Performance Evaluation of Proactive and Reactive Routing protocols for high Node Density under Various Mobility in MANET

***Monika Yadav**

****Poonam Lilhare**

ABSTRACT

Today the world is moving towards wireless system. Wireless networks are gaining popularity to its peak today, as the users want wireless connectivity irrespective of their geographic position. In these networks, devices are used as nodes. Recently many researchers have been done their work on MANET. In this work nodes have been used as devices and based on comparison between three mostly used routing protocols Ad hoc on demand distance Vector routing protocol (AODV), Dynamic source routing protocol (DSR) and Destination sequence based distance vector routing protocol (DSDV) in MANET scenario with 20 nodes, 60 nodes and 100 nodes with different mobility which are 5m/sec, 10m/sec and 15m/sec and performance has been calculated on the basis of Residual energy, packet delivery ratio, throughput and end to end delay with different environment. The tool chosen for this work is NETWORK SIMULATOR (NS2).

Keywords: MANET, AODV, DSDV, DSR and NS-2.35.

* Monika Yadav, Research Scholar, IPS Academy, Indore, yadav.monika021@gmail.com

** Poonam Lilhare, Assistant Professor, IPS Academy, Indore, poonamlilhare@gmail.com

I. INTRODUCTION:

Ad-Hoc networks have no infrastructure where the nodes are free to join and left the network. The nodes are connected with each other through a wireless medium. A node can serve as a router to forward the information to the neighbors' nodes. Therefore this kind of network is also known as infrastructure less networks. These networks do no formed centralized structure [8]. Ad-Hoc networks have the capacity to handle any malfunctioning in the nodes or any changes that its experience due to topology changes. Whenever a node in the network is leaves the network that causes the broken link between other nodes. The affected nodes in the network simply request for new routes and new links are established Ad-Hoc network can be categorized in to static Ad-Hoc network (SANET) and Mobile Ad-Hoc network (MANET).

Static Ad-hoc Network:- In static Ad-Hoc networks the geographic location of the nodes or the stations are stable. There is no movement in the nodes of the networks, that's why they are known as static Ad-Hoc networks.

Dynamic Ad-hoc Network:- Mobile Ad-Hoc network is an autonomous system, where communicating nodes are connected with each other through wireless links. There is no restriction on the nodes to join or leave the network, therefore the communicating nodes can join

or leave path freely. Mobile Ad-Hoc network topology is dynamic that can change rapidly. This property of the nodes makes the mobile Ad-Hoc networks unpredictable from the point of view of scalability and topology.

II. CHARACTERISTICS OF MANET

Mobile ad hoc network is a collection of autonomous and mobile elements such as laptop, smart phone, tablet PC etc. The mobile nodes can dynamically self-organize in arbitrary temporary network topology. There is no preset infrastructure thus it does not have the clear boundary. Some main characteristics of MANET are discussed below:

Infrastructure less:-MANET is an infrastructure less system which has no central server, or specialized hardware and fixed routers. All communications between nodes are provided only by wireless connectivity.

Wireless Links:- Wireless links make Mobile Ad Hoc Network unreliable and susceptible to various kinds of attacks. Because of limited power supply of wireless nodes and mobility of nodes, the wireless links between those nodes in the mobile ad hoc network are not consistent for communication participants.

Node Movement:- Mobile nodes are autonomous units in network which continuously change their position and topology independently. Due to continuous motion of nodes the topology changes frequently which mean tracking down of particular node become difficult. The nodes can easily come out of or into the radio range of various other nodes. The routing information of nodes changes continuously as their movement becomes random.

Power limitation:- The mobile hosts are small and light weight. They are supplied by limited power resources such as small batteries. This limitation causes susceptibility namely when attackers may target some node batteries to disconnect them, that may lead to network partition. Some attacks may try to engage the mobile nodes un-necessarily, so that they keep on using their battery for early drainage.

