Improved Link aware Source Routing protocol for MANET

B.R. Devi
Department of Electronics and Communication Engineering
Kakatiya Institute of Technology and Science , Warangal, Telangana, INDIA

B. Komuraiah
Department of Electronics and Communication Engineering
Kakatiya Institute of Technology and Science , Warangal, Telangana, INDIA

A. Saipriya
IV/IV B.Tech, Department of Electronics and Communication Engineering
Kakatiya Institute of Technology and Science , Warangal, Telangana, INDIA

Abstract- The routing layer has received a lot of attraction while making research on MANETs. Unlike wired routings, information transmitted in a wireless routing may be over heard by devices which do not intend to receive the information thereby resulting in collision. Our one of the main goals of wireless routing is to make the wireless links as good as wired links. Opportunistic information sharing represents a promising solution. Anyway it has not been widely used in MANET because of the insufficient of an efficient routing method with strong source routing capability. In order to support opportunistic information sharing in MANETs, ILSR (Improved Link Aware Source routing) has been proposed which can maintain more routing topology information to facilitate source routing so that information can be properly routed to the destination. Moreover it has much smaller overhead when compared to proactive protocols.

Keywords – source routing, proactive, reactive, MANET

I. INTRODUCTION

In mobile ad-hoc network (MANET), there is no fixed support and no centralized controller as shown in Fig. 1. The device destined to receive information might be out of area of a device which is transmitting the information. There might be many intermediate devices present between the source and destination device. Intermediate devices are necessary to forward the information to the destination, if the source (S) and destination (D) are in non-line of sight with each other. Considering this a routing procedure is always needed to search a path so as to forward the information's appropriately between the initial sender and the final destination in such mode that a information correctly reaches the required destination. Anyway in the case of ad-hoc routings, each device must be able to forward information for other devices considering the problems that arise due to dynamic topology which is unpredictable connectivity changes [1]. A routing protocol governs the way that two communication entities or devices exchange information or packets. It used in establishing a route from source to destination, makes decision in sharing the information to next device and also helps in maintaining route or recovery in case of route failure. Many routing protocols [2-7] have been proposed earlier to meet different objectives.

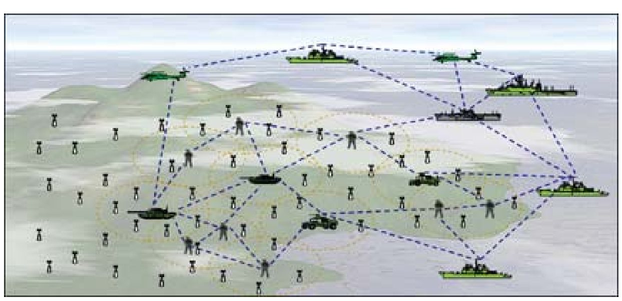

Figure 1. MANET

II. RELATED WORKS

Larsson proposed a four-possible handshake approach as the coordination protocol in his Selection Diversity Sharing [8]. In Selection Diversity Sharing, if a device has information to transmit, it just broadcasts the information to every neighbour. Then, every neighbour listens the information successfully will send back an Acknowledgement with their local packets to the transmitter unit. The transmitter takes a decision based on the Acknowledgements and sends a Sharing Order (SO) to the best forwarder candidate. Once the selected relay device receives the SO, it will send the Sharing Order Acknowledgement (SOA) back to the transmitter and then proceed next sharing. This operation proceeds until the final destination is reached. Anyway, the acknowledgements and SOA may get lost in the wireless environment, and either one loss will lead to unnecessary resending. The other is that such a gossiping scheme wastes a best deal of resources and introduces more delay. One of the major research challenges is to reduce the routing overhead. In EXOR [9], when a source wants to transmit the information to D, it broadcasts the information. Some neighbourhood nodes groups receive it and initiate the route discovery process. A node in these groups which has shortest route to the D will broadcasts the information. After that, during second hop, a node nearest to D among the neighbourhood group of nodes in this transmission range will broadcasts the information. This process will repeat until D receives the information. The MAC sub layer require intermediate nodes with better utilization of long-haul sharing. Anyway in order to support timeserving information sharing in a mobile wireless routing as in ExOR, an IP information needs to be enhanced such that it lists the ids of the devices that lead to the message D. It requires selecting devices afar the next hop to D. PROACTIVE routing [10] is a table driven routing protocol and needs frequent updates of routing information of the nodes in the network. A node selects group neighbour devices as "multipoint relays" (MPR). The selected relay nodes forward the routing and control information. MPRs streamline the broadcast routing and control packets by slicing the number of transmissions required. Even though PROACTIVE is an optimization over LS routing protocols and it could support source routing, it includes interconnectivity information between remote devices, needed to a particular source. It leads to large overhead which is fairly high for load sensitive MANETs[11]. DSR [12], anyway, takes a different approach to on demand source routing. In DSR, a device employs a path finding starts when there is a need to send information to a particular destination. Once a path is identified by the returning search control information's, this entire path is embedded in all information's to that destination. Thus, intermediate devices do not even need a sharing table to transfer these information's. Because of its on demand behaviour, it is highly appropriate for occasional or lightweight information transportation in MANETs. If we wish to support opportunistic information sharing in a MANET with constantly active information communication between many device pairs, the reactive nature of DSR renders it unsuitable. DSR also has a long bootstrap delay and are therefore not efficacious for frequent packet transmission, particularly when there are a large number of information sources. AODV [13] allows mobile devices to obtain routes quickly for new destinations, and does not require devices to maintain routes to destinations that are broken communication.

