Probability Based Reliable Retransmission AODV in MANET

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Abstract— Mobile Adhoc Network is a special type of wireless mobile network in which mobile hosts can communicate without any aid of established infrastructure and can be deployed for many applications such as battlefield and rescue etc. Broadcasting is to transmit a message from a source to all the other nodes in the network. It is widely used to resolve many network layer problems. In a Mobile Adhoc Network, in particular, because of host mobility, the broadcastings can be applied to many areas like as sending an alarm signal, paging a particular host, and finding a route to a particular host, etc. In this research, we have modified the AODV (Ad-hoc on demand distance vector routing) by introducing failure probability. The proposed modification is simulated using the NS2. The simulation result shows that the Packet Delivery Ratio of the proposed system is increased and the latency i.e. end 2 end delay, energy consumption and loss rate is decreased.

Keywords— AODV, Broadcasting, MANET, End 2 End delay, Probability.

I. INTRODUCTION

Mobile ad hoc networks (MANETs) are becoming more essential to wireless communications due to growing popularity of mobile devices [1]. Their ability to be self-configured and form a mobile mesh network using wireless links makes them suitable for a number of cases that other type of networks cannot fulfill the necessary requirements. MANETs offer the freedom to use mobile devices and move independently of the location of base stations (and outside their coverage) with the help of other network devices [1]. The nodes are free to move randomly. Therefore the network's wireless topology may be unpredictable and may change rapidly. The minimal configuration, quick deployment and absence of a central governing authority make ad hoc networks suitable for emergency situations like military conflicts, natural disasters emergency and medical situations etc [2].

Wireless links in MANET are highly error prone and can go down frequently due to mobility of nodes. Stable routing is a very critical task due to highly dynamic environment in Mobile Ad-hoc Network [4]. The most widely used routing protocols in MANETs are known as dynamic routing protocols, such as dynamic source routing (DSR) [6], ad hoc on-demand distance vector routing (AODV) [5], and location-aided routing (LAR) [7]. Dynamic routing protocols consist of two major phases that is route discovery and route maintenance [8]. Route discovery is the phase in which a route between source and destination nodes is established for the first time. In first phase the source broadcasts a route request (RREQ) packet to its neighbors which then forward it to their neighbors and so on, till either the destination itself or a node that have a fresh route to the destination is located, that subsequently responds with a route reply (RREP) packet back to the source through the route from which it first received the RREQ. In the route maintenance phase route is maintained; and if it is broken for any reason, then the source either finds other known route on its routing table or initiates new route discovery procedure, so the cost of information exchange during route discovery is higher than the cost of point to-point data forwarding after the route is established [9].
II. BROADCASTING

Broadcasting is a fundamental communication primitive for route discovery in MANETs [10]. One of the earliest broadcast mechanisms proposed in the literature is pure flooding, which is also known as simple or blind flooding [11]. Although it is simple and reliable pure flooding results in contention, serious redundancy, and collisions in the network; such a scenario has often been referred to as the broadcast storm problem (BSP) [12]. To eliminate the effects of the BSP during route discovery, variety of flooding optimization techniques have been developed to reduce the number of retransmission. As the number of retransmissions required for broadcasting is decreased, bandwidth is saved and contention and node power consumption are reduced and this will improve the overall network performance.

III. AODV IN MANET

Ad-hoc on demand distance vector routing (AODV) is a stateless on-demand routing protocol. Ad-hoc On Demand Distance Vector (AODV) classified under reactive protocols. Operation of the protocol is divided in two functions as route discovery and route maintenance. Whenever a route is needed to some destination, the protocol starts route discovery [13] in Adhoc routing. Then the source node sends route request message to its neighbors. And if those nodes do not have any information about the destination node and they will send the message to all its neighbors and so on. Whenever any neighbor node has the information about the destination node, the node sends route reply message to the route request message initiator. By this process a path is recorded in the intermediate nodes. It identifies the route and is called the reverse path. After all each node forwards route request message to all of its neighbors more than one copy of the original route request message can arrive at a node. The unique id is assigned when a route request message is created. When a node received then it will check this id and the address of the initiator and discarded the message if it had already processed that request. Node that has information about the path to the destination sends route reply message to the neighbor from which it has received route request message. And this neighbor does the same. Because of the reverse path it can be possible. Then the route reply message travels back using reverse path. Although a route reply message reaches the initiator the route is ready and the initiator can start sending data packets [13].

![Fig. 2: Message routing in AODV](image)

Above fig. 2 shows the message routing for AODV protocol. Node “A” wants to send messages to another node “F”. It will generate a Route Request message (RREQ) and forwarded to the neighbors and those node forward the control message to their neighbors’ nodes. When the route to destination node is located or an intermediate node have route to destination. They generate route reply message (RREP) and send to source node. When the route is established between “A” and “F”, node then they communicate with each other [14].

IV. PROPOSED ALGORITHM

The existing work proposed a novel scheme to calculate the rebroadcast probability. Scheme considers the information about the uncovered neighbors (UCN), connectivity metric and local node density to calculate the rebroadcast probability. Mainly 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;

b. Connectivity factor that reflects the relationship of network connectivity and the number of neighbors of a given node.

The existing technique results lesser end to end delay as compared to conventional AODV but the delay is greater than the other techniques. In proposed system we are reducing the end to end delay without degrading the performance. To reduce the end 2 end delay the rebroadcasting must be reduced. In the proposed work the AODV is modified and a table is maintained in the AODV to store the failure probability from particular node to the one hop neighbor node. Hence whenever the transfer of data initiated from one node it checks all the neighbor nodes in decreