Middle-East Journal of Scientific Research 23 (10): 2440-2445, 2015
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2015.23.10.22595

Performance Enhancement in Mobile AD-HOC Network Using Modified ZRP

[1]*A. Kumaravel and* [2]*Dr. M. Chandrasekaran*

[1]Department of ECE, Paavai Engineering College, Namakkal India- 637018
[2]Department of ECE, Govt. College of Engineering, Bargur, India - 635104

Abstract: A Mobile Ad-hoc Network (MANET) is a collection of mobile nodes which moves frequently without the aid of any centralized network and they are self-organized and self-configurable network by a collection of mobile nodes. Due to mobility of nodes, there introduces frequent link failures which lead to increased routing overhead and introduce delay during data transmission. These problems put in force to design an efficient routing protocol by combining NCPR with modified ZRP (Zone Routing Protocol) to reduce the routing overhead, power and delay. Reactive Routing protocol causes less overhead when compared to Proactive routing protocol. In the existing system Neighbor Coverage based Probabilistic Rebroadcast protocol (NCPR) is used for reducing routing overheads in MANETs. As NCPR is a reactive routing protocol there introduces some delay and high power consumption, so it is necessary to combine the modified hybrid routing protocol (ZRP) along with NCPR to enhance the network performance. In our proposed system since both proactive and reactive concepts are there it perform better for route discoveries. The simulation result shows that the delay and power has been reduced by using modified ZRP along with NCPR.

Key words: Mobile Ad-Hoc Networks・Modified ZRP・NCPR

INTRODUCTION

A mobile ad hoc network (MANET), sometimes called a mobile interconnect network, is a self-configuring network of mobile devices connected by wireless links. The Ad hoc network is a wireless networking paradigm for mobile nodes. Unlike conventional mobile wireless networks, ad hoc networks do not rely on any permanent communications. Instead, hosts rely on each other to sustain the network connected. Wireless communication is established by nodes acting as routers and transferring packets from one to another in ad-hoc networks. The network is decentralized, where all system action, including discover the topology and send messages must be executed by the mobile nodes. The participating nodes act as router, are free to move randomly and manage them randomly; thus, the network's wireless topology may vary quickly and unpredictably. Routing in these networks is highly complex due to moving nodes and hence many protocols have been developed. The MANET routing protocols were devised into two types namely the Table – driven (Proactive) and on- demand (Reactive) routing protocols [1].

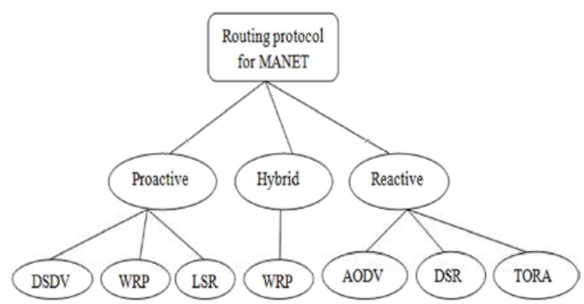

Fig. 1: MANET Routing Protocols

In conventional on-demand routing protocols, flooding is used to discover a route to a particular target, where Route Request (RREQ) packet is broadcasted to its immediate neighbors and the broadcasting induces excessive surplus retransmissions of RREQ packet and cause the broadcast storm problem, which leads to a huge number of packet collisions, particularly in intense networks. It is essential to optimize this broadcasting mechanism. Due to node mobility in MANETs, frequent link breakages might through to regular path failures and path detection, which could increase the overhead of routing protocols and decrease the packet deliverance

Corresponding Author: A. Kumaravel, Department of ECE, Paavai Engineering College, Namakkal India- 637018.

Table 1: Comparison of Routing Protocols

Protocol	Advantage	Disadvantage
Proactive	Latency is reduced. Information is always available	Routing information is flooded in the network. Overhead is high
Reactive	Path available when needed overhead is low and free from loops.	Latency is increased in the network
Hybrid	Suitable for large networks and up to data information available.	Complexity increases

ratio and increase the end delay. There are four types of broadcasting techniques namely probability based technique, trouble-free flooding, neighbor information technique and region based technique. The problems in these techniques are put in force to design an efficient routing protocol for multicast environment [2].

