Collision Avoidance In Cognitive Radio Adhoc Networks Using Leach Algorithm

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Abstract—One of the most important operation in ad hoc networks is the broadcast whose protocol is very useful in the wireless system. In earlier days infrastructure based networks were used which denied secondary users from using the free channels.
The existence of ad hoc networks makes the cognitive radio very useful. A stream of channels are available for the secondary users in cognitive radio along with the primary users. In this paper, we discuss the modified version of a fully-distributed Broadcast protocol in multi-hop Cognitive Radio ad hoc networks with collision avoidance, BRACER. We consider the availability of spectrum for the unlicensed users along with the primary user for the transmission to take place.

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I. INTRODUCTION

Cognitive Radio (CR) technology is a suitable solution to the problem of optimum spectrum utilization. Cognitive Radio has the ability to sense the frequency bands and alter its operation parameters based on the detected frequency bands. The frequency bands are allocated to the licensed users also called Primary users and the remaining frequency bands are allocated to the unlicensed users also called Secondary users. These secondary users can form either a CR infrastructure-based network or a CR ad hoc network. These ad hoc networks have various applications. One of the major applications of CR ad hoc networks is broadcast. The exchange of control information is very important in ad hoc networks. Control information include channel availability and other routing information. He control information is generally transmitted in the form of broadcast messages. Some of the important data packets such emergency messages, alarm signals etc. are transmitted as broadcast messages.

Considering the importance of the broadcast operation in our paper, we describe the broadcasting issue in multi hop CR ad hoc networks. Broadcast messages have to be transmitted to all destination nodes as fast as possible. So it is necessary to obtain a high broadcast ratio and a low broadcast delay. The problems related to broadcast have been more prominent in ad hoc networks. In traditional single-channel or multi-channel ad hoc networks, the channel availability is uniform. However, in CR ad hoc networks, the channel availability is not uniform, i.e. different Secondary users may get different sets of available channels. This non-uniform channel availability causes several problems in CR ad hoc networks and the design of such systems is difficult. Due to the uniformity of channel availability in traditional single-channel and multi-channel ad hoc networks, all the participating nodes in the system can be aligned to the same frequency band. The broadcast messages transmitted by a single node can be heard by all the other nodes in the network. However, in CR ad hoc networks there is no single channel for control information.

II. PROCEDURES

A. Existing system

A single channel can be used to transmit broadcast messages. There is no existence of a common channel in a CR adhoc network. It is important to note that a secondary user is unaware of the available channels of its neighbouring nodes before any control information is exchanged. Therefore, broadcasting messages on a global common channel is not feasible in CR ad hoc networks.

Existing system disadvantage
➢ Non-uniform channel availability in Cognitive Radio.
➢ Secondary user is unaware of the available channels of its neighboring nodes.

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B. Proposed system

A fully-distributed broadcast protocol in a multi-hop CR ad hoc network, BRACER, is proposed. Some of the practical scenarios are considered into existence: 1) no existence of any global or local channels; 2) the global network topology is not known; 3) the channel information of any other SUs is not known; 4) the available channel sets of different SUs are not assumed to be the same and 5) tight time synchronization is not required. The idea delivered in our paper can provide very high delivery ratio with very short broadcast delay. It can also avoid broadcast collisions.

C. Software used
  ➢ Linux CentOS 6.5/Ubuntu 14.04
  ➢ NS2
  ➢ OTCL
  ➢ NAM
  ➢ X-Graph
  ➢ Trace Graph
  ➢ C++
  ➢ AWK

D. Greedy algorithm

The algorithm solves the problem of makes local optimal choice at each stage and also gives hope of making global optimal choice in future.
It holds the advantage of solving problems which are easier to understand and use. Also it is widely used for network routing.
But the drawback is it causes loss of packets while transmission along the nodes.
This makes it unfit for the usage and we replace this algorithm with LEACH algorithm for our paper.

