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Enabling Efficient Rebroadcast For Reducing Routing Overhead In Manets

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Abstract: Mobile Ad Hoc NETwork is a wireless network formed by wireless nodes without any help of infrastructure. In this network, nodes are mobile and can communicate dynamically in an arbitrary manner. The network is characterized by the absence of central administration devices like base stations and access points. One of the fundamental challenges in Mobile Ad Hoc NETwork is to discover the route with good performance and less overhead. The overhead of a route discovery cannot be neglected. Limiting the number of rebroadcasts can optimize the broadcasting. Enabling efficient rebroadcast for reducing routing overhead in Mobile Ad Hoc NETwork is used to reduce the number of retransmissions and routing overhead. The probabilistic rebroadcast algorithm is used to calculate the Covered Neighbor set and UnCovered Neighbor set for broadcasting. Broadcasting based on probabilistic rebroadcast algorithm can effectively discover the route by using the additional coverage ratio and connectivity factor. Simulation results are demonstrated using NS-2 Simulator. From these results, the proposed system significantly decreases the number of retransmissions, routing overhead and increases the routing performance.

Index terms: Mobile Ad Hoc Networks, Route Request, Connectivity factor.

I. INTRODUCTION

Mobile Ad Hoc NETworks (MANETs) [5] consist of a collection of mobile nodes that can move freely. These nodes can communicate without any aid of infrastructure and can be deployed for many applications such as battlefield, disaster relief and civilian applications. One of the fundamental challenges in MANETs is to design a routing protocol with good performance and less overhead. Ad hoc on-demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) are some of the on-demand routing protocols that improve the scalability of MANETs by reducing the routing overhead in route discovery. The node mobility in MANETs causes frequent link breakages may lead to frequent path failures and route discoveries. Thus, reducing routing overhead in route discovery is an essential problem. Many routing protocols have been suggested for MANETs over the past few years. Routing protocols are mainly used to find the route to the destination for sending the packet. In general, the routing protocols for MANETs fall into three categories based on the initiation of route discovery process such as Proactive Routing, Reactive Routing and Hybrid Routing. Destination Sequence Distance Vector routing (DSDV) is the example for proactive routing. Ad hoc on-demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) are the examples for reactive routing. In conventional on-demand routing protocols, the route discovery is done by using either flooding technique or broadcasting technique. In flooding technique, source node blindly flood the Route REQuest packet (RREQ) [8] to all the other nodes that are present in the network until it find the route to the destination. Flooding of RREQ packet to all the other nodes continues until the source node gets the reply from the destination. This causes severe overhead. In broadcasting technique, the source node has to find the route to the destination node. The source node broadcast RREQ [1] only to its neighbors. The neighbors of the source node start to rebroadcast the RREQ packet to their neighbors. The broadcasting of the RREQ packet continues until it finds the route to the destination. This causes the same RREQ packet to be received again by same node. It is necessary to optimize broadcasting in route discovery. For that, Broadcasting based on neighbor coverage information is mainly used to effectively exploit the neighbor coverage knowledge using a rebroadcast delay. The rebroadcast delay is needed to determine the rebroadcast order and additional coverage ratio. It is also used to keep the network connectivity and reduce the redundant retransmissions. A metric named connectivity factor is needed to determine the number of neighbors that receive the RREQ packet. Additional coverage ratio and connectivity factor are combined to obtain rebroadcast probability. Rebroadcast probability can be used to reduce the number of rebroadcasts of the RREQ packet to reduce the number of rebroadcasts of the RREQ packet to improve the routing performance.

II. RELATED WORK

Broadcasting is an important technique used to find the route to the destination. But the routing overhead associated with broadcasting is quite large in dynamic networks. Williams et al [6] proposed comparison of broadcasting technique for Mobile Ad Hoc NETworks. It uses simple flooding technique and counter based scheme. In this, source node blindly flood the RREQ packet to all the other nodes until it find the route to the destination. This technique failed to operate in congested networks. Perkins et al [1] proposed Ad Hoc On-demand Distance Vector Routing. AODV uses the simple broadcasting technique. In this technique, source node broadcast RREQ packet only to its neighbors. The neighbor of source node broadcast RREQ packet to its neighbors. It continues until it finds route to the destination. This technique is not suitable for more than 50 nodes. Zhang et al [7] proposed a probabilistic broadcasting scheme based on coverage area and neighbor confirmation. This technique uses the coverage area to set the rebroadcast probability. It also uses the neighbor confirmation to guarantee reach ability. Wu et al [4] proposed routing overhead as a function of node mobility modeling framework and implications on proactive routing. It uses proactive routing technique. The nodes maintain a table of routes to every destination in the