III. MANET ROUTING PROTOCOL

Routing is an important and challenging issue in dynamic multi-hop networks. Thus, many routing protocols algorithms have been proposed in recent years. A routing protocol is used to discover routes between nodes allowing communication within the network. The main goal of such a routing protocol is to establish a correct and efficient route between a pair of nodes, so that messages can reach their destination in a timely manner. During the last two decades, many mobile ad hoc network routing protocols have been proposed because of their importance in

dynamic networks [4]. It is not possible to consider a particular algorithm or class as the best for all scenarios. Each protocol has its own advantages and disadvantages and may only be suited for certain situations [1]. Due to a variety of challenges, designing a mobile ad hoc network routing protocol is a tough task. Firstly, in mobile ad hoc networks, the topology changes frequently because of node mobility. Secondly packet losses may occur frequently because of the variable and unpredictable capacity of wireless links. Furthermore, the broadcast nature of the wireless medium introduces the hidden terminal and exposed terminal problems, mobile nodes have limited power, limited bandwidth resources and require effective routing schemes.

Destination Sequenced Distance Vector (DSDV):- DSDV is a proactive routing protocol which maintains routes regardless of their usage. It is based on the Bellman-Ford routing algorithm, which can become unacceptable in mobile ad hoc networks because of its long convergence time. Numerous extensions or modifications to DSDV have been proposed to improve its performance such as [9-16]. DSDV is a distance vector routing protocol and it solves the major problem associated with the Distance Vector routing of wired networks (i.e., Count-to-infinity), by using destination sequence numbers. Also, at all times, the DSDV protocol guarantees loop-free paths to each destination.

Using DSDV, each mobile node maintains a routing table that lists one route for each destination. Each routing table entry consists of the destination node, the first hop towards the destination, the metric (number of hops to reach the destination), and the sequence number which is originally generated by the destination node. Sequence numbers are used to distinguish the new routes from the stale routes. The routing table is used to transmit packets between the nodes of the network.

Ad Hoc On- Demand Distance Vector Routing Protocol (AODV):- Ad hoc On-Demand Distance Vector Routing Protocol (AODV) [17][19][20] is a unicast reactive routing protocol, where the routes are constructed only when needed. AODV maintains a routing table where routing information about the active paths is stored.

AODV protocol use four control packets: Hello messages, Route Requests (RREQs), Route Replies (RREPs), and Route Errors (RERRs). Each node maintains a routing table which contains: Destination, Next Hop, Number of hops (metric), Sequence number for the destination, Active neighbors for this route, and Expiration time for the route table entry. Each time a route entry is used, the timeout of the entry is reset to the current time plus active route timeout. The sequence number is used to ensure loop freedom in distance vector routing protocols. The sequence number is sent with RREQ (for source) and RREP (for destination) and stored in the

routing table. The larger the sequence number the newer the route information. If a new route is offered, the sequence numbers of the new route and the existing route are compared. The route with the greater sequence number is used. If the sequence numbers are the same, then the new route is selected only if it has less number of hops.

Dynamic Source Routing Protocol (DSR):- The second reactive routing protocol is the Dynamic Source Routing Protocol (DSR) [18]. It is based on the concept of source routing. Unlike other unicast routing protocols, DSR does not maintain a routing table, but uses a Route Cache to store the full paths to the known destinations. Unlike other protocols, DSR requires no periodic packets. For example, it does not use any periodic routing advertisements. The lack of periodic activity may reduce the control overhead. The protocol is composed of two mechanisms to discover and maintain the source routes: Route discovery and Route Maintenance.

IV. IMPLEMENTATION

In this work, the random way point mobility model is used for the simulation of MANET routing protocols. The source-destination pairs are spread randomly over the network where the point to point link is established between them.

In this work TCP agent with FTP traffic is used with random packet size and speed rate used for the transmission. The simulation configuration for mobile nodes consists of many network components and simulation parameters that are shown in the table in detail.

