A Neighbor Discovery Approach for Cognitive Radio Network Using intersect Sequence Based Channel Rendezvous

Tahmina Akter
Department of Computer Science and Engineering,
Dhaka University of Engineering & Technology (DUET),
Gazipur-1700, Bangladesh
tahmina.duet23@gmail.com

Md. Delwar Hossain
Department of Computer Science and Engineering,
Dhaka University of Engineering & Technology (DUET),
Gazipur-1700, Bangladesh
delwar.duet@gmail.com

Md. Rafiqul Islam
Department of Computer Science,
City University,
Saver, Dhaka, Bangladesh
rafiqulislam.cse24@gmail.com

Abstract— In wireless networking, The cognitive is efficient manner to bandwidth utilization. But rendezvous is the most important issue for two or more users on a common channel to establish data communication. Neighbor discovery is a critical task in cognitive radio ad hoc networks, since the secondary users operate on available channels which are dynamically changing according to the primary users activities. It can possible to communicate by using three well known mechanisms. First of all common control channel, second channel hopping procedure and broadcasting. All of these introduce few particular problems. But channel hopping procedure is able to reduce various kind of problem such as hidden terminal problem. In this paper, we propose Channel hoping but that would be efficient by this manner. These devices want to communicate each other they must have at least one common channel by which they can communicate. To find the common channel the cognitive users comparing their available channel in ascending order. So it is possible to find the intersect users between them. Then that would be essay and simple way to find the common channel to rendezvous (TTR).

Keywords— Rendezvous ; Common control channel; Channel hopping; Broadcast ;Intersect sequence ; Primary user (PU); Secondary user (SU).

1 INTRODUCTION

At all wireless networks are regulated by fixed spectrum assignment policy. So Scarcity of bandwidth is increasing due to large number of wireless devices. Cognitive radio (CR) is the enabling technology for supporting dynamic spectrum access. The basic definition of Cognitive Radio Networks (CRN) is Scarcity of bandwidth due to large number of wireless devices in different networks guides the unlicensed ISM (Industrial, Scientific and Medical) band to a saturation state. So to meet the demand of bandwidth utilization at the absence of primary user, opportunistic medium access into licensed bands by the secondary users in different channels renders better bandwidth provisioning. If pair of SUs want to communicate each other then they need to rendezvous on a channel that would be available for both users. And this is difficult to find out the available channel for both that is known as puzzle of cognitive radio network for large number wireless devices in different networks(e.g., Bluetooth, WLAN (Wireless Local Area Network), WSN (Wireless Sensor Network),WBAN (Wireless Body Area Network),WMN (Wireless Mesh Network)).

The available channels for each SU might also change dynamically. However, if a pair of SUs wishes to communicate with each other, they need to meet on a channel that is commonly available to both of them and exchange necessary control information for negotiation such as requestto-send (RTS)/clear-to-send (CTS) Distributed Coordination Function (DCF). This task is not trivial in CR networks since SUs may operate on different channels independently. This is generally called rendezvous or neighbor discovery problem .if X is a device and Y is another device then they want to communicate each other. X would have few available channels and also Y have few available channels. Among the available channels few would be common channel by which can possible to communicate show in figure-1.

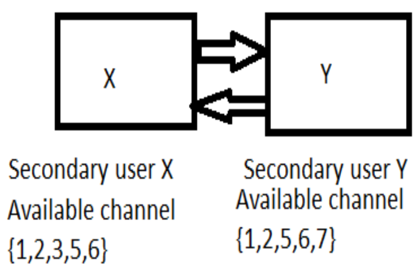

Figure: 1 There are two common channel so can pssible to communicate by these channel

But find out the specific common channel is not very essay. Generally search one by one. And if there is same channel available then try to communicate.

But if it is go to other way after discover the available channel comparing them to find the common channel comparing the devices available channel in ascending order. So possible to find the intersect device between them. Then that would be essay and simple way to find the common channel to communicate and provide minimum time to rendezvous (TTR).