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network and periodically exchange messages. Every time the routes to destinations are ready to use. The disadvantages of this routing are every time routes to destinations are updated, even if it is not used. Johnson et al [2] proposed the dynamic source routing protocol for Mobile Ad Hoc NETworks. It uses DSR protocol. In DSR, every node is responsible for confirming the next hop in the source, until confirmation is received from the next hop. Route receives the packet. Each packet is only forwarded once by a node (hop-by-hop routing). If a packet cannot be received by a node, it is retransmitted. The disadvantage is that the same node will receives same RREQ packets again and again. Mohammed et al [12] proposed On the reduction of Counter-based Broadcast scheme for Mobile Ad Hoc NETworks. It uses counter based technique to find the route to the destination. In counter based technique, a counter threshold is chosen and initialize counter c=1, if the broadcast message is received for the first time. If the counter value is less than the counter threshold value, rebroadcasting continues. If the counter value is greater than the counter threshold value, rebroadcasting cannot be done. The disadvantage is every time node has to check whether it is less than the counter threshold value or not. Jing Jing Xia et al [13] proposed neighbor coverage based probabilistic rebroadcast for reducing overhead in MANETs. It uses the NCPR protocol. It considers the neighbor coverage knowledge. The disadvantage is that the same node will receives the same RREQ packet again and again. It creates routing overhead in Mobile Ad Hoc NETworks.

III. ENABLING EFFICIENT REBROADCAST FOR REDUCING ROUTING OVERHEAD

The initial motivation of the system is to optimize broadcasting in route discovery. To optimize the rebroadcast in a more efficient manner, Enabling efficient rebroadcasting for reducing routing overhead in MANETs is used by combining the advantages of neighbor coverage and probabilistic rebroadcasting methods. The main objective of this technique is to reduce the number of rebroadcasting and to reduce the routing overhead.

A. Rebroadcasting Delay

Rebroadcasting delay is to determine the forwarding order. The node that has the more common neighbors with the previous node has the lower delay. Rebroadcast delay enables the information that the nodes have transmitted RREQ packet spread to more neighbors. If node Pi receives the RREQ packet from its previous node K, node K can use the neighbor list in the RREQ packet to estimate number of neighbors have not been covered by the RREQ packet. If node Pi has more neighbors uncovered by the RREQ packet from node K, the node Pi rebroadcast the RREQ packet; the RREQ packet can reach more number of neighbor nodes.

B. Enabling Efficient Rebroadcast Technique

The main contributions of this approach are to calculate the rebroadcasting delay and rebroadcasting probability. The rebroadcast delay is to determine number of nodes that having more neighbours. The rebroadcast probability is calculated by considering the information about the additional coverage ratio and connectivity factor. Additional coverage ratio is the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors. Connectivity factor reflects the relationship of network connectivity and number of neighbors of a given node. It determines number of covered neighbours and uncovered neighbours. Using this technique, the broadcast storm problem is avoided and reducing the routing overhead.

C. Rebroadcast Probability

Rebroadcasting probability considers the information about the UCN and connectivity metrics. The node that has a larger rebroadcast delay may listen to RREQ packets from the nodes that have lowered one. It is not needed to adjust rebroadcast delay because rebroadcast delay is used to determine order of disseminating neighbor coverage details. If the timer of rebroadcast delays of node Pi expires, the node obtains the last UCN set. The nodes belonging to that UCN set are the nodes that need to receive and process the RREQ packet. If the node does not receive any duplicate RREQ packets from its neighbor, there is no change in uncovered neighbour set. The last UCN set is set to the rebroadcast probability. The mobile node is located in the area close to the sender means it has smaller additional coverage area Ould-Khaoua et al [8] and its neighbors may receive the same broadcasting message from others. Broadcasting probability is set as lower. If a mobile node is located in the area far away from sender means its additional coverage area is large, its rebroadcasting probability is set higher. Each and every node has to maintain the routing table. The routing table consists of source id, destination id, and neighbors list and additionally it consists of the list that having the number of neighbors that already receives the RREQ packet and the number of neighbors that not yet receives RREQ packet. To determine covered and uncovered neighbors, using the mathematical formulation,

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

Where, U(pi) - Uncovered Neighbors set,

N(pi) - Neighbors sets of node ni, S - Source node

N(s) - Neighbors sets of source node s.

Every node has to monitor the routing table of its neighbors and also its own routing table. From that, node will broadcast the RREQ packet only to the neighbors that not yet receives the RREQ packet and it avoid sending the RREQ packet to the neighbors that already receives the RREQ packet.