Table1:- Simulation Parameter

Parameter	**Value**
Simulation TOOL	Network Simulator-2.35
IEEE Scenario	802_11
Mobility Model	Two Ray Ground
Number Of Nodes	20, 60, 100
Node Movement speed	5m/sec, 10m/sec, 15m/sec
Traffic Type	TCP
Antenna	Omni Directional Antenna
MAC Layer	IEEE 802_11
Routing Protocols	AODV, DSDV,DSR
Queue Limit	50 packets
Simulation Duration	200 sec
Simulation Area(in meter)	2000*2000

Queue type	Droptail, CMUPriqueqe
Channel	Wireless Channel

V. SIMULATION RESULTS

In order to quantify the differences between ad hoc routing protocols, we have used a set of performance metrics. We chose to evaluate the ad hoc routing protocols based on the following five metrics:

Packet delivery ratio:- Packet delivery ratio is the ratio between the number of packets originated by the application layer and the number of packets received by the final destination. It is important that a routing protocol keep the packet delivery ratio as high as possible since efficient bandwidth utilization is important in wireless networks where available bandwidth is a limiting factor. This metric is important since it reveals the loss rate seen by the transport protocols and also characterizes the completeness and correctness of the routing protocols.

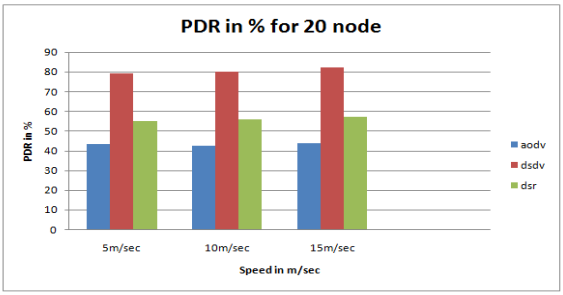

Figure1:-PDR for 20 node with different speed

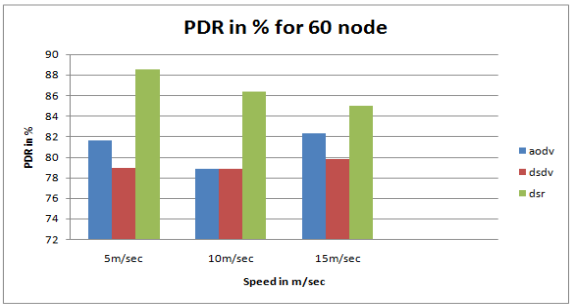

Figure2:-PDR for 60 node with different speed

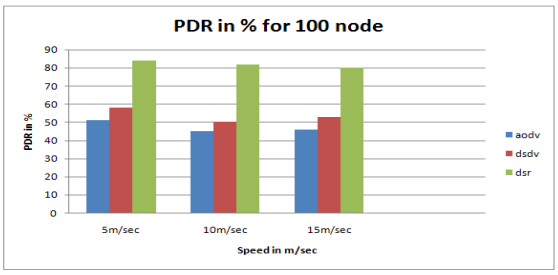

Figure3:-PDR for 100 node with different speed

Throughput:- Since the available bandwidth in a network is fairly well known, it is interesting to know the actual throughput. This value shows how efficient a routing protocol is. The higher the average throughput, the less routing protocol overhead is consuming bandwidth.

