An Enhanced Table Driven Source Routing Protocol for Wireless Ad Hoc Networks

A.S.V.Vandana
M. Tech Student
Department of Information Technology
GNITS
Hyderabad,India
e-mail:srivishnuvandana@gmail.com

Dr. N Laxmi Manasa
Professor
Department of Information Technology
GNITS
Hyderabad,India
e-mail: name@xyz.com

Abstract— Analysis of MANETs led to the research on network layer. Different routing protocols were designed for numerous objectives and purposes. The way data packets are handled with in a multi-hop wireless network refers to Opportunistic data forwarding. During present research, we propose enhanced table-driven source routing protocol. This protocol maintains additional topology information which is different from Distance Vector (DV) routing protocol. The proposed approach will reduce overhead compared to the ancient Distance Vector based protocols. Base on the test results performed using Computer Simulator (Network Simulator 2) observed that the overhead in the proposed solution is just a fraction of the overhead of the standard proactive protocols. Performance of the current solution is better for transportation of higher information compared to existing proactive routing protocols.

Keywords-*Opportunistic data forwarding, Proactive routing, Source Routing,MANETs.*

*****

I. Introduction

MANET (Mobile Ad hoc Network) is a wireless network where nodes are mobile in nature. These nodes can act as either a router as well as a host depending on their role in the path identification process. They can shape distinctive topologies as per their development inside the system. Nodes communicate with each other by utilizing routing data stored in their routing modules [1]. An efficient routing protocol is required to establish communication between each node and deliver the packet to the correct destination.In general, the routing protocols are classified in three categories. They are:

- Reactive Routing Protocol (On-request)
- Proactive Routing Protocol (Table-driven)
- Hybrid Routing Protocol.

A. Reactive Routing Protocol

Reactive routing is a new routing idea where routing overhead is reduced by sending routing packets when
communication is requested and route is created as and when required. This approach is called on demand i.e. reactive.The route remains valid till node reaches the destination or until the route is no longer needed. Some reactive routing protocolsare Dynamic source routing (DSR), Ad-hoc on-Demand Distance vector (AODV) and so forth.

B. Proactive Routing Protocol

Proactive routing protocols are table-driven and will effectively decide the format of the system. Network topology packets are exchanged between the nodes of network, regularly to maintain total picture of the network at every node. Hence minimal delay is achieved indetermining the route. In proactive routing protocols, every node maintains at least one tablewith routing info of every other node in the network. All nodes update these tables periodically to maintain up-to-date changes in the network. Some Proactive routing protocols are Destination Sequenced Distance Vector (DSDV), Optimized Link State Routing (OLSR) etc.

C. Hybrid Routing Protocol

Hybrid routing protocol in MANETs contains the nature of both proactive and reactive routing protocols. The hybrid routing protocol includes Zone routing protocol (ZRP).

A. Proactive Source Routing(PSR)protocol

In PSR topology information is exchanged periodically between nodes. Every node incorporates a spanning tree of network to maintain shortest routing path. PSR maintains Breadth-first spanning tree(BFST) to provide higher transportation of information and reduce overhead.

B. Lightweight Proactive Source Routing(LPSR) protocol.

Zehua Wang, Yuanzhu Chen and Chen Li proposed Lightweight Proactive Source Routing(LPSR). LPSR preservers greater topological information than other protocols.
Our simulation results indicate that network topology performs better data transportation capability after adding the link failure detection technique. There is decrease in overhead and increase in throughput in comparison with Proactive Source Routing(PSR)protocol and Lightweight Proactive Source Routing(LPSR)protocol.

The rest of the paper is organized as follows. In Section 2, contains a brief introduction to previous literature related to PSR. In Section 3, we explain the design and implementation details of our enhanced routing scheme. In Section 4, we analyze the performance of the proposed protocol observed on the computer simulation, and comparisonwith other protocols is presented. Section 5 summarizes numerical results, and Section 6 concludes the paper.

II. Related works

Researchers are continually being directed to enhance the efficiency of the routing protocols which give opportunistic data forwarding in MANET.

