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Radio Interference Detection in Capacity Optimized Co-operative Networks

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***Abstract*—** Wireless networks with Cooperative Communication have received incredible interest in communication networks. Most accessible works based on COCO(Capacity optimized cooperative) topology control, in cooperative communications are mainly focused on the physical layer issues, commonly outage probability and outage capacity. Therefore, the network upper layer issues are highly ignored. The main upper layer issues are topology control, routing control as well as network capacity. From the analysis we have to say that cooperative communication based on the physical layer has momentous impacts in improving the network capacity. The proposed topology control scheme can considerably improve the network capacity. A Radio Interference Detection algorithm (RID) is used to detect run-time radio interference relations among nodes. The interference revealing results are used to intend real collision-free environment for transmission of data. RID suppresses the interference parameters corresponding to physical layers and using RID, Network Capacity and Data rate is largely increased.

Keywords*-COCO topology control scheme, Cooperative communication, MANET, Network competence, RID.*

I. INTRODUCTION

In wireless network, according to the high-level needs the demand for speed is considerably increasing. The introduction of cooperative communication is for increasing the transmission range in the MANETs. Due to this the network performances can also be increased. So commonly in cooperative communication the user not only share but also coordinate their resources. Ad-hoc wireless networks are based on multi- hop communications, where the information from the source to the destination is relayed through other mobile nodes. An ad-hoc network does not have a fixed infrastructure, so this relaying operation is essential in order to overcome the path loss incurred over a very large distances. Multi hop ideas are also utilized in cellular and wireless LAN systems to provide very high quality of communication, power consumption and comprehensive coverage. Cooperative communication involves two main ideas: (I) Use of relays (or multi-hop) (ii) Envision a collaborative scheme.

Most existing works on cooperative communications are focused on link level physical layer issues. With physical layer cooperative communications, there are three transmission etiquettes in MANETs [2]: Direct transmissions, multi hop transmissions and cooperative transmission. Fig 1 shows the step by step communication taken place in MANETs using HD-ND sequence.

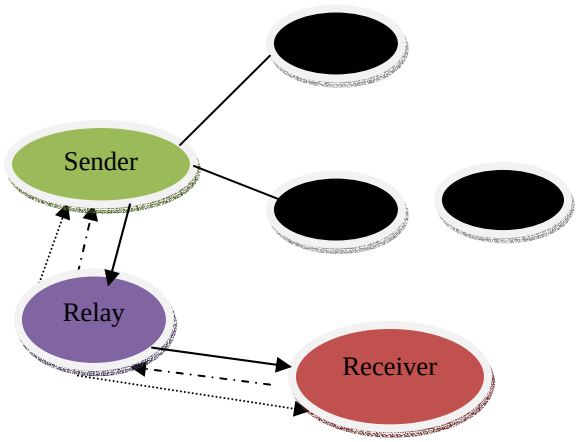


Figure 1. Communication using HD-ND sequence

For increasing the range of communication relay based communication is efficient. But the main criteria behind the relay selection are that the relay node should have connection with all other nodes within the communication range. Then only it can share and coordinate its resources. Most of the previous work for relay selection uses the current observed channel condition, but in case of time varying nature of some mobile environments uses finite state Markov channels in the relay selection problem [1] .The main problem observed in the relay based communication is the occurrence due to unwanted information in the communication path and also to the receiving node. This collection will reduce the security in the communication due to the packet loss during transmission.

A. DSR (Dynamic Source Routing)

The Dynamic Source Routing protocol (DSR) is an efficient routing protocol used in MANETs. DSR helps the mobile nodes in MANET to be fully self organizing without any fixed infrastructure .Based on two mechanisms such as route discovery and route maintenance the DSR protocol will efficiently work in Adhoc network. Fig 2 shows packet routing by means of routing table formation from the initiator to the target. In DSR the routing is mainly used for getting loop free

path and also using a cache based storage scheme for forwarding and overhearing packets, rather than maintaining the intermediate routing information. It is completely an on-demand protocol. It allows the routing packet overhead of DSR to scale automatically to react to changes in the routes currently in use.