The protocol AODV allows mobile devices to respond to link breakages and changes in routing topology in a timely mode. When links break, AODV causes the affected set of devices to be notified so that they are able to invalidate the routes using the broken connection. Route Requests (RREQs), Route Replies (RREPs), and Route Errors (RERRs) are the information types defined by AODV as shown in Fig. 2. These information types are received via UDP, and normal IP header operation applies. This means that such information's are not blindly forwarded. As long as the endpoints of a communication connection have valid routes to each other, the protocol AODV does not do any role. When a route to a new destination is needed, the device broadcasts a RREQ to find a route to the destination. AODV has not been designed for source routing; hence, it is not suitable for opportunistic information sharing. The reason is that every device in these protocols only knows the next hop to reach a given destination device but not the complete path. Path finding algorithms [14] eliminate the counting to infinity problems by using the predecessor information. Predecessor information can be used to infer an implicit path to a destination. Using this path information, routing loops can be detected. Anyway, the route update strategy as in the PFA, where path updates are triggered by network changes is reasonable For the PFA in the Internet, where the topology is relatively stable, but this turns out to be fairly resource demanding in MANETs because of the amount of the information stored and exchanged.

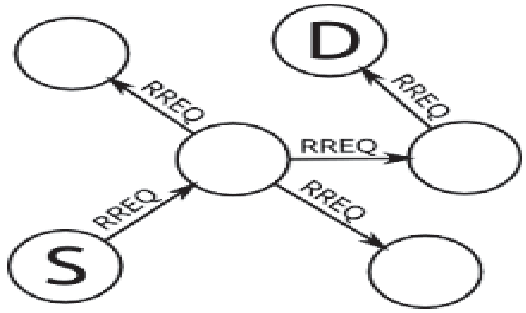

Figure 2. Req/Rep process

III. Design of Enhanced Proactive Source Routing Protocol

The The main aim was to develop a routing protocol which could support opportunistic routing in such mode that it can maintain entire topology information to correctly route information from source to destination Moreover; the overall overhead should be comparatively low when compared to previous routing protocols. The information's should be successfully delivered to the destination with minimum delay and minimum information loss. The ILSR (Improved Link Management Proactive Source routing) protocol proposed in order to meet the objective. In ILSR, every device maintains a breadth-first spanning tree (BFST) of the entire routing rooted at it. The devices periodically broadcast the tree structure to their best knowledge in all iteration. Based on the information collected from neighbours during the most recent iteration, a device can expand and refresh its knowledge about the routing topology by constructing a deeper and more recent BFST. This knowledge will be shared to its neighbours in the next circle of operation On the other hand, when a neighbour is deemed lost, a procedure is started to remove its relevant information from the topology repository maintained by the detecting node .As initial node routing is taking place, each device can update the details about neighbour devices and filters the useless data's. In case of any link failure, an immediate link failure detection technique is required so that minimum information loss occurs. This can be done by keeping a check on link availability. In order to get the link availability information, a cross layer operation has been used i.e. a device can use the basic CSMA/CA protocol to send the information without any collision. To make communication the CSMA/CA protocol uses the RTS/CTS/ACK sharing. For each information transmission the device need to check the clearance detail from the receiver device by collecting the CTS signal. And if the information is delivered in indented receiver then the sender can get proof of information reception by the Acknowledgement sharing. By connecting the MAC layer with the routing layer the device can monitor the information delivery. If the information is not delivered or there in no clearance information from the neighbour receiver then MAC layer of sender can know the link is broken. In this way the MAC layer will share this failure information to the routing layer. Once the failure information is received in routing layer then the routing information of the neighbour and destination which depends on the broken neighbour will be deleted. If the routing table is modified then route has to be refreshed. So the device will then check