Simulation Analysis of Wireless Mobile Ad Hoc Network Using Steerable and Omni Directional Antenna with Varying Transmission Power

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***Abstract*--** MANET is a mobile ad hoc network within which nodes are move freely and perform the communication. In mobile ad hoc network, antenna (steerable and Omni) plays a significant role. antenna (steerable and Omni) has several benefits like accrued transmission vary, higher gain and reduced interference. This antenna uses a collection of components that has fixed beam nature and radiate the frequency altogether directions and additionally at a particular angle. The present paper performance of the wireless ad hoc network has been analyzed using Steerable and Omni Directional Antenna with Varying Transmission Power in terms of throughput, average end to end delay and average jitter of ad hoc demand distance vector routing protocol.

Keywords-- MANET, AODV, RWP, Directional antenna (steerable and omni)

I. Introduction

Directional antenna [8] will radiate the frequency in all directions and additionally give the great area of coverage and reduction in power consumption. With these options antenna has been utilized in mobile ad hoc network. Manet could be a network while not infrastructure. Mobile ad hoc network features a new structure within the field of communication network. they are doing not need any fixed infrastructure as an example a base station to figure. The nodes amendment addresses topology themselves because of the random mobility model of nodes. These nodes use a radio medium [7] [9]. Within the infrastructure less networks the nodes will freely move inside the vary however in an infrastructure mode all the nodes are stationary. Because of the mobility of nodes and increasing range of nodes/users, the transformation of data can consume most of the information measure. To transmit the information [7] from one node to a different node we have a tendency to use differing kinds of protocols like reactive, proactive and hybrid.

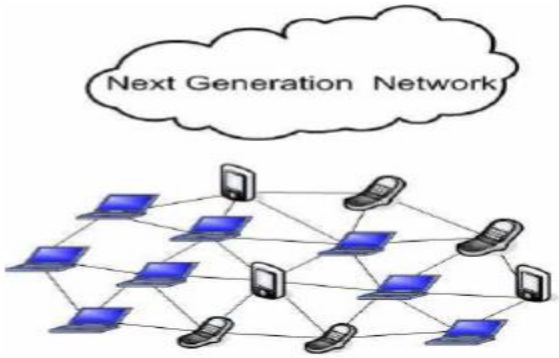

Figure 1 Mobile Ad hoc networking (MANET)

II. Ad Hoc Demand Distance Vector Routing Protocol

AODV protocol is specially used for mobile ad hoc networks and provides a fast adaptation to dynamic link condition, link fault, low process and memory usage transparency [13]. AODV permit mobile nodes to find route quickly for new destinations, and does not need nodes to keep up routes to destinations that are not in active communication. It supports each IPv4 and IPv6. Once a node i.e. supply node is

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prepared for communication and does not have a legitimate route to the destination then it performs two operations principally, path finding and path preservation [5].

2.1 Route discovery*:* As the name suggest, to transmit the data a new route be exposed. Toward inquire with reference to out a fresh path, AODV concern via distribution the route request (RREQ) packet. If the neighboring nodes that receives the RREQ has no route information relating to the destination, it will still broadcast RREQ packet within the network. Once the destination is found, it will send a solution key by the route reply (RREP) packet to the sender from that RREQ is received. once the RREP is received at the foundation node, the route be recognized. RREQ contain source header information, source sequence range, broadcast id, destination address, destination sequence range and hop count [5].

2.2 Route maintenance: It is consecutive step that is followed by the AODV protocol once route discovery. During this step, it finds the error that comes during transmission like if the two nodes that were listed as neighbor on the route
moved out of the vary of every different and link is broken [5] then source node is informed with a ROUTE ERROR packet then once more route discovery mechanism is employed to seek out a route.

III. Random way point mobility model

Mobility models are used for the simulation of network i.e. for the analysis of network protocols. During this paper report we have used random waypoint mobility model to examine the performance analysis of the routing protocols in Mobile ad hoc network. This model is incredibly widespread and additionally simple to implement and additionally referred to as the "benchmark" mobility model employed in MANETs.
In this mobility model all the mobile nodes randomly move with none restriction. The two flavors of this model are.