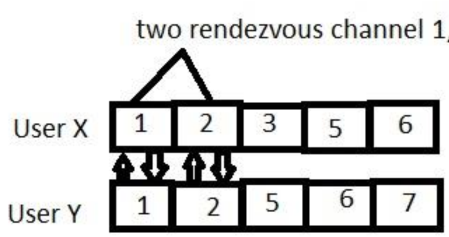

Figure-2: Possible to communicate by channel 1 and 2

Such as in two secondary device X and Y corresponding available channel is {1,3,4,5,6} and {2,4,5,7,8} so there is a common channel available which is 4. So in this general situation they can`t rendezvous to meet each other which show in figure-3 due to they couldn't come in proper time slot. We know that to meet the channel both user have to come in same time in same channel but if it is possible to hold the user channel previous value after change the time slot then can possible to apply this method. They can meet easily after 4 iteration. But for this reason have to consider about time and previous channel value. In figure-4 there are two user and consider those value is ascending order and in the first iteration user x[0] location and user y[o]location are not same there consist value 1 and 2 respectively so find out the which user location value is smaller after that increment this location value. So x[o] would be x[1] because user x value was smaller again compare the x[1]and y[0] in second iteration there is no common channel and find out which value is smaller between them. Consist 3 and 2 respectively so increase the user Y location would be x[1] and y[1] then compare the value 3 and 4 respectively. Now increment the value of user x location that would be x[2] and y[1] and there is a common channel which is 4 show in figure-4.

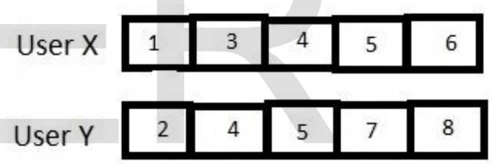

Figure-3: Although there are two common channel but They can`t meet each other for communication

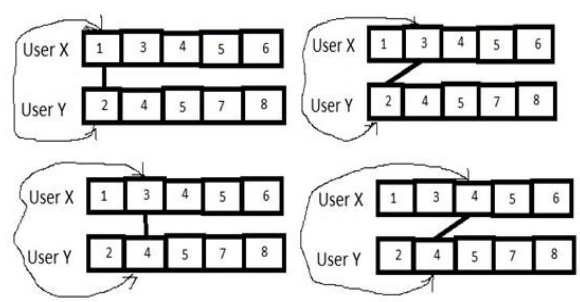

Figure-4: Compare the user values in various scenario

2 Related work & Motivation

The major challenge in CR networks is rendezvousing on a common channel. This task is not trivial, since SUs may operate on different channels independently, which gives rise to the rendezvous problem of CR networks. Note that this problem is more challenging in CR ad hoc networks, as there is no centralized coordinator. Currently, there are three well known approaches to enable a rendezvous in CR ad hoc networks:

1) Using a dedicated common control channel (CCC)

2) Using channel hopping. And

3) Broadcasting approach

2.1Common Control Channel

The simplest way to solve the rendezvous problem is to use a predefined CCC. Most of the proposed medium access control (MAC) protocols for CR networks were designed by assuming the existence of a CCC, and further assuming that it is available for every SU. All the necessary control information is exchanged among SUs via the CCC. When an SU wants to initiate communication, it first switches to the CCC during the control interval, and attempts to negotiate with the intended receiver or neighbor. After negotiating on the CCC, data communication can be accomplished during the data interval via other available channels, known as data channels. Although it is formally introduce the way by which possible to communicate but it has few limitation.

1) Lack of CCC Availability

The main drawback of using the CCC approach is that it is susceptible to PU activities. When a PU appears on a CCC, all SUs must defer their transmissions on the CCC, and vacate the channel immediately. Not only does their presence degrade the overall throughput of a CR network, but if a PU transmission period is significantly long on a CCC, the presence of the PU may also block channel access for SUs. Moreover, the available channel sets in CR networks, including the CCC, change dynamically, hindering the establishment of an ever-available control channel for all SUs.

2) Control Channel Saturation Problem

The principle of the CCC approach forces SUs to transmit all control packets on the CCC. Thus, the collision rate of control packets is high when the number of users in the network is large, since all users use only one channel for negotiation.