the destination details with old hop count and if the old hop count is less than half of total route then the intermediate device will start the route searching by broadcasting route request. Due to the proactive nature of our base work, the devices can get know the destination availability. So the intermediate device can give the reply back to the device which searches the route to destination. Once reply received the device can update new route and then the information sharing will be done. In case, the device is far away from the destination, then the device will share the route error information to the neighbours about unreachable destination details. And if the error information is received from neighbour then the device will deletes the broken neighbours from the routing table. If the device is source of information then the device need to be starting the searching operation about broken destination so in the proposed work the reactive nature has been added to a proactive routing protocol to rebuild instant route. This novel technique can improve the QOS in MANET when compared to proactive routing. A tree-based routing protocol which has been put Forward has been inspired from PROACTIVE and PFA. In order to reduce the communication overhead incurred by Proactive Source Routing (PSR) [15] routing agents and make ILSR more suitable For MANETs, the Following strategy is adopted: A combined route update strategy is adopted that takes advantage of both "event-driven" and "timer-driven" approaches. Specifically, devices would hold their broadcast after receiving a route update for a period of time. If more updates have been received in this window, all updates are consolidated before triggering one broadcast. Even though each device has the full-path information to reach all other devices, for it to have a very small Footprint, ILSR's route messaging is designed to be very concise.

It uses only one type of information, i.e., the periodic route update, both to exchange routing information and as hello beacon information's. Rather than packaging a set of discrete tree edges in the routing information's, the information's include neighbour information in the form of hops. The system architecture is shown in Fig. 3.

The proposed scheme is tested using ordinarily image processing. From the simulation of the experiment results, we can draw to the conclusion that this method is robust to many kinds of watermark images.

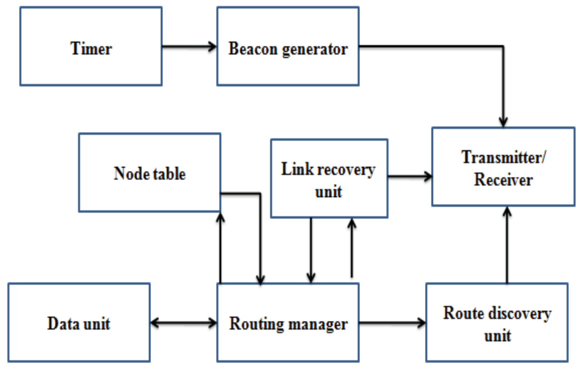

Figure 3. System Architecture

Timer: It is used to create periodic triggers.

Beacon generator: Based on the triggering the beacon generator will send the beacon information outside by using the transmitter. Information unit: The information unit will generate the information.

Routing manager: The information generated will be forwarded to the routing manager and the routing manager will trigger the route discovery unit based on route availability information.

Link Recovery unit: It recovers the link in a reactive mode whenever a link is found to be broken and informs the routing manager.

Device table: It is a table which is maintained at every device and contains information about its immediate neighbors.

Algorithm

1) Initialize the Hello timer H_{tim}
2) In n node, If $H_{tim}.Exip = True$
    a. Initialize $Table_{neigh}.dst$
    b. If $Filtering = False$
        i. Create the broadcast packet Pkt
            1. $pkt.src = n$
            2. $pkt.type = Hello.Norm$
            3. $n \cup pkt.Path$
            4. Foreach $Nd \in Table_{neigh}$
                a. If $Nd \nexists pkt.neigh$
                    i. $Nd \cup pkt.neigh$
        ii. Broadcast pkt
    c. Resched $H_{tim}.Exip = Time_{now} + Rand_{time}$
3) If Pkt recv in node n
    a. If $pkt.type = Hello.Norm$
        i. If pkt not duplicate
            1. $update(Table_{neigh} \leftarrow pkt.info)$
            2. $n \cup pkt.path$
            3. Set time $filtering$
            4. Rebroadcast pkt
    b. If $pkt.type = Hello.Routerecov$
        i. If $Node_{failed} = Node\_active$
            1. Send pkt_reply
        ii. Else
            1. $Table_{neigh} = Table_{neigh} \setminus Node_{failed}$
    c. If $pkt.type = reply$
        i. $update(Table_{neigh} \leftarrow pkt.info)$
4) If $link = Failed$
    a. $Table_{neigh} = Table_{neigh} \setminus Node_{failed}$
    b. Send $Hello.Routerecov$