The neighbor coverage based probabilistic rebroadcast protocol which combines both neighbor coverage and probabilistic methods. In order to successfully utilize the neighbor coverage knowledge and to determine the rebroadcast order it is necessary to calculate the rebroadcast delay and rebroadcast probability. The rebroadcast delay is to determine the forwarding order and also rebroadcast delay enables the information that the nodes have transmitted the packet that spread to more neighbors. The information about the uncovered neighbors (UCN), connectivity metric and local node density are needed to calculate the rebroadcast possibility. The rebroadcast possibility is poised of two parts: additional coverage ratio and connectivity factor [3].

This paper proposes neighbor coverage based probabilistic rebroadcast protocol along with zone routing protocol for reducing routing overhead and delay incurred in MANETs. NCPR comes under a reactive routing protocol so its latency time is high. So the modified hybrid routing protocol (ZRP) is used to reduce the latency time. Hybrid routing protocol has been used to reduce the control overhead of proactive routing protocol and decrease the latency caused by route discovery in reactive routing protocol. In ZRP proactive routing protocol is Intra-Zone Routing Protocol (IARP) which is used inside the routing zones, reactive routing protocol is Inter-Zone Routing Protocol (IERP) which is used between routing zones [4].

Related Work: Broadcasting is often used as a building block for route discovery in on-demand ad hoc routing protocols. For scheming for ad hoc networks, one of the prime goals is to diminish the overhead (collision and retransmission, surplus retransmission) as getting all the nodes in the network [5].

In [1], AlAamri proposed a new routing protocol for Ad hoc networks, called OTRP which combines the idea of hop-by-hop routing such as AODV with an efficient route discovery algorithm called Tree-based Optimized Flooding (TOF) to improve scalability of Ad hoc networks when there is no previous knowledge about the target. To accomplish this in OTRP, direction finding overheads are minimized by selectively flooding the network through a limited number of nodes, referred to as branch-nodes. The theoretical study and simulation results showed that OTRP outperforms AODV, DYMO and OLSR and it decrease overheads as number of nodes and traffic increase.

In [2], Stewart proposed a novel threshold based multipath routing approach for enhanced Quality of Service in MANETs. It describes that when the available bandwidth of a link decreases below a discrete threshold or regular load or the forwarding delay at a node increases beyond a discrete threshold, channel is distributed over reliable several routes to reduce the load at a congested node.

In [6], Perkins proposed a new dynamic probabilistic counter-based broadcast scheme that can dynamically compute the forwarding probability at a node based on its neighborhood information. Simulation results illustrate that the novel broadcast scheme achieves superior performance in terms of retransmitting nodes, smash rate and end-to-end delay without sacrificing reachability compared to the existing schemes [7].

In [8], Sumit Gwalani proposed an AODV and DSR are the two most widely studied on-demand ad hoc routing protocols. To improve the concert of AODV, AODV is modified to take account of the source route accumulation attribute of DSR. This is named as AODV with path gathering. This protocol optimizes AODV to carry out effectively in terms of routing overhead and delay during high load. The recital of the protocol is evaluated by a simulation model under a variety of network situation. It has been exhibited that how a small variation to the AODV protocol can lead to significantly improved performance results.

In [9], Ramaraj proposed a novel technique is proposed to find shortest path between large numbers of nodes, so that the time to entrance is minimized. The multipath confined path finding protocol is used for the minimization of the path selection between several paths. It creates cache routes on an amount of metrics such as bandwidth and sorted based on the availability of the network. If path crash occurs, host node finds the nearest neighbor through multipath local routing thus minimize the over heading concern in MANETs. It establishes a confined improvement path with maximum bandwidth from its route cache [10].

