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ANALYSIS OF EFFECT OF MOBILITY AND TRANSMISSION POWER ON AODV AND DSR IN MOBILE ADHOC NETWORK

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ABSTRACT- In recent years the rapid development in telecommunication technologies leads to a non linear growth in the number of users of mobile electronic gadgets accessible to a communication network. These electronic gadgets are nothing but the nodes of the MANET (Mobile Ad hoc Network) and thus the mobility of the nodes effects a much the performance of the network. A change in mobility can be meant as the change in speed of node during motion in the network or pause time at different points during its motion between a source and destination point in the network. Due to change in mobility link between neighbors nodes can break a number of times as a result of which the performance of a network may be hampered. Also a number of packets may be dropped at different layers of the network. This paper describes a detailed analysis of performance affected due to change in mobility and transmission power. The parameter describing the reason of variation in performance are (1) number of link breaks and (2) number of packet delivered. (3)End to end delay. The simulator we have used in our work for the calculation of performance matrices is GLOMOSIM. The performance comparison has also made considering two types of routing protocols AODV and DSR.

Keywords- MANET, Packet Delivery Fraction, Average end-to-end delay, AODV, DSR.

1. INTRODUCTION

A mobile ad hoc network (MANET) [1] is a communication network formed from the collection of a number of wireless mobile terminals without the use of any fixed infrastructure. Therefore each and every node can be treated as a source, destination or routing node. The nodes of such a network are allowed to move freely in random fashion, the network topology changes dynamically. The mobility and transmission power of a mobile node plays an important role on performance of routing protocols. However a detailed analysis of performance can give an idea about the reasons of performance degradation. Corrective measures to those causes may increase the performance. Considering the mobility feature of the nodes it is required to use a suitable routing protocol based on the network environment [6]. This is because while the nodes are mobile and are moving randomly in variation with speeds, to get a valid route between a source and destination node is an important issue. In our simulations we have considered AODV & DSR as the routing protocol for the performance comparison at different pause time and transmission power.

2. AODV ROUTING PROTOCOL

There are many reactive protocols proposed for MANET, AODV [1, 3, 5, 8, 9, 10, 11] is an on-demand routing protocol, in which the route between the source and destination node is discovered as and when needed. In this protocol each node maintains routing information in the form of a routing table having one entry per destination. Route table contains usually the IP (internet protocol) addresses of source and destination, the next-hop to reach the destination and sequence number of the source and destination along with route expire time. Therefore when a node has to send data packets to a destination at first it takes the help of its route table, if route is not available then starts searching of a new route. To do so the source node starts broadcasting the route request packets (RREQ) and gets confirmed about the complete route with the reception of route reply (RREP) packet from destination node in a limited time. The source sequence number available in the RREQ packets indicates the freshness of the route search. During the transmission of RREP packet from destination to source each intermediate node updates its route table (i.e. stores the next hop for the specified destination along with life time of route). Besides these two another kind of routing message is transmitted in the network known as route error (RERR). This packet is transmitted by the intermediate node to the source as soon as a link breaks or one of the intermediate node or destination node moves beyond the transmission range of its neighbor node in one.

3. DSR ROUTING PROTOCOL

DSR uses ‘source routing’ i.e. the senders node knows the complete hop-by-hop route to the destination and these routes are stored in its route-cache. In route cache multiple routes may be available for same destination. The DSR protocol is composed of two mechanism i.e. route discovery and route maintenance. When a node in the network originates a new packet to send to the destination, it places the source route in the header of the packet. Normally the source first search its route cache if no route is found then it initiates route discovery process. Route discovery performed by flooding the

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network with route request (RREQ) packets. Each node receives an RREQ and rebroadcast it, unless it is the destination or it has a route to the destination. Such a node replies to the RREQ with a route reply (RREP).The RREP routes itself back to the source by traveling backward. Then this route is registered at source cache for future use. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. Then the route is removed this link from its cache. If the route is still needed then it initiates route discovery process.

4. SIMULATION ENVIRONMENT AND PERFORMANCE METRICS

For the performance analysis, we have used GloMoSim as the network simulator [2], where in the simulation is done above mentioned routing protocol. The mobility model we have chosen is Random Way Point model [3, 4, 7]. The other parameters that we have chosen for the network in the simulator are as listed in the table 3.1. The simulation has done for 900 sec. Each simulation corresponds to a seed. For 5 different seeds the simulation has been carried out. To get a point related to a performance metrics in the plot the average of 5 seeds are taken. We have chosen the following metrics for analyzing the performance of the network using the above two routing protocols.