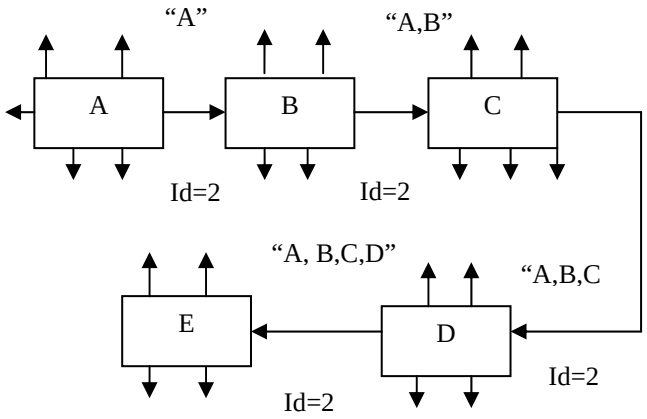


Figure 2. Communication using HD-ND sequence

II. RELATED WORKS

The existing system introducing, a new technology called capacity optimized cooperative (COCO) topology control scheme in order to increase the performance in cooperative communication. For this a relay node based communication is chosen. In order to control the topology of the network, we have to apply clustering concept in the transmission medium. In this concept the cluster head is selected as the relay node and transmitting through this relay node. Due to this establishing a new communication path in the network this will increases the range of communication and also increases the data rates and the energy efficiency and will reduces the packet loops as well as delay.

Due to the user mobility the MANET topology changes dynamically. Mean while, the topology in a MANET is controllable by adjusting some parameters such as the transmission power, channel assignment etc. **"**A survey on position based routing in Mobile Ad Hoc Network" was proposed by Martin Mauve et al the paper deals with the overview of Adhoc routing protocols which makes forwarding decisions based on geographical positions of the destination nodes. This paper explains briefly the concepts of location services and forwarding strategies. The main disadvantage of this paper is that it is based on the geographical position of a packet destination and also its Packet loss is high [2].

Another approach followed in cooperative communication is "Cooperative Communication in Wireless Networks" was proposed by Aria Nosratinia et al**.** This paper provides a clear idea about the wireless cooperative communication technique that allows single antenna mobiles to share their antennas and thus enjoy some of the benefits of multiple antenna systems. The main advantage of this paper is Single antenna mobiles in a multi-user environment act as multiple antenna systems, Transmit diversity and network capacity is high. The main disadvantage of this work is high Packet loss and low Data rate [3].

In Impact of Topology Control on Capacity of Wireless Ad Hoc Network proposed by Quansheng Guanet al discuss about the Capacity based topology management. This paper also discusses the impact of topology control on network capacity by introducing a new concept of the expected capacity that is first analyzed in the perspective of cross layer optimization. The main advantage of this work is optimal techniques used for neighbor selection and the transmission power control. It maximizes the capacity and the disadvantages of this work are Network architecture is non infrastructures and the interference is high [4]. From all this approach we can see that the main problem in all these approaches is the interferences in the communication path. Y. Wei proposed a new scheme to increase the network performance in communication network by means of using the distributed optimal relay selection scheme.

Andrew Chickadel et al proposed a variety of approaches for reducing the Interference by using the graph coloring methods. In this paper the author analyzes the interference reduction problem from a graph theoretical viewpoint. The graph coloring methods are exploited to model the interference reduction problem [5].

One important approach on Interference reduction in MANET is proposed by Maaly et al. This paper propose a new interference-aware connected dominating set-based (IACDS) topology construction algorithm, namely, IACDS algorithm, a simple, distributed, interference-aware and energy-efficient topology structure mechanism that discovers a sub-optimal connected dominating set (CDS) to turn redundant nodes off while keeping the network connected and providing whole communication coverage with minimum interference[6]. Interference Reduction Technique in Mobile Ad hoc Networks using Mathematical Prediction Filters proposed by Suseendran says that the Hidden Markov Model (HMM) used for predicting the interference of the nodes [7].