In [11], Zhang proposed an estimated distance (EstD)-based routing protocol (EDRP) to steer a route discovery in the general direction of a target, which can limit the broadcast range of route request (RREQ) and reduce the routing overhead. In the EDRP, the transform reliability of the received signal strength (RSS) is exploited to estimate the geometrical distance between a couples of nodes, which is called the estimated geometrical distance (EGD). The EstD is a combination of EGD and ETD. In the protocol, every node evaluate the link quality through the computational process of the EGD to eliminate the weak links and then uses the EstD (EGD and ETD) to steer the RREQ packets toward the general direction of the target. Simulation results show that the future protocol can significantly reduce the routing overhead and improve the routing performance in dense or high-mobility networks.

In [12], Zhang proposed a neighbor coverage-based probabilistic rebroadcast protocol for reducing routing overhead in MANETs. In order to effectively develop the neighbor coverage knowledge, a new rebroadcast delay has been suggested to determine the rebroadcast order and then it is sufficient to attain the more correct additional coverage ratio by sensing neighbor coverage knowledge. And also a connectivity issue has been defined to provide the node thickness adaptation. By combining the added coverage ratio and connectivity factor, a logical rebroadcast possibility can be set. Our approach combines the reward of the neighbor coverage knowledge and the probabilistic method, which can significantly decrease the number of retransmissions so as to reduce the routing overhead and can also recover the routing performance.

Existing System: In the existing system a neighbor coverage-based probabilistic rebroadcast (NCPR) protocol has been used to reduce routing overhead in MANET. Hence,

- In order to effectively exploit the neighbor reporting knowledge, a new *rebroadcast delay* is used to find out the rebroadcast order and then an additional coverage ratio can be attained;
- In order to keep the network connectivity and reduce the surplus retransmissions, connectivity factor is used to determine how many neighbors should receive the RREQ packet. Subsequently, by combining the further coverage ratio and the connectivity factor, established a *rebroadcast probability*, which is used to diminish the number of rebroadcasts of the RREQ packet, to progress the routing performance [13].
- *additional coverage ratio*, which is the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors; and
- *Connectivity factor*, which reflects the connection of network connectivity and the number of neighbors of a given node.

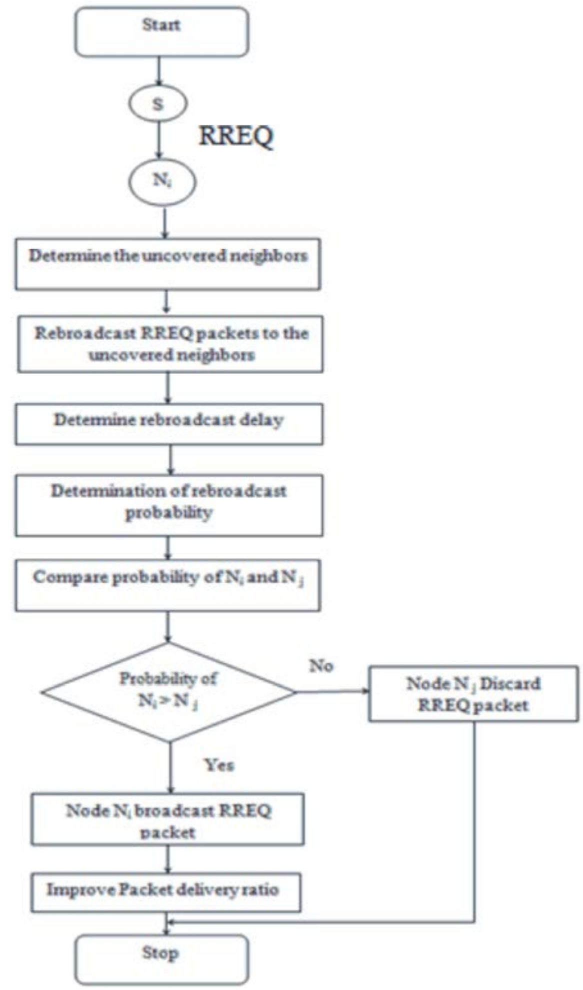

Fig. 2: Flow diagram of NCPR

To reduce the overhead of Hello packets, it is necessary to avoid using periodical Hello mechanism. Since a node transfer any dissemination packets can be able to inform its neighbors about its existence.

