ISSN No. 0976-5697

Volume 7, No. 1, January-February 2016

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

Impact of Node Density and Mobility on Performance of DSR Routing Protocol in Mobile Ad hoc Network

Surinder Singh
Research Scholar, GKU
Talwandi Sabo, Punjab, India

Dr. B.S. Dhaliwal
Dean Academics, GKU
Talwandi Sabo, Punjab, India

Dr. Rahul Malhotra
Director-Principal GTBKIET
Malout, Punjab, India

***Abstract*:** Mobile ad hoc network is a dynamic network. In this network the mobile nodes dynamically form a temporary network without any centralized administration or the use of any existing network infrastructure. A number of routing protocols like Ad Hoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR) and Destination-Sequenced Distance-Vector (DSDV) have been proposed. The Dynamic Source Routing protocol (DSR) is an efficient routing protocol designed specifically for use in wireless ad hoc networks of mobile nodes. In this work an attempt has been made to check the performance of DSR routing protocol for mobile ad hoc networks on the basis of varying number of nodes and varying node speed. The simulations are carried out using MATLAB .

Keywords: DSR, MANET, Performance Evaluation, Protocol, MATLAB

I. INTRODUCTION

Unlike traditional networks, in mobile ad-hoc network (MANET) all nodes can be mobile, while communication. Moreover, there are no dedicated routers or other network infrastructures to support the nodes [1, 2, 3, 8]. Any node can be a sender, receiver as well as a router where it takes part in forwarding other node's packets. The wireless links in an Ad-hoc network are highly error prone because of node mobility, interference and channel fading [5]. There are many applications for Ad-hoc networks in military operations, relief work in disaster, conferencing, home networking [4]. Among all other challenges in launching MANET, routing is the most crucial as there is no supporting infrastructure [2]. Depending upon the mechanism, MANET routing protocols can be classified into three categories: proactive, reactive and hybrid routing protocols. Destination-Sequence Distance-Vector (DSDV), Wireless Routing Protocol (WRP), and OLSR come in the category of proactive routing protocols [3]. Among on-demand routing protocols Cluster Based Routing protocol (CBRP), Ad-hoc on demand Distance Vector Routing (AODV), Temporally Ordered Routing Algorithm (TORA), and Dynamic Source Routing Protocol (DSR) are mainly used [9] [18]. Among all on-demand routing protocols DSR is straight forward and simple, and recently a lot of modifications are going on in this protocol. Some are introducing security and power issue and many other concepts. Therefore we are closely examining the protocol and its performance under various working conditions using simulation techniques. In this work we use MATLAB for simulation [17] because of its acceptability.

II. DSR ROUTINGPROTOCOL

Dynamic Source Routing protocol (DSR) is a reactive, on-demand routing protocol [4], which finds the route as and when required, dynamically. DSR routing protocol manage the network without centralized administrator or infrastructure. In route discovery this protocol discovers for the routes from source node to destination. In DSR, data packets stored the routing information of all intermediate nodes in its header to reach at a particular destination [10, 16]. Routing information for every source node can be change at any time in the network and DSR updates it after each change occurs [6]. Intermediate routers don´t need to have routing information to route the passing traffic, but they save routing information for their future use [14]. Basic purpose to develop DSR was to reduce the overhead on the network and designing self-organizing and self-configuring protocol to support wireless networks. The DSR protocol contains two phases in its routing mechanism [7].

a) *Route discovery*: In the route discovery phase the source node establishes a route by flooding route request packets (RREQ) [10, 15]. The RREQ contains the source IP address and destination IP address. The neighbor nodes accumulate the traversed path into the RREQ and broadcast to its next neighbor if the current node is not the destination node. Each mobile host participating in the ad hoc network maintains a route cache in which it caches source routes that it has learned. When one host sends a packet to another, the sender first checks its route cache for a source route to the destination. If the route is found, the sender uses that route entry to transmit the packet. If

