RESEARCH ARTICLE   OPEN ACCESS

A New Approach For Reducing Routing Overhead In MANET

Shraddha Dabhade[1], Shilpa Verma[2]

[1](ME Student, Department of Computer Engineering,
Thadomal Shahani Engineering College, Mumbai University, Mumbai-50)
[2](Associate Professor, Department of Computer Engineering,
Thadomal Shahani Engineering College, Mumbai University, Mumbai-50)

****

Abstract:

In MANET, the mobiles nodes are connected dynamically with the help of wireless links without having a fixed infrastructure or centralized administration. These nodes move freely and organize themselves arbitrarily thus change the network topology rapidly and unpredictably. As a result, there exits frequent link breakages which leads to path failures and route discoveries. The route discovery can lead to overhead which cannot be neglected. Therefore, the fundamental challenge of MANET is to develop a dynamic routing protocol that efficiently establish routes to deliver the packets with minimum overhead, high throughput and low end to end delay. In order to handle overhead issues, the proposed system has presented a novel scheme rebroadcast delay and a rebroadcast probability which will help to reduce the number of retransmissions thereby improving routing performance. In addition, the proposed system is compared with existing routing protocol AODV in terms of packet delivery ratio, packet loss and end to end delay

Keywords **— Networking, Mobile Ad-Hoc Network, Routing overhead, NCPR, NS2**

****

I.   INTRODUCTION

With the increased popularity of mobile ad-hoc network, a growing research activity is carried out due to its potential civilian and military applications. In MANETs, mobiles nodes are interconnected without having fixed infrastructure via wireless links. These mobile nodes move freely and are self organized dynamically without having a centralized administration.

MANETS offers various advantages such as fault tolerance, less infrastructure costs and ease of establishment. However, node mobility is the key factor within MANET which can cause the network topology to change rapidly which leads to frequent link breakages and path failures.

Various routing protocols have been proposed for mobile ad-hoc networks over the recent years. The routing protocol for MANETS fall into two categories depending upon the initiation of route discovery: proactive and reactive. The proactive routing protocols such as DSDV and OSLR aims to maintain consistent and up-to-date routing information for every node. These mobile nodes are required to periodically locate and maintain paths to every possible destination which leads to large routing overhead in high mobility environment. In reactive routing protocols such as AODV and DSR, routes are discovered on demand thereby improving scalability of MANETS. However, node mobility can cause frequent link breakages which leads to path failures and route discovery thereby increasing routing overhead.

This paper proposes a novel Trusted Neighbour Coverage-Based Probabilistic Rebroadcast Scheme that integrates the approach of Probabilistic mechanism and Neighbour Coverage Knowledge which will significantly help to decrease the number of rebroadcasts thereby reduce the routing overhead and enhance routing performance. The proposed system has a novel rebroadcast delay which can be used to determine the rebroadcast order thereby help to effectively exploit the neighbour coverage knowledge. In addition, the

proposed system has a novel rebroadcast probability which can be used to decrease the number of retransmission of the RREQ packets thereby help to enhance the routing performance.

II. RELATED WORK

The effective mechanism for route discovery is Broadcasting. However, this mechanism causes excessive redundant rebroadcasts of RREQ packets and packet collision in high dynamic networks. This phenomenon is termed as broadcast storm problem. Haas et al.[3] proposed a gossiping based approach where each node transmits a packet with a gossiping probability. This approach reduces 35 percent of routing overhead than broadcasting. However, this approach is limited for high density networks.

Kim et al.[2] propounded probabilistic broadcasting approach which utilizes coverage area information to set the rebroadcast probability and also requires neighbour approval to ensure attainability. Peng and Lu[4] proposed a Scalable Broadcast Algorithm which decides the retransmission of RREQ packet based on the fact whether this retransmission would reach auxiliary nodes.

Ni et al.[1] examined the broadcasting protocol experimentally and showed that retransmission is very expensive and utilizes too much network resource. In addition, broadcasting increases routing overhead and incurs various issues such as contentions, collisions and redundant rebroadcasts.

Keshavarz-Haddad et al.[6] propounded two timer-based broadcast approach called as Dynamic Reflector Broadcast and Dynamic Connector-Connector Broadcast. This approach results full attainability and robustness during the situation of mobility and node failure.

Chen at al.[5] propounded an AODV protocol with Directional Forwarding Routing which can significantly trace the subsequent hop node for packet forwarding when a route breaks.