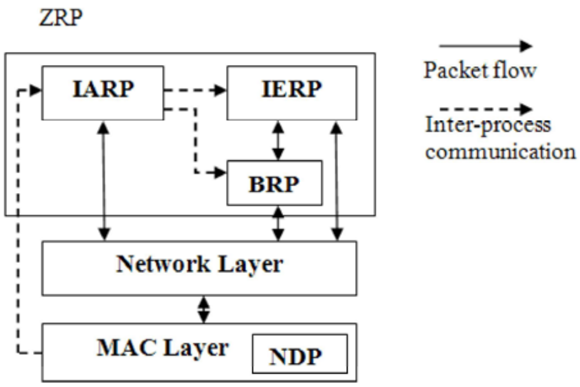

Fig. 3: ZRP Architecture

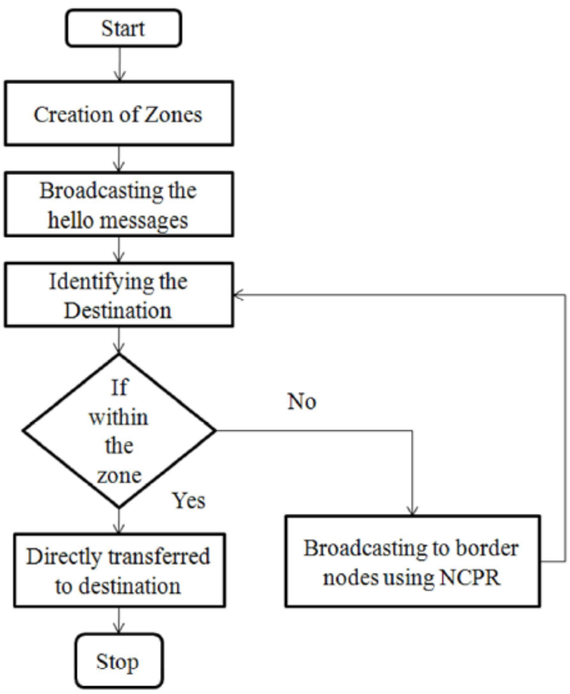

Fig. 4: Flow diagram of NCPR along with modified ZRP

The dissemination packets such as RREQ and route error (RERR) can play a role of Hello packets. Here using the following mechanism to reduce the overhead of Hello packets: Only when the time elapsed from the last dissemination packet exceeds the value of Hello Interval, there is a need to send a Hello packet by the node. The value of Hello Interval is equivalent to that of the original AODV protocol.

Proposed System: In the proposed work, NCPR protocol is implemented along with zonal routing protocol to reduce delay during data transmission and to enhance the efficiency of the network. As NCPR is a reactive routing protocol and there occurs some delay, so it is required to combine the modified hybrid routing protocol (ZRP) along with NCPR to reduce the delay.

The proactive theory is used for identifying the paths and reactive is used for dissemination packets as both proactive and reactive concepts are there it outperforms for finding paths.

ZRP refers to the locally proactive routing component as the IntrA-zone Routing Protocol (IARP). The globally reactive routing component is named IntEr-zone Routing Protocol (IERP). IERP and IARP are not specific routing protocols. As an alternative, IARP is a narrow-depth; proactive link-state routing protocols and maintains routing information for nodes that are within the routing region of the node. Likewise, IERP is a reactive routing protocol that offer enhanced route discovery and route maintenance services based on local connectivity monitored by IARP. Figure: 3 show the architecture of ZRP.

Route updates are trigger by NDP, which notify IARP when the neighbor table is updated. IERP use the routing table of IARP to react to route queries. IERP broadcast queries with BRP. BRP uses the routing table of IARP to direct route queries away from the query source.

Figure: 4 shows the flow chart, in which network is divided into number of zones and then hello messages will be broadcasted to update the nodes presence and then it searches for the destination. Once if the destination is present inside the zone of source node, the data will be directly transmitted to the destination or else the RREQ will be broadcasted to its boarder nodes using NCPR and then it searches again for the presence of destination in its zone, if the destination present inside its zone means, the data will be directly broadcasted otherwise the process continues by broadcasting to its boarder nodes.

