the neighboring nodes. ECS originally is a null set. As the edges are removed, the corresponding channel is added to ECS.

For example, review the neighbor graph shown in Fig: 1b. The step wise formation of a minimal neighbor graph and the ECS. ECS is set to void. Since channel 1 has the highest degree inDC node, the edges corresponding to channel 1 are removed in theinitial step. Also, nodes B, C and D are removed from the graphand channel 1 is added to ECS. It can be seen that sets DCand ECS are reorganized for the next step. This process continuesuntil only the source node is left. At this point ECS containsall the necessary channels. The minimal neighbor graph isformed by removing all the edges from the original neighbour graph, which do not correspond to the channels in ECS. Thefinal minimal neighbor graph is shown in Fig. 2. Since, ECSis constructed by adding only the required channels from C;ECS is a subset of C.

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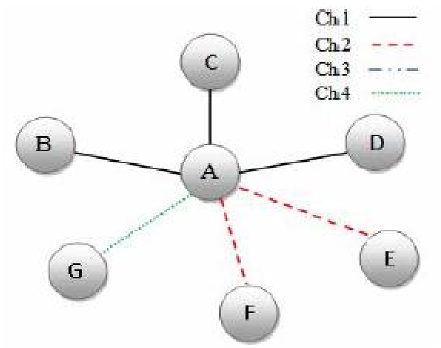

Figure 3.Final minimal neighbor graph of fig. 2b.

VI. PERFORMANCE EVALUATION

In this section the performance of the selective broadcast is compared with complete broadcasting by studying the delay in broadcasting control information and redundancy of the received packets. The performance evaluation used in all these experiments is shown below. For eachexperiment, a network area of 1000m×1000m is considered.The number of nodes is different from 1 to 100. All nodes aredeployed randomly in the network. Each node is assign arandom set of channels changing from 0 to 10 channels. Thetransmission range is set to 250m. Each data point in the graphsis an average of 100 runs.Before looking at the routine of the proposed idea,two observations are made that help in understanding the simulation results. Fig. 3 shows the plot of channel spread as afunction of number of nodes. Channel spread is defined as thecombination of all the channels covered by the neighbors of a node.

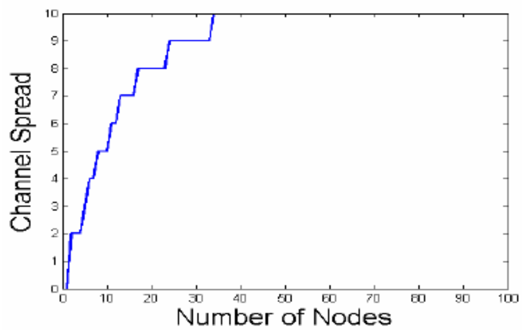

Figure 4 Plot of channel spread with respect to number of nodes for a set of 10 channels.

A. *Broadcast Delay*

In this part transmission delay ofselective broadcast and complete broadcast are compared.Broadcast delay is defined as the total time taken by the node toeffectivelybroadcast one control message to all its neighbors.Each point in thegraph is the average wait of allnodes in the network. The minimum time to broadcast in achannel is assumed to be 5 msec.

In selective broadcasting the delay in disseminating the control information to all neighbours of a node is reduced amount of the complete broadcast. In selective broadcasting, the delay increases with the number of nodes because, it increase the number of nodes and the nodes are spread over increased number of channels. As a result, a node may have to transmit over a large number of channels. In complete broadcasting, a node transmits over all its obtainable channels. Since these channels are assign randomly to each nodes, the average number of channels at each node is almost constant.

The average delay increases linearly with large number of channels in the case of successful broadcast, because the node transmit in all its available channels. On the other hand, in selective broadcasting, the rate of increase in delay is small. This is because, increasing theamount of channels, the number of neighboring nodes enclosed by each channel also increases. As a result, the minimum channel set required to cover all the neighbors remains constant and keeping the delay constant.

B. *Redundancy*

'Redundancy' is defined as the total numberof additional copies of a message received by all nodes in thenetwork if all of them transmit control messages once.It is observed that the number of redundant messages increases with amount of nodes in both the cases and the curve are similar in shape. This implies that the difference in redundancies is not a purpose of the number of nodes. The average M to M ' ratio was found to be 2.5. This concludes that the reduced total redundancy is due to the reduction in channel set in selective broadcast. It has been verified that redundancy is reduced by a factor of (M /M ').

The rate of increaseof redundancy is lower in selective broadcast when comparedto successful broadcast. In complete broadcast, the number ofredundant messages at each node is equal to the number ofchannels it has frequent with the sender. Therefore, withincrease in number of channels the redundant messages approximatelyincrease linearly whereas in selective broadcast the increase issmall due to the selection of minimum channel set.In this section, it has been demonstrated that selectivebroadcasting provides lower transmission delay andredundancy. It should be noted that, due to the decrease inredundancy of messages, there will be less congestion in thenetwork and hence, there is possible for improvement inthroughput by using selective broadcasting.

VII. CONCLUSION

In this paper the concept of selective broadcasting in MHCRNs is introduced. A minimum set of channels called the Essential Channel Set (ECS), is derived by neighbor graph and minimal neighbor graph. This set contains the minimum number of channels which cover up all neighbors of a node and hence transmitting in this selected set of channels is called selective broadcasting iscompared to complete broadcast or flooding. It performs better with increase in number of nodes and channels. It has also been exposed that redundancy in the network is reduced by a factor of (M /M '). As a result there is a possible for improvement in overall network throughput.

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