III. CURRENT WORK

The current work consists of the following process. The entire process is divided in to two different modules, for getting the comparative analysis .This comparative analysis can be used for the performance evaluation for the MANET. In COCO topology control, the relay selection process is used for communicating in a cooperative medium where the data is forwarded using the clustering algorithm.

In order to increase the performance evaluation, a new topology control scheme is introduced. It is based on the RID (Radio Interference Detection), and it consists of the following modules for reducing the interference occurrence during the communication.

A. Design Methodology

The flow chart shown in the fig 3 gives a detailed overview of the algorithm proposed.

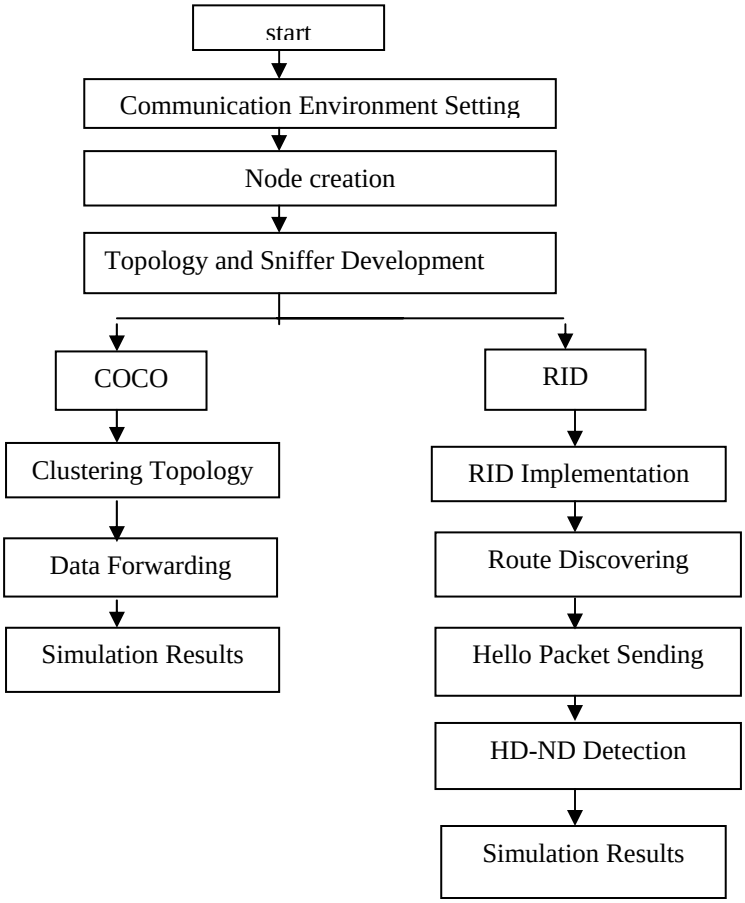


Figure 3 Flow chart for proposed method

B. Module 1

1) Node Formation Module:

In this module based on the necessity, the number of nodes is chosen. In this work, 50 nodes are taken and arranged in a flat grid topology manner. Initially the nodes are accomplished in a basic node called the god node. From the god node all other nodes are generated and they are placed in a fixed position. Set time for all nodes are fixed as 5ms and after the set time all the nodes will start to move with respect to its x and y axis. This is shown in fig 4.