S. Biswas and R. Morris [4] proposed EXOR (Extremely Opportunistic Routing). A cooperative communication based routing, where nodes can catch packets and forward a packet which is incorporated into the forwarder list. Extremely Opportunistic Routing spreads advances bunches of packets to diminish the communication cost. When a source node transmits a data packet towards a destination node, sourcenode broadcasts that packet to its neighbor nodes. These neighbors collectively execute an algorithm to select a best forwarder from the forwarder list and the node that is neighboring to the destination will get highest priority in the forwarder list.

Forwarder again communicates the packets to its neighbor's and determination of a forwarder to next hop transmission likewise done. These procedures will be rehashed until 90 percent of packets get delivered. Remaining packets ought to be transmitted utilizing traditional routing.

Zehua Wang, Yuanzhu Chen and Chen Li proposed Lightweight Proactive Source Routing(LPSR). LPSR preservers greater topological information than other protocols.

S. Chachulski et al. [5] proposed MORE (MAC-independent Opportunistic Routing and Encoding), it randomly mixes the packets then forwards and avoids duplication in transmitting a records packet. Here source first broadcast all the packets; router then creates linear combinations of those packets randomly, so they come to be coded packets. Every data packet header contains code vector, batch ID, source and destination IP with forwarder list. The sender transmits the coded packets until it reaches an acknowledgment from destination after which it takes packets from the subsequent batch and once more beginning the equal method. Forwarder flushes all buffered packets after arrival of new batch with ID greater than the current lively batch. Destination decodes the packet the use of code vector. MORE no longer require coordination between nodes and spatial reuse is preserved.

Z. Wang et al. [14] proposed CORMAN (Cooperative Opportunistic Routing in Mobile Ad hoc Network). It is a powerful extension of extremely opportunistic routing which reduces delay and overhead. Use of a proactive source routing will give routing information of each and every node in the network and route information can be updated periodically through beacon messages. CORMAN gives two additional features compared to EXOR which increases the efficiency of the routing protocol which are termed as small-scale retransmission and large scale live update. In Large scale live update forwarded list is updated by intermediate nodes. Small scale retransmission means to retransmit missed packets during transmission which are not present in the forwarder list. It ensures the reliability of the communication. Survey of Routing Protocols in Mobile Ad-hoc Network.Kevin C. Lee, Uichin Lee and Mario Gerla [2]; This paper talks about the favorable circumstances and drawbacks of topology-based and position-based directing protocol and investigates the inspiration driving their plan and follow the development of these routing protocol.

Routinginpacket-switched networks using path findingalgorithms (PFA) [11] depends on DVs. Thus, the whole way to every node can be remade by associating the destinations and antecedents. Meanwhile, the link vectors (LV) calculation [12] lessens the number of link-state vectors(LS) calculations to an incredible arrangement by including connections which are utilized as a part of information sending in directing updates. The outrageous instance of LV, where just a single connection is incorporated per destination, matches with the PFA

PFA and LV methods are initially proposed for the Internet, but they are used for directing protocol in MANET. The early method to port LS routing protocol to MANETs is Wireless Routing Protocol (WRP) [13]. It is based on a similar system to PFA to utilize a tree to accomplish circle free routing at every node. This has somewhat high correspondence overhead. This topology is generally steady, hence ends up being reasonably asset requesting in MANETs. We have incorporated the WRP in the test examination later in this paper.

III. Design of E-PSR

Proposed solution is enhancement of PSR(E-PSR). The design of E-PSR protocol incorporates the accompanying:

A. Breadth-first traversing tree (BFST)
B. Route Update (RU)
C. Neighborhood trimming (NT)
D. Streamlined differential refresh (SDU)

Hello message is broadcasted to all nodes to collect neighbor information in the network. Every node sends back a reply message to all other nodes located within the transmission range. By using this information, a neighbor list is generated including the location information and distance between the neighbor nodes.

 ISSN: 2321-8169
655 – 659

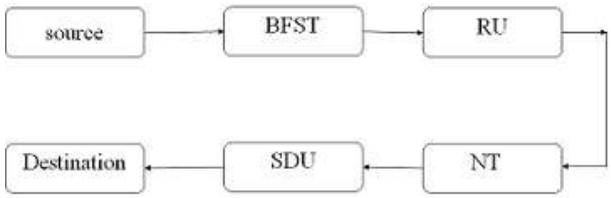

Figure 1: Block diagram

A. Breadth-first spanning tree (BFST)

Proposed solution uses breadth-first spanning tree (BFST) to collect neighbor information.Every node broadcast the packet in the form of the tree structure and this important data is gathered from all the neighboring nodes. Node will refresh its data regarding network topology based on the gathered information. There are procedures to update neighbor lost, information at the repository maintained by the detection node.