IV PERFORMANCE EVALUATION

A. Simulation Model and Parameters

To evaluate the performance of proposed system, compare it with some existing techniques using NS-2 Simulator. There are 50 nodes created that can run in 1000m X 1000m square region in simulation environment. Assume that all the nodes can run in constant speed with the transmission range 250m. Bandwidth is taken as 2mbps and packet size is 512bytes. The simulation parameters are helpful in simulating the proposed system.

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TABLE1
Simulation parameters

Simulation Parameter	Value
Simulator	NS-2 (V2.30)
Topology Size	1000m X 1000m
Number of Nodes	50, 100, …, 300
Transmission Range	250m
Traffic Type	CBR
Bandwidth	2Mbps
Packet Size	512 bytes
Packet Rate	4 packets/sec
Pause Time	0s
Min Speed	1 m/s
Max Speed	5 m/s

B. Performance Metrics

In enabling efficient rebroadcast technique, each and every node has to send hello packet within its communication range to update their neighbors. All the nodes have to maintain the cache to store the neighbor list temporarily. Source node starts to broadcast the RREQ packets to its neighbors. Finding the covered and uncovered neighbors sets by using connectivity factor. According to the connectivity factor, nodes start to broadcast received RREQ packets. Determining the nodes that having more number of neighbors by using Rebroadcast delay. Each and every node monitors the routing table of its neighbors to avoid sending same RREQ packets. Nodes send the RREQ packets to the uncovered neighbors. If duplicate packets are received for the same node, the node compares the list of neighbors in the RREQ packet with the neighbor list that is present in the cache. Adjusting the neighbor lists that are present in the cache. In order to evaluate performance of the proposed scheme, comparing the proposed scheme with existing scheme by using NS-2 Simulator. Conventional AODV routing is compared with the proposed scheme. The performance can be compared and evaluated by using the following performance metrics.

Throughput: Throughput is one of the metrics to evaluate the performance. It refers to the number of data that can be transferred from one location to another in a given amount of time.

Routing overhead: The average number of transmitted control bytes per second, including both the data packet header and the control packets.

Packet drop: Packet drop is one of the metrics defined as number of packet lost to the total number of packets send.

C. Results

Enabling efficient rebroadcasting for reducing routing overhead in MANETs is evaluated by comparing it with AODV protocol using the NS-2 Simulator. Fig.1 shows routing overhead of the proposed protocol over AODV protocol. It shows that comparing to AODV, proposed protocol having less overhead.

