Shortest Path Geographic Routing for Mobile Ad Hoc Networks

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Abstract— Mobile Ad-hoc Network (MANET) is a Network in which contains nodes that are dynamic, which means their positions are not fixed or they are can move. Since the positions are not fixed they do not have a permanent infrastructure. So the communication between the mobile nodes should be taken cares of very well for the efficient communication between the nodes. The main challenge that is being faced in the MANET is the dynamicity of the nodes, because of which the positions are changing. The routing between the nodes in the MANET should be based on the current status of the nodes. The routing protocols should adapt in such a way that optimum route between the source and destination is being obtained. The routing task in the MANETs has become very challenging due to the mobility of nodes. The conventional routing strategies for the wired networks cannot be adopted for these highly mobile networks. Geographic routing is one of the efficient routing strategies for routing. Geographic routing has greedy forwarding and recovery forwarding. In this paper the proposal is that among the paths found, the shortest path is being selected using the distance formula.

Keywords-*:* MANET, Geographic Routing, Greedy Forwarding, Recovery Forwarding.

I. INTRODUCTION

MANETs can be described as self organizing networks which do not have a predefined infrastructure. The MANETs contains nodes which act as both router and hosts. The nodes communicate between each other using multi hop links. The nodes in the MANET self organize themselves such that the communications between the nodes happen in an efficient manner.

A number of routing protocols was proposed for efficient routing. The routing protocols were mainly categorized into two categories which are topology based routing and position based routing. Link information was used for topology based routing, that is path information is maintained and based on the links that exist in the network routes are established. The topology based routing is further classified into proactive, reactive and hybrid. Proactive protocols which are very much

similar to the classical routing strategies constantly discover routes and maintain them in routing tables. High bandwidth usage was the main overhead that was incurred by this approach, which will affect the performance.

Position based also known as geographic routing [1, 2, 3] was introduced to overcome the limitations of topology based protocols. The nodes physical location information was in geographic routing. Thus it was necessary to get the position information of the nodes using some kind of location service.

The rest of this paper is organized as follows. Section 2 gives an idea of Geographic routing protocol. Section 3 give an idea about self adaptive on demand geographic routing. Related works are explained in section 4. Proposal for improvement is discussed in section 5 and a conclusion is made in section 6.

II. BRIEFING OF GEOGRAPHIC ROUTING

Geographic Routing operates without any routing table, and when once the position of the destination is known then the communication is strictly local. Due to the scalability feature of geographic routing it has become one of the most suitable routing strategies in the wireless mobile ad hoc networks. The two reasons why geographic routing scale better for ad hoc networks are that it is not necessary to keep the routing tables up-to-date and there is no need to have a network topology and its changes. Establishment and route maintenance is not necessary because no routing table is there. Greedy forwarding, which is the principle approach in geographic routing, fails if a void node is encountered by the packet, i.e., if there is no one hop neighbour that is closer to the destination than the forwarding node itself. To overcome these problem recovery strategies was introduced.

A. Greedy Forwarding

The Greedy forwarding strategies can be defined in terms of progress, distance and direction towards the destination. The progress can be defined as the distance between a node S and the projection A' of a neighbour node A onto the line connecting S and final destination D. [2]

Greedy Forwarding can be formulated as follows:

Greedy Routing GR

0. Start at s.

1. Proceed to the neighbor closest to t.

2. Repeat step 1 until either reaching t or a local minimum with respect to the distance from t, that is a node v without any neighbor closer to t than v itself. [3]

The forwarding node, F will attempt to forward a packet greedily to a neighbor closest to the destination, D and closer to destination, D than itself. When no next hop to destination cached, forwarding node, F buffers the packet first and broadcasts a request message *REQ*(*D*, *posD*, *posF* , *hops*) with *hops* = 1 to restrict the searching range to one-hop neighbors. A neighbor node N closer to D than F will send back a REPLY. F will record N as the next hop to D with transmission mode as *greedy* and unicast the data packet to N.[1]

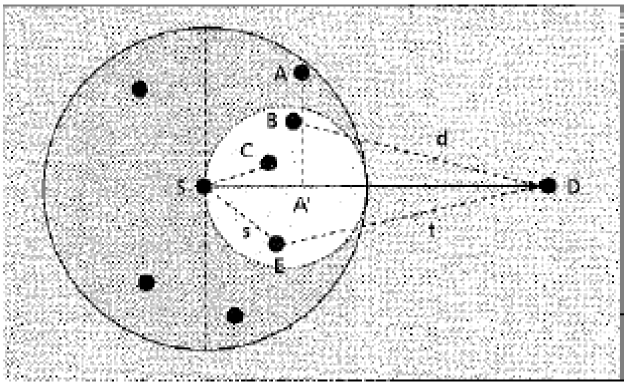

Fig. 1 Greedy Routing Strategy based on progress, distance and direction

To avoid collisions, N will wait for a backoff period before sending the REPLY and the pending REPLY will be cancelled if it overhears a REPLY from another neighbor closer to D than itself. To make sure the neighbor closer to D responds sooner and suppresses others' REPLYs, the backoff period should be proportional to *dis* (*N, D*) and bounded by the max value *hops*×*Intvalbackoff* , where *Intvalbackoff* is a protocol parameter, and *hops* = 1 in greedy forwarding. The backoff period is calculated as:

$$backoff = hops \times Intval_{backoff} \times \left(1 - \frac{dis_{(F,D)} - dis_{(N,D)}}{hops \times R}\right), \quad (1)$$

where R is the transmission range of mobile nodes.[1]