Protocol Implementation and Performance Evaluation

Protocol Implementation: In Mobile Ad hoc NETworks (MANETs) the nodes will be in a mobile state so there may be a frequent link breakage which leads to frequent path failures and route discoveries. Sending periodical message causes overhead. Reactive routing protocol causes less overhead when compared to proactive routing protocol. In the existing system they used Neighbor Coverage based Probabilistic Rebroadcast protocol (NCPR) for reducing routing overheads in MANETs. The authors used SBA and NCPR for finding routes. As NCPR is a reactive routing protocol latency time will be higher, so they are combining the modified hybrid Zone Routing Protocol (ZRP) along with NCPR to reduce the latency time.

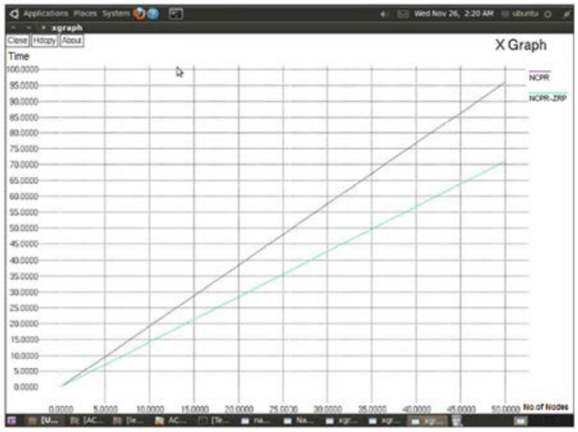

Fig. 5: End-To-End Delay with Varied Number of nodes

ZRP is the combination of proactive and reactive routing protocol. In NS-2 the combination of NCPR and modified ZRP is implemented; since implementing in real time is costlier, simulation has been preferred. By combining modified ZRP to NCPR each node has a zone. Some nodes have overlapping zones. In modified ZRP the message is directly transferred from the source to target if the target node presents inside the zone of the source node. Else the source node sends the message to the border node and that border node checks whether the target node is present inside its zone or not. If the node is present it transfers the message. So the time taken to transfer the message from source to target is low when compared to NCPR.

In order to reduce the overhead of Hello packets, it is necessary to avoid periodical Hello mechanism. Since a node sending any dissemination packets can inform its neighbors of its existence, the dissemination packets such as RREQ and route error (RERR) can play a role of Hello packets. To reduce the overhead of neighbor list in the RREQ packet, each node needs to observe the variation of its neighbor table and maintain a cache of the neighbor list in the received RREQ packet.

Probabilistic Rebroadcast: The node which has a larger rebroadcast delay may listen to RREQ packets from the nodes which have lowered one. For example, if node n_i receives a duplicate RREQ packet from its neighbor n_j, it knows about its neighbors have been covered by the RREQ packet from n_j. Therefore, node n_i might further change its UCN set according to the neighbor list in the RREQ packet from n_j. Then, the U (n_i) can be adjusted as follows:

$$U\ (n_i) = U\ (n_i)\text{-}[U\ (n_i)\ n\ N\ (n_j)].$$

After adjusting the U (n_i), the RREQ packet received from n_j is discarded. And there is do not need to adjust the rebroadcast delay because the rebroadcast delay is used to determine the order of disseminating neighbor coverage knowledge to the nodes which receive the same RREQ packet from the upstream node. Thus, it is resolute by the neighbors of upstream nodes and its own.

Simulation Environment: In order to evaluate the performance of the proposed NCPR protocol with modified ZRP, it is necessary to compare it with some other protocols using the NS-2 simulator. To evaluate the routing performance of the proposed NCPR protocol with modified ZRP, choose the Dynamic Probabilistic Route Discovery (DPR) protocol which is an optimization scheme for reducing the overhead of RREQ packet incurred in route discovery in current literature and the predictable AODV protocol.

Figure 5: show the reduction of end-to-end delay as the number of nodes increases.