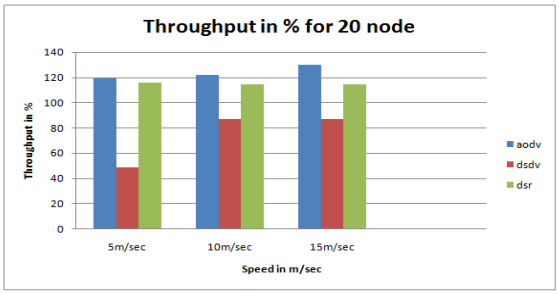

Figure4:-Throughput for 20 node with different speed

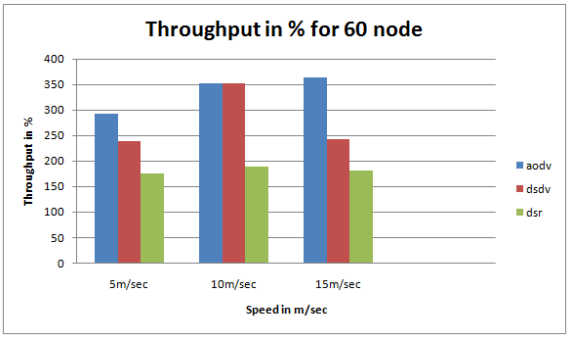

Figure5:-Throughput for 60 node with different speed

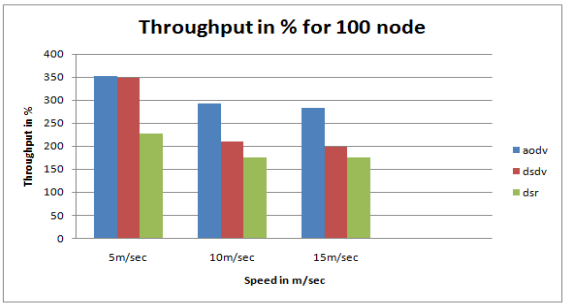

Figure6:-Throughput for 100 node with different speed

End-to-End delay:-The end-to-end delay is the total delay that a data packet experiences as it travels through a network. This delay is the result of the several delays that a packet experiences as it passes through the network. These delays include the time spent in packet queues, forwarding delays, propagation delays (the time it takes for a packet to travel through the medium), and time needed to make retransmissions if a packet got lost.

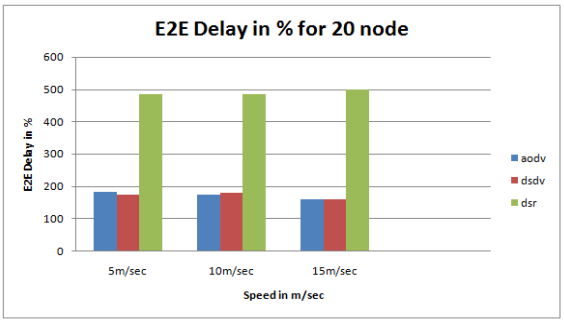

Figure7:- End to End Delay for 20 node with different speed

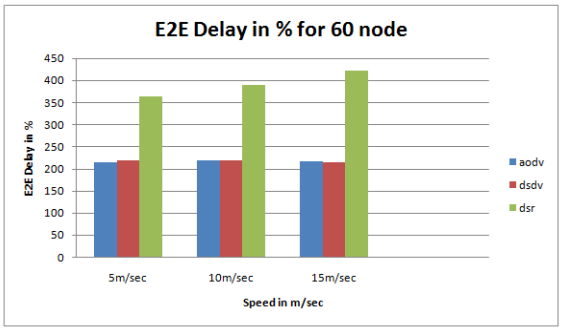

Figure8:- End to End Delay for 60 node with different speed

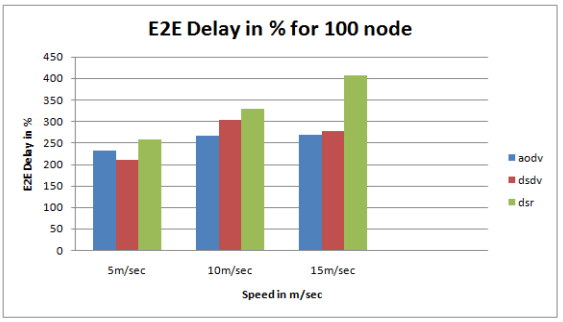

Figure9:- End to End Delay for 100 node with different speed

VI. CONCLUSION

From all the above analysis it concluded that for different performance matrices different cases has been observed for example DSR routing protocol is having Very good PDR as compared with DSDV and AODV. If conclude relatively PDR is directly proportional to Throughput but inversely proportional to End to End Delay thus from this analysis it has been proved. The mobile environment is being used with various mobility of node. This work results could be very helpful for future researches for a smart mobile environment. Below table demonstrate brief results of all the protocols.