B. Route Update (RU) Units

In E-PSR, the Route Update operation is iterative and dispersed among all nodes in the system. BFST is exchanged between the neighbors. Path from a specific source todestination is updated by using shortest path algorithm. Due to the high random movement of nodes this path is not stable. Hop counts between the end nodes are minimized using shortest path algorithm. The Algorithm returns the minimum hop count path and the overall energy consumption is reduced. Since the transmission range taken here is most extreme, the amount of packet drops also reduced. Tree based routing has more delay in route discovery process. By using this shortest path algorithm delay also reduced.

C. Neighborhood trimming (NT)

When a neighbor node is seemed to be lost, then the all information contributed by that node towards the network should be removed from the list. This methodology will be activated when any of the two conditions are met.

1. No data packet or routing update from neighbor from certain period of time.
2. Failure of data transmission to a node.

After detecting the shortest path, the remaining nodes are ignored for the further transmission of data. Only the minimum distance is considered.

D. Streamlined differential update (SDU)

Instead of sending full update messages every time short length messages are interleaved. The short message contains the difference information of the current and previous node routing module.The size of full message is reduced using compact representation of a tree.

In our base paper, every node can update the details about neighbour node and filter the unnecessary packets. In our enhanced work, we have added the link failure detection technique.

To get know the link availability info, we have used the cross-layer operation. In that, the node can use the basic CSMA/CA protocol to send the data without collision. To make communication the CSMA/CA protocol uses the RTS/CTS/ACK sharing. For each data transmission, the node needs to check the clearance detail from the receiver node by collecting the CTS signal. And if the data is delivered in indented receiver then the sender can get proof of data reception by the acknowledgment sharing. In enhanced method, there is connection between the MAC and network layer so that the node can monitor the data delivery. If the data is not delivered or there in no clearance information from the neighbor receiver then MAC layer of the sender can know the link is broken. Then the MAC layer will share this failure information to the network layer. Routing information is updated on reception of failure message from network layer. Routing information related to broken neighbors is deleted.

Route should be updated if there are any changes in Routing table.

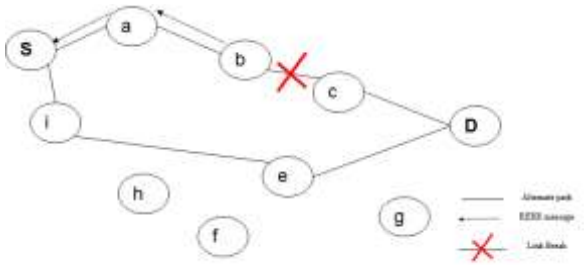

Figure 2: Route Maintained when connection failed

Thus, the nodes will check the destination details with old hop count, if the old hop count is not as much as half total route then the intermediate node will start the route searching by broadcasting route request. In the present work, the nodes can know the destination accessibility. Presently, the intermediate node can give the answer back to the nodes which search the route to the destination. Nodes can find new route dynamically and the information is shared after finding the route to destination. If the destination is not reached or much far then the node can share the route error message to the neighboring nodes. And if the error message is received then the node can delete the broken neighbors from the routing table. If the node is the source of data packet then the node need to start the searching process about a broken destination.By this novel technique, we can enhance the quality of service.

IV. PERFORMANCE EVALUATION

We concentrate the execution of system topology data based source routing protocol using Network Simulator 2 variant 2.34. We compare Proactive Source Routing(PSR) against proposed approach. Lightweight Proactive Source Routing (LPSR) with fluctuating network densities and node mobility rates. EPSR is evaluated with below parameters using Network Simulator 2.

 ISSN: 2321-8169
655 – 659

Parameter	Value
Number of mobility nodes	50
Size of Environment	1000x1000
Network Simulator	NS-2
Traffic Source	CBR
Speed	0-30 m/s
Time of simulation	10 secs
Pause duration	Dynamic
Model of mobility	Random Way Point
Antenna Type and connection	Omni-Directional and UDP

Table 1. Simulation Parameters

Figure 3: Simulation Scenario

In LPSR there is no route failure detection in network layer. PSR always uses the periodic update. In proposed solution failure detection is found at network layer hence route can be updated without waiting for next periodic update.

