Improved DSR with Compressed IP Technique

1 Ravi Goswami, 2 Bhargav Makodia, 3 Paras Narkhede

1 Research Scholar

GTU PG School, Ahmedabad, India

2 Assistant Professor

VenusICT

Gandhinagar,India

3 Research Scholar

GTU PG School, Ahmedabad, India

Abstract

Mobile Ad-hoc Network (MANET) is a network where nodes or the network itself can change the location and organize itself on the go. Most of the routing protocols are designed for mobile ad-hoc network on flooding of route request to create a path between source and destination. This type of technique usually creates lots of overhead in network which bring down the overall network performance. In DSR routing protocol Route Request packet header size increases with each hop. This makes one of the major disadvantage of DSR. Using IP compression techniques we can reduce the packet size. Each IP address occupy 32 bit space, which is a not that necessary for addressing nodes in such small topology. If somehow we can manage this addresses efficiently we can increase scalability of the protocol reduce the overhead also.

I. Introduction

Today the world around us is going wireless and it's all about staying connected to each other via our devices. People today don't like the restriction of wires on them all day, they prefer freedom of moving freely anywhere they want and still stay connected to the world around them. The main concern today is to communicate with each other. Wireless devices rule the world now.This devices create ad-hoc network to communicate with each other. This ad-hoc network does not require any kind of infrastructure to set up. All the wireless devices run on external battery, which will eventually run out of juice. So it is very important that we make use of most of it.

Ad-hoc Network is a collection of movable nodes which can move anywhere in Network. As nodes are mobile, it can dynamically change their topology at any time. MANET is an infrastructure less i.e. nodes can communicate with each other without any access point. In single-hop fashion node can directly communicate with each other. But when nodes are not directly communicate with each other, so instead of using single –hop communication multi hop communication used, where the source node send the packets to the destination node through the several intermediate nodes. [1].

MANET at link layer is routable. It also has features like self-forming and self-healing.Organizing the network, controlling routing and scheduling links in network requires efficient distributed algorithms. In MANET packets are transferred between source and destination via direct communication. So finding a optimal path for communication is an important task here [2].

Routing protocol has a task of finding optimal path for packets to travel from source to destination through a randomly placed nodes. Almost all routing protocols uses flooding as a way to find an optimal path. So what is flooding?. Another term for flooding is broadcasting. Where a node transmit data to all of it's neighbour, and the neighbour will continue this until the information is available to the whole network. This flooding technique is used in route discovery phase of many routing protocol. These protocols can be broadly classified in two categories called proactive and reactive(also know as table driven and on-demand respectively) based on the way they operates.

DSR

DSR is one of the protocol which falls under Reactive category. The ability of DSR is the utilization of source initiated routing. The sender(source) knows the entire path towards the destination. The reason behind that DSR node contains an extraordinary feature called cache memory. Entire route information store in the cache memory in DAG(Direct9 Access Graph) format. DSR-reactive protocol contains two major parts : Route Discovery and Route maintenance.

Route Discovery

When source wants to send data to the destination, Source floods RREQ packets. When this RREQ packets received by an any node. The task of that particular node is to check if the route to destination node is stored in its cache memory or not. And add its own id inside packet header. In case path to the destination is not available in cache memory, node will rebroadcast RREQ packet with modified packet header.

If the receiving node has the destination path inside cache memory or the node itself is the destination node, this node will generate RREP packet and will sent to the source node. Both RREQ,RREP packets are source routed. The task of RREQ packet is to generate a path it has traversed to the destination. Entire route will be stored in the cache memory which is utilized in the future communication. Route discovery is the process of finding the optimal path between source and destination at very first time [3].

Route Maintenance

In case any link breakage, immediate previous node will send RRER packet to the source node.Source will delete every route containing this from its cache. If the route is still needed, it is the task of source node to reinitiate route discovery phase [3].

II. Overhead

Routing overhead is defined as "the ratio of the total number of routing control packets sent by all nodes to the number of data packets received at destination node." In AODV routing protocol control packet comprise RREQ, RREP, RRER and Hello packets. This control packets are send and fixed interval to monitor the active routes and ease the transmission of data packets. This makes routing protocols a necessary evil [4].

