Study of effect of Mobility on some Reactive Protocols in MANET

Rupak Mohanayak[1]*, Mamtamayi Rath[2], Suman Pradhan[3], Dr. Kailash Chandra Rout[4]
Department of Electronics and Communication Engineering
[123]Gandhi Institute for Education and Technology, Baniatangi, Bhubaneswar
[4]Capital Engineering College, Bhubaneswar
* Corresponding Author

***Abstract*:** Rapid advancement of telecommunication technologies has resulted in a nonlinear increase in the number of users of mobile electronic devices connected to a communication network in recent years. These electronic devices are the nodes in a MANET (Mobile Ad hoc Network), and their mobility has a significant impact on the network's outcome. A change in mobility can be defined as a change in node speed. Because of changes in mobility, the path between neighbour nodes can break a number of times, lowering a node's performance. Several packets may also be dropped at various tiers of the network. This work presents how the changes in mobility affect performance term of Packet drop, end to end delay and Packet delivery ratio. NS2 is used as simulator to calculate performance matrices in our work. Here two reactive protocols AODV and DSR are used to compare performance.

Keywords: MANET, Packet Delivery Fraction, Average end-to-end delay, Link-to-link break, AODV, DSR.

I. 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 of mobile nodes 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 traffic density.

II. 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.

III. 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 route 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 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.

IV. 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.

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)

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.

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.

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

c) Number of *Link to link breaks:* It is the number of link breaks noticed by the nodes in the network

V. 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 different number of sources (i.e. 10, 20 and 30).

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 10,20 and 30 sources differently.

1) Packet Delivery Fraction vs Pause time

Fig.1 (a), (b), (c) below indicates the plot between packet delivery fraction and pause time for 10, 20 and 30sources. From the figure it can be observed that in AODV with low network load (i.e. 10 sources) and high mobility scenario(i.e. zero pause time), the packet delivery fraction is higher in comparison to high network load (i.e. 20 and 30 sources). It means, with the increase in network load packet delivery fraction decreases. This is because with increase in network load, the routing load also increases significantly which leads to non availability of routes from source to the destination. It can also be observed that with increase in pause time the packet delivery fraction in AODV for both the traffic load i.e. 20 and 30 sources, packet delivery fraction increases.

In DSR with low network load (i.e. 10 sources) and high mobility scenario the packet delivery fraction is less about 45% than AODV .It is due to continuous link break and use of stale route. Packet delivery fraction in DSR increases with increase in pause time.

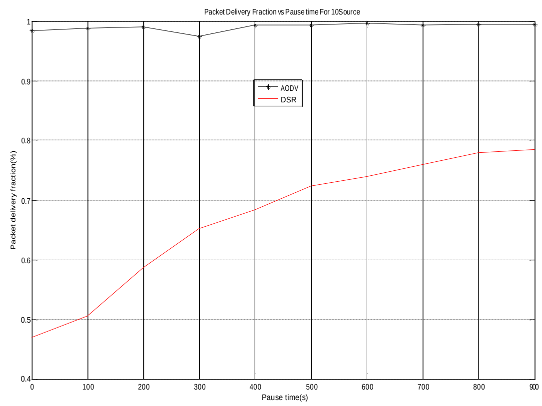

Fig1(a) Packet delivery fraction vs pause time for a MANET of 50 nodes with 10 sources for AODV& DSR.

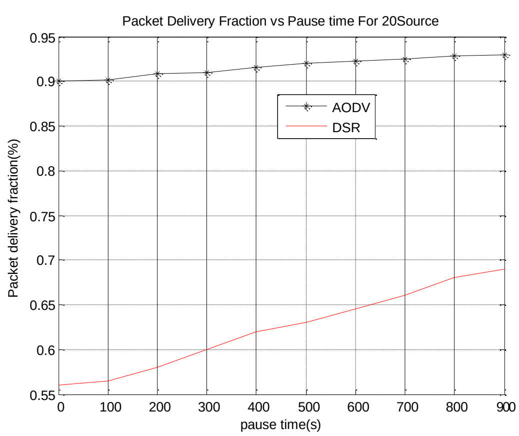

Fig1(b) Packet delivery fraction vs pause time for a MANET of 50 nodes with 20 sources for AODV& DSR

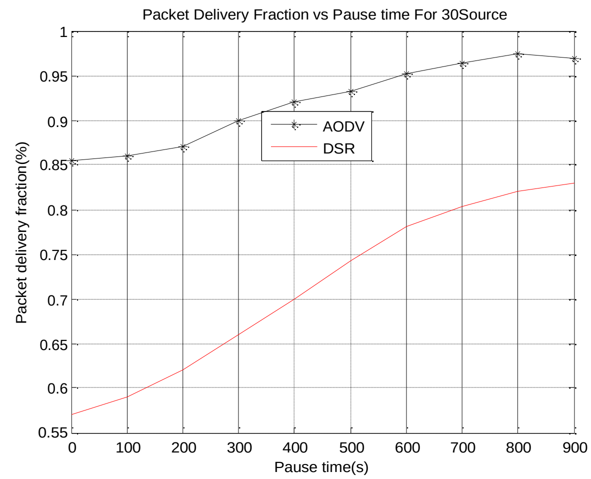

Fig1© Packet delivery fraction vs pause time for a MANET of 50 nodes with 30 sources for AODV& DSR

The packet delivery fraction of DSR in high network load (i.e. 20 and 30 sources) with low mobility scenario (i.e. high pause time) increases and the number of link break in the network decreases.