III. PROPOSED METHOD

The proposed system is a novel scheme that calculates a rebroadcast delay which helps to determine the forwarding sequence of the packet. The node that has more common neighbors will have less delay. Hence, the key to success for the proposed system is rebroadcast delay which will help to determine the node that has received duplicate packets. In addition, the proposed system also calculates a rebroadcast probability which helps to determine whether the node lies in dense network or sparse network. The rebroadcast probability is composed of two parts: additional coverage ratio which is a ratio of number of nodes to be covered by a single transmission to the total number of neighbors and connectivity factor which helps to keep network connections and decrease the redundant rebroadcasts.

A. Network Formation with various mobile nodes

In this module, the mobile network is formed. The network consists number of nodes and a base station. Each node is assigned a node id and a port number required for broadcasting. A topology is constructed to provide communication paths for wireless network.

B. Identification of Uncovered Neighbours Set

When node n_i gets a RREQ packet from its preceding node s, it uses the neighbor list in the RREQ packet to determine how many of its neighbors have not been covered by the RREQ packet from s. If node n_i has maximum uncovered neighbors by the RREQ packet sent from s, which implies that the node n_i must rebroadcast the RREQ packet in order to cover more additional neighbour nodes. To quantify this, the Uncovered Neighbors set U(n_i) is defined of node n_i as follows:

$$U(n_i) = N(n_i) - [N(n_i) \cap N(s)] - \{s\}$$

where N(s) and N(n_i) are the neighbors sets of node s and ni, respectively. Node s sends a RREQ packet to node n_i. From this step, the initial Uncovered neighbor set(UCN) is obtained.

C. Rebroadcasting Delay calculation

Due to transmission features of a RREQ packet, node n_i can receive the duplicate RREQ packets from its neighbors. Node ni can further modify the $U(n_i)$ with the help of neighbor list knowledge. In order to sufficiently obtain the neighbor knowledge and avoid channel collisions, each node sets a rebroadcast delay. The rebroadcast delay of node n_i is defined as follows

$$(n_i) = 1 - \frac{|N(s) \cap N(n_i)|}{|N(S)|}$$

$(n_i) = \text{MaxDel X } (n_i)$

Here (n_i) is the delay ratio of node ni, and MaxDel is a small constant delay. |.| is the total number of components in a given set.

D. Rebroadcast Probability

The rebroadcast delay increases with the increase in uncovered neighbors. Therefore, the nodes which has high delay due to more uncovered neighbors listens to RREQ packets from the nodes which have lower rebroadcast delay . For example, if node n_i gets a duplicate RREQ packet from its neighbor n_j, it has information about its neighbours covered by the RREQ packet from n_j from its neighbors list. Thus, node n_i can further modify its uncovered neighbor set depending upon the neighbour list in the RREQ packet from n_j. Then, the $U(n_i)$can be adjusted as follows:

$U(n_i) = [U(n_i) \cap N(n_j)]$.

After modifying $U(n_i)$, the RREQ packet received from n_j is rejected. When the timer of the of node ni becomes void, the node acquires the final UCN set. The nodes that are associated to the final UCN set should receive and process the RREQ packet. In addition, if a node does not recognise any duplicate RREQ packets from its neighborhood, its UCN set is not modified, which is the initial uncovered neighbor set[1][2][3].

E. Additional Coverage ratio

The additional coverage ratio of node n_i can be defined as :

$T_a (n) = |U(n_i)|/|N(n_i)|$

This metric indicates the ratio of the number of nodes that are covered by the transmission to the total number of neighbours of node n_i. The nodes that has been covered are required to receive and process the RREQ packet. As T_a increases, more nodes will be covered by the transmission, and more nodes need to receive and process the RREQ packet, and, therefore, the rebroadcast probability is set higher.

F. Connectivity Factor

The minimum $F(n_i)$ as a connectivity factor can be defined as :

$F_c (n_i) = N_c /|N(n_i)|$

Here $N_c = 5.1774\log n$, and n is the total number of nodes in the mobile network. When $|N(n_i)|$ is greater than N_c and $F_c(n_i)$ is less than 1, it implies that node lies in the dense area of the mobile network.. Also, when $|N(n_i)|$ is less than N_c and $F_c(N_i)$ is greater than 1. It implies node n_i lies in the sparse area of the mobile network. Therefore node n_i should transmit the RREQ packet in order to achieve network connectivity. In addition, the additional coverage ratio and connectivity factor is combined to obtain the rebroadcast probability. The rebroadcast probability pre(n_i) of node n_i is defined:

pre $(n_i) = F_c (n_i) . T_a (n)$.
Here, the pre(n_i) is set to 1 when the pre(n_i) is greater than 1,.

