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Deafness Removal for Directional MAC in Ad-hoc Network

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Abstract - This paper refers the problem of deafness that arise while MAC protocols are intended by using directional antennas. In brief, problem of Deafness is caused while two nodes are active in current communication and a different node (Deaf Node) requests to converse with one of these active nodes. But it gets no reply because transmission of two nodes is in process. This term paper proposes DRDMAC (Deafness Removal for Directional MAC) to defeat the problem of deafness. In DRDMAC, NCTS (Negative CTS) packets are transmitted by the transmitter node and the node receiver subsequent to the booming the exchange of RTS (Request To Send) frames and CTS (Clear To Send) frames are directionally to advise the current statement to prospective source node that may experience problem of deafness. We estimate our protocol during a broad simulation study with different values of parameters such as the number of flow and number of RTS packet retransmission. The experimental outcome shows to facilitate DRDMAC outperforms offered directional MAC protocols, such as D-MAC and Traditional IEEE Protocols.

Keywords - *Ad Hoc Network, Medium Access Control, Directional Antenna.*

1. Introduction

A wireless ad hoc network is a network where nodes can converse with every one without the aid of fixed infrastructure or central administration [1]. Communication is directly between nodes or through transitional nodes acting as routers. It can be set up easily and quickly with low cost. In earlier works on ad-hoc wireless networks [2], omnidirectional antennas that radiate or receive power equally well in all directions are usually used. Traditional MAC protocols using omnidirectional antennas such as IEEE 802.11 DCF (Distributed Coordination Function) [3] cannot accomplish the greatest throughput for ad-ho wireless networks because they dissipate a huge part of the capacity network as discussed in [3]. Directional antenna has huge prospective to compact with this problem and to develop the performance of network, such as collection expansion and the greater spatial reuse. Therefore, numerous MAC protocols using a directional antennas for wireless ad hoc networks have been planned recently. This paper proposes DRDMAC (Deafness Removal for Directional MAC) to grip the issue of deafness problem of Deafness in directional MAC protocols. Problem of Deafness occurs when the source node is not able to converse to its intentional receiver node, for the reason that the receiver‘s node is leaning to a different node [15]. In DRDMAC, NCTS (Negative Clear to Send) packets are transmitted by the transmitter node and the receiver, when they receive RTS request from potential transmitter after the doing well replace of RTS and CTS packets directionally to report the enduring statement to possible source node that may experience problem of deafness. NCTS Packets are transmitted only in that direction where potential transmitter nodes are located to reduce the control overhead.

We estimate our protocol during the broad imitation revise with different values of parameters such as the throughput of networks and number of RTS Packets retransmission . The investigational outcome demonstrate that DRDMAC outperforms existing from DMAC (directional MAC) protocols and Traditional IEEE Protocols in terms of throughput, RTS retransmission failure ratio in the mainstream of scenarios investigated.

2. Related Work

Even though omnidirectional RTS/CTS [4, 5] are one simple solution to avoid deafness by notifying the on-going communication to all neighbors, this reduces the profit of spatial reuse and range extension. Recently, various MAC protocols using directional antennas, usually referred to as the directional MAC protocols, have been developed for Ad-hoc wireless networks. In [6], Choudhury et al. suggest Directional MAC (DMAC_ in

which all packets are transmitted and established directionally, and physical and virtual carrier sensing functions are also performed directionally. In this paper, we submit to this protocol as directional MAC with DPCS (Directional Physical Carrier Sensing). Directional virtual carrier sensing is realized by a directional version of NAV which is called DNAV. The issues of directional MAC protocols including deafness are discussed in paper but no solution is provided.

To solve the problem of deafness, numerous additional directional MAC Protocols utilize extra manage packets to report neighbor nodes about ongoing communication. In Circular RTS MAC [7], multiple directional RTS packets are transmitted successively in a spherical way to report the enduring statement to neighbor nodes. While it prevents the problem of deafness in the locality of the correspondent node, but problem of deafness in the locality of the receiver node may still appear. To handle deafness problem at the recipient face, Circular RTS and CTS MAC (CRCM) [8] uses the circular CTS frames transmitted towards unaware neighbor nodes. Although it can advise the current statement to every one fellow citizen nodes approximately the sender node and the receiver node, the circular transmission of RTS-CTS packets for every transmitted data packet may incur the delay and large control overhead as well as collisions between control frames. In MDA Protocol (MAC protocol for Directional Antennas) [9], multiple RTS and CTS packets are transmitted directionally in DOD procedure, called Diametrically Opposite Directions, during the antenna beams with neighbors following the victorious the replace of RTS and CTS frames directionally to optimize the spherical communication of control packets. conversely, it is unnecessary to report the imminent communication to neighbors, which is not intended to correspond through the transmitter or the receiver. Obviously, there is a essential exchange between deafness avoidance by using control frames and overhead reduction by using the optimized control frame transmission method. This Paper refers this exchange.