Table 3.1 PARAMETERS USED FOR SIMULATION

Parameters	Value/Specification
Terrain Area	1500Mx300M
Number of Nodes	50
Node Mobility model	Random Waypoint
Number of sources	10 ,20 and 30
Maximum Speed	20 M/S
Pause time	0 S to 900 S
Simulation Time	15 M
Transmission Range	250 M
Mac Protocol	802.11
Routing Protocol	AODV,DSR
Packet size	512 bytes
Data rate	2 Mbps
Type of Data traffic	CBR (Constant Bit Rate)

a) ***Packet delivery fraction***: The ratio between the number of packet delivered to the destination and the total number of packet generated at the different sources.

$$P = \sum_{n=1}^{N} Pdn \Big/ \sum_{k=1}^{K} Psk$$

Total packet drop= $D_b+D_r+D_c+D_m+D_{ch}$

P_{dn} = Number of Packets received by nth the destination

P_{sk} = Number of packets generated by kth sources

D_b = Number of packets drop due to buffer overflow.

D_r = Number of packets dropped due to unavailability of route to destination.

D_m = Number of packets dropped due to the unavailability of channel.

D_{ch} = Number of packets dropped due to channel impairments

N= Total number of destination

K= Total number of source

b) ***Average end-to-end delay***- All possible delays during route discovery, queuing at the interface queue, retransmission delay and transfer times.

$$T_i = T_{buffer} + T_{queue} + T_{transfer} + T_{retransmission} + T_{propagations}$$

$$T_D = T_i \; {}^{1}\!/_{N} \sum_{n=1}^{N}$$

N = Number of destinations

T_i = Average packet delivery delay of ith destination

T_D = Average packet delivery delay of the network

5. SIMULATION RESULT AND ANALYSIS

In this section we present the simulation results for AODV and DSR routing protocol along with a detailed analysis of the performance. The analysis is based on the comparison of different metrics stated in the last section for the above mentioned routing protocol. For the analysis we have also considered the metrics for the same network with 10 sources.

Variation in pause time

Pause time in MANET corresponds to the period of time for which a anode halts at a intermediate node before moving to destination point [10]. Indirectly this indicates the mobility feature of a node. A low pause time corresponds to high mobility and high pause time corresponds to low mobility. Therefore the plots given in this paper indicates different values of performance metrics as mentioned in the last section with a variation in pause time from 0 to 900s corresponding to the network of 50 nodes with 10sources.

1) Packet Delivery Fraction vs. Pause time

Fig.1 (a), (b), (c), (d) below indicates the plot between packet delivery fraction and pause time for 10 sources and transmission power 10 dbm,15 dbm, 20dbm,25dbm. From the figure it can be observed Packet Delivery Fraction of DSR is well below AODV at high mobility condition because at high mobility the number of link break is more so there will be more discovery of route. In case of DSR the complete address is carried but RREQ and RREP so processing time is more at the node hence discovery time is also more.
But in case of AODV only one entry is done at route cache of receiving node so processing time is less hence discovery time is less so PDF is better in

AODV as compare to DSR. In low mobility condition route break in both the cases decreases because of low mobility hence DSR PDF increases close to AODV.

The PDF of AODV & DSR increases with increase in transmission power at high mobility because as transmission power increases the transmission range also increases (Pt ~ R). So the chance of route break decreases at high mobility as transmission power increases so PDF also increases.

Fig1 (a) Packet delivery fraction vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 10dbm for AODV& DSR.

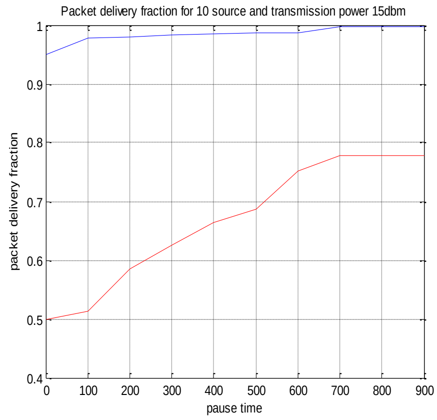

Fig1(b) Packet delivery fraction vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 15dbm for AODV& DSR.

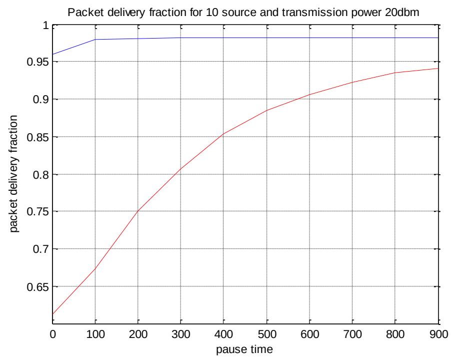

Fig1© Packet delivery fraction vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 20dbm for AODV& DSR.

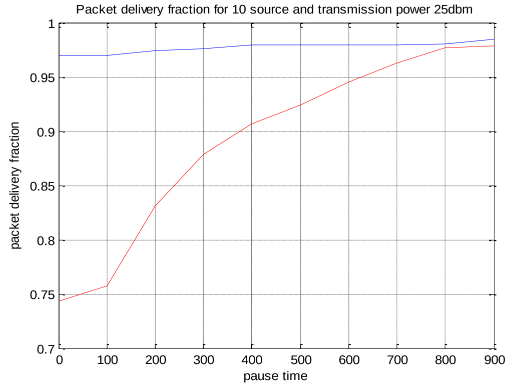

Fig1 (d) Packet delivery fraction vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 25dbm for AODV& DSR.