no route entry is found, the sender may attempt to discover one using the route discovery mechanism. Until the route is discovered, the sender host will be waiting and during this time it can do other operations like sending or forwarding other packets. Once the route is discovered, the sender sends its required packet using the new learned route [6]. Finally the packet of interest is received by the destination. The sender updates its route caches too for that particular destination for future use [14].When a sender does not know the path to a node to which it wants to send a packet, it generates a route request packet and broadcasts to its neighbors. The neighbors get the packet and give route information either if they have that in their cache or if the destination is their neighbor. Otherwise they again re-broadcast the same packet to their non recipient neighbors. Finally, when this packet reaches to the destination, it replies a route reply packet through the reverse path the packet traveled. When this packet comes back to the originator, it updates its routing cache and start sending packets using this newly discovered path [12]. If the originator receives multiple route reply packets, it keeps the shortest one. Also it stores the current time along with the cache entry in order to keep track of how old the path is. Since topology of an ad-hoc network might change frequently, a path is not used for a long time. Therefore, a cache expiration time is enforced after which the entry is deleted. A route maintenance agent periodically checks all links and updates the route cache of a node.

b*) Route Maintenance:* Route maintenance can be accomplished by two different processes:

Hop-by-hop acknowledgement at the data link layer and End-to-end acknowledgements .Hop-by-hop acknowledgement is the process at the data link layer which allows an early detection and re-transmission of lost packets. If the data link layer determines a fatal transmission error, a route error packet is being sent back to the sender of the packet [6, 8]. The route error packet contains the information about the address of the node detecting the error and the host's address which was trying to transmit the packet. Whenever a node receives a route error packet, the hop is removed from the route cache and all routes containing this hop are truncated at that point [10].When wireless transmission between two hosts does not process equally well in both directions, End-to-end acknowledgement may be used. As long as a route exists, the two end nodes are able to communicate and route maintenance is possible. In this case, acknowledgements or replies on the transport layer used to indicate the status of the route from one host to another. However, with end-to-end acknowledgement it is not possible to find out the hop which has been in error.DSR has special feature that there is no need of periodic updates to send over the network about neighbors or link state information. This reduces overhead on the network by eliminating the periodic updates send on the network [2]. The both operations of DSR are on demand basis. A node may save more than one route for the same destination. In DSR it is carried out by listening to passing traffic, or by saving the additional routes when attempts for single route discovery. This property make DSR to use cache route in case of one route broke down, there is no need of route discovery as alternative routes are already available to the destination. Another important property of DSR routing protocol is network flexibility [12]. A packet using DSR routing protocol can reach its destination even when the intermediate nodes are using different type of network. DSR make it possible that nodes with different network types can participate in ad hoc networks, DSR protocol consider them as Ad hoc Network. There is unidirectional link support. The basic algorithm for route discovery can be optimized in many ways. To avoid too many broadcasts, each route request could contain a counter [10]. Every node rebroadcasts the request increments the counter by one. Knowing the maximum network diameter, nodes can drop a request if the counter reaches this number. A node can cache path fragments from recent requests. These fragments can now be used to answer other route requests much faster. A node can also update this cache from packet headers while forwarding other.

III. SIMULATION ENVIORNMENT AND PERFORMANCE MEASURING PARAMETERS

The main method of evaluating the performance of MANETs is simulation. The simulation of DSR routing protocol is done in MATLAB. The network is taken as 1000X1000 square meters. The performance is recorded taking different number of nodes and varying speed. The nodes are placed randomly in the network. The packet size is taken as 512 bytes and the traffic type is Constant bit rate (CBR). The parameters taken for simulation are listed below in the Table 1

TABLE 1

PARAMETERS	USED IN SIMULATION
Simulator	MATLAB(2010)
Channel type	wireless channel
Antenna type	Omni Antenna
Radio-propagation model	two ray ground
Mac type	Mac/802.11
Protocol studied	DSR
Simulation area	1000×1000m2
Transmission range	250m
Node movement model	Random waypoint
Traffic type	CBR(UDP)
Packet size	512 Bytes
Number of nodes	100
Speed	10to 50m/sec

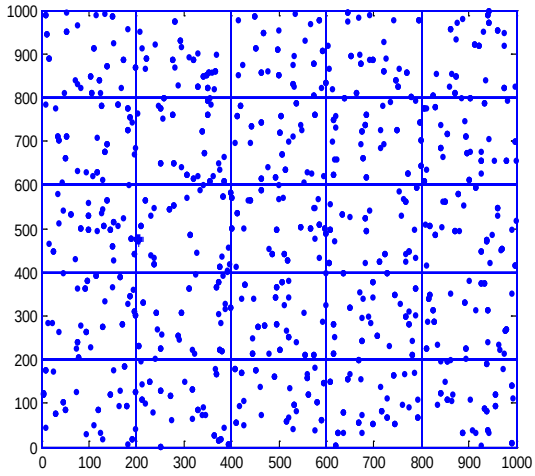
The performance is measured on the basis of some parameters which are described as follows:

Packet Delivery Ratio- Packet delivery ratio is defined as the number of packets actually delivered to the Destination to the number of data packets supposed to be received .The better the packet delivery ratio, the more complete and correct is the routing protocol.