Routing overhead could have a catastrophic on network performance. Several parameters is affected from this overhead such as increased end-to-end delay,decreased packet delivery ratio,and decreased throughput. This overhead is usually more in highly mobile network. Causes of large overhead can be collisions, contentions, and retransmissions. So if we can optimize flooding in route discovery, we can improve performance of the routing.

III. Related Work

In [5] Bhagyashri R Hanji, et al. proposed a location base solution where each nodes location is known.In routing mechanism he restrict RREQ packet flooding to a specific area. This area is calculated based on the location of source node and destination node. Here if destination node is in transmission range of source node they communicate directly with each other. In case if source and destination node are out of each other's communication range locate the intermediate nodes which lie in the window specified by (srcx, srcy, destx, desty). RREQ packets will be allowed to be forwarded in this window only. Now select node which reside in the window whose energy is greater than threshold energy. This way better routing and control overhead, Packet delivery ratio, and energy consumption can be achieved. The proposed solution works better in a network where node mobility is minimum. In case where node mobility is frequent location of node will be changed. Which will lead to more control packets. And in case source node and destination node are at diagonal point of the network the proposed window will cover the entire network and solution will be of no use. It will be just a node selection based on energy of nodes.

In [6] Ranjan, et al. Modified OAS-AODV routing algorithm [7]. OAS-AODV is used to find a route to communicate with least number of control packets. Modified protocol called IOAS-AODV also take care of route repair and congestion control. Here when a node finds a broken link to the next hop, it try to find a reason. It checks the last known battery status of the node. If it is lower than threshold value it waits for some time and checks if the node is available in communication range or not. If not node will try to find next to next node or the next best intermediate node. This process continues until route to destination node or next to next node is found.This algorithm selects a limited set of nodes in order to find a new alternate route based on battery status, queue length, quadrant position, and forwarding region. This algorithm work really nice where the reason for link broken link is movement of very few nodes. In case of a high mobility where the step of finding next to next node just become just unnecessary and could have been avoided after few steps. This solution modifies OAS-AODV protocol in a slightly better way. Solution holds up to performance parameters: Packet delivery ration, Average end-to-end delay, Routing overhead, Route breakages, Network Throughput.

In [7] Thongthavorn, et al. proposed solution is based on using LAR protocol as their main base. Their main focus is on modifying the forwarding zone. So that the misdirection flooding problem which was introduced by DREAM protocol. Author proposed a solution by using LAR protocol as a precursor, they focused on the forwarding zone modification to overcome the misdirection flooding problem inspired by DREAM protocol. Here they used divided nodes in two categories where one will act as forwarding node which will participate in forwarding and packets, While the other type of node will be left out. This classification or labeling will stay as it is until a link is broken or any topology is changed. As they have concluded from simulation result and analysis their proposed method increase performance of GPS-assisted ad-hoc network. They have deduced this result comparing some of the parameters like data PDR, time to establish route and consumption of energy with some of the traditional protocol. Although there are certain situation where this solution won't work like when destination node speed reaches to zero. The reason behind this is empty forwarding zone.

In [8] Sharma, et al. tried to reduce the overhead in MANET by optimizing the use of HELLO packets. What author proposed is that the nodes which are in involved in data transmission are allowed to transmit HELLO packets, rest of the nodes cannot transmit HELLO packets. In AODV protocol author limited the use of HELLO packets to nodes which have routing table, Hence every node in the network which on an active route will have forwarded or received RREQ and/or RREQ packet, doing this will create a routing table to store the entries of forward and backward routes. So every node on working route with their neighbour nodes will be allowed to exchange hello packets while others will not be allowed to do so. This proposed system work fine I both dense and sparse network. This increase the network performance and lifetime. Reduction of overhead seems to be getting low if number of nodes goes from 20 to 30. The reason behind this reaction is more number of interference in medium. The final conclusion is that their solution is reducing overhead compared to classic hello process.

