Evaluation of Routing Performance in Mobile Ad hoc Networks Using Domination Set

S. Pasupathy(Associate Professor)[1], P. Nandhini(PG scholar)[2]
[1, 2] Department of Computer Science and Engineering
[1, 2]Annamalai University, Chidambaram, India

Abstract- *Mobile Ad hoc Network requires improved routing performance. Nodes are frequently gets change in ad hoc network, so there is increase in the routing overhead. In this paper, the routing performance is improved by reducing control overhead. In the proposed system, the domination set based routing is implemented. The nodes which use to connect all the other nodes in the network are called dominating nodes, and the dominating node with its adjacent nodes forms domination set. The routing of data packet from source to destination is only through domination nodes. Suppose, if there is any link failure, then the corresponding domination node rectifies it locally and send the data by any other alternate node. This project work proposes an efficient method for finding the route and reducing the re-route establishment delay and increases the Packet Delivery Ratio, Throughput and decreases the Routing Overhead, Packet Drop Ratio. The efficiency of this routing method is demonstrated through the simulation study.*

Keywords- Ad hoc Routing Performance, Domination Node, Domination Set, Overhead, Link Failure.

I. INTRODUCTION

Mobile Ad hoc network is a collection of independent mobile nodes forming a temporary network without the aid of any fixed infrastructure or centralized administration. The network topology may change quickly and randomly due to mobility of nodes. MANET contains short radio range and limited bandwidth. Also, in MANET the decentralized network leads to perform the routing functionalities by nodes themselves such as route discovery, topology discovery and delivering messages from source to destination. So, it requires efficient routing method to send the data packet from source to destination as much as possible. Mobile stations in MANETs are free to move around. Because of the fixed transmission range of mobile terminals, the network topology changes dynamically resulting in network establishment and breaking of some existing network links. Conventional routing algorithms are not suitable for MANET. Routing algorithms are categorized into three i.e., Reactive, Proactive and Hybrid. In Reactive routing algorithms, the route is established and determined only at the time of data packet transmission. So that route establishment process, it takes more time to find the route and there is a much delay occur. And also the routing information's are not available readily in reactive routing protocol. For finding the route, it needs many control packets. Usages of too many control packets to find the route induce the control overhead in the network. In proactive routing algorithm, the nodes are keeps the routing information on the routing table periodically, When there is a need of sending the data packet from source S to destination D. Then all the nodes know about its neighbors node due to its periodic exchange of information between all the nodes, in this case the routing overhead is very high. In hybrid routing protocol algorithm is used to determine the optimal network destination and its reports the modifications in the network topology. As per the study, the reactive protocol algorithms are more efficient than the other two protocols. Due to the frequent topology changes, frequent disconnections are occurring in MANET. In all of this algorithm, when there is a route failure occur then the re-route process diminish the performance of the network by inducing more overhead.

II. RELATED WORK

D.B. Johnson and D.A. Malts [1], have described about the DSR based routing. The dynamic source routing (DSR) without constructing any routing tables. Normally, the resultant routing path is not the shortest. However, this protocol adapts quickly to routing changes when host movement is frequent, yet requires little or no overhead during periods in which hosts move less frequently. The approach consists of *route discovery* and *route maintenance*. Route discovery allows any host to dynamically discover a route to a destination host. Each host also maintains a *route cache* in which it caches source routes that it has learned. Unlike regular routing-table-based approaches that have to perform periodic routing updates, route maintenance only monitors the routing process and informs the sender of any routing errors. One can easily apply Johnson's approach to the dominating set- based routing, where route discovery is restricted to the sub-network containing the connected dominating set.

Matulya Bansal,Gautam Barua [2] have described about the performance of on-demand routing protocols such as Ad hoc on demand distance vector (AODV) and Dynamic source routing (DSR) routing protocols in the scenario of Random Mobility Model using both conventional TCP and

TCP Vegas traffic sources. The objective of the work is to understand the working mechanisms and to investigate which routing protocol gives better performance when TCP and TCP Vegas are used as the traffic source.