2. .Average end-to-end delay

Fig.2 (a),(b),(c) below indicates the plot between average end-to end delay and pause time for 10, 20 and 30sources.

The average end-to-end delay for 10sources at high mobility, AODV shows high delay than DSR.

AODV uses table which contain next hop address towards destination, .So when node moves and link breaks, and it again initiate route discovery process, which will consume time but in DSR alternative route is available so it does not requires route discovery most of the times like AODV. Therefore AODV shows high delay compare to DSR. With the increase in traffic load (i.e.20, 30 sources) at high mobility the delay increases in AODV and DSR. This is because with increase in network load the routing load also increases significantly which leads to non availability of routes from source to the destination.

The average end-to-end delay in higher traffic load (i.e.20,30 sources) at low mobility gradually decreases in AODV and DSR. This is because at low pause time, link break is less.

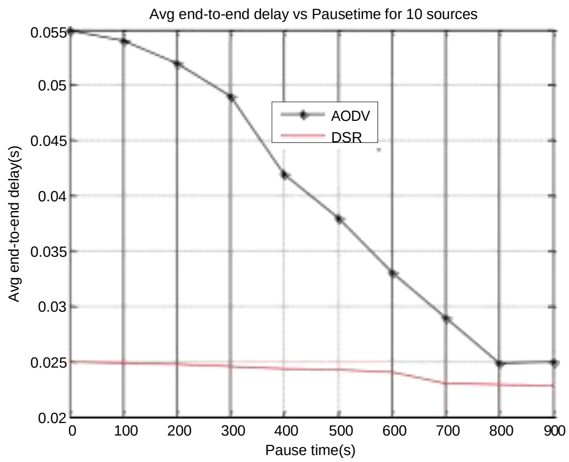

Fig 2(a) Average end-to-end delay vs pause time for a MANET of 50 nodes with 10 sources for AODV& DSR.

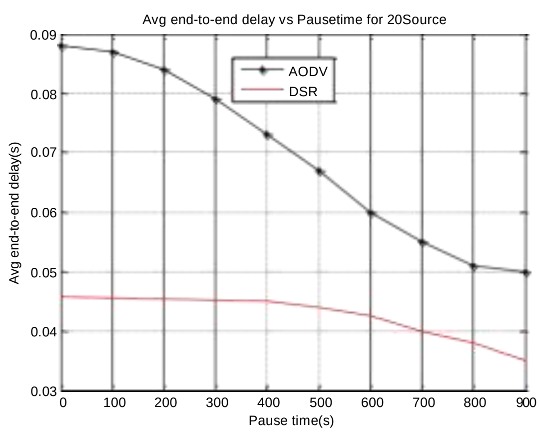

Fig2(b) Average end-to-end delay vs pause time for a MANET of 50 nodes with 20 sources for AODV& DSR.

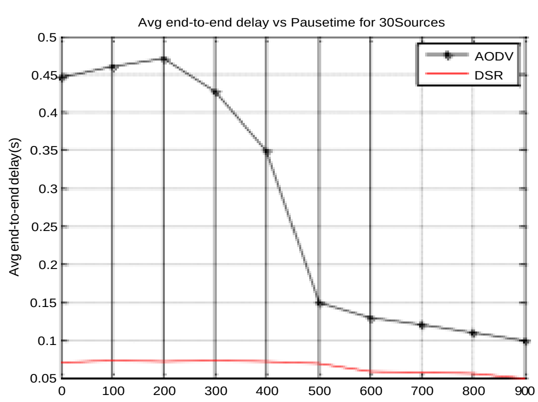

Fig2(c) Average end-to-end delay vs pause time for a MANET of 50 nodes with 30 sources for AODV& DSR.

3. Link-to-Link break

Fig.3 (a),(b),(c) below indicates the plot between link-to-link break and pause time for 10, 20 and 30sources.

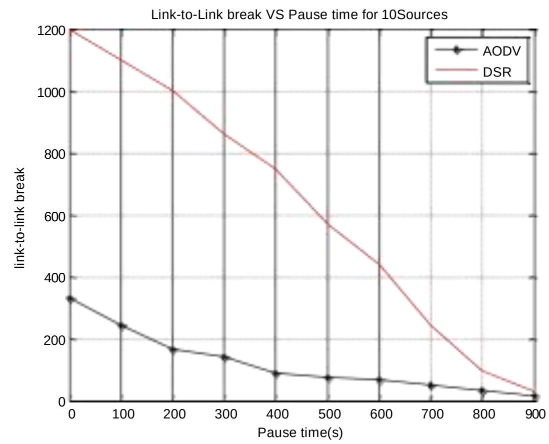

Fig 3(a) Link-to-Link break vs pause time for a MANET of 50 nodes with 10 sources for AODV& DSR.