In [9] Ernst, et al. has proposed two techniques for overhead reduction. First one is Optimized HELLO message format. They removed all the unused (reserved) fields from the message format. They also used compressed addresses for communications. Second is Refresh Method. They have used a concept of Topology Control (TC) messages, that distributes information in the network regarding the local neighbourhood and last for longer periods [12].And therefore using the old OLSR message REFRESH, they have introduced their new extension called RFRSH. Using the sequence number of previous HELLO message from its header they sends a REFRESH message without including address. If there is no change in the nodes link which is set since the last send HELLO or REFRESH message, a node broadcasts REFRESH message instead of hello. This shows that the topology is not changed and allows the node to verify that its neighbour is available. A node can receive a REFRESH message instead of previous HELLO messages only if, 1) the neighbour is new to the sender or 2) previous message is lost. Therefor they have proposed that a REQUEST will be sent to show that information received was incomplete. A REQUEST message is unicasted to the node that has sent the incomplete information. REQUEST messages are completely empty. A node replies with a full HELLO message in response to the REQUEST message received. If the node moves to a new neighbourhood than it may cause high number of HELLO message emitted. Therefor the emission extra message is limited to 1/4 of the HELLO interval. The result clearly shows that overhead in keeping or improving link detection quality created by standard OLSR in traditional neighbourhood discovery is outperformed. By decreasing the size of control messages the data rate available to the user is improved and yields a more stable network as the risk of message lost because of interference is reduced. With the help of their RFRSH-FST extension, OLSR reacts faster to new links available and gradually increases the available user data capacity. In static network their improvement performed really well for high density. This extension must be used always because the compression done doesn't harm the the performance of the protocol and can be applied to the existing OLSR implementation without any modification to the protocol itself. In order to achieve optimal overhead reduction in static and mobile scenarios we need to use OPT extension while using RFRSH or RFRSH-FST extension.

IV. PROPOSED WORK

According to literature DSR protocol have a major limitation when it comes to large networks.In large network sometimes size of the data to carry is small compared to the size of the packetheader. Main reason behind this limitation is the increasing size of route request and route replyheader. As the number of nodes increases size of route request and route reply packet will increase.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Option Type  |  Opt Data Len |         Identification        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Target Address                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Address[1]                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Address[2]                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                               ...                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Address[n]                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4.1: Route Request Header [10]

Opt Data Len

It is a 8-bit integer field. options length,without the opt fields of Data len and Option Type,inoctets.It MUST be a set equal to (4 * n) + 6 ,in which n is total number of addresses in the RouteRequest Option field.

Identification

It is a unique integer which is produced by original sender.every Nodes Nodes starts a RREQ toproduce a new unique integer value. This value allows destination to see whether it already hasa copy of route request or not. If this value is captured by destination node in its table, than the receiving node must have to discard this value. When the flooding of the route request take place,this field is copied from received copy and again flooded by adding latest copy.

Target Address

Nodes address which is aims of the route request.

Address[1..n]

This is an IPv4 address of the i-th wireless node which is stored in the route request option field.The address exists in the Address[i] is the IPv4 address of the i-th node recorded in the Route Request option. the ad-dress allocated in the IP header is the initiator's address.which must not be listed in address[i]field;Opt Data Len field defines the total number of address in the field (n =optData Len -6).nodes flooding the route request appends its address to this list . which increases the Opt Data Len value.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                |  Option Type  |  Opt Data Len |L|   Reserved  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Address[1]                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Address[2]                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              ...                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Address[n]                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4.2: Route Replay Header [10]

Opt Data Len

It is a 8-bit integer field. options length,without the opt fields of Data len and Option Type,inoctets.It MUST be a set equal to (4 * n) + 1 ,in which n is total number of addresses in the RouteRequest Option field.

Last Hop External (L)

last hop produces the route reply(link from Address[n-1] to [n] which is a random route in theDSR network; outside route is note declare in the Route Reply. This route will be flagged in thecache memory.This kind of last hop must not be added in the last hop route reply cache memory.toInitiate the route finding a route should be choosen which is not contains hops flagged as External.

Reserved

it is sent as 0 and eliminates on receiver side

Address[1..n]

Route reply is responsible to generate the source route. The source route being returned by the Route Reply. The route consists a sequence of hops, and the destination node's route request IP header is contains the source nodes information,In order to filtering every Address[i] nodes in the route reply, last node is declared by Address[n]. Address[1..n] fields is known as Opt Data Lenfield in the option (n = (Opt Data Len - 1) / 4).

SOLUTION

Here each route request and route reply packet will have IP-address of all the nodes in their route.Each address occupy 32bit storage. Nodes in same network have common pre-fix in IP- addresses.(i.e. xxx.xxx.xxx.001, xxx.xxx.xxx.002, xxx.xxx.xxx.003).