M.R. Pearlman and Z.J. Hass [3] the *zone-based routing* compromising approach, where each routing table keeps information for destinations within a certain distance (the corresponding area is called a *zone*). Information for destinations outside the zone area is obtained on an on-demand basis, i.e., through a route recovery phase as in DSR.
Puneet Kumar Bhardwaj, Shipra Sharma,Vandana Dubey [4] this paper presents conducted survey of protocol properties of various MANET routing algorithms and analyzed them. The routing algorithms considered are classified into two categories proactive (table driven) and reactive (on demand). The algorithms considered are DSDV, DSR, and AODV. The comparison among three routing protocols are based on the various protocol property parameters such as Route Discovery, Network Overhead, Periodic Broadcast ,Node overhead etc. reactive routing protocol AODV performance is the best considering its ability to maintain connection by periodic exchange of information, which is required for TCP, based traffic. DSR/AODV performs better than DSDV with large number of nodes. Hence for real time traffic AODV is preferred over DSR and DSDV. For less number of nodes and less mobility, DSDV's performance is superior.

Shivi Sharma*, Sonia Jangra [5] the hello Messaging scheme is proposed to solve the problems related to battery consumption and network overhead. The Hello Messaging Scheme aims to reduce unnecessary hello messages while neighbour discovery and also to establish a reliable connection between the source node to the destination node.

III. COMPUTATION OF DOMINATION SET

In graph theory, the domination set is the subset of the graph such that each node is either in the set or has a neighbors in the set. The determination of the domination set is distributed among the nodes. Every node in the network can be reached through the domination nodes.

The below Fig. 1 shows a domination set formation of Mobile Ad hoc Network.

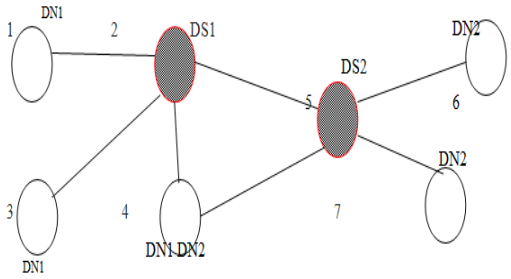

Figure 1: Domination Set Formation

DN - Domination Node
DS - Domination Set

A. Algorithm for finding Domination Set

The algorithm below establishes the domination set

Step 1: **Input:** N-number of nodes in a network
Step 2: **Output:** Maximum flow of Data packet using Minimum Bandwidth and high Throughput
Step 3: Begin
Step 4: Node (x)
Step 5: if Y is a neighbor, add to the neighbor list.
Step 6: Send this list to its neighbors.
Step 7: all nodes know the neighbor list of nodes.
Step 8: From the neighbors list, the weight-age of each node is identified.
Step 9: The node which have higher weight-age is selected as a domination node.
Step 10: Domination set is formed from the Domination Node.
Step 11: Send packet units of Flow.
Step 12: Update weight-age based on the neighbors list.

IV. DOMINATION SET BASED ROUTING

First step of this algorithm is to find the domination set. Then the route is established to the destination only through the domination nodes. The nodes in the domination set are able to connect all the nodes in the network as soon as possible. So it is easy to get the destination within no time. When the route failure occurs in MANET then the corresponding domination node identifies and rectifies the problems locally. It can reach the destination through other nodes if possible. Otherwise it will flood the route failure report to the other domination nodes. In the initial phase, the domination nodes are determined form the Weight-age base. For that each node determines its neighbour node by sending the HELLO packet. After determining the neighbours, the neighbouring list is sent to the adjacent nodes and each node

prepares its own routing table. From this table, the route which has higher number of neighbours it taken as a domination node. It is easy to find out the dominating nodes and finally domination set, as by using the above mentioned algorithm.

V. RESULT AND DISCUSSION

The proposed domination set based algorithm is implemented successfully by using the NS2 network simulator. The performance of this DBR (Domination set Based Routing) is compared with the existing AODV algorithm. By this Comparison the DBR performance is better than the AODV in terms of packet delivery ratio, throughput, routing overhead, Packet drop ratio. The simulation parameters are as follows.

