AN ANTENNA SELECTION FOR MANET NODES AND CLUSTER HEAD GATEWAY IN INTEGRATED MOBILE ADHOC NETWORK

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ABSTRACT

As we know in Mobile Ad hoc network our Nodes are highly mobile. They move around the Network. Due to this network topology and number of neighboring nodes in each node frequently change. Movement of nodes from one to another network also affect to the communication between them. As we know if nodes are within the range of each other they will work properly. But any of one node is not in the range of other node communication will Break. As the number of nodes increases interference and complexity of MANET increases in various issues. For this reason various approaches has been produced to reduce the complexity such as cluster head technique and dominating set based gateway technique introduced. We remove the limitation from the above mentioned approaches using Cluster Head Gateway node (CHG) [1]. In this paper we introduces the selection of Antenna in such a way that if CHG nodes want to send the data to other (CHG or Cluster Nodes) then how the communication will takes place with minimum interference and High QoS. By selecting the appropriate antenna we will reduce the interference and overhead [2], try to re-establish the break link between nodes and increase the performance, throughput and QoS for an ad hoc network and also prevent packet drops during Nodes mobility when data transaction going on between nodes. Finally, this paper conducts simulation experiments in the conditions where we will do the comparative study between Omni-Directional and Directional Antenna.

Keywords: *MANET, QoS, Omni Directional Antenna, Directional Antenna, Bit Error per Packet, Throughput, SNR.*

1. INTRODUCTION

Ad hoc mobile network is composed of mobile terminals that communicate with each other through broadcast radio transmissions within the transmission power range using antenna. The routing schemes for Ad hoc networks usually employ single-path routing [3], However, due to radio range & interference limitations, we may require a multi-hop scenario, where packets are relayed by intermediate terminals contains directional antenna, to the destinations. Applications of mobile ad hoc networks use in military field communications, where the networks must be deployed immediately without the support of base stations and fixed network infrastructures, to inter-vehicle communications, designed for both traffic safety enhancement and entertainment purposes. In ad hoc networks every node is self-organized and can communicate directly with all other nodes. This infrastructure-less communication fulfills the desire of users, but we are still lag behind to use the full advantage of wireless communication, think about the area where war is going on and a natural disasters area, a defense application, where there is no infrastructure, to serve the such kind of application mobile ad hoc network based communication is introduced, Ad hoc networks are key to the evolution of wireless networks [4]. Ad hoc networks are typically composed of equal nodes that communicate over wireless links without any central control. Although military tactical communication is still considered the primary application for ad hoc networks, commercial interest in this type of networks continues to grow [5, 6]. Ad hoc wireless networks inherit the traditional problem of wireless and mobile communication; we have some various challenges like Battery Back up, Node Mobility, Bandwidth constraint, Routing Protocols, Security problems and transmission quality enhancement. A mobile Transaction is structured as a Distributed transaction. In which the transaction is completed by the help of mobile nodes, providing different services. The mobile environment produces the significant challenges to transaction processing. The wireless network provides limited bandwidth so network bandwidth is a scarce resource. Battery power drains with data transmission and transaction processing. Due to the Dynamic mobility of CHG nodes it affect to the communication link which should be maintain properly during mobility. Here we are trying to prevent data interference during CHG and MANET nodes mobility. For this we are focusing over Directional Antenna. The Directional Antenna transmits the data in a particular direction to specific node and minimizes the interference between nodes while Omni-directional antenna radiates data in all the direction with equal amount. The chance of data interference in Omni-directional antenna is more than directional antenna.

An Antenna Selection for MANET Nodes and Cluster Head Gateway in Integrated Mobile Adhoc Network is newest and latest work in this direction which can be helpful for Mobile Ad hoc Network.

The rest of the paper is organized as follows: Section II presents the related work. Section III describes our proposed working model. Section IV presents the simulation experiment setup and gives the performance evaluation of our proposed strategy. Section V concludes the paper.

2. RELATED WORK

The existing approaches proposed a priority based communication scheme, which essentially selects shortest path for a high priority flow and reserves a zone known as high priority zone, along this path. Other low priority flows are forced to avoid this zone and take a longer diverse route to forward their messages to allow a contention-free communication to high priority flows. In this context, the use of directional antenna, having smaller transmission beam-width and larger transmission range compared to Omni-directional antenna [7] [8], helps to easily decouple interfering routes, and improves the overall utilization of the wireless medium through Space Division Multiple Access (SDMA) [7].

3. PROPOSED WORKING MODEL

Previously, As we know the cluster Network approaches are mainly based on cluster head and cluster gateway where all MANET nodes including Cluster Head & Gateway contains Omni-Directional antenna through which data will send and receive, But in our case we considering one common node which is combination of cluster head and cluster gateway i.e. Cluster head gateway (CHG) [1] with Directional antenna.

As in given figure 1, if any Cluster node want to communicate with other node (either CH at different network or Cluster node within network). Firstly the request will send to its cluster head from the cluster node using Omni-directional antenna then it pass to cluster gateway in order to find the path. once the gateway node find the path it forward the request to other networks cluster head and that cluster head further pass this request to particular node present at that network. Once the request Received by particular node. Both nodes can communicate to each other.

But as we can see in Figure 1 between source node and destination node there are some neighbor nodes which can create Interference because using Omni-directional antenna these neighbor nodes can also transmit data in all the direction i.e. data communication over one path will interfere with data communication in other path, and creates Bit error and packet drops. To overcome this limitation we using CHG with directional antenna in figure 2.

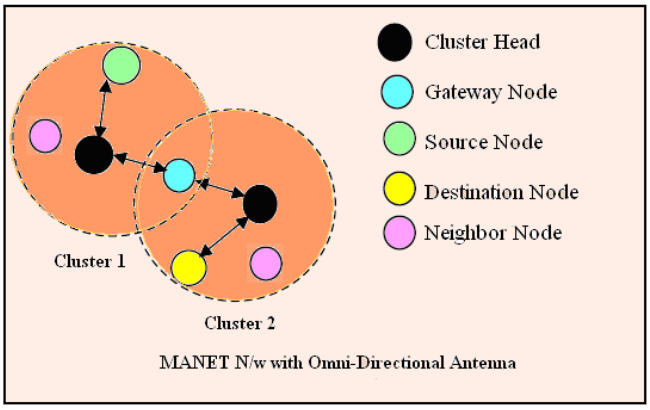

Figure 1. Showing the Previous approach having Cluster Head, Cluster Gateway and Cluster Nodes with Omni-Directional antenna.

Now, In our approach instead of using two different nodes (Cluster Head and Gateway) with Omni-directional antenna. We have single node (CHG) with Directional antenna. Using this we can decrease the Interference, no. of nodes, Average Transmission Delay and overheads. As we can see in figure 2.

In figure 2 if cluster head gateway node (CHG) wants to send the data to another CHG exist in different network, it will send data to particular CHG at specific direction only, using directional antenna.

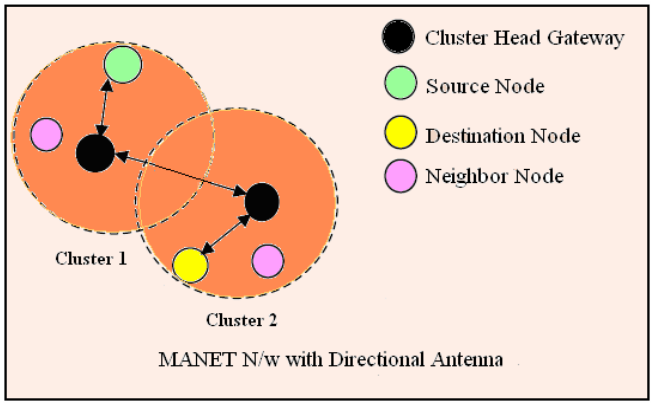

Figure 2. Showing the Current approach having Cluster Head Gateway (CHG) and Cluster Nodes with Directional antenna.

So after analyzed figure 2 we can say Data Interference (Data Quality) is one of the major challenges in MANET. It is also one of the reasons for data loss. In Ad hoc we can minimize this using Directional Antenna because using directional antenna all MANET Nodes including CHG (Cluster Head Gateway) will transmit data in a particular destination direction due to this occurrence of interference and packet drops are very less.

4. SIMULATION SETUP AND RESULTS DISCUSSION

4.1. Simulation Setup

To simulate our Cluster Head Gateway Network, we used Opnet 14.0 v. The simulation parameters and their values are given in Table 1.

TABLE I. SIMULATION PARAMETERS

PARAMETER	VALUE
Number of MANET Nodes	12
Number of Moving Nodes	2
Number of Simultaneous communication	10
Size of Area	8000*4000 (m.)
Transmission Range	250 (m.)
Traffic Type	Constant Bit Rate (CBR)
Standard Ad hoc Speed	20 m/s
Datagram forwarding rate	100,0 (packets/sec)
Simulation Time	1800 (sec)
Wireless Channel Bandwidth	10 (KHz)
Node Movement Model	Reference Point Group Mobility (RPGM)
Data rate	1.024 (kbps)
Transmission Power	146 (db)
Maxi. Receive Life time	1800 (sec)

4.2. Result Discussion

The Performance of the proposed comparative study of Omni and Directional antenna is analyzed with respect to Bit Error per Packet, Throughput, SNR Ratio, Traffic Received and Packet loss ratio.