Since DSR has scalability issues.Here we will limit the number of node to 254.

So instead of using 32 bit IP-address. We propose that use only last 8 bit of IP-address. Since all the node will have the same first 24 bits upon receiving a RREQ packet node will be capable of generating the full IP-address. And since we are using same 32bit IP address there is no need to change any other layer protocol.

Figure 4.3: Modified Route Request Header

In route reply header packet we can also use same IP compression

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                |  Option Type  |  Opt Data Len |L|   Reserved  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Address[1]  |   Address[2]  |   Address[3]  |   Address[4]  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Address[4]  |   Address[5]  |   Address[6]  |   Address[7]  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              ...                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Address[n-3] |  Address[n-2] | Address[n-1]  |   Address[n]  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4.4: Modified Route Reply Header

ALGORITHM

For RREQ Packet

1. Sender will create RREQ packet with last 8 bit of source and destination IP-address.
2. Upon receiving RREQ packet node will add its own last 8 bit of IP-address and forward it further
3. If a node has a path to the destination generate RREP packet and send it to source node

For RREP Packet

1. If a node receive a RREQ for a node and path for that node is available in cache memory. Generate RREP packet and send it to source node.
2. If the node receiving RREQ is the destination node generate RREP using IP addresses in RREQ and send it to source node.

V. CONCLUSION

DSR protocol is quite useful for small topological network. The main disadvantage of DSR is that it is not scalable. As the number of node increases the overhead in DSR increases too. This makes DSR inefficient for bigger networks. Using the new proposed solution DSR packet size will be reduced and DSR will be able to work on beyond a point where it becomes inefficient. This new protocol can be used wherever traditional DSR is used. And in such situations where number of nodes where problem for DSR. This solution will help DSR to overcome scalability issue. New RREQ and RREP packet will occupy very less space compared to traditional DSR. Due to small size less energy will be used which will lead to longer network lifetime.

REFERENCE

[1] Mrs. N . D. Kure, Prof. S.A Jain," Minimum Overhead Routing Protocol in MANET", International Journal of Advance Foundation and Research in Computer (IJAFRC), Volume 1, May 2014. ISSN 2348 – 4853.

[2] Hetal P. Mistry, Nital H. Mistry," A Survey: Use of ACO on AODV & DSR Routing Protocols in MANET", International Conference on Innovations in Information Embedded and Communication Systems ICIIECS'15, 2015 IEEE.

[3] Rais Khan, Ansari Mohammad Nabi Azad S., Anilkumar Vishwakarma, " Enhancement of Manet Routing Protocol", 20 14 IEEE.

[4] Sharma, Dhirendra Kumar, Tarun Chand Behra, and Chiranjeev Kumar. "An adaptive hello process for overhead reduction in MANETs." Electrical, Electronics, Signals, Communication and Optimization (EESCO), 2015 International Conference on. IEEE, 2015.

[5] Hanji, Bhagyashri R., and Rajashree Shettar. ”Improved AODV with restricted route discovery area.” Computer Communication and Informatics (ICCCI), 2015 International Conference on. IEEE, 2015.

[6] Ranjan, Pravin, and R. Leela Velusamy. ”Optimized local route repair and congestion control in Mobile Ad hoc Network.” Computing and Communications Technologies (ICCCT), 2015 International Conference on. IEEE, 2015.

[7] Thongthavorn Thananop, Worrawat Narongkhachavana, and Sumet Prabhavat. ”A study on overhead reduction for GPS-assisted mobile ad-hoc networks.”TENCON 2014-2014 IEEE Region 10 Conference.IEEE, 2014.

[8] Sharma, Dhirendra Kumar, Tarun Chand Behra, and Chiranjeev Kumar. ”An adaptive hello process for overhead reduction in MANETs.” Electrical, Electronics, Signals, Communication and Optimization (EESCO),2015 International Conference on. IEEE, 2015.

[9] Ernst, Rolf, Sascha Alexander Jopen, and Tobias Bartelt. ”Reducing MANET neighborhood discovery overhead.” Local Computer Networks (LCN), 2014 IEEE 39th Conference on. IEEE, 2014.

[10] https://www.ietf.org/rfc/rfc4728.txt