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Performance Analysis of Wireless Mobile ad Hoc Network with Varying Transmission Power

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Abstract

Mobile Ad Hoc networks have gained popularity due to continuous communication even in changing topology conditions, which are the prime characteristics of such networks as it does not have fixed infrastructure and any centralization control mechanism. The communication between mobile nodes also uses multihop wireless links without any precondition and preformation. In the network nodes acts as router, forwarding data packets to other nodes. Routing protocols plays an important role to facilitate communication within the network. Routing protocols is a way through which the nodes discover their own routes. In this paper performance of the network has been analyzed for different transmission power in term of the metrics: Throughput, Average end to end delay, Average jitter of AODV routing protocol.

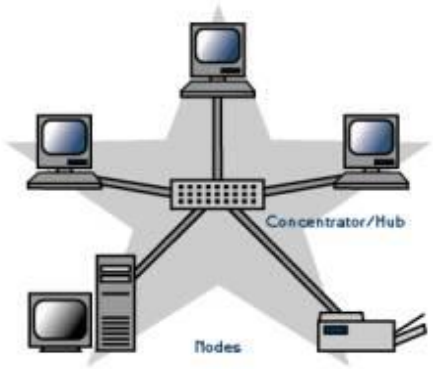
Keywords: *MANET, AODV, RWP (Random way point), Qualnet 6.1*

1. Introduction

Networks classified in two categories

A. Fixed Infrastructure Network

The network consisting of fixed infrastructure containing wired access points in their range of transmission. A wired network is simply a collection of two or more computers, printers, and other devices linked by Ethernet cable.



B. Infrastructure Less Network

This network is also called as MANET. Mobile adhoc networking (MANET) does not rely on the fixed infrastructure for their communication. MANET is self-configuring, data packets are passed through their intermediate nodes while moving from source to destination [1].

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A collection of mobile nodes each having both transmitter and receiver for the communication with the other nodes via wireless links is MANET. Due to the technological development and reduction in the cost price from the past decades wireless networks are preferred more than wired networks. Generally Adhoc Network gives a problem while communicating with the other nodes. Nodes must be in the transmission range of the base station as it moves out of its range then network fails [3]. MANET solved this problem in this process nodes follow the multihop pattern for communicating with the other nodes. Mostly MANET are used in military communication by soldiers, battlefield, rescue operations, earthquakes, floods, fire and in emergency situation like quicker access about patient data records, human induced disasters .

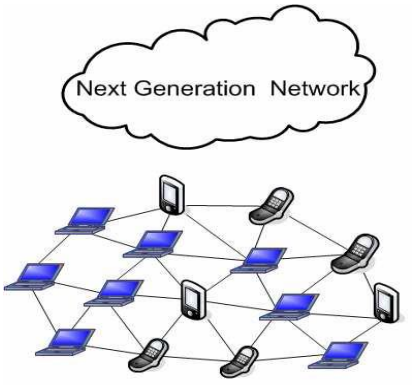

Figure 1. Mobile Adhoc Networking (MANET)

2. Routing Protocol

As MANETs (mobile adhoc networking) is decentralized it changes its network topology frequently so there is big risk of packet loss while transmitting, so routing protocol is used to set up the routes between transmitter and receiver. Routing protocols are classified according to their routing strategy.

A. Proactive Routing Protocol
B. Reactive Routing Protocol

A. Proactive or Table driven Routing Protocol

Proactive protocols, is also called table driven as the routes are predefined. Packets usually transferred to these predefined routes [4]. As the routes are predefined the packets can be forwarded immediately. Each nodes stores the updated information whenever there is change in its network topology.
For *e.g.* Destination sequenced distance vector routing (DSDV)

B. Reactive or On-demand Routing Protocol

Reactive or on-Demand Routing protocols, In this routes are not predefined [4]. In this reactive protocols, Nodes maintain their routes on the on-demand process to send its packets to the destination. Nodes send its packets to all the neighbor or intermediate nodes and this technique is repetitive until packets are reached to its destination. For *e.g.* Adhoc on-Demand Routing protocol (AODV), Dynamic source Routing (DSR)

B.1. Adhoc on-demand Distance Vector Protocol (AODV)

AODV is a pure on-demand route acquisition system [2], as nodes maintain their own routes. AODV is based on distance vector technology [7]. The AODV is the joined

mechanism process of DSDV and DSR *i.e.* Hop-by-hop routing [6], sequence number and periodic beacons from DSDV, and on-demand mechanism of route discovery and route maintenance from DSR [6]. The AODV protocol consists of two phases:

i. Route discovery
ii. Route maintenance

Route Discovery

When a node needs to communicate with another node then, he seeks for the route in the routing table. If the node get suitable routes then communication starts immediately otherwise node initiates route discovery phase [5]. In this route discovery process node send a route request (RREQ) if the node has the route to the destination then it replies to it with (RREP) message and so on process continues. In this process the reply route (RREP) contains the address of the source node ie. The address through which (RREQ) is received. This address is associated with every reply route for the future.

Route Maintenance

Route maintenance is the procedure in which nodes maintain their route while travelling session of data packets, and if the connectivity losses with the next hop of the route, it rebroadcast RREQ [7]. In the route maintenance procedure if the node don not have any route to the destination then it replies to the route request by send route error (RERR). An active node maintains the route record to keep the track of the neighboring nodes which uses entry to route data packets [7].

3. 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. Simulation Parameters

Parameters	Value
Simulator	Qualnet 6.1
Terrain area (m*m)	1500*1500
Routing protocol	AODV
No. of nodes	50
CBR	3 (Bidirectional)
Mobility	Random waypoint
Pause time	10,15,20,25,30
Simulation time	300 sec
Antenna height	1.5m
Transmission power in DBm	10DBm ,13DBm, 16DBm

3.1. Performance Metrices

Some of the important performance metrices can be evaluated

Throughput

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

$$Throughput = \frac{Total\ packet\ received}{total\ packet\ sent}$$

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

$$D = (T_R - T_S)$$

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.

$$Average\ end\ to\ end\ delay = \frac{\sum(Arrival\ time - sent\ time))}{Total\ no.of\ connections}$$

4. Simulation Results

The simulation result have been shown in terms of Throughput, Average end to end delay, Average jitter

Throughput - It is evident from the result graph that throughput of overall network for the transmission power of 16DBm is better than that of transmission power 10DBm and 13DBm in the Routing protocol AODV. Since more the transmission power more the reception of data packets at the destination.

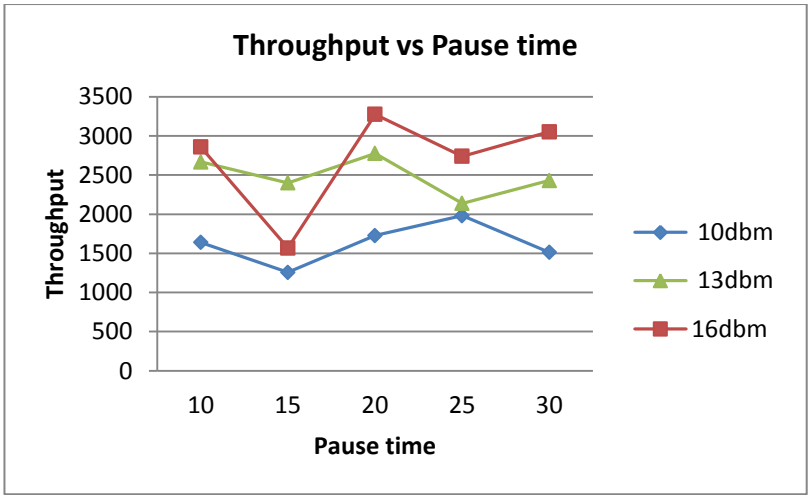

Figure 2. Throughput (Bits/sec) with Different Transmission Powers

Average End to End Delay - Delay in the average time when the packets are delivered from source to destination is average end to end delay. In the analysis it is observed that transmission power of 16dbm has less average end to end delay in comparison to other transmission powers. Because more the transmission power less will be the delay in packets delivery

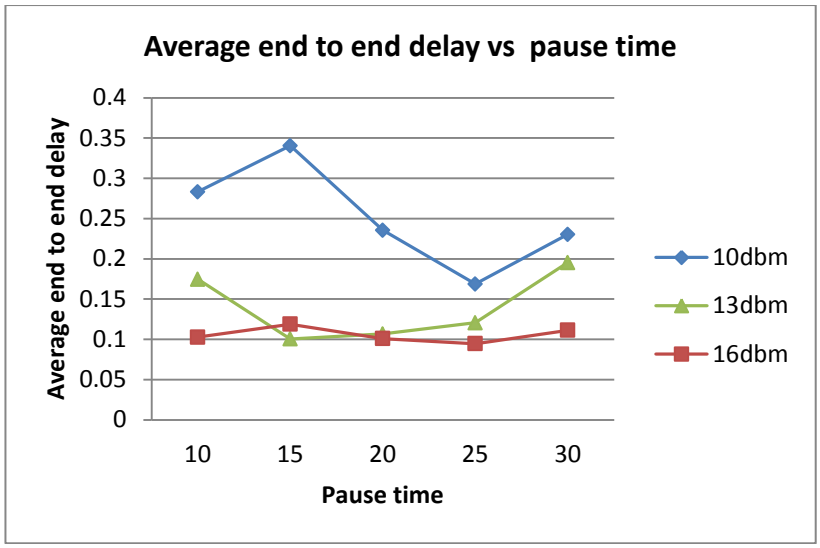

Figure 3. Average End to End Delay with Different Transmission Power

Average Jitter – 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 transmission power 16DBm due to less time in arrival to packets in given time than 10DBm, 13DBm

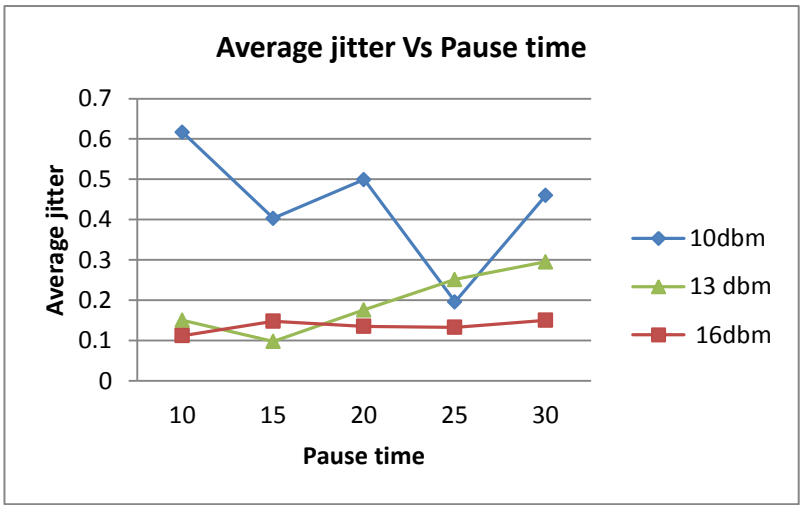

Figure 4. Average Jitter with Different Transmission Powers

5. Conclusion

It is observed in the analysis that the transmission power of 16DBm for over all network is better than that of the transmission power 10DBm and 13DBm in 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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