Figure 3 to 7 shows the performance with respect to the bit error per packet, throughput, signal to noise ratio, traffic received and packet loss ratio respectively. The performance is first evaluated between Omni and Directional antenna. Figure 3 showing Bit Error per Packet Vs time Duration graph. In this graph for Directional antenna, up to 2.5 min. the bit error rate is increasing with respect to time period which is around 50, At 5 min. time period bit error is 340

maximum but after 6 min. it is showing zero value up to 30 min. time period. In Omni-directional antenna for the same time period bit error per packet is varying between 340 and 350.
Means Directional antenna has lesser bit error rate than Omni-directional antenna i.e. Directional antenna has less data loss.

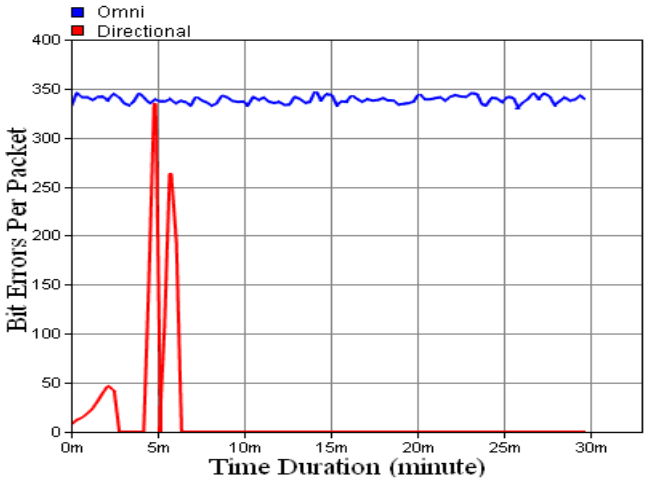

Figure 3. Radio Receiver Bit Error Per Packet Vs Time Duration

Figure 4 showing the Throughput of the whole network with respect to time Duration graph. For Directional antenna when time period below and equal to 2.5 min. throughput is varying between 0 and 1(packets/sec), After 2.5 min. throughput is constantly varying across 1 till 30 min. time period. But For the same time period for Omni-directional antenna value of throughput is 0 (packets/sec) due to the interference with other neighbor nodes.
Directional antenna is having better throughput because it radiates data in a particular direction to avoid interference.

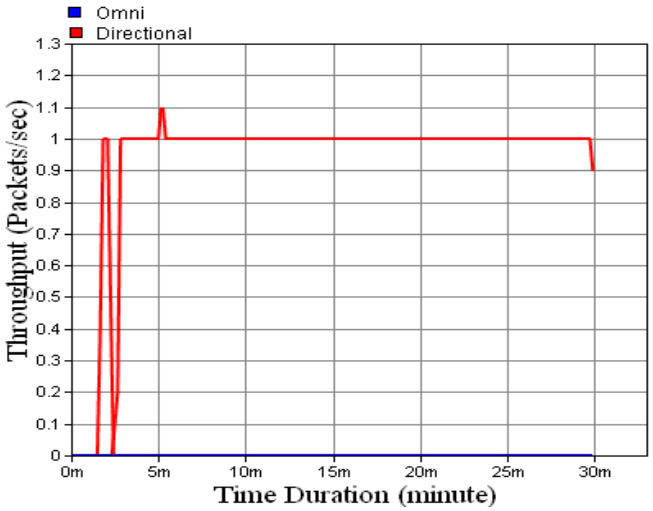

Figure 4. Throughput Vs Time Duration

Figure 5 shows the Signal to Noise Ratio (SNR). For Directional antenna when time period below 2.5 min. SNR is decreasing with time, at 2.5 min. SNR is 16 (db). While time period is 3 min. to 6 min. SNR value is varying between 194 and 9.5 (db). After 6 min. time period SNR value is constantly moving across 195.3 (db) till 30 min. time period. In Omni-directional antenna for the same time period SNR Ratio is varying between -20 and -30.
So, we can say directional antenna is providing better SNR values. Means transmitting more useful data signal as compare to noise.