Average end-to-end delay: - Average end-to-end delay signifies how long it will take a packet to travel from source to destination node. It includes delays due to route discovery, queuing, propagation delay and transfer time. This metric is useful in understanding the delay caused while discovering path from source to destination.

Throughput- Throughput is the ratio of number of packets sent and total number of packets. It describes the average rate of successful message delivery over a communication channel. Throughput measures the efficiency of the system.

Normalized Routing Load (NRL): It is the ratio of number of routing packets and number of received packets at the destination.



Simulation environment 1000X 1000 sq .m

IV. SIMULATION RESULTS AND ANALYSIS

Simulation study shows that performance of routing protocol in terms of throughput, packet delivery ratio, end to end delay and routing overhead strongly depends upon network conditions such as mobility, no. of nodes .The set of experiments uses varying no. of nodes and varying speed with throughput, packet delivery ratio, end to end delay and routing overhead. In DSR protocol, each node maintains a route cache, where all routes it knows are stored.

Performance analysis with varying node density

1) packet delivery ratio vs. nodes

Figure 1(a), (b) indicates the plot between packet delivery ratio and no. of nodes. Packet Delivery Ratio decreases as the number of nodes increases. As packets move from source to destination, the collision occurs due to traffic, which causes loss of packets. Moreover, the mobility of nodes may lead nodes to move out of network and packet does not reach the desired destination node.

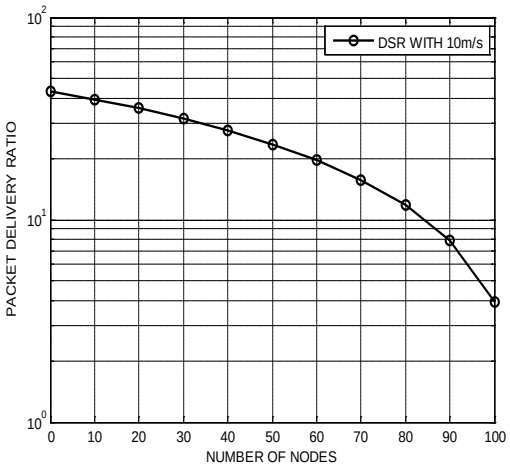


Fig.1 (a) Packet delivery ratio vs. no. of nodes for speed 10m/sec

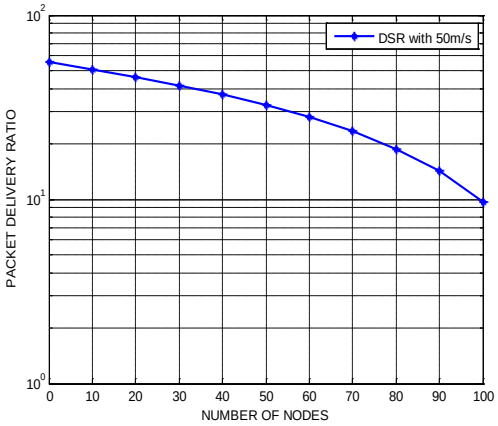


Fig.1 (b) Packet delivery ratio vs. no. of nodes for speed 50m/sec

2) Throughput vs. no. of nodes

Figure 2(a), (b) indicates the graph between throughputs vs. no. of nodes. As the no. of nodes increase, the throughput decrease. This is due to the fact that packet delivered to the destination are lost during transmission.