IV. RESULT ANALYSIS

The performance of ILSR in MANETs is studied using NS-2 Simulator version 2.34. ILSR is compared with routing protocols PROACTIVE, LPSR routing protocols. Our tests show that the ILSR offers a high information delivery fraction when compared to LPSR and PROACTIVE and it has an advantage over delay too when compared to the other two routing protocols. The overhead of ILSR is also low when compared to PROACTIVE. As ILSR has better information delivery with least cost and provides global routing information.

Two-ray ground reflection propagation model is considered for simulation. Fig. 4 depicts a bar graph which compares information delivery fraction of the three protocols in percentage. PDF is the percentage of the number of delivered information to the destination. The x-axis represents PDF in '%' while the y-axis represents the technology used. The PDF of ILSR is the highest when compared to the other protocols i.e. proactive and LPSR .This means that by using ILSR protocol, maximum number of information's can be delivered from source to destination with minimum loss.

Fig. 5 depicts a bar graph which compares overhead of the three protocols in terms of total number of information's sent or received. information which is sent across a wireless routing is housed in a information envelope called a information. Each transmission includes additional information, called overhead, that is required to route the information to the proper location. We can calculate routing overhead by sending a fixed-size information transmission across the routing and observing the number of extra bytes of information transmitted for the action to be completed.

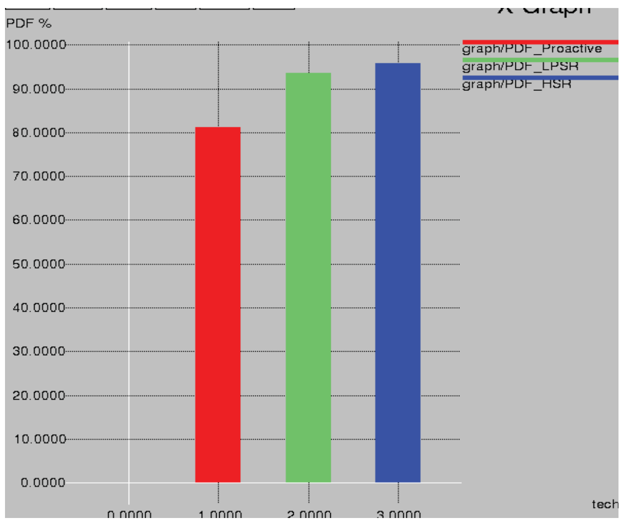

Figure 4. Bar graph depicting PDF against different technologies

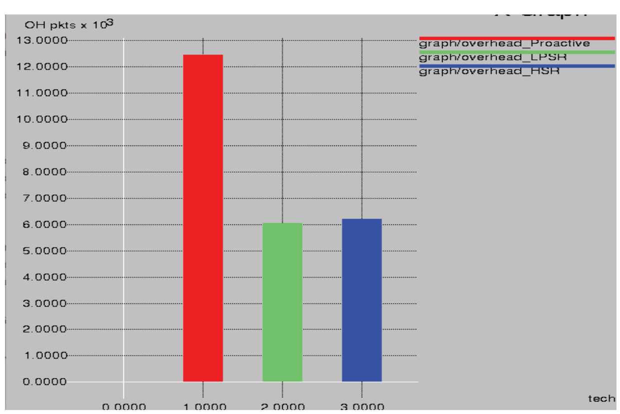

Figure 5. Bar graph depicting the overhead against different technologies

V. CONCLUSIONS AND FUTURE WORK

This paper provides an insight of opportunistic information sharing in mobile ad hoc network. A new routing protocol was required which could give network topology information as in distance vector routing protocol and have less routing overhead compared to LS and MPR routing techniques. Thus, a tree based routing protocol i.e. ILSR has been put forward where each device has the complete about other devices. Anyway it has a small footprint. One of the main objectives is to transmit the information from source to destination with minimum loss or maximum information delivery fraction. Another objective is to transmit the information with minimum delay which has been achieved to some extent. Anyway, some effort has to be put in reducing overhead in order to improve information delivery especially in position based routing. We have tested our system with TCP protocol, while some other researcher doing the same with UDP.

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