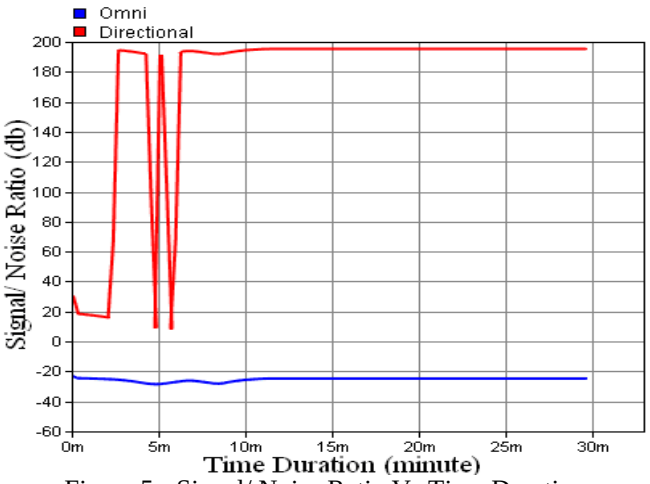

Figure 5. Signal/ Noise Ratio Vs Time Duration

Figure 6 shows Traffic Received Vs time Duration graph. Here for Directional antenna Traffic Received value is increasing with respect to time duration, and varying between 25,000 and 30,000 (bites) but for Omni-directional antenna for the same time period Traffic Received value is decreasing with respect to time period between 20,000 and 5,000 (bits).

Using Figure 6 we can analyze the Traffic Received between Directional and Omni-Directional antenna and calculate the data loss (packet drops).

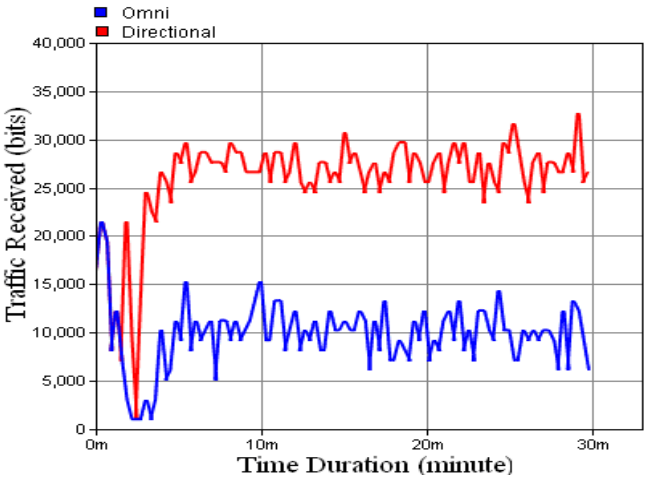

Figure 6. Traffic Received Vs Time Duration

Figure 7 shows Packet loss Ratio Vs time Duration graph. Here for Directional antenna Packet loss ratio is varying between 1 and 0, below and at 6 min. time period. After 6 min. time period packet loss ratio value is zero up to 30 min. time period. While for Omni-directional antenna Packet loss ratio is constantly varying across 1 up to 30 min. time period.

After analyzing the packet loss ratio between directional and Omni antenna we can say directional antenna have less data loss (packet drops) as compare to Omni.

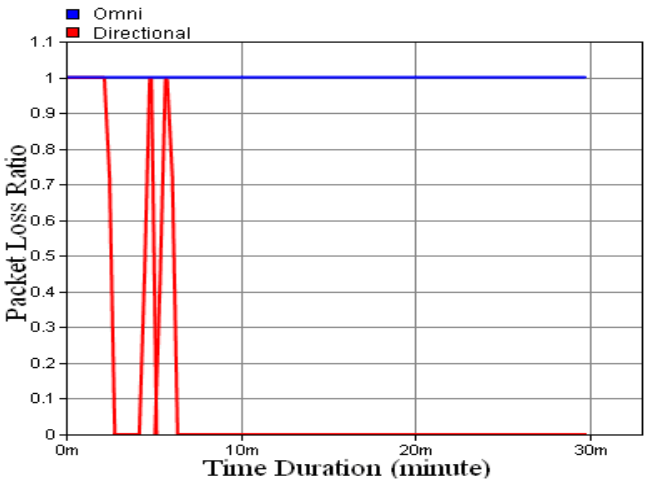

Figure 7. Packet Loss Ratio Vs Time Duration

5. OVERALL CONCLUSIONS

In this paper, we proposed An Antenna Selection for MANET Nodes and Cluster Head Gateway in Integrated Mobile Adhoc Network. We provide minimum interference with high data quality for MANETs by using a Directional Antenna. One of the notable features of this integration strategy is that, Using Directional antenna it reduce the data loss which can be responsible for low QoS at the time of communication between mobile nodes, we are expecting that the proposed strategy will provide better connectivity, Bit Error Rate and better packet delivery with minimum packet loss as compare to Omni-directional antenna. A detailed performance was made with respect to Bit Error per packet, Throughput, SNR Ratio, Traffic Received and Packet loss Ratio. The simulation results confirm that, the purposed approach has better connectivity with less data loss and Interference, good throughput and less Bit Error Rate. In future this approach can be evaluated under different mobility scenarios and the performance can be measured with other large N/w's. Therefore it can be used to extend the network coverage.

6. ACKNOWLEDGEMENTS

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