- Random Walk Model
- Random Direction Model

IV. ANTENNA

4.1 Omni directional antenna

An Omni directional antenna is used to avoid the co-channel interference. It is a device that radiates/receives the electromagnetic energy altogether directions. Direction antenna is additionally referred to as smart antenna that consists of range of radiating elements in addition as management unit that is implemented by the digital signal processor. Once a network is closely filled with a large range of nodes then the transmission vary of every node is folded with others. As a result of this collapsing of varies, nodes face the co-channel interference during transmission. The quantity of packet drops will increase and thus the network performance decreases. Routing algorithms of Omni directional antennas and fixed transmission power have an upper bound to the number of intermediate hops between a combine of supply and destination. To overcome this downside the Omni transmitting aerial focus the beam at slender angles and radiate the Energy all told direction [8] [7].

4.2 Steerable antenna

Steerable antenna is additionally a kind of directional antenna that is used to reduce the interference. In an exceedingly network, once the source nodes cannot focus to a selected angle of the receiver node, a steerable antenna has capability to try and do this. Steerable antenna consists of every type of antenna elements in such a way that the beam is directed towards the receiver node at a selected angle. The antenna elements are placed in such the way that main lobe, side lobe and tail lobe do not create interference and thus interference is reduced [8] [7].

V. Simulation Setup

The Qualnet 6.1 simulator is used for the analysis process, Qualnet is a 3d simulator in which the comparative study and analysis is done. The design of the scenario is random in which constant bit rate (CBR) is applied between source and destination. The random waypoint model of the mobility is used in the scenario. The simulation parameter used in the scenario is shown in the Table 1.

Table 1.1 simulation Parameter

Parameter	Value
Simulatior	Qulanet 6.1
Terrain size	1200*1200
Routing protocol	AODV

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No. of nodes	30
Traffic	CBR
Mobility	Random waypoint
Transmission power	15 Dbm, 20Dbm, 25 Dbm, 30 Dbm, 35 Dbm
Antenna height	1.5 m
Simulation time	300s
Mac layer	IEEE 802.11
PHY layer	IEEE 802.11a
Antenna type	Directional (steerable and Omni)

VI. Performance Matrices

Throughput: Throughput is the average rate of all the successful data packets received by the destination from source. This is measured in bits/sec

$$Throughput = Total\ packet\ received / total\ packet\ sent$$

Average End to End Delay: The delay in the average time, reception of data packet at destination forwarded by source is end to end delay. It includes all possible delays caused by buffering during route discovery latency, retransmission delay. This is calculated by the

Formula $D = (TR - TS)$

Average Jitter: Jitter is the variation of the packet arrival time. The packet arrival time is low, for the better performance in ad-hoc networks delay between the different packets should be low.

$$Average\ end\ to\ end\ delay = \Sigma\ (Arrival\ time - sent\ time)) / Total\ no.of\ connections$$

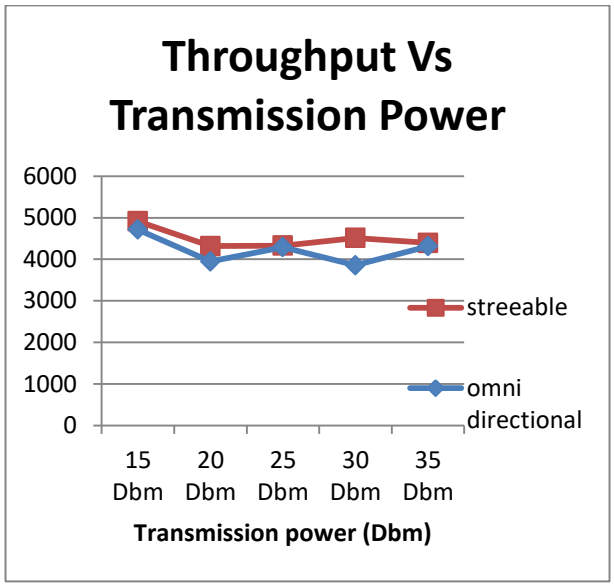

Figure 1.1 Throughputs with Varying Transmission Power

It is evident from the result graph that throughput of overall network of steerable antenna is high then Omni directional antenna for all the transmission power in the Routing protocol AODV. Since in steerable antenna more the transmission power more the reception of data packets at the destination then Omni directional antenna.