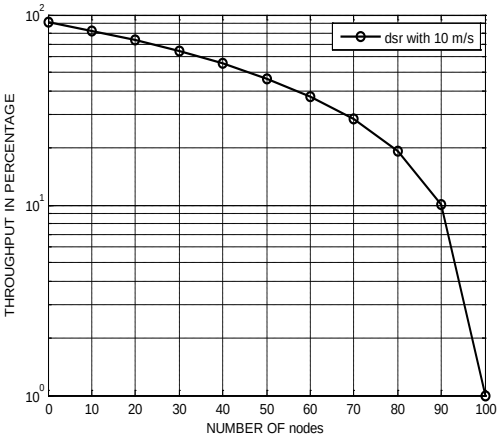


Fig.2 (a) Throughput vs. no. of nodes for speed 10m/sec

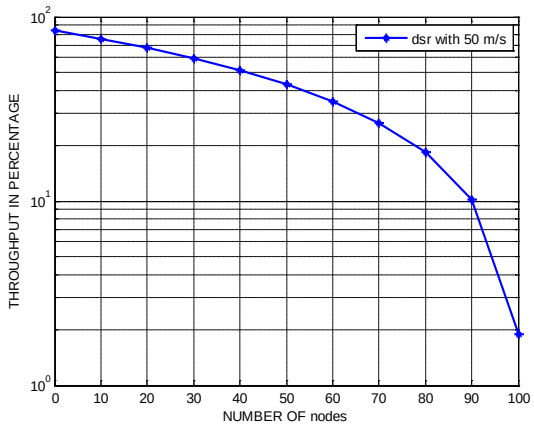


Fig.2 (b) Throughput vs. no. of nodes for speed 50m/sec

3) End To End Delay vs. no. of nodes

Figure 3(a); (b) indicate the graph between end to end delays vs. no. of nodes. It increases as number of nodes increase. End to end delay increases due to aggressive use of caching and lack of any mechanism to expire stale routes or determine the freshness of routes. DSR protocol have a large delay because their route discovery takes more time as every intermediate mode tries to extract information before forwarding the reply.

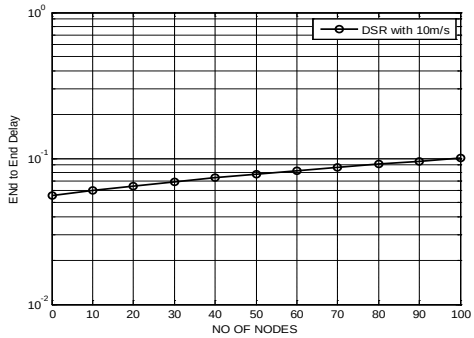


Fig.3 (a) End to End delay vs. no. of nodes for speed 10m/sec

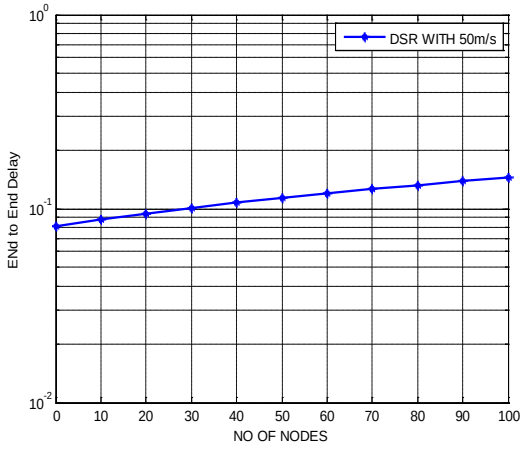


Fig. 3(b) End to end delay vs. no. of nodes for speed 50m/sec

4) Routing Over head vs. no. of nodes

Node density may increases the probability of collision, which in turn, leads to more retransmission attempts, thereby number of control packets for establishing a new route increases, which leads to increase in routing overhead.