In [10] Masanori Takata et al. proposed a DMAC/DA. In DMAC/DA (Directional MAC with Deafness Avoidance), WTS (Wait To Send) packets are transmitted via the source node and the receiver node subsequent to the victorious replace of RTS (Request To Send) and CTS (Clear To Send) packets directionally to report the current statement to potential source node that may understanding deafness. Wang et al. [11] proposed SYNDMAC, which alleviates deafness problem using the timing structure with clock synchronization. The time that deafness lasts is compacted to a little period. though, this scheme requires that nodes are synchronized to identify the timing structure. Choudhury and Vaidya [12] proposed a Tone DMAC, a tone based directional MAC mechanism to hold the problem of deafness reactively. They first proposed the omnidirectional physical carrier sensing during back off periods. In this paper, we submit to this variant of the directional MAC (DMAC) as DMAC with OPCS (Omnidirectional Physical Carrier Sensing). DMAC with OPCS is easy but it prevents problem of deafness only all through backoff periods. They then suggest the tone based response mechanism, called ToneDMAC, to differentiate problem of deafness from collision. However, ToneDMAC desires a devoted manage control to convey tones as well as data channel.

3. Antenna Model

We have implemented a total and supple directional antenna section (switch beam antenna) at the Network Simulation (NS – version 2.34) [13] and guess that every node in the network is prepared with a switched beam antenna which is comprised of M fixed beam pattern Non-overlapping directional beams are numbered from 1 to M, and preliminary at the three o'clock position and running clockwise. The antenna system operates in two separate modes: Omni and Directional. In Omni form, a node receives signals beginning all directions with gain Go. An idle node waits for signals in Omni mode. After a indication is sensed in Omni form, the antenna detects the direction on which the sign power is highest and goes into the Directional mode. In Directional form, a node can point its beam towards a specific direction with gain Gd > Go.

4. Deafness Problem

Directional antennas can offer us with a much greater spatial reuse as we can allocate numerous transmissions approved away at the similar instance, which is not promising when we use omnidirectional antennas. In the scenario 1 shown in Fig. 2, by using directional antennas we can permit the communication between node A and node B, and the communication between node C and node D at the similar time. However, while we exercise the directional antennas, deafness is a severe problem [1] [14]. This happens while a node sends a RTS packets to its recipient node but gets no reply because receiver is busy in other communication. Then the senders will twice its contention window and then back off. If the proposed recipient node is transmitting or getting a lengthy data, the sender node will not succeed to get CTS packet for a lot of period. consequently subsequent to the receiver node finishes its communication and becomes at rest, the sender node will have a huge conflict gap and may possibly have selected a very lengthy back off phase. after that the control will be at rest for a lengthy moment. inferior is that, the receiver node may want to initialize a novel

communication with further nodes. It will prefer a backoff gap according to a a lot lesser contention window than that of the sender node. since a outcome, the receiver node will be capable to create a further transmission before the sender sends out its RTS. Thus, the sender node will keep deaf for a extremely lengthy time. It may still fall the package subsequent to it beat the greatest numeral of ineffective attempts. Scenario 2 in Fig. 1 shows the problem of deafness.In this case, there is a transmission between node A and node B. During this transmission, A will not be capable to receive the RTS from C because it is beam forming in a diverse trend. So C will not get any response from A. Similar to that, D will not get any response from B if it sends a RTS to B. Thus, both C and D suffer from the problem of deafness.

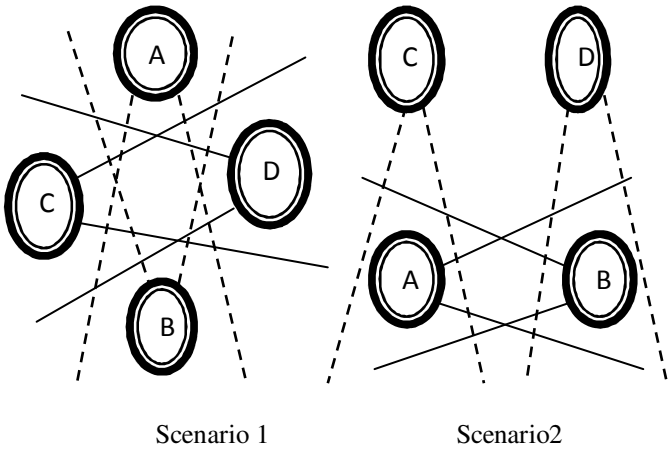

Fig. 1: Two scenarios when directional antennas are used.

