Reducing Routing Overhead With Neighbor Knowledge Probabilistic Approach

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Abstract— A MANET is a bunch of mobile users that communicate over limited bandwidth of wireless links. As the nodes are moving, the network topology may change unpredictably and speedily over time. The changes into topology results into frequent link breakages that may cause path failures and route discoveries. In this paper we propose a protocol for reducing routing overhead in MANETs based on neighbor coverage-based probabilistic rebroadcasting. It uses very important terms like connectivity factor, additional coverage ratio, neighbor coverage knowledge and rebroadcast delay. This approach also secures data to be sent by using encryption.

Keywords— MANET, Connectivity factor, additional coverage ratio, neighbor coverage knowledge, rebroadcast delay.

I. INTRODUCTION

A MANET is a collection of mobile users which communicate over limited bandwidth of wireless links. As the nodes are mobile, the network topology may change unpredictably and quickly over time. The network is not centralized, where all network activity like finding the topology and delivering messages must be executed by the nodes. MANET is used for various important applications like military crisis operations and emergency preparedness and response operations. This is because of their infrastructure less property. Each node not works as a host but as well as act as a router. Nodes receives packets and they need cooperation with every other node to forward the data packets, in such a way a wireless local area network is formed. But there are some serious drawbacks from a perspective of security. As there id absence of infrastructure, there are some new challenges in securing the protocols in the MANET. Many research works have focused on the security of MANETs. One of the basic challenges of MANETs is the dynamically changing routing protocols along with best performance and lesser overhead. Because of node mobility in MANETs, often link breakages may lead to frequent failures of path and route discoveries, which might increment the traffic of routing protocols and reduces the ratio of packet delivery and increasing in end-to-end delay.

II. RELATED WORK

A) Routing Protocols

A routing protocol has been proposed for wireless ad-hoc networks. These protocols are very important in MANET also. Depending on the routing protocols, request of routing will be sent so as to reach the destination faster. These routing protocols are may be mainly classified as either proactive or reactive

a) Proactive:

When proactive routing protocols would be having routing information to a destination before it would actually route data to that particular destination. For this routing tables are maintained. Route updates need to be changed periodically to reflect the changes in topological information. The
protocols designed to update the routing tables are referred as proactive protocols. To make sure that routing tables are getting updated and reflect the actual network topology, nodes which are using a proactive protocol continuously exchange route updates and recalculate paths to all possible destinations. The proactive routing protocols are required the maintenance of routing tables and in MANET, nodes would need to exchange routing updates periodically as its topology is changing dynamically.

b) Reactive:
If on demand routing protocols are used, when data is to be routed to a destination, a source node might be required to initiate a search for the destination. A reactive protocol is characterized by a path discovery procedure and a maintenance procedure. Path discovery is based upon a query-reply cycle that adopts flooding of queries. The destination is eventually reached by the query and at least one reply is generated. Discovery of Path is carried out asynchronously on-demand only whenever there is a need of the transmission of a data packet as well as when there is no path to the destination is known by the source node. Discovered paths are maintained by the route maintenance procedure until they are no longer used. Reactive protocols determine the proper route only when required, that is, when a packet needs to be forwarded. In this instance, the node floods the network with a route request and builds the route on demand from the responses it receives.

B) Route discovery:
When the source does not have a route to destination in its route cache, it broadcasts a route request (RREQ) packet with the destination node. The RREQ packet includes a route record which specifies the series of nodes to be traversed by the packet. If an intermediate node receives a RREQ, it will check if it already in the route record. If it is, it deletes the message. This is to prevent routing loops. The intermediate node forwards the RREQ to the next node according to the route mentioned in the header. As soon as the destination receives the RREQ, it sends back a route reply message. If the destination has a route to the source in its route cache, then it can send a route response (RREP) message along this route. Otherwise, the RREP message can be sent along the reverse route back to the source. Intermediate nodes may also use their route cache to reply to RREQs. If an intermediate node has a route to the destination in its cache, then it can append the route to the route record in the RREQ, and send an RREP back to the source containing this route. This can help limit flooding of the RREQ. However, if the cached route is out-of-date, it can result in the source receiving stale routes.