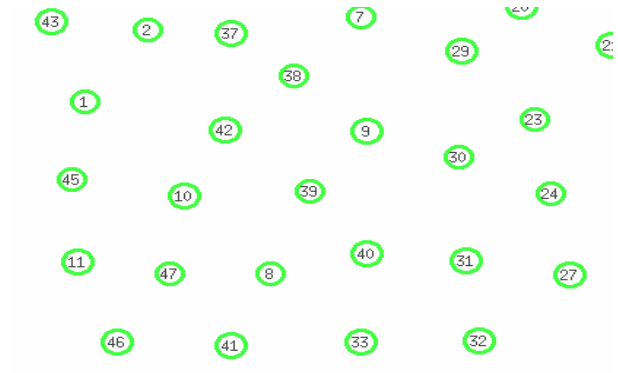


Figure 4 Creation of Nodes

C. Module 2

1) Topology and Sniffer Development:

Topology defines the arrangement of nodes in position and connecting them through link for the communication. In this project the topology used is flat grid topology. Where, each node undergoing communication is connected through a UDP agent. Why using UDP agent means it will activate connection only when there is a need. And also for each node attach a traffic agent CBR for monitoring the traffic. Wireless sniffers are often used to monitor Aps (Access Point) in Wireless LANs (WLANs) for network management, fault detection, traffic characterization, and optimizing deployment. It is cost effective to deploy single-radio sniffers that can monitor multiple nearby APs. However, since nearby APs often operate on orthogonal channels, a sniffer needs to switch among multiple channels to monitor its nearby APs. The table 1 shown below gives a detailed view of the simulation parameters.

TABLE I. SIMULATION PARAMETERS

Parameter	Value
Simulator	Ns2.26
Routing protocol	DSR
MAC layer	802.11
Packet size	512bytes
Simulator time	150 sec
Simulator area	1600m x 1100m
Traffic type	TCP(FTP)
Number of mobile nodes	50
Initial Energy	100 Jouls

D. Module 3

1) RID Implementation:

RID implementation is the main part of the project. It is sub divided into two main parts.

- *Nearest Neighbor Calculation*
- *Packet forwarding based on HD-ND*

a) Nearest Neighbor Calculation:

Nearest neighbor calculation is used for making the communication through the nearest node, from the sender. So rather than calculating the shortest path for communication, calculating the nearest neighbored path. Then only there will be a strong link established between the nodes in the communication path. For that again two sub processes are included. They are given below

- *Hello Packet Sending*

This is for making the communication environment. For that assume 0 as the base node and it will send a hello packet to all other nodes surrounded by it, and by means of receiving the hello packet all the nodes will be getting alerted and ready for transmission.

- *Route Discovery*

This is for the purpose of creating the routing table in order to calculate the distance between the nodes. From each node we have to send a route discovery message to other nodes. Then choosing a path from the sender to receiver which having the minimum distance and this will increase the strength of the link between the nodes. According to the concept a strong link has low interference range while the weak link has high interference range.

b) Packet forwarding based on HD-ND:

In this module after selecting the nearest neighbor path forwarding a HD packet from the receiver to all nodes which are included in the selected path. The HD packet consist of the transmitter ID from which the packet is coming, assuming highest power for this packet. The nodes receive this HD packet and save the ID. Once the process is completed, from the receiver to the sender a route acknowledgment message is forwarded. If the acknowledgment is correctly reached to the sender then the sender will transmit the ND packets which consist of the actual data to the receiver. Due to this the interferences occurred in communicative path due to unwanted packets from other nodes within that communication range can be avoided. The packet transmission concept is shown in fig 5.