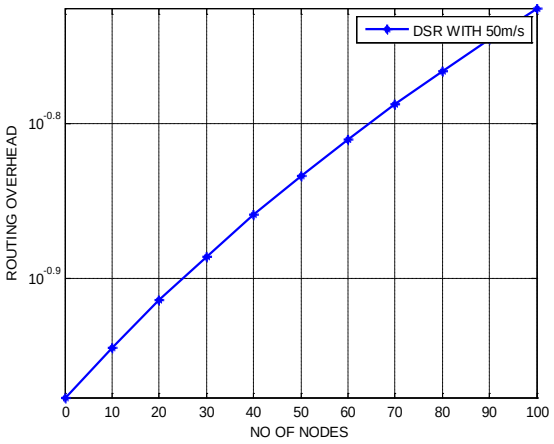


Fig.4 (a) routing overhead vs. no. of nodes for speed 50m/sec

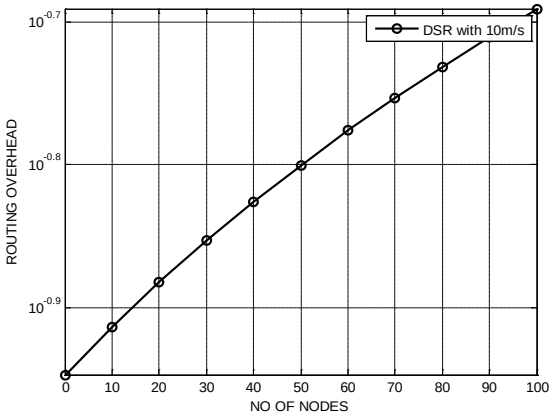


Fig.4 (b) routing overhead vs. no. of nodes for speed 10m/sec

Performance analysis with varying node speed

5) Packet delivery ratio vs. node speed

Figure 5(a); (b) indicate Graph between packet delivery ratio and mobility of nodes by keeping 100 nodes constant. Packet delivery ratio decreases as the speed of nodes increases. This is due to the cause of link failure at high mobility and use of stale route in DSR due to source routing .Another cause of decrease of PDR in DSR is the network congestion due to node density .In low mobility, PDR is better due to alternate route available in route cache of DSR.

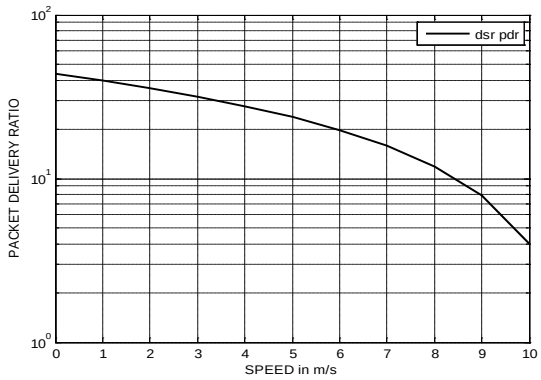


Fig 5(a) packet delivery ratio vs. node speed

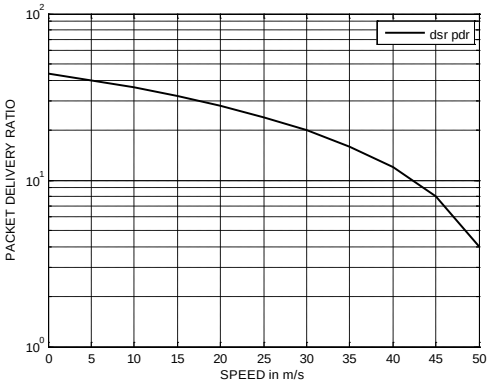


Fig 5(b) packet delivery ratio vs. node speed

6) Throughput vs. node speed

Figure 6(a); (b) indicate Graph between throughput ratio and mobility of nodes by keeping no. of nodes constant. As nodes mobility increases, the throughput decreases.