IV.   PERFORMANCE EVALUATION

The performance of existing protocol AODV and proposed system is evaluated based on following measures:

1. PACKET DROP

The average number of packets(including RREQ, route reply(RREP) and RERR packets) dropped resulting from the collision.
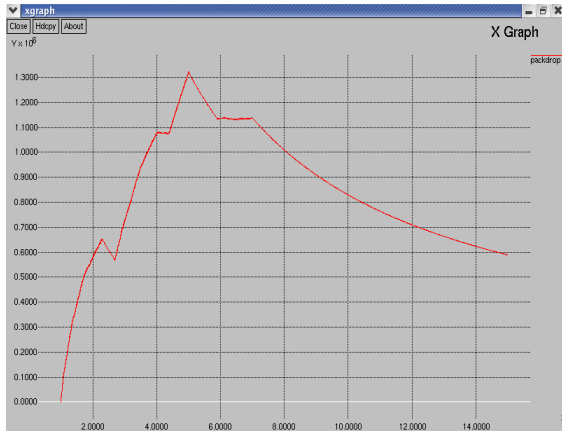

Fig.1 Packet drop of AODV Protocol

The existing protocol AODV has higher packet drop than the proposed system NCPR due to routing overhead.
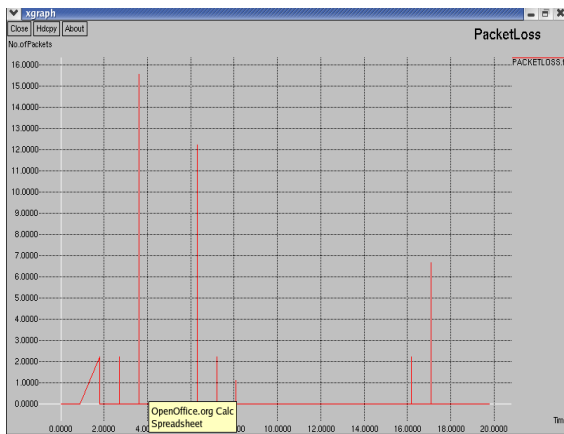

Fig.1 Packet drop of NCPR Protocol

NCPR protocol reduce the redundant rebroadcast, so as to reduce the packet drops caused by collision therefore it can significantly reduce the routing overhead incurred during the route discovery especially in dense network.

2. PACKET DELIVERY RATIO

PDR(Throughput) defines the ratio of the number of packets sent by constant bit rate(CBR) source node to the number of packets received by the destination node .
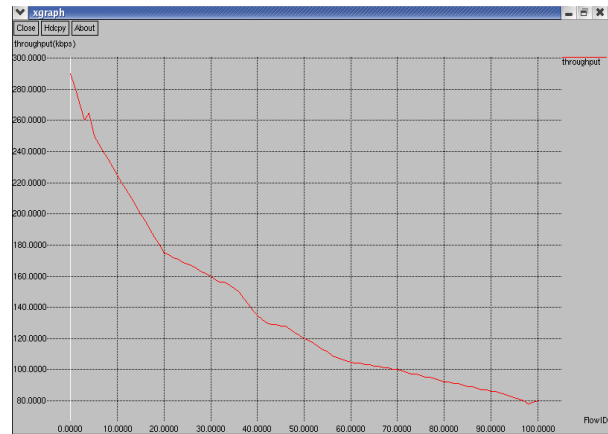
Fig.3 Packet delivery ratio of AODV Protocol

When the number of node is increased, the throughput/PDR of the existing protocol AODV gradually decreased.
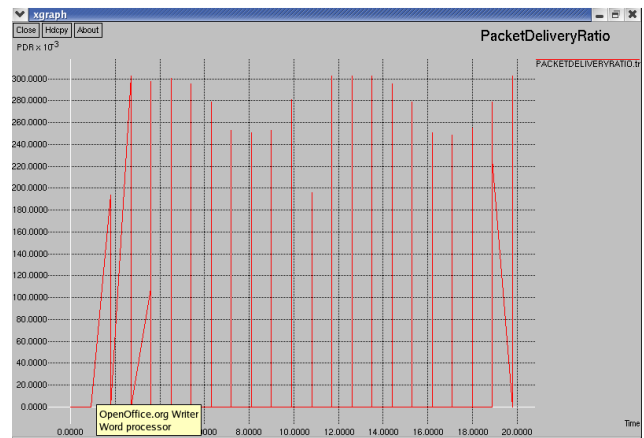
Fig.4 Packet delivery ratio of NCPR Protocol

The PDR ratio of proposed system NCPR is higher than the existing protocol AODV because it significantly reduces the number of packet drops caused by collision.