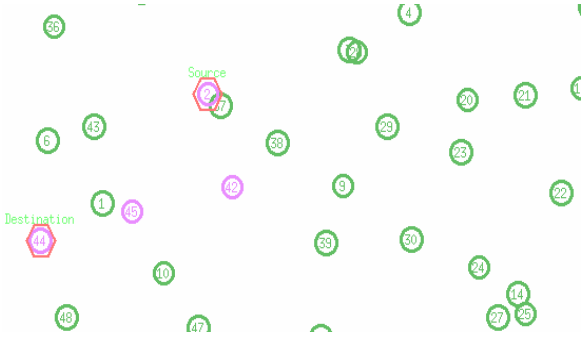


Figure 5 Packet Transmission

E. Algorithm

- Procedures for RID

The main procedures are
(i) Route request
(ii) Neighbor selection
(iii) Route Acknowledgment

Procedure for RID for route request (RID-REQ)

It based on
(a) RQT (Route Request Table)
(b) EQT (Entry Request Table)

Step 1: Search entry of RQT with EQT
If((source, destination, source sequence))=((source RID-REQ_ip, destination RID-REQ_ip, source sequence RID-REQ_ip)).

Step2: If the entry is exists in EQT
That node must store in the broadcasting node filled in the table.

Step3: Other wise create the RQTE and store the RID-REQ in the new entry and increase the expiration time by 15ms

Procedure for neighbor selection

Step1: Select two nodes for calculation, which have x-coordinates value and y-coordinate values(x1&x2,y1&y2)

Step 2: Calculating the distance between each other using the following equation

Sqrt (pow(($x2-$x1)+pow(($y2-$y1),2)))]
If{$d<=250},if {$nd2!=$nd1!}

Step3: From the table minimum distanced node is considered as the neighbor for communication.

Procedure of RID for Route Acknowledgment

The route acknowledgment is produced from the receiver after getting the node id. It is used for checking the choosed path is correct or not

Step 1: Check if the REQ is coming from the neighbor node and it has the HD- ID

Step 2: Accept the REQ and send the node ACK through the same node.

Step 3: The process is continued until the node having the sender ID.

IV. RESULTS & DISCUSSIONS

The result analysis can be done in the form of four important factors in order to increase the network performance are (1) Energy Consumption (2) Throughput (3) Packet Delivery Ratio (4) Packet Drop.

A. Energy Consumption

The energy consumption should be low for better communication. In COCO the final energy obtained after 20ms is 95J .So the energy consumption is seems to be 8%. The energy consumption is calculated using the formla

Energy Consumption= Initial energy-Final energy

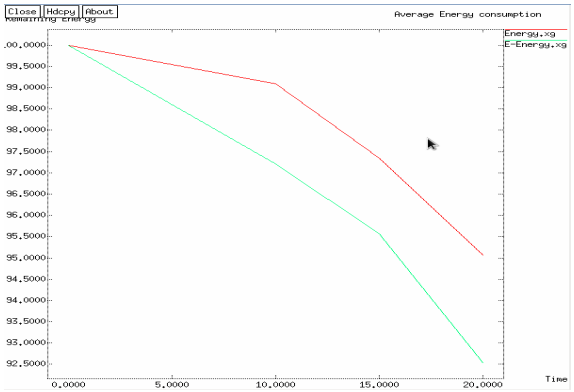


Figure 6 Energy Consumption Graph

While using the proposed scheme(RID) the energy consumption is reduced to 5%. This can be seen clearly from fig 6.

B. Throughput

Throughput is gradually an increase from the starting time (0ms) and at 15 ms it gets its maximum value as 75. For COCO it is almost 50% in the overall communication. For the proposed method RID the throughput is increased up to 95%. Fig 7 shows the throughput for the proposed scheme.