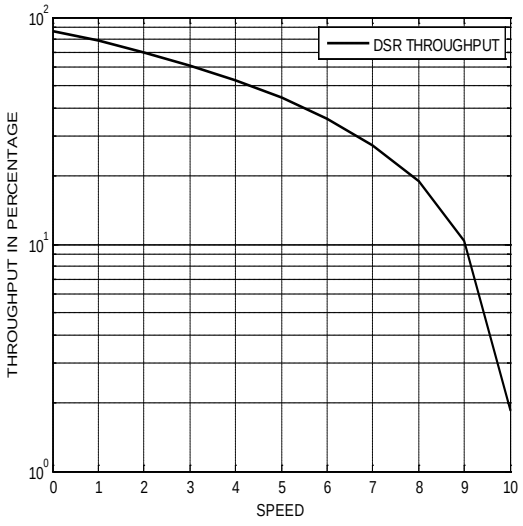


Fig 6(a) Throughput vs. node speed

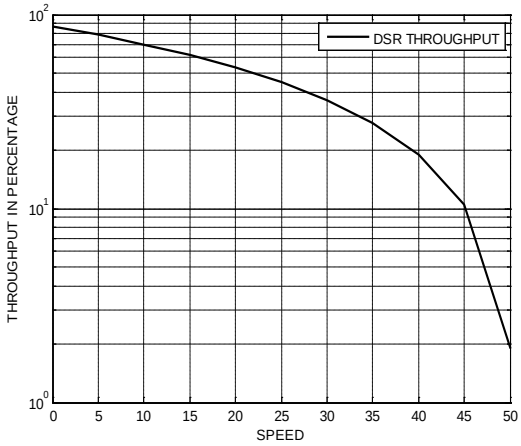


Fig 6(b) Throughput vs. node speed

7) End to End Delay vs. node speed

Figure 7(a); (b) indicate Graph between end to end delay and mobility of nodes by keeping no. of nodes constant. As the speed increases, more retransmission of routing packets is required to get source to destination path in case of link failure. Due to this end to end delay is more at higher speed.

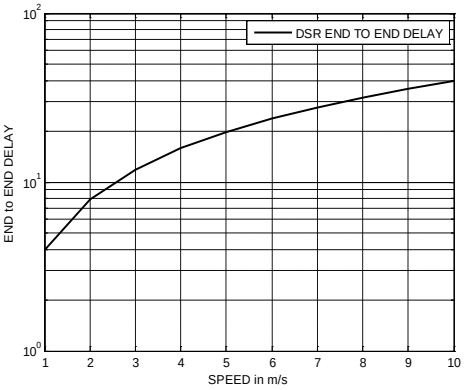


Fig.7 (a) End to End delay vs. node speed

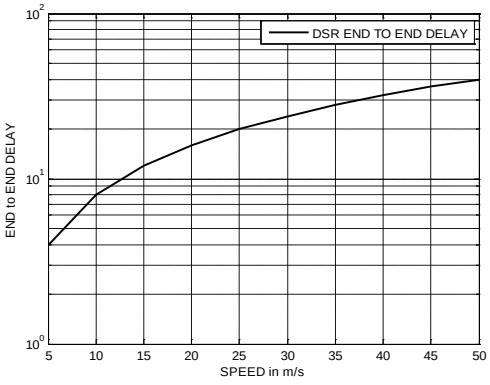


Fig.7 (b) End to End delay vs. node speed

8) Routing Overhead vs. node speed

Figure 8(a) (b) indicate Graph between routing overhead and mobility of nodes by keeping no. of nodes constant By increasing the speed, network topology changes frequently and link break occur, thereby number of control packets for establishing a new route increase, which leads to more routing overhead is more.

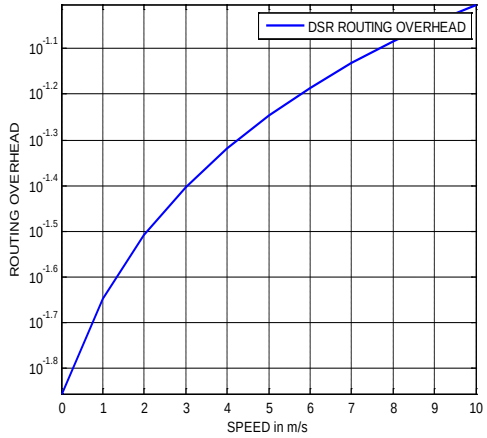


Fig .8(a) Routing overhead vs. node speed

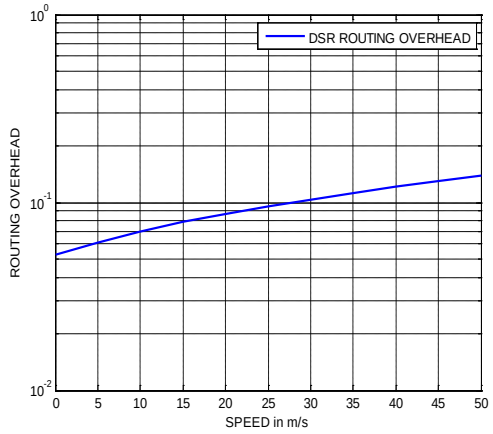


Fig. 8(b) routing overhead vs. node speed

V. CONCLUSION

In this work, performance of mobile ad hoc network routing protocol DSR has been studied and evaluated by using MATLAB. DSR protocol using source routing and route cache. Performance carried out in terms of packet delivery ratio, Throughput, end to end delay, routing overhead. From the analysis, it is observed that packet delivery ratio, throughput decreases as node density and node speed increases. Also it is observed that end to end delay and routing overhead increases as node density and node speed increases.