V. Results and analysis

The proposed quick and dependable tree based table driven source routing is contrasted with the current PSR. Control packet overhead, End to end delay and Amount of packet drops are utilized as parameters.

Simulation results show that energy consumption and delay are reduced in the proposed solution compared to existing methods. The graphical outcomes demonstrate that control packet overhead at larger amount nodes decreased byusing mobile sink node for collecting these packets and send to root node. The measure of packet drops additionally diminished by utilizing shortest path routing since it sets transmission to go as greatest. Throughput is enhanced in the proposed approach. Comparing results are demonstrated as follows.

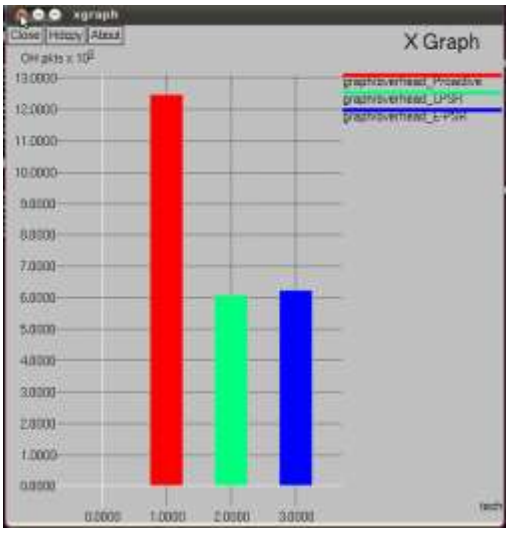

Figure 4: Overhead comparison

Figure 4 shows the overhead of the proposed E-PSR protocol along with Lightweight Proactive Source Routing protocol (LPSR) and Proactive Source Routing protocol(PSR). This graph demonstrates overhead reduction is high in proposed method.

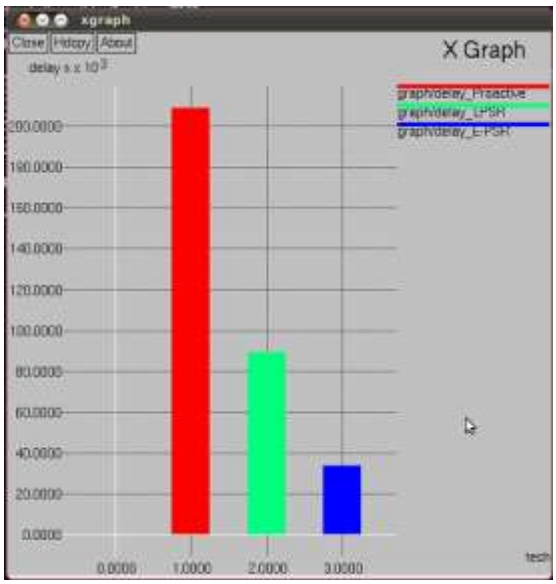

Figure 5:comparison ofEnd- to- End Delay

Figure 5 shows End to End delay of the proposed E-PSR protocol along with Lightweight Proactive Source Routing protocol (LPSR) and Proactive Source Routing protocol(PSR). This graph demonstrates that End to End delay is reduced in proposed method.

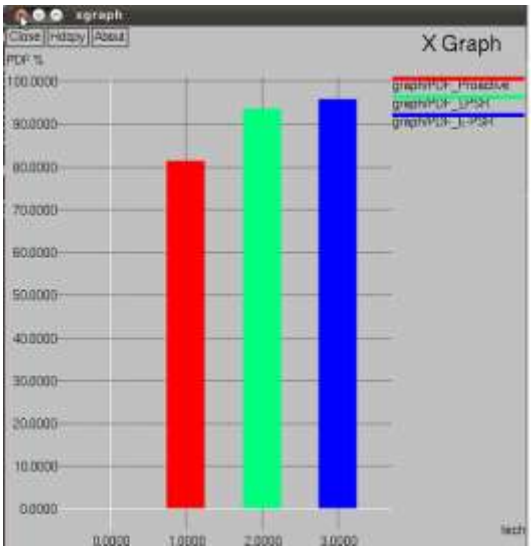

Figure 6:comparison of Packet Delivery Ratio.