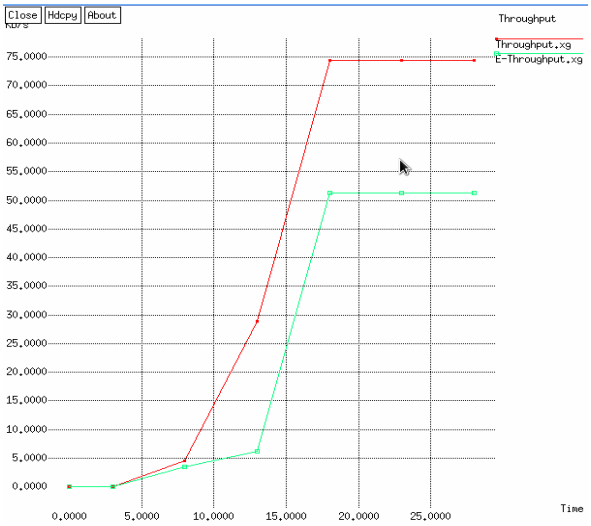
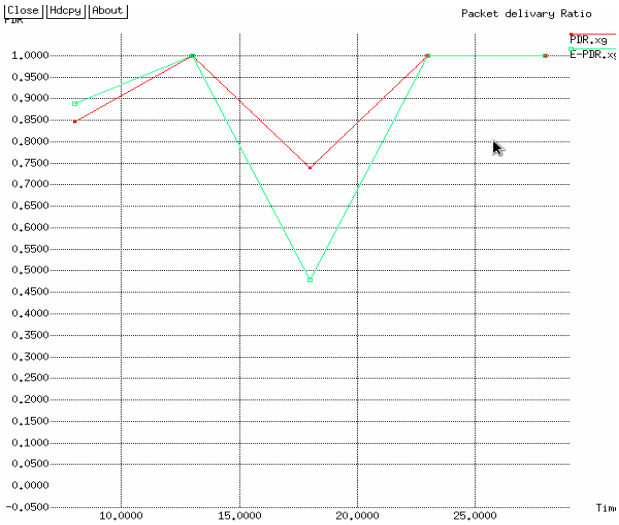


Figure 7 Throughput Graph

C. Packet Delivery Ratio

For increasing the capacity of the communication the packet delivery ratio should be increased.5ms is the set time for the communication. In the previous method the lowest packet delivery ratio obtaineed is 0.450 is almost 45%. In

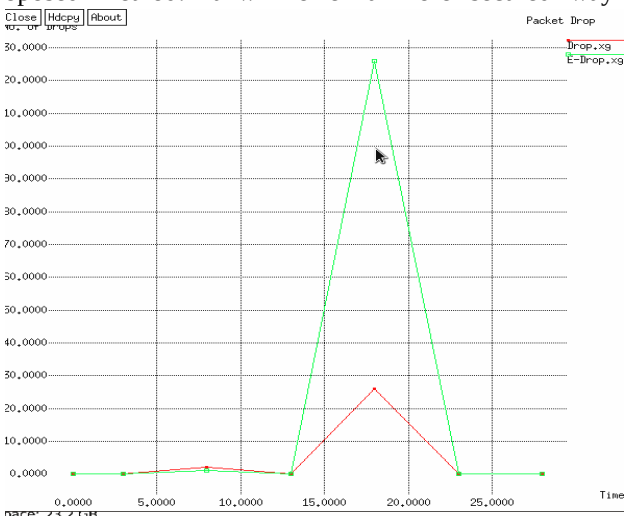


RID it is increased up to 75%. Fig 8 shows the ratio.

Figure 8 Packet Delivery Ratio Graph

D. Packet Drop

Packet drop should be very less for a secuire communication. Using the COCO topology control scheme in between 15-25ms ,there is ahighest value of packetloss with a peak value of 130. But in case of RID the drop is reduced toa peak of 25. Almost 80% of packet drop reduction is acchived using theproposed scheme. Fig 9 shows the drop ration of the proposed method. It will offer a more secured way of



communication in MANET.

Figure 9 Packet Drop Graph

V. CONCLUSION

The performance characteristics show that the radio interference detection technique in the cooperative communication will reduce the interferences during communication. It is getting analyzed mainly using HD-ND detection sequence. Topology control is originally developed for wireless sensor networks (WSNs), MANETs, and wireless mesh networks to reduce energy consumption and interference. Power control and channel control issues are coupled in MANETs to get high performance. The goal of topology control in cooperative communication is to get an interference-free communication to minimize the energy conception for the maximum throughput.

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