E. Leach algorithm

LEACH stands for Low Energy Adaptive Clustering Hierarchy.
A type of hierarchy protocol where nodes transmit to the cluster heads and the cluster heads forwards them to the base station (sink). To decide whether a node is to become the immediate next cluster head, a stochastic algorithm is used. The nodes are assumed to have radio energy which is considered powerful enough to reach the nearby cluster head. But this usage of radio waves causes loss in energy.

Properties of this algorithm include:
  ➢ Cluster based
  ➢ Adaptive cluster membership
  ➢ Data aggregation at cluster head
  ➢ Sink or user is being communicated directly by the cluster head
  ➢ TDMA is used for communication with the cluster head
  ➢ Threshold value.

The algorithm is broken into 4 phases:
  1. Advertisement phase
      ➢ Decision made by the nodes whether or not to become the cluster heads(CH).
      ➢ Advertises itself as CH.

  2. Cluster set-up phase
      ➢ Decision made among nodes to which cluster it belongs.
      ➢ The node then notifies the cluster head.

  3. Schedule creation
TDMA created by cluster heads to decide which nodes can transmit.
Data transmission
Each node can send data during their allotted time.
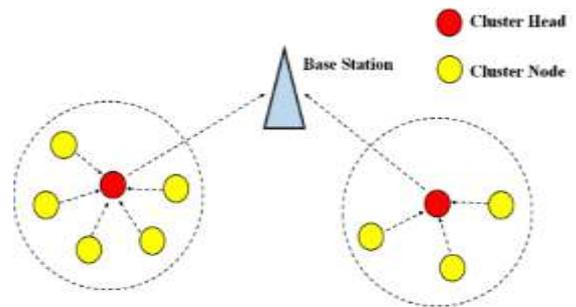
Fig 1: Leach Algorithm

The main advantage of this algorithm is it causes no loss of transmission packets which makes it feasible for the usage in this paper.

III. APPENDIX

   Sample code
AODV.CC

```
#include <ip.h>
#include <aodv/aodv.h>
#include <aodv/aodv_packet.h>
#include <random.h>
#include <cmu-trace.h>
//#include <energy-model.h>
#define max(a,b)       ( (a) > (b) ? (a) : (b) )
#defineCURRENT_TIME
Scheduler::instance().clock()
//#define DEBUG
//#define ERROR
#ifdef DEBUG
static int route_request = 0;
#endif
```

IV. HELPFUL HINTS

F. Snapshots of outputs:

Fig 2: Node initialization

The nodes are initialized in the Leach algorithm by using the code as follows: set ns [new Simulator]
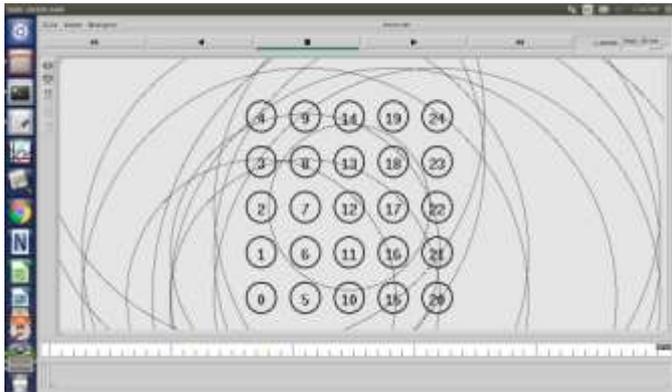
Fig 3: Node initial level configuration

The nodes are initially configured so that they can transfer packets according to the requirement.
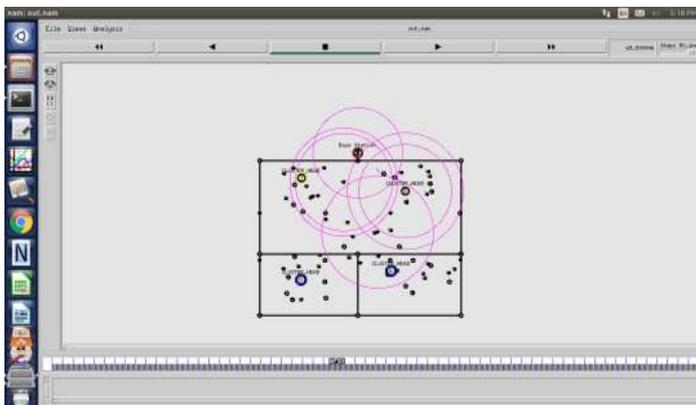
Fig 4: Configured all nodes to each other