Parameter	Value
Routing Protocols	DBR, AODV
MAC Protocols	IEEE 802.11
Number of Nodes	15
Simulation Area	500 × 500
Packet Size	1024

Suppose in AODV, route failure is detected means, this will be reported by the intermediate node to the source node and the source node re-initiates the route discovery process by sending too many control packets. This will surely degrade the performance and throughput because some of the packet missed in the midst of the transmission. All the node need to maintain the routing information. If there is a link failure while transferring data packet, then again the source node need to retransmit the data packet. This clearly justifies that the proposed work is more efficient in terms of packet delivery ratio, control overhead and packet drop ratio and Throughput. In this method, initially all the dominating nodes in the networks are located. From this a domination set is created. The route is established through the members in the domination set only. All nodes in the network can be reached through the dominating nodes. When the route fails, it is easy to find the new route by using the domination nodes. This ensures the re-route establishment without any delay and overhead, thereby enhancing the routing performance, even when the route breaks occurs.

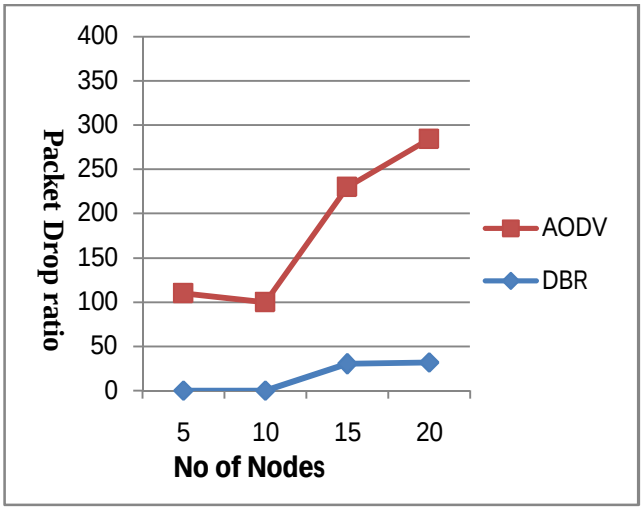

Figure 2: Packet Drop Ratio

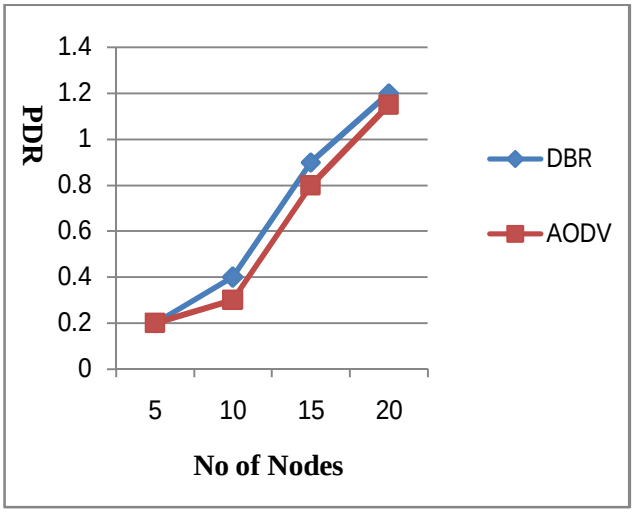

Figure 3: Packet Delivery Ratio

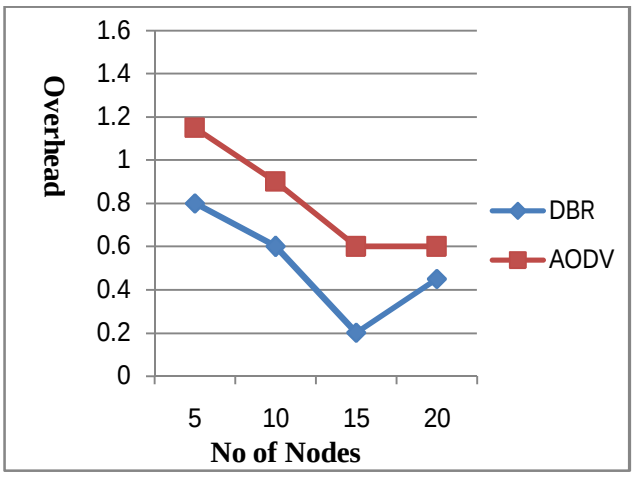

Figure 4: Routing Overhead

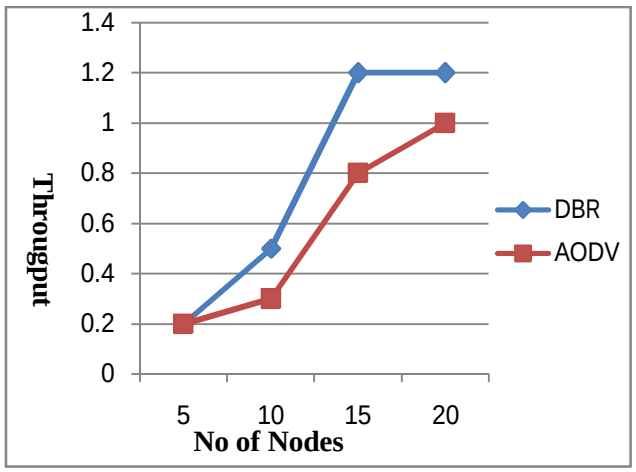

Figure 5: Throughput

VI. CONCLUSION

In this paper, an algorithm was proposed for routing the data packet from source to destination in effective manner. In existing system, when the route failure occurs, the route establishment process starts from the beginning in the normal case. This causes many packet losses and the retransmission of the lost packet is high. But in our proposed work, domination set based routing (DBR) is implemented, the route reestablishment and retransmission is carried out by domination nodes and the delay gets reduced. Accordingly new route discovery process is not required, while the active communication can be continued. This ensures the performance enhancement in terms of packet delivery ratio (PDR), number of packets dropped and the network overhead. On the whole, the challenge in routing is reduced by this proposed algorithm.

REFERENCES