The above graph shows that the delay has been reduced in the proposed system compared to the existing system.

CONCLUSION

In this paper, a NCPR along with modified ZRP protocol has been proposed to improve the performance of the network. The neighbor coverage knowledge includes additional coverage ratio and connectivity factor in which a new scheme has been proposed to vigorously estimate the rebroadcast delay. Simulation results show that the proposed protocol generates less rebroadcast traffic than the flooding and some other optimized scheme in the related work. As a result of less additional rebroadcast, the proposed technique reduces the network smash and conflict, so as to improve the packet deliverance ratio and reduce the average end-to-end delay and power. The simulation results also illustrate that the proposed protocol has reduced the delay and power when number of nodes increases and also has good performance when the network is in high density or the traffic is in heavy load.

REFERENCES

1. Thenmozhi, K. and Dr. E. Ramaraj, 2014. Routing Overhead in MANET-Minimization with Multipath Local Route Discovery Routing Protocol,in International Journal of Engineering Trends and Technology (IJETT), 13(4).

2. Kumaravel, A. and M. Chandrasekaran, 2014. A Complete Study on Power Aware Routing Protocol for Mobile Ad-hoc Network, at IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN: 2278-1676, p-ISSN: 2320-3331: 71-75.
3. Ali, M., B.G. Stewart, A. Shahrabi and A. Vallavaraj, 2014. QoS Aware Multipath Threshold Routing for Mobile Ad hoc Networks,International Journal of Applied Information Systems (IJAIS), 7(1).
4. Zhang, X.M., E.B. Wang, J.J. Xia and D.K. Sung, 2013. Neighbor Coverage based Probabilistic Rebroadcast for Reducing Routing Overhead in Mobile Ad hoc Networks, IEEE transactions on mobile computing, 12: 3.
5. Zhang, X.M., E.B. Wang, J.J. Xia and D.K. Sung, 2011. An Estimated Distance Based Routing Protocol for Mobile Ad Hoc Networks, IEEE Trans. Vehicular Technology, 60(7): 3473-3484.
6. Ramesh, V., Dr. P. Subbaiah and K. Sangeetha Supriya, 2010. Modified DSR (Preemptive) to reduce link breakage and routing overhead for MANET using Proactive Route Maintenance (PRM), Global Journal of Computer Science and Technology, 9(5).
7. AlAamri, H., M. Abolhasan and T. Wysocki, 2009. On Optimising Route Discovery in Absence of Previous Route Information in MANETs, Proc. IEEE Vehicular Technology Conf. (VTC), pp: 1-5.
8. Karthikeyan, N., Dr. V. Palanisamy and Dr. K. Duraiswamy, 2009. Performance Comparison of Dissemination methods in Mobile Ad Hoc Network, International Journal of Future Generation Communication and Networking, 2(2).
9. Mohammed, A., M. Ould-Khaoua, L.M. Mackenzie, C. Perkins and J.D. Abdulai, 2009. Probabilistic Counter-Based Route Discovery for Mobile Ad Hoc Networks,Proc. Int'l Conf. Wireless Comm. and Mobile Computing: Connecting the World Wirelessly (IWCMC '09), pp: 1335-1339.
10. Johnson, D., Y. Hu and D. Maltz, 2007. The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR), IETF RFC 4728, 15: 153-181.
11. Wu Xianren, Hamid R. Sadjadpour and J.J. Garcia-Luna-Aceves, 2007. Routing Overhead as A Function of Node Mobility: Modeling Framework and Implications on Proactive Routing," Proc. IEEE International Conf, pp: 1-9.
12. Gwalani Sumit, Elizabeth M. Belding-Royer and Charles E. Perkins, 2003. AODV-PA: AODV with Path Accumulation, IEEE, pp: 527-531.
13. Sinha Prasun, Srikanth V. Krishnamurthy and Son Dao, 2000. Scalable Unidirectional Routing with Zone Routing Protocol (ZRP) Extensions for Mobile Ad-Hoc Networks, at Wireless Communications and Networking Conference, WCNC. IEEE, pp: 3.