G.   Graphical output
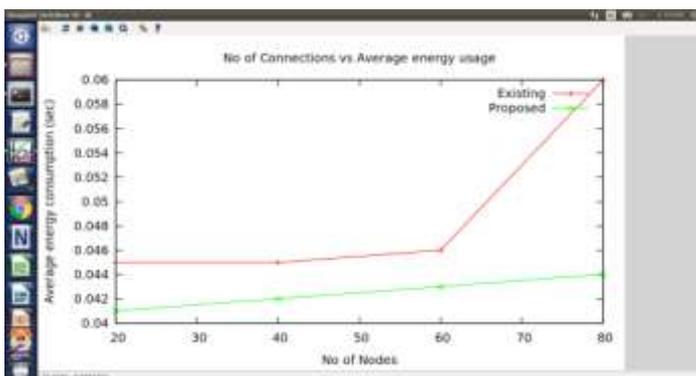
Fig 5: No of Connections vs Average energy usage

The graph above describes the difference in energy usage in the existing and the proposed model. The energy used in the existing model is more than the proposed. Hence it can be considered as one of its drawback.
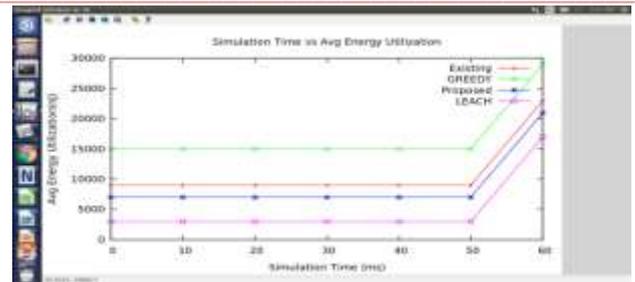
Fig 6: Simulation Time vs Average Energy Utilization

The energy utillisation is lest in case of LEACH Algoritm. This makes it the reason to choose LEACH over GREEDY algoritm.
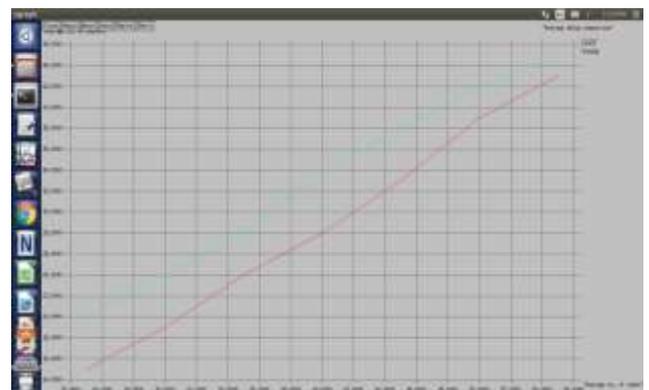
Fig 7: Average delay comparison

ACKNOWLEDGMENT

CONCLUSION

In this paper, the broadcasting challenges specifically in multi-hop CR ad hoc networks under practical scenarios with collision avoidance have been addressed for the first time. A fully-distributed broadcast protocol named BRACER is proposed without the existence of a global or local common control channel. By intelligently downsizing the original available channel set and designing the

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broadcasting sequences and broadcast scheduling schemes, our proposed broadcast protocol can provide very high successful broadcast ratio while achieving very short broadcast delay. In addition, it can also avoid broadcast collisions. Simulation results show that our proposed BRACER protocol outperforms other possible broadcast schemes in terms of higher successful broadcast ratio and shorter average broadcast delay.

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