[1] Johnson D.B. and Malts D.A. (1996), 'Dynamic source routing in ad hoc wireless networks', Mobile Computing, eds. T. Imielinski and H. Korth (Kluwer Academic, Dordrecht).

[2] Matulya Bansal and Gautam Barua (2002), 'Performance Comparison of Two On Demand Routing Protocols for Mobile Ad hoc Networks', IEEE Personal Communication.

[3] Pearlman M.R. and Hass Z.J. (1999),' Determining the optimal configuration for the zone routing protocol', IEEE Journal on Selected Areas in Communications, 1395–1399.

[4] Puneet Kumar Bhardwaj, Shipra Sharma,Vandana Dubey (2012), 'Comparative analysis of reactive and proactive protocol of mobile ad hoc networks', International Journal on Computer Science and Engineering.

[5] Shivi Sharma and Sonia Jangra (2015), 'Energy Efficiency using Adaptive Hello Scheme for MANET', International Journal of Advanced Research in Computer Science and Software Engineering, Vol.5(7).

[6] Cheng X. and Du D. (2002), 'Virtual backbone-based routing in multihop ad-hoc wireless networks', Technical Report 02-002, University of Minnesota, Minnesota, USA.

[7] Das B., Sivakumar R. and Bhargavan V. (1997), 'Routing in ad hoc networks using a spine', IEEE International Conference on Computers and Communications Networks.

[8] Gao et al. (2004), 'An Effective Distributed Approximation Algorithm For Constructing Dominating Set in Wireless Ad Hoc Networks', proc. of the fourth international conference on computer and information technology (CIT'04).

[9] Guha S. and Khuller S. (1998), 'Approximation algorithms for connected dominating sets', Algorithmica, Vol. 20(4), pp. 374–387.

[10] Theoleyre F. and Valois F. (2005), 'Virtual structure routing in ad-hoc networks', IEEE ICC, Seoul, Korea.

[11] M. Chatterjee, S. Das and D. Turgut, 'WCA: A weighted clustering algorithm for mobile ad hoc networks', Cluster computing Journal, Vol. 5, No. 2, pp. 193–204, 2002.

[12] Z. El.Bazzal, M. Kadoch, B. L. Agba, F. Gagnon and M. Bennani, 'A flexible weight based clustering algorithm in mobile ad hoc networks', International Conference on Systems and Networks Communications, pp. 50, Tahiti, 2006.

[13] N. Chauhan, L. K. Awasthi, N.Chand, V. Katiyar and A. Chugh, 'A distributed weighted cluster based routing protocol for MANETs', Wireless Sensor Network, Vol. 3, No. 2, pp. 54 – 60, 2011.

[14] Network Simulator, http://www.isi.edu/nsnam/ns/index.html.

[15] Elizabeth Royer and C.K.Toh, 'A Review of Current Routing Protocols for Ad hoc Mobile Wireless Networks', IEEE Personal Communication Magazine, April 1999, pp. 46-55.