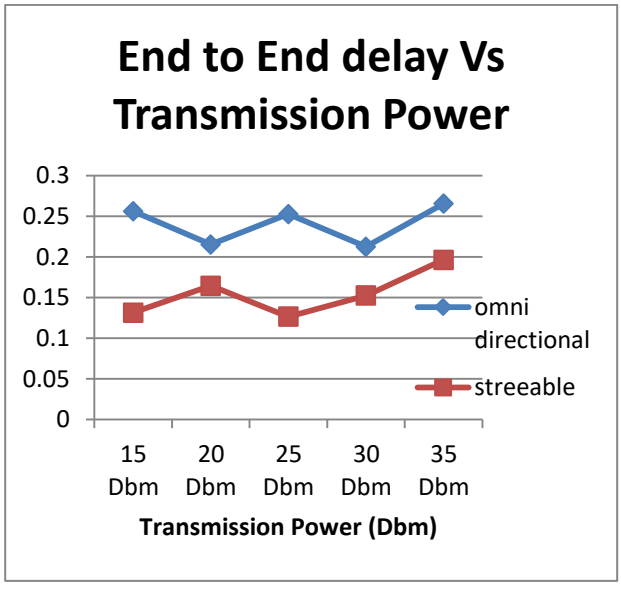

Figure 1.2 End To End Delays with Varying Transmission Power

Delay in the average time when the packets are delivered from source to destination is average end to

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end delay. In the analysis it is observed that Omni directional antenna has high delay and steerable antenna has less delay for all transmission power. Because more the transmission powers less will be the delay in packet delivery.

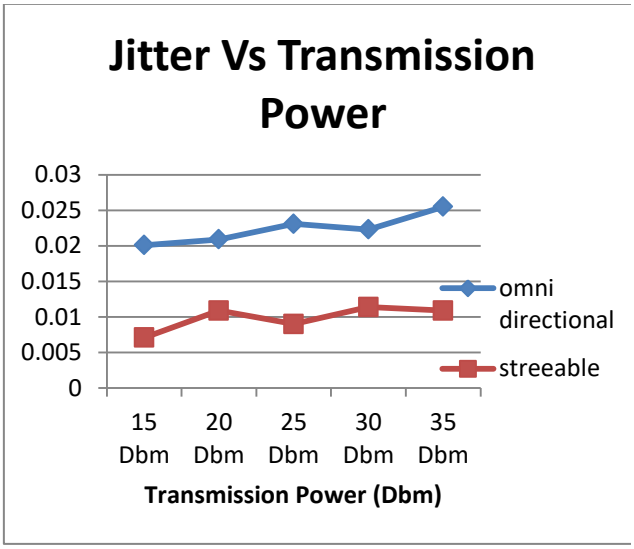

Figure 1.3 Average Jitter with Varying Transmission Power

This is the very important metric for any routing protocol to check the variation of packet arrival time. In this analysis the average jitter is less in steerable antenna as compare to Omni directional antenna due to less time in arrival to packets in given time.

VII. Conclusion

Finally we plotted the graphical representation of comparison between different antenna i.e. Omni directional and steerable antenna using different transmission power. During simulation we analyze different parameters such as Throughput, Average Jitter and End to End Delay. It is observed in the analysis that the transmission power over all networks is better in steerable antenna than that of the transmission power in Omni directional antenna every performance metrics. Gain in the overall network is good when the high transmission power is given to the antenna. As the transmission power increases drop in the data packets and delay in the time of reception of the data packets reduces.

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