5. DRDMAC

In this segment, we suggest a DRDMAC (Deafness Removal for Directional MAC) protocol to resolve the Problem of deafness . In DRDMAC every node maintains a neighbor table, and NCTS (Negative CTS) Packets are transmitted via the sender node or recipient node subsequent to the doing well replace of RTS and CTS frames directionally to report the continuing statement to possible source node. NCTS Packets are transmitted only when sender or receiver receives RTS frame from their potential transmitter. The details of DRDMAC Protocol are presented next. 5.1 method of Communicating Nodes To explain the procedure of DRDMAC, We use Fig. 3. while node A has a package toward sent in the direction of B node , initially, it will complete physical carrier sensing in Omni mode through backoff period like related to a DMAC with OPCS [12]. If the channel remnants at rest through backoff period than A node switches to the Directional mode and sends RTS towards and node B and stays for the CTS frame (Fig.3). If B node is too at rest then it switches to the directional mode and sends the CTS frame in the way of A. subsequent to the packages RTS-CTS handshake is effectively accomplished. Than both node will calculate the time duration for which they will be busy, once this time period has been calculated, A node sends the DATA packet to receiver node and stay for the ACK package from B node. if DATA has been lost and node A does not receive ACK in predefined time than A node resend the DATA frame. After B node receives the DATA package effectively than it sends the ACK packet to A node. Both node A and node B exchange reverse to the Omni mode subsequent to the Data or ACK package exchange.

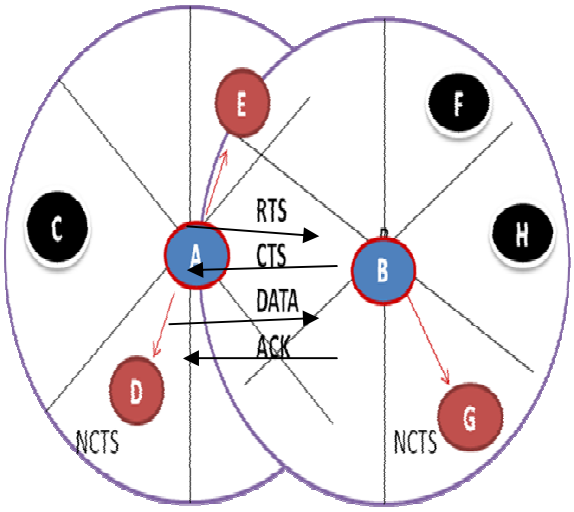

Fig.2: DRDMAC

During this data transmission between node A and node B any other neighbor node (potential sender) sends RTS to these node than an message DRDMAC (Deafness Removal Directional MAC)is generated by A and B. this message contain the time period for which intended receiver (A and B) is busy. This message means that potential node has to stay for a particular time period (which is given in NCTS Packet).

After that time period intended receiver will be free (idle), and it will send RTP (Ready to Proceed) frame to its potential sender. Potential node can sends DATA frame after receiving RTP frame from its proposed recipient node; they do not need to resend the RTS. First Potential node, which sends RTS to its proposed recipient node, will get first priority to connect with it. Node, who sends second RTS to same receiver, will get second priority and so on. Waiting time for next potential node (as in Neighbor Table) get double as compare to previous potential node. As in fig.3 node D and E are to potential

sender of A. node D will get first priority because it sends the RTS to its proposed recipient node A first, and node E will get second priority. Node D and E will get NCTS from node A. and node G is a potential sender of node B so it will get WTP from B.

5.1 Procedure of Neighboring Nodes

When the neighbor nodes receive the NCTS, these nodes set the sender of the NCTS as a deaf node in its own neighbor table and postpone their hold transmissions addressed to it for the moment stage to evade the problem of deafness awaiting the whole data conduction completes.

This can prevent packet drops due to unproductive retransmissions which are caused by the problem of deafness . When neighbor node receives the NCTS, than it simply wait for that time period. And as that time period completes, proposed recipient node suit free than it sends the RTP frame to its potential sender. If potential sender does not receive RTP frame after time period completion than it may resend RTS or cancel its transmission by sending TC (Transmission Message) message to its proposed recipient node. Potential also cancel its transmission if its waiting time period is too long.

6. Simulation Results

To evaluate the piece of our proposed protocol comparison with D-MAC and IEEE 802.11 on the basis of throughput. we consider the number of transmission packets and amount of nodes in below graph chart.