3. END TO END DELAY

End to End Delay metric is the time taken by the packet to reach the destination node from the source node. It gives the mean time in milliseconds(ms).
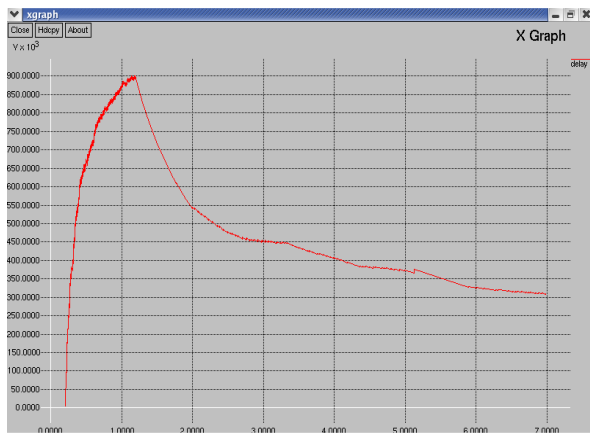
Fig. 5 End to End Delay of AODV Protocol

The end to end delay ratio of AODV protocol is higher due to routing overhead caused by RREQ rebroadcasts.
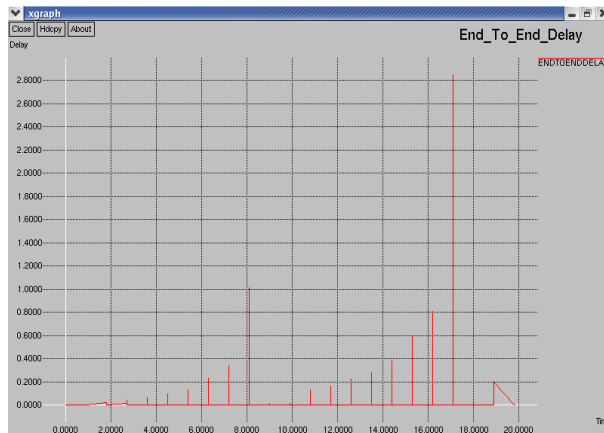

Fig. 6 End to End Delay of NCPR Protocol

The end-to-end delay ratio of the proposed system NCPR is lower than the existing protocol AODV due to a decrease in the number of redundant rebroadcasting packets.

V.   CONCLUSION

The proposed system is a probabilistic rebroadcast protocol based on neighbor coverage knowledge and probabilistic approach propounded to decrease the routing overhead in mobile adhoc network. The proposed system includes additional coverage ratio and connectivity factor. A novel scheme rebroadcast delay is proposed which is used to determine the forwarding order and more effectively acquire the neighbor coverage knowledge. Simulation results show that the proposed protocol generates less routing overhead than the existing routing protocol AODV. Because of less redundant rebroadcast, the proposed protocol reduces the contentions and network collision, in order to increase the packet delivery ratio and substantially reduce the end-to-end delay. The simulation results also show that the proposed protocol has good performance when the network is subjected to heavy load or is in high density area.

ACKNOWLEDGMENT

REFERENCES

[1]   S.Y. S. Y. Ni, Y.C. Tseng, Y.S. Chen, and J.P. Sheu, S.Y. Ni, Y.C. Tseng, Y.S. Chen, and J.P. Sheu, "The Broadcast Storm Problem in a Mobile Ad Hoc Network," Proc. ACM/IEEE MobiCom, pp. 151-162, 1999.

[2]   J. Kim, Q. Zhang, and D.P. Agrawal, "Probabilistic Broadcasting Based on Coverage Area and Neighbor Confirmation in Mobile Ad Hoc Networks," Proc. IEEE GlobeCom, 2004.

[3]   Z. Haas, J.Y. Halpern, and L. Li, "Gossip-Based Ad Hoc Routing," Proc. IEEE INFOCOM, vol. 21, pp. 1707-1716, 2002.

[4]   W. Peng and X. Lu, "On the Reduction of Broadcast Redundancy in Mobile Ad Hoc Networks," Proc. ACM MobiHoc, pp. 129-130, 2000

[5]   J. Chen, Y.Z. Lee, H. Zhou, M. Gerla, and Y. Shu, "Robust Ad Hoc Routing for Lossy Wireless Environment," Proc. IEEE Conf. Military Comm. (MILCOM '06), pp. 1-7, 2006.

[6]   A. Keshavarz-Haddady, V. Ribeirox, and R. Riedi, "DRB and DCCB: Efficient and Robust Dynamic Broadcast for Ad Hoc and Sensor Networks," Proc. IEEE Comm. Soc. Conf. Sensor, Mesh, and Ad Hoc Comm. and Networks (SECON '07), pp. 253-262, 2007.