Figure 6 shows Packet Delivery Ratio (PDR) of the proposed E-PSR protocol along with Lightweight Proactive Source Routing protocol (LPSR) and Proactive Source Routing protocol(PSR). This graph demonstrates amazingly high Packet Delivery Ratio for EPSR.

VI. Conclusion

In this paper, Enhanced Table Driven Source Routing Protocol is proposed to reduce the overhead and improve the low packet delivery ratio. Every node maintains a breadth-first search spanning tree (BFST). This information is sometimes exchangedbetween neighboring nodes for updating network topology information, Route Update(RU) procedure updates the routes once topology changes.

Neighborhood Trimming methodology expels nodes that are going away the station. By changing the rooted tree into a binary tree, control packet length was minimized. Completely different techniques like stable BFST could diminish the routing overhead in E-PSR. Delay in routing and energy consumption are minimum by using shortest path algorithm.

We had verified the algorithm under the conditions of transmission connection breakage. Proposed approach performed admirably under dynamic topological changes in the system.

Acknowledgment

I would like to thank Dr.N Laxmi Manasa, Associate Professor, Computer science and Information Technology engineering department for providing continuous support in understanding the concepts behind the routing protocols and her help during the experiments and simulations.

References

[1] M.Natkaniec,"Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications", Communications Magazine,IEEE, Volume:47, Issue: 5,2009,pp.

[2] Kevin C. Lee, Uichin Lee and Mario Gerla.;"Survey of Routing Protocols in Mobile Ad-hoc Network.";International Journal of Engineering Trends and Technology (IJETT) – Volume 15 Number 1 – Sep 2014.

[3] R. Rajaraman, "Topology control and routing in ad hoc networks: A survey," ACM SIGACT News, vol. 33, no. 2, pp. 60–73, Jun. 2002.

[4] S. Biswas and R. Morris. "EXOR: Opportunistic multi-hop routing for wireless networks", in Proc. ACM Conf, (2005). SIGCOMM, pp. 133-144.

[5] Zehua Wang, Yuanzhu Chen, Cheng Li, (2014). "PSR: A lightweight Proactive Source Routing Protocol For Mobile Ad Hoc Networks", Vehicular Technology, IEEE Transaction on, vol. 63, no. 2, pp. 859-868

[6] S. Yang, F. Zhong, C. K. Yeo, B. S. Lee, and J. Boleng,(2009). "Position Based Opportunistic Routing for Robust Data Delivery in MANETs", in Proc. 2009 IEEE Conference on Global Telecommunications (GLOBCOM), pp. 1325-1330

[7] Haseena M. K., Annes Philip,"Fast and Reliable Tree based Proactive Source Routing in Mobile Adhoc Network."International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 4 Issue 7 July 2015, Page No. 13422-13425

[8] R. Shenbagapriya and Kumar Narayanan "An Efficient Proactive Source Routing Protocol for Controlling the Overhead in Mobile Ad-Hoc Networks",.Indian Journal of Science and Technology, Vol 8(30), 61429, November 2015

[9] Lavanya.R, Dr.M.A.Goutham,"SPSR: A Lightweight Secure Proactive Source Routing Protocol for Mobile Ad-Hoc Networks". IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 03, 2015 | ISSN (online): 2321-0613

[10] P.Larsson,"Selectiondiversityforwardinginamulti-hoppacketradionetwork with fading channel and capture," ACM Mobile Comput. Commun. Rev., vol. 5, no. 4, pp. 47–54, Oct. 2001

[11] S.Murthy,"Routinginpacket-switched networks using path findingalgorithms," Ph.D. dissertation, Comput. Eng., Univ. California, Santa Cruz, CA, USA, 1996.

[12] J. Behrens and J. J. Garcia-Luna-Aceves, "Distributed, scalable routing based on link-state vectors," in Proc. ACM Conf. SIGCOMM, 1994, pp. 136–147.

[13] S. Murthy and J. J. Garcia-Luna-Aceves, "An efficient routing protocol for wireless networks," Mobile Netw. Appl., vol. 1, no. 2, pp. 183–197, Oct. 1996.

[14] Z. Wang, Y. Chen, and C. Li, (2012) "CORMAN: A novel cooperative opportunistic routing scheme in mobile ad hoc networks", IEEE J. Sel. Areas Commun., vol. 30, no. 2, pp. 289- 296.