The main issue that is faced in greedy forwarding is that it does not guarantee delivery to the destination even if there is a path from the source to the destination, this is called local minimum.[3] Proposals are there based on memorization to keep and use the information about past routing tasks that guarantee delivery. Since the communication overhead is very high, stateless algorithms based on routing in planar geometric graphs attracted more attention as recovery mechanisms. So, greedy forwarding is used along with recovery strategy which is responsible for handling the packet as long as greedy routing fails, i.e, greedy routing continues until it reaches a local minimum and fails. When the greedy forwarding fails, it switches to the recovery strategy.

B. Recovery Forwarding

When a source node starts a communication to the destination, it initiates a route request and the message is broadcasted. If greedy forwarding fails than we have extend the searching range to two hops. Nodes sends request message up to two hops if any nodes satisfies request than it sends reply to intermediate nodes. If reply already received than current reply is dropped to avoid collisions. If reply for the request is not within the two hops, then the hop count is increased till the reply will be got or maximum up to the maximum number of hops.

F, the forwarding node may not have neighbors closer to destination D, resulting in a local "void". A recovery strategy with expanded ring search is being used, which is normally used in path searching in topology-based routing [4][5]. After sending a REQ with *hops* = 1, if there is no REPLY after 1.5×*hops*×*Intvalbackoff* , F will increase its searching range to two hops and broadcast a REQ with *hops* = 2. When a second-hop neighbor of F gets this REQ and is closer to D, it sends a REPLY following the reverse path of the REQ message, with backoff period calculated from Eq. 1 with *hops* = 2. The intermediate nodes will record the last hop of the REPLY as the next hop towards D with transmission mode as *recovery*. To avoid overhead, an intermediate node will drop a REPLY if it already forwarded or overheard a REPLY from a node closer to D than the current replier. F will unicast the data packet to the detected next hop. If the route searching fails with *hops* = 2, F may expand the searching range again by increasing *hops* until *hops* reaches *Maxhops*.

III. PROPOSAL FOR IMPROVEMENT

Several paths are found between the source and destination using greedy forwarding and recovery forwarding.. So among the several paths obtained, the best path need be found. In this proposal, choose the best path according to the distance., i.e, the shortest path using the distance formula,

$$d = \sqrt{(\Delta x)^2 + (\Delta y)^2} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}. \quad (2)$$

Where d is the distance, x1, x2, y1 and y2 are the coordinate positions of the source and destination.

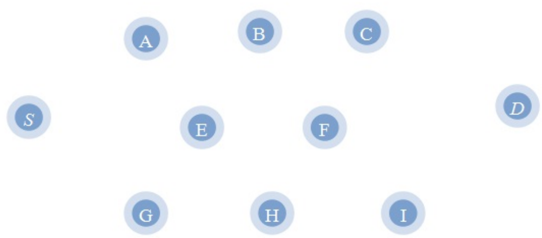

Fig 2: Nodes in the network

Let S and D be the source and destination, there are various paths from S to D. Some of the possible paths are S-A-B-C-D, S-E-F-D, S-G-H-I-D etc.

To find the shortest path the distance of each path is calculated. For example, the distance of path S-E-F-D can be calculated as first the distance of S to E is calculated, then E to F is calculated, then F to D is calculated. Then all these will be added to get the total distance of the path .

$$\text{Total distance} = \sum_{i=0}^{n} di \quad (3)$$

Likewise all the path distances will be calculated and the path with the shortest distance will be selected.

IV. RESULTS AND DISCUSSION

The following network is created with the nodes.

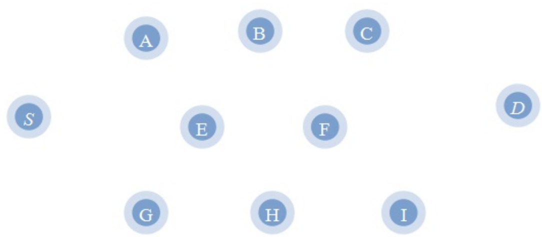

Fig 4: Network of nodes

The distances of the various paths available was calculated using the distance formula as described in the proposal and the distance was obtained using the distance formula. Then all the distances were compared and the shortest distance was taken as the path. Since the shortest path was found time delay was reduced and a significant increase in performance was obtained.

V. CONCLUSION

In the geographic routing path from source to destination is found. In this paper among the paths found, the shortest path is found using the distance formula which will be giving the best path among the available paths. Thus the delay for data transmission is being reduced.

VI. REFERENCES

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