2. .*Average end-to-end delay*

Fig.2 (a),(b),(c),(d) below indicates the plot between average end-to end delay and pause time for 10sources and transmission power 10 dbm,15 dbm, 0dbm,25dbm.

The End to End Delay in AODV is more than DSR because in case of DSR the total address of the route is carried out by data header during data sending so the processing time at intermediate node is less. So it reaches faster at destination than AODV. In case of AODV the processing time at each node is more because the data header will contain only one node address towards destination so as soon as the intermediate node reached, next node address will be available at route cache of the intermediate node so here delay is more.

As transmission power increases the number of route break also decreases so the ETD of AODV and DSR decreases with increase of transmission power inform of transmission range.

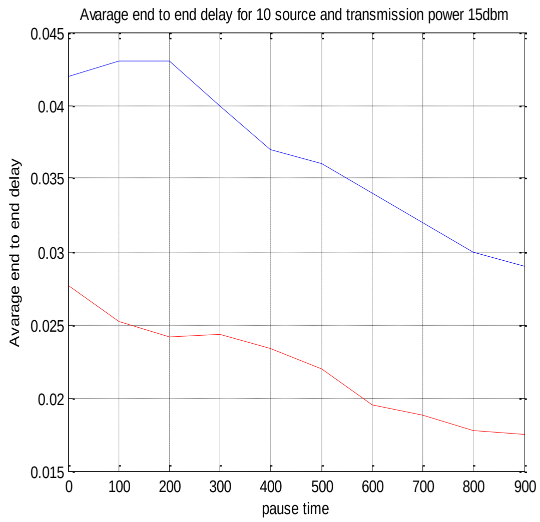

Fig 2(a) Average end-to-end delay vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 10dbm for AODV& DSR.

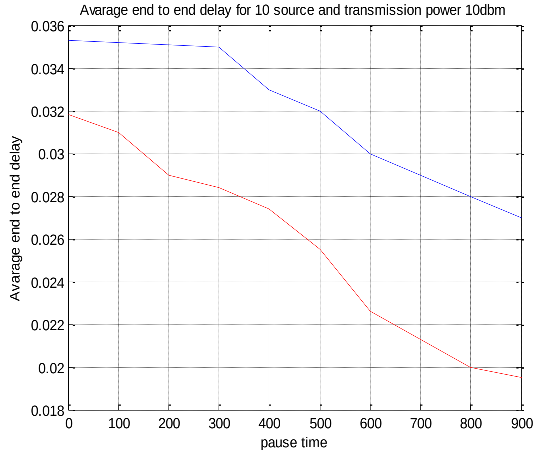

Fig2 (b) Average end-to-end delay vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 15dbm for AODV& DSR

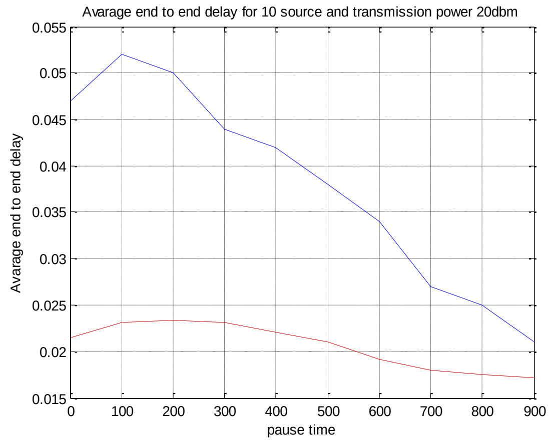

Fig2(c) Average end-to-end delay vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 20dbm for AODV& DSR

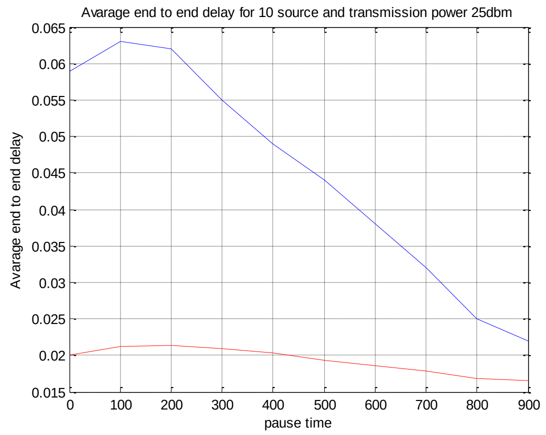

Fig2 (d) ***Average end-to-end delay vs. pause time for a MANET of 50 nodes with 10 sources and transmission power 25dbm for AODV& DSR***

6. CONCLUSIONS

In this paper we explained the concept of AODV and DSR routing protocol briefly. Using GloMoSim simulator different performance parameters related to the AODV & DSR routing protocol are calculated and analyzed. From the analysis it is observed that the Packet delivery fraction is more in AODV routing protocol than DSR routing protocol at high mobility condition and it increases in decrease in mobility. The end to end delay is more in AODV routing protocol than DSR routing protocol at high mobility condition and almost equal in low mobility.

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