VI. REFERENCES

1. Golam Kaosar, Ashraf S. Hasan Mahmoud, Tarek R.Sheltami,"Performance Improvement of Dynamic Source Routing Protocol Considering the Mobility Effect of Nodes in Cache Management," International Journal of Soft Computing and Engineering (IJSCE), Volume-2, Issue-3, July 2012.
2. Prachi Mishra, Neelesh Gupta, "Performance Evaluation of AODV and DSR Protocols in MANET," International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences (IJIRMPS) ,Volume 3, Issue 1, February 2015,pp 45-55.
3. S.R. Biradar et al., " Analysis QOS Parameters for MANETs Routing Protocols, " International Journal on Computer Science and Engineering ,Vol. 02, issue 03, 2010, pp 593-599.
4. Nehal Jadeja, Roma Patel, " Performance Evaluation of AODV, DSDV and DSR Routing Protocols Using NS-2 Simulator," International Journal of Engineering Research and Applications, Vol. 3, Issue 2, April 2013, pp.1825-1830.
5. Harminder Kaura, Ravinder Singh Sawhneya, "Reducing routing overheadusing ant colony optimization in wireless mobile networks," Elseware.
6. K.A. Akpado, V.E. Idigo, and C. Uzoh, "Analysis of dynamic source routing protocol for wireless mobile ad-hoc networks," Journal of Engineering and Applied Sciences, May 2010.
7. Manjusha S. Patil Bokade, Prof. M.N.Thakare, Prof. B. J. Chilke, "Simulation of MANET Routing Protocols DSDV, DSR and AODV for different Mobility," International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) Volume 3, Issue 6, December 2014, Page 287-295.
8. Mukesh Kumar Garg, Dr. Ela Kumar, "Relative Performance Analysis of Reactive (on-demand-driven) Routing Protocols." International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Volume 3, Issue 12, December 2014, pp 4167-4172.
9. L Raja, Dr. S Santhosh Baboo, "Performance Analysis and Simulation of Reactive Routing Protocols (AODV, DSR and TORA) in MANET using NS2,"International Journal of Advance Research ,Volume 2, Issue 8, August 2014
10. Sahil Gupta, Sunanda Arora, Gaurav Banga, "Simulation Based Performance Comparison of AODV and DSR Routing Protocols in MANETS," International Journal of Applied Engineering Research, Vol.7, issue.11 (2012)
11. Krishan Kumar , Navin Kumar Sehgal,"MANET: comparison on AODV and DSRKrishan Kumar al. International Journal of Recent Research Aspects, Vol. 2, Issue 2, June 2015, pp. 153-158
12. Nand Kishore, Sukhvir Singh and Renu Dhir, "Energy Based Evaluation of Routing Protocols MANETS,"International Journal of Computer Science and Engineeringr Research paper, Volume 2.
13. Ragb O. M. Saleh, Md Yazid Mohd Samanand M Nordin A Rahman, "Impact of Route Selection Metrics on the Performance of DSR Protocol for MANETs,"IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 2, March 2013.

14. K Amjad, A J Stocker et al, "Impact of node density and mobility on the performance of AODV and DSR in MANETS,'' Communication Systems Networks and Digital Signal Processing (CSNDSP), 7th International Symposium, IEEE2010, pp61-65.
15. Banoj Kumar panda, Bibhudatta Das, Rupinta Das, Ajit sarangi, "Mobility and its impact on performance of AODV and DSR in Mobile Ad hoc Network, '' IEEE 2012.
16. S.Mohapatraa, P .Kanungob, "Performance analysis of AODV, DSR, OLSR and DSDV Routing Protocols using NS2 Simulator,'' Elsevier, International Conference on Communication Technology and System Design 2011, pp 69 – 76.
17. Sandeep Gupta, BS Dhaliwal, Rahul Malhotra, "ALL-EMBRACING REVIEW OF WIRELESS NETWORK PROTOCOL, OPTIMUM NETWORK SIMULATOR", International Journal of Computer & Organization Trends –Volume3Issue3- 2013, pp 45-54.
18. Sandeep Gupta, BS Dhaliwal, Rahul Malhotra, "A REVIEW OF ADHOC ROUTING PROTOCOLS: AODV, TORA & DSR", International Journal of Research In Computer Applications And Robotics, Vol.3 Issue.6, pp 40-47, June 2015.