2.2Channel Hopping Approach

The second famous approach to simplify the rendezvous problem in CR ad hoc networks is using channel hopping (also known as sequence-based protocols). The common goals of most of the existing sequence-based protocols are to overcome the drawbacks of a CCC, and to eliminate the need of a CCC. In channel hopping approaches, SUs generate their own channel hopping sequences [14]. When an SU (e.g., a sender) needs to communicate with its neighbor (the receiver), it switches from one channel to another, by following a predefined hopping-sequence, until it finds its neighbor When two SUs meet on a common channel, they need to exchange the necessary control information to complete rendezvous.

1) Channel Access Delay

In sequence-based protocols, when an SU wants to communicate with its neighbor, it will switch from one channel to another, by following a hopping sequence, until it finds its neighbor. Accordingly, a user needs a significant amount of time to meet with its neighbor, which results in a channel access delay or time to rendezvous (TTR). The value of TTR is typically measured in time slots, and dependent on the channel hopping algorithms.

2) Complexity

The next difficulty in sequence-based protocols is overcoming the complexity of generating channel hopping sequences.

3) Lack of Network Status Information

The most miserable drawback of sequence-based protocols is the lack of information regarding neighbors' communications.

2.3Message Broadcasting Procedure

In this procedure, to find neighbors in CRN a secondary user broadcasts a control first on one channel and nodes those get that message repeatedly broadcast the same information over multiple channels. As a result, all the secondary nodes in the network reach to a convergence point knowing the channel information of the initial SU and thereby, make rendezvous with it. Broadcasting mechanism helps node a to propagate its channel information taking help of other nodes. However, frequent channel switching, message broadcasting, and flooding issues raise the main question about the effectiveness and performance of such approach.

1. Redundant data:

   In the Broadcasting procedure it is very difficult to control the redundant data. May be a node receive same data from two or more than two different node. So it is one of the most disgusting lack of Broadcasting procedure which increase the communication time.

2. Define the counter value:

   It also difficult to define the counter value for broadcasting there have to consider about channel number, total number of node and minimum value. Then n = N/m and [logn(m)] < r ≤ m.

3 Proposed Method and Performance

We have derived the performance of the proposed intersect based channel hopping sequence, where the results are evaluated and compared with the existing pseudo random channel hopping sequence approach. Implementations were done in C/C++ compiler (code block C++) in a PC having Windows 8 OS, Core i5 processor, and 4 GB RAM. In this case, we have considered two SU nodes: Sender and Receiver. The sender is considered to have different number of channels: is {1,3,4,5,6} and Recover channel is {2,4,5,7,8} so there is a common channel available which are 4 and 5. So in this general(pseudo random) situation they can`t rendezvous to meet each other which show in figure-3 due to they couldn't come in proper time slot and this compare in one by one. We know that to meet the channel both user have to come in same time in same channel but if it is possible to hold the user channel previous value after change the time slot then can possible to apply this method. They can meet easily after 4 iteration. But for this reason have to consider about time and previous channel value. In figure-4 there are two user and consider those value is ascending order and in the first iteration user x[0] location and user y[o]location are not same there consist value 1 and 2 respectively so find out the which user location value is smaller after that increment this location value. So x[o] would be x[1] because user x value was smaller again compare the x[1]and y[0] in second iteration there is no common channel and find out which value is smaller between them. Consist 3 and 2 respectively so increase the user Y location would be x[1] and y[1] then compare the value 3 and 4 respectively. Now increment the value of user x location that would be x[2] and y[1] and there is a common channel which is 4 show in figure-4. By this way possible to get more performance than pseudo random.

4 Conclusion

We have presented the new channel hopping approach where rendezvous problem of CR ad hoc networks few would be removed. It is able to effectively deal with, among other things, the dynamics of resource availability due to primary users. A key concept in intersect hopping sequence is the use of a dynamic and totally distributed which, among other things, is used to support network-wide. This has been evaluated analytically, through simulations and implemented in a real hardware prototype. Performance results are very promising and some of them have been presented here. We believe that intersect hopping sequence give a new research directions in MAC protocols for cognitive radio networks.

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