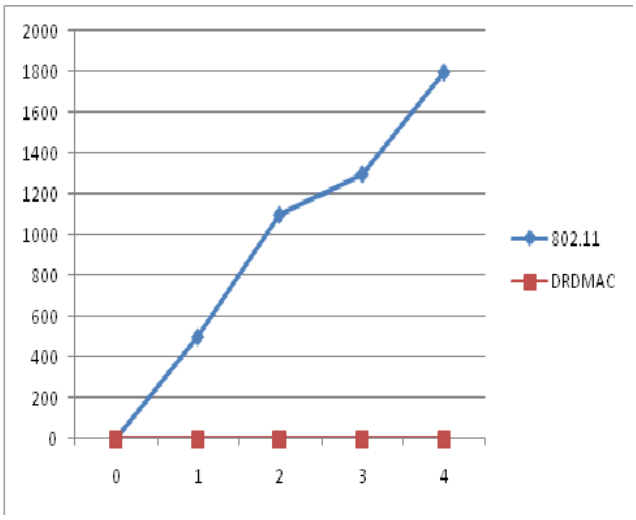

Fig. 3 A Comparison of the Number of RTS Retransmissions

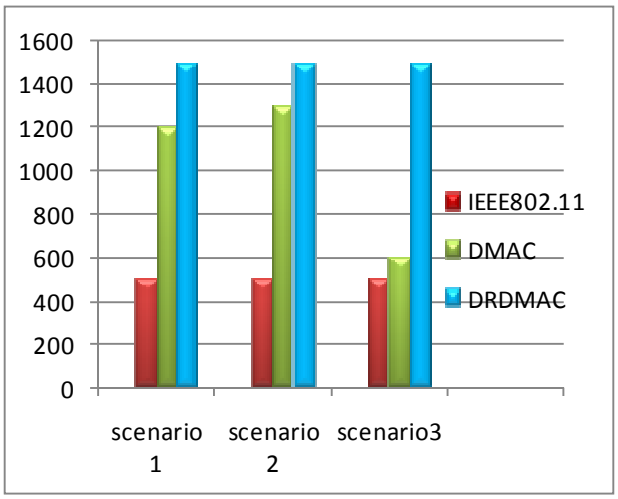

Fig.4 Throughput in kbps comparison of DRDMAC with 802.11 and DMAC protocols.

The performance of Our scheme also eliminates unnecessary RTS re-transmissions comparison to D-MAC and Traditional IEEE 802.11. In the first scenario, we assume that only connection 1 between nodes 0 and node 1 when node 0 sends an RTS to node 1, node 1 responds with a CTS and data transmission begins. Thus there are no RTS re-transmissions.

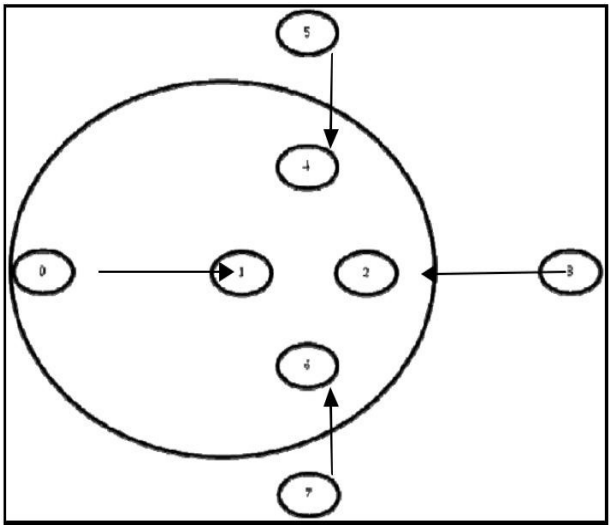

Fig. 5 A topology with four different connections between node 0 and node 1

7. Conclusion

This paper has focused on problem of deafness that may concern the show of the MAC protocols for wireless ad hoc network using the directional antennas, and proposed DRDMAC to hold the problem of deafness problem. In

DRDMAC, the NCTS Packets are transmitted by the source node or the receiver node (only when they receives RTS frame from any potential transmitter), subsequent to the doing well replace of the directional RTS and CTS frames to report the continuing statement to prospective transmitters node that may experience deafness problem. The experimental result shows that New DRDMAC protocol improves overall the concert of network capacity and provides effectively handling of the network traffic. It should be noted that wireless Ad hoc wireless is a dynamically changing scenario therefore the final performance depends on network topologies, and flow patterns in the network.

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