REFERENCES

1. N. Balloon and J. Go, “Increasing Broadcast Reliability in Vehicular Ad Hoc Networks,” In Proc. of the 3rd ACM Int. Workshop on Vehicular Ad Hoc Networks VANET'06, NY, USA, pp. 104-105, 2006.
2. Aaron and J. Wang, “Performance Comparison of Ad-hoc Routing Protocols for Networks with Node Energy Constraints”, IEEE INFOCOM, Hong Kong, 2004.
3. C. Perkins and P. Bagwig, “Highly dynamic destination sequenced distance-vector routing for mobile computers”, Computer Communication Review, pages 234-244, October 1994.
4. Elizabeth M. Royer, Chai -Keong Toh, “A Review of Current Routing Protocols for Ad Hoc Mobile Wireless Networks”, IEEE Personal Communications, April 1999.
5. Pietro Michiardi and Refik Molva , “A Collaborative Reputation Mechanism to enforce node cooperation in Mobile Ad hoc Networks”, in proceeding of Institute Euro com – 2229 Route des Cretes BP 193 06904 Sophia Antipolice , France.
6. J. Broch, D. A. Maltz, D. B. Johnson, Y. Hu and J. Jetcheva, “A Performance comparison of multi-hop wireless ad hoc network routing protocols,” in Proc. ACM/IEEE Int. Conf. on Mobile Computing and Networking, pp. 85-97, October 1998.
7. T. Clausen, P. Jacquet, A. Laouiti, P. Minet, P. Muhlethaler, A. Qayyum, and L. Viennot "Optimized Link State Routing Protocol(OLSR)," RFC 3626 (Experimental), IETF, October 2003.
8. Parno, and A. Perrig “Challenges in securing vehicular networks,” In Proc. of the Int. Workshop on Hot Topics in Networks (HotNets-IV), 2005.
9. J. W. Creswell, “Research Design: Qualitative, Quantitative and Mixed Methods Approach”, 2nd Ed, Sage Publications Inc, California, July 2002.
10. G. Korkmaz, E. Ekici, F. Özgüner, and U. Özgüner, "Urban multi-hop broadcast protocol for inter-vehicle communication systems," In Proc. of the 1st ACM Int. Workshop on Vehicular Ad Hoc Networks VANET'04, NY, USA, pp. 76-85, 2004.
11. Ale Vallejo, Guiomar Corral, Jaume Abella and Agustin Zaballos, "Ad hoc routing performance study using NS2 ," University Ramon Llull, Barcelona ,Spain, 2006.
12. Johnson, Y. Hu and D. Maltz, "Dynamic Source Routing Protocol (DSDV) for mobile ad -hoc networks," RFC 4728 (Experimental), IETF, Feb. 2007.
13. Seddik-Ghaleb, Y. Ghamri-Doudane, and S. M. Senouci, "Effect of ad hoc routing protocols on TCP performance within MANETs," in Proceedings of 3rd Annual IEEE Communications Society on Sensor and Ad Hoc Communications and Networks, 2006, SECON '06, vol. 3, pp. 866-873, January 2007.
14. C. Mbarushimana, A. Shahrabi, and H. Larijani, "The effect of routing protocol dynamics on TCP performance in mobile ad hoc networks," in Proceedings of the First International Conference on Network-Based Information Systems, NBiS 2007, Regensburg, Germany, 2007, pp. 20-29, 2007.
15. David B. Johnson, “Ariadne : A Secure On-Demand Routing Protocol for Ad Hoc Networks”, in Wireless Networks (WINET), ACM and Springer, 11(1-2):21-38, January 2005.
16. Otman Basir , “A Reliable Data Transmission Approach in VANET using RLSMP”, International Journal of Computer Science and Telecommunications [Volume 3, Issue 3], March 2012.