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Enhanced Link Aware Source Routing for MANET

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Abstract: **The routing layer has received a lot of attention while conducting research on MANETs. Unlike wired routings, a Information transmitted in a wireless routing may be over heard by devices which do not intend to receive the Information thereby resulting in interference. Our one of the main goals of wireless routing is to make the wireless links as good as wired links. Opportunistic data sharing represents a promising solution. However it has not been widely used in mobile ad hoc routings because of the absence of an efficient routing method with strong source routing capability. In order to support opportunistic data sharing in MANETs, ELMPSR (Enhanced Link Management Proactive 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.**

Key word: **Source routing, Proactive, Reactive, MANET**

1. INTRODUCTION

In mobile ad-hoc Networks, there is no fixed support and no centralized controller. The device destined to receive a 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. As all the devices may not be within the transmission area of each other, thus they require other devices to forward data. Considering this a routing procedure is always needed to find a path so as to forward the Information's appropriately between the source and the destination in such mode that a Information correctly reaches the required destination. However in the case of ad-hoc routings, each device must be able to forward data for other devices considering the problems that arise due to dynamic topology which is unpredictable connectivity changes. 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 have been proposed earlier to meet different objectives.

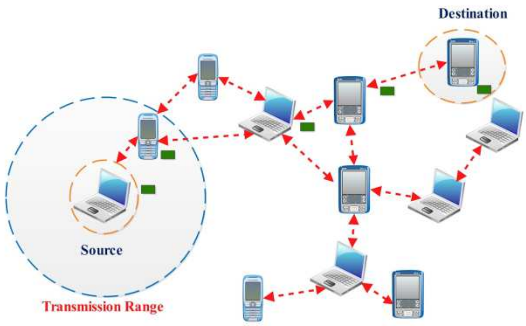

Fig.1 Example Mobile ad-hoc network

2. RELATED WORKS

Larsson proposed a four-possible handshake approach as the coordination protocol in his Selection Diversity Sharing. In Selection Diversity Sharing, if a device has Information to transmit, it just broadcasts the Information to every neighbour. Then, every neighbour lessens 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. However, 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. Its overhead needs to be significantly reduced before it can be implemented in practical routings. In EXOR, when a source device has Information that it wishes to deliver to a distant destination, the source broadcasts the Information. Some sub-group of the devices receives the Information. The devices run a protocol to discover and agree on which devices are in that sub-group. The device in the sub-group that is closest to the destination broadcasts the Information. Again, the devices that receive this second transmission based on the closest receiver, which broadcasts the Information. This operation proceeds until the destination has received the Information. Even though, the MAC sub layer can desire the actual next-hop forwarder to better utilize the

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long-haul sharing's, However in order to support timeserving data sharing in a mobile wireless routing as in ExOR, an IP Information needs to be enhanced such that it lists the id's of the devices that lead to the message destination. This requires a routing protocol where devices see beyond merely the next hop leading to the destination. PROACTIVE operates as a table driven, proactive algorithms, i.e., exchanges routing information with other devices of the routing regularly. Each device selects a set of its neighbour devices as "multipoint relays" (MPR). In PROACTIVE, only devices, selected as such MPRs are responsible for sharing control traffic, aimed for Diffusion into the entire forwarding. MPRs provide an efficient mechanism for broadcast control traffic 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, which is hardly useful for a particular source device, and this incurs prohibitively large overhead which is fairly high for load sensitive MANETs. DSR, however, 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 data to a particular destination. Once a path is identified by the returning search control Information's, this entire path is embedded in each data Information 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 data transportation in MANETs. If we wish to support opportunistic data sharing in a MANET with constantly active data 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 data sources. AODV 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. 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 data 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 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.

3. DESIGN OF ENHANCED PROACTIVE SOURCE ROUTING PROTOCOL

The main aim was to develop a routing protocol which could support opportunistic routing in such a 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 ELMPSR (Enhanced Link Management Proactive Source routing) protocol proposed in order to meet the objective. In ELMPSR, 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 distributed to its neighbours in the next round of operation On the other hand, when a neighbour is deemed lost, a procedure is triggered to remove its relevant information from the topology repository maintained by the detecting device .As source routing is taking place, each device can update the details about neighbour devices and filter the unnecessary Information'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 data without any collision. To make communication the CSMA/CA protocol uses the RTS/CTS/ACK sharing. For each data transmission the device need to check the clearance detail from the receiver device 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 Acknowledgement sharing. By connecting the MAC layer with the routing layer the device can monitor the data delivery. If the data 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

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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 data 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 data Information then the device need to be start 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 PSR's routing agents and make ELMPSR more suitable For MANETs, the SOllowing 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 Soot print, ELMPSR'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.

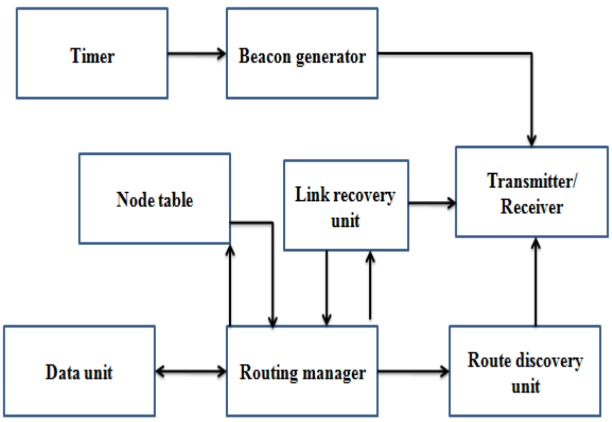

Figure 2 System Architecture

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.
Data unit: The data unit will generate the data Information.
Routing manager: The data 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 Sound 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.