The link-to-link break for 10sources at high mobility (i.e. zero pause time) DSR shows higher link break than AODV.This is because DSR uses source routing where each source there is many alternative route to the destination. Hence the number of link break is more in DSR.The graph shows in high mobility AODV link break is 30% lesser than that of DSR.

With the increase in traffic sources (i.e.20 30 sources) the network traffic increases and more number of sources used to send data. So at high mobility (i.e. zero pause time) due to movement of node the link break increases in DSR. From the graph it has been observed that link break in AODV is around 23% lesser than and in compare to that of DSR.

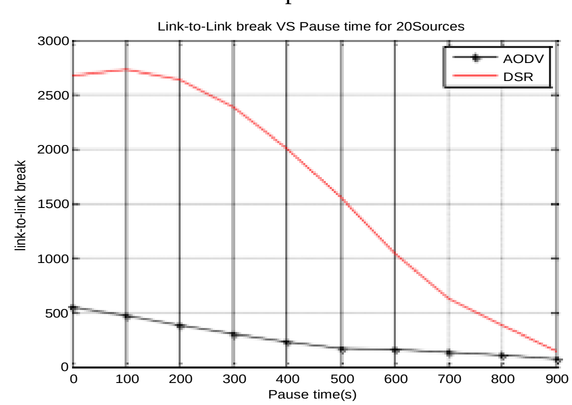

Fig 3(b) Link-to-Link break vs pause time for a MANET of 50 nodes with 20 sources for AODV& DSR.

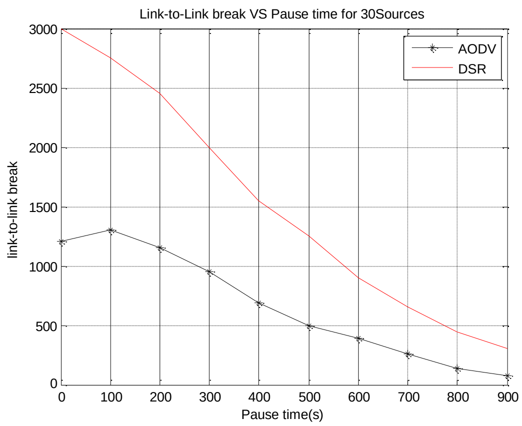

Fig 3(c) Link-to-Link break vs pause time for a MANET of 50 nodes with 30 sources for AODV& DSR

.

At high mobility, the link breaks in AODV and DSR decreases because of less moment of node in high pause time.

VI. 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 Number of link break of DSR routing protocol is more than AODV at high mobility condition and it decreases in increase in mobility.

.

REFERENCES

[1] Charles E. Perkins “ Ad-hoc Networking ” Text book, Addison-wesley-2001.

[2] L. Bajaj, M. Takai, R. Ahuja, K. Tang,R. Bargodia and M. Gerla, *GlomoSim: A Scalable Network Simulation Environment,CSD Technical report*, University of California at LosAngles, 1997.

[3] Josh Broch, David A. Maltz, David B. Johnson, Yih-Chun Hu, Jorjeta Jetcheva, “A Performance Compassion of Multihop Wireless Ad-hoc Network Routing Protocols*”, MOBICOM‘98*, pp. 85-97, (October 1998).

[4] Charles E Perkins, Elizabeth M. Royer, Samir R. Das, Mahesh K. Marina, “Performance Comparison of Two on Demand Routing Protocols for Ad-hoc Networks”, *IEEE Personal Communications*, pp. 16 - 28, (February 2001).

[5] C.E Perkins, E.M. Royer and S.R.Das, ”Ad hoc on Demand Distance Vector Routing, ” *IETF internet draft* (*draft – ietf- manet- aodv-06.txt*), July 2000.

[6] E .M. Royer, P .M. Melliar-Smith, L .E Moser, **”** An analysis of the optimum node density for ad hoc mobile networks,”*Proc. ICC-2001*, Vol.3, pp. 857-861, (June 2001).

[7] N. Adam, M. Y. Ismail and J. Abdulla, “Effect of node density on performance of three MANET routing protocols”. ICEDSA-2010, pp. 321-325.

[8] K. Amjad and A. J. Stocker, “Impat of node desity and mobility on performance of AODV and DSR in MANET”. CSNDSP-2010, pp. 61-65.

[9] Iftikhar Ahamad and Mata ur Rahman, “Efficient AODV routing based on traffic load and mobility of node in MANET, ICET-2010, pp. 370-375.

[10] Vasudha Arora and C Ramakrishna, “Performance evaluation of routing protocols for MANET under different traffic condition”. ICCET, VOL-6, pp. 79-84.

[11] Nurul I Sarkar and Wilford G Lol, “Study of MANET routing protocols: Joint node desity ,Packet length and Mobility” IEEE 2010, pp 515-520.

[12] Xi Hu, J.K.Wong, C.R. Wong and Cong Wong, “Is mobility is always harmful to routing protocol performance of MANETs” , ICCEDCKD 2010, pp. 108-112.