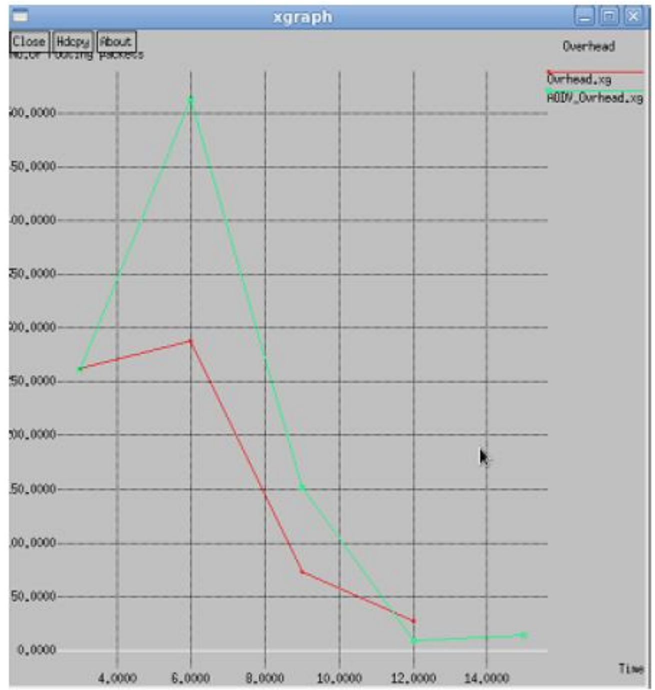

Fig. 1 Overhead

The throughput of the proposed protocol over AODV protocol is shown in Fig. 2

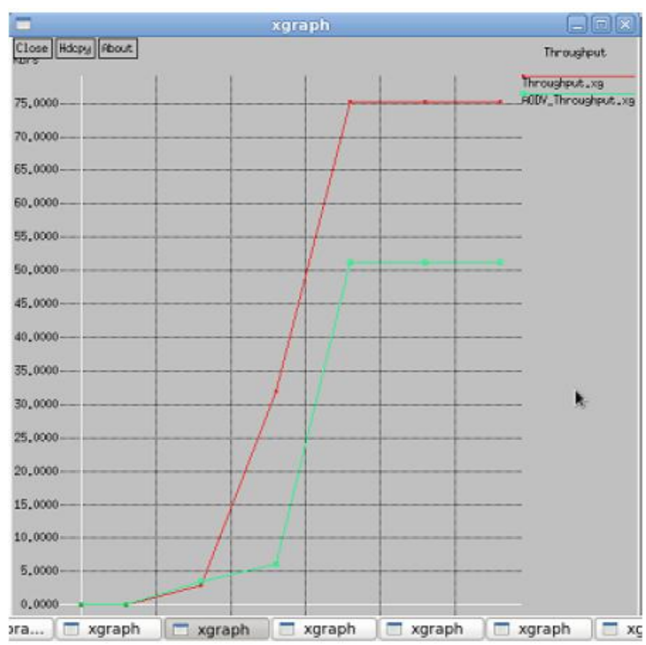

Fig. 2 Throughput

ISSN 2347-4289

V CONCLUSION

Enabling efficient rebroadcast for reducing routing overhead in MANETs is proposed to reduce the number of rebroadcasting and routing overhead in MANETs. It includes neighbor coverage information that considers rebroadcasting delay and connectivity factor. Connectivity factor identifies the covered neighbors and uncovered neighbors. The proposed system reduces number of rebroadcasting than the flooding and counter based methods. Because of less redundant rebroadcast, the proposed system reduces the network collision and contention and increase the packet delivery ratio. Simulation results are defined using Network Simulator version 2. From the Simulation results the proposed system has high packet delivery ratio and low routing overhead Link failure is the important problem in MANETs. Link failure occurs, the source node has to discover another path for sending the packet to destination. Instead of discovering the path for sending the packet, the neighbor nodes of the failed link takes the backup and starts to send the packet. The source node need not discover another path for sending the packet. This is the future enhancement of the system.

REFERENCES

[1]. C. Perkins, E. Belding-Royer, and S. Das, Ad Hoc On-Demand Distance Vector (AODV) Routing, IETF RFC 3561, 2003.

[2]. D. Johnson, Y. Hu, and D. Maltz, The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR) for IPv4, IETF RFC 4728, vol. 15, pp. 153-181, 2007.

[3]. H. AlAamri, M. Abolhasan, and T. Wysocki, “On Optimising Route Discovery in Absence of Previous Route Information in MANETs,” Proc. IEEE Vehicular Technology Conf. (VTC), pp. 1-5, 2009.

[4]. X. Wu, H.R. Sadjadpour, and J.J. Garcia-Luna-Aceves, “Routing Overhead as a Function of Node Mobility: Modeling Framework and Implications on Proactive Routing,” Proc. IEEE Int’l Conf. Mobile Ad Hoc and Sensor Systems (MASS ’07), pp. 1-9, 2007.

[5]. 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.

[6]. B. Williams and T. Camp, “Comparison of Broadcasting Techniques for Mobile Ad Hoc Networks,” Proc. ACM MobiHoc, pp. 194- 205, 2002.

[7]. 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.

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

[9]. J.D. Abdulai, M. Ould-Khaoua, L.M. Mackenzie, and A. Mohammed, “Neighbour Coverage: A Dynamic Probabilistic Route Discovery for Mobile Ad Hoc Networks,” Proc. Int’l Symp. Performance Evaluation of Computer and Telecomm. Systems (SPECTS ’08), pp. 165-172, 2008.

[10]. X.M. Zhang, E.B. Wang, J.J. Xia, and D.K. Sung, “An Estimated Distance Based Routing Protocol for Mobile Ad Hoc Networks,” IEEE Trans. Vehicular Technology, vol. 60, no. 7, pp. 3473-3484, Sept.2011.

[11]. F. Xue and P.R. Kumar, “The Number of Neighbors Needed for Connectivity of Wireless Networks,” Wireless Networks, vol. 10, no. 2, pp. 169-181, 2004.

[12]. F. Stann, J. Heidemann, R. Shroff, and M.Z. Murtaza, “RBP: Robust Broadcast Propagation in Wireless Networks,” Proc. Int’ Conf. Embedded Networked Sensor Systems (SenSys ’06), pp. 85-98, 2006.

[13]. 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.

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

[15]. Jing Jing Xia and Xin Ming Zhang , “A Neighbor coverage based probabilistic rebroadcast for reducing routing overhead in Mobile Ad Hoc Networks”, IEEE Transactions on Mobile Computing, Vol.12, No.3, 2013.

[16]. Mohammed . A and Jabaka. M.L , “On the Performance of Counterbased broadcast scheme for Mobile Ad Hoc Networks”, Nigerian Journal of Basic and Applied Science, Vol.17, no.2, pp. 166-176, 2009.