3.1) 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. $Table_{neigh} = Table_{neigh} \backslash Node_{failed}$
    c. If $pkt.type = reply$
        i. $update(Table_{neigh} \leftarrow pkt.info)$
4) If $link = Failed$
    a. $Table_{neigh} = Table_{neigh} \backslash Node_{failed}$
    b. Send $Hello.Routerecov$

4. RESULT ANALYSIS

The performance of ILMSR is studied using computer simulation with Routing Simulator 2 version 2.34 (ns-2). ILMSR is compared against PROACTIVE, LPSR which are fundamentally different routing protocols in MANETs. Our tests show that the ILMSR 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 ILMSR is also low when compared to PROACTIVE. As ILMSR provides global routing information at such a small cost, it offers similar or even better information delivery performance.

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We select a two-ray ground reflection propagation model in our simulation to present a consistent and comparable result.

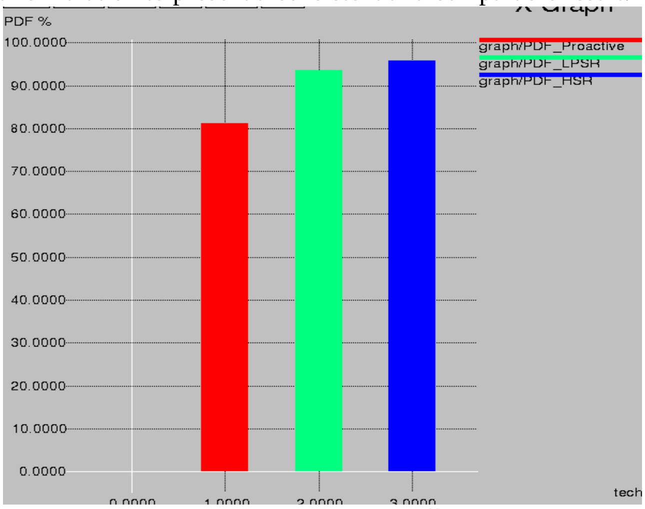

Figure 2: Bar graph depicting PDF against different technologies.

The above figure 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 Information to the destination. This illustrates the level of delivered information to the destination. The x-axis represents PDF in '%' while the y-axis represents the technology used. The PDF of ILMSR is the highest when compared to the other protocols i.e. proactive and LPSR .This means that by using ILMSR protocol, maximum number of Information's can be delivered from source to destination with minimum loss.

The above figure 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.

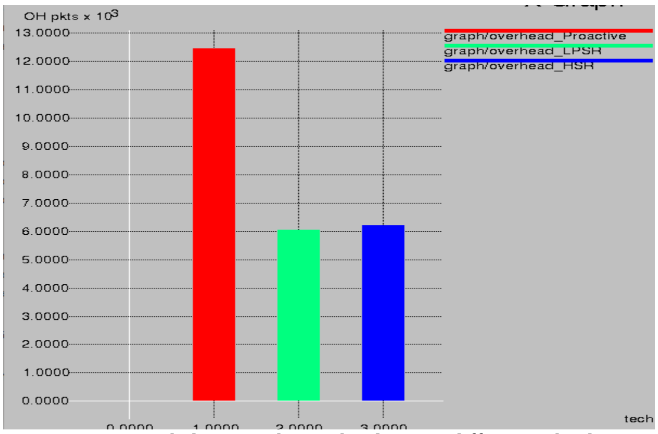

Figure 3: Bar graph depicting the overhead against different technologies

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.

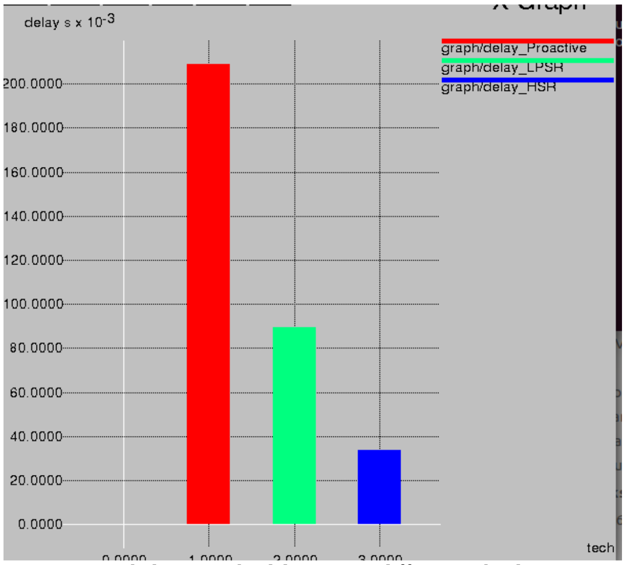

Figure 4: Bar graph depicting the delay against different technologies

The above figure depicts a bar graph which compares delay of the three protocols in seconds. The delay specifies how long it takes For a Information to travel across the routing from one device to another. It is typically measured in multiples or fractions of seconds. Delay may differ slightly, depending on the location of the specific pair of communicating devices. The x-axis represents the delay in seconds while the y-axis represents the technology used. The delay of ILMSR is the lower when compared to both the protocols. The reason is the reactive nature of link recovery mechanism.

5. CONCLUSION AND FUTURE WORK

This work has been motivated by the need to support opportunistic information sharing in *MANETs*.A protocol was required which could provide more topology information than DVs but must have significantly smaller overhead than LS routing protocols; even the MPR technique in PROACTIVE would not suffice. Thus, a tree based routing protocol i.e. ILMSR has been put Forward where each device has the full-path information to reach all 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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