C) Route maintenance:
When a node detects a broken link while trying to forward a packet to the next hop, it sends a route error (RERR) message back to the source containing the link in error. When an RERR message is received, all routes containing the link in error are deleted at that node.

III. PROPOSED WORK
A) NCPR (Neighbor Coverage Probabilistic Routing Protocol)
Due to high movement of nodes in mobile ad hoc networks (MANETs), there is chance of frequent link breakages which may cause frequent path failures and route discoveries. The overhead of a route discovery is unnegligible. In a route discovery, broadcasting is a basic and effective data dissemination technique where mobile node blindly rebroadcasts the received route request packets though it don’t have a route to the destination, and thus it creates the broadcast storm problem. This paper, propose a neighbor reachability-based probabilistic rebroadcast protocol for reduction of routing overhead in MANETs. To get the knowledge of coverage of neighbor, this paper propose a rebroadcast delay to decide the order of rebroadcasting, and then one may get the exact additional coverage ratio by sniffing neighbor coverage knowledge. We also define a connectivity factor to find
out the node density. With mixing of the additional coverage ratio and connectivity factor, we make reasonable rebroadcast probability. Our approach mixes the plus points of the knowledge of neighbor coverage reachability and the probabilistic mechanism term, which may make less number of retransmissions so as to make the routing overhead lesser, and can also improve the routing performance.

They broadcast a Route REQuest (RREQ) packet in a networks, and this broadcasting may create excessive redundant retransmissions of RREQ packet which creates the broadcast storm problem which leads to number of packet collisions, most of in a dense networks. The initial motivation of our protocol is limiting the number of rebroadcasts as they can effectively optimize the broadcasting and the neighbor knowledge methods perform better than the area-based ones and the probability-based ones then we propose a neighbor coverage-based probabilistic rebroadcast (NCPR) protocol. Therefore, 1) in order to get the neighbor coverage knowledge, we need a term called as rebroadcast delay which determines the rebroadcast order, and then we can get a more accurate additional coverage ratio; 2) To maintain the connectivity of network and to reduce the retransmissions of message, we need a mathematical term named connectivity factor which determines how many neighbors must receive the RREQ packet. After that, by mixing of the additional coverage ratio and the connectivity factor, we find a rebroadcast probability, which can be used to reduce the number of rebroadcasts of the RREQ packet, and to improve the routing performance. The main contributions of this paper are as follows:

1. We propose a novel scheme to calculate the rebroadcast delay. The rebroadcast delay = it is to determine the packet forwarding order. The node having more common neighbors along with the previous node will have the lower delay. If this node rebroadcasts a packet, then all common neighbors will understand this fact. Therefore, this rebroadcast delay enables the information that the nodes have transmitted the packet spread to more neighbors, which is the key to success for the proposed scheme.

2. We also propose a novel scheme to calculate the rebroadcast probability= The scheme considers the information about the uncovered neighbors (UCN), connectivity metric and local node density to calculate the rebroadcast probability. The rebroadcast probability is composed of two parts:
   a. additional coverage ratio= which is the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors; And
   b. connectivity factor= which reflects the relationship of network connectivity and the number of neighbors of a given node.

<table>
<thead>
<tr>
<th>Simulation parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation</td>
<td>NS 2(v2.30)</td>
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<tr>
<td>Topology size</td>
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<td>Number of nodes</td>
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<td>Transmission range</td>
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<td>Bandwidth</td>
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<td>Number of CBR connections</td>
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<tr>
<td>Max speed</td>
<td>5 m/s</td>
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</tbody>
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*Table 1: Simulation Table*
IV. CONCLUSION

The purpose of the work is to reduce the routing overhead caused due to frequent link breakages in MANET. Several techniques exist to address the routing overhead problem but everyone comes with its own limitation. Our approach uses neighbor based probabilistic rebroadcasting technique to reduce routing overhead. It mixes the advantages of the neighbor reachability knowledge and the probabilistic mechanism term, which can significantly decrease the number of retransmissions so as to reduce the routing overhead, and can also improve the routing performance. Use of simple mathematical terms like connectivity factor, additional coverage ratio and node density requires less computation time thereby reducing time required to compute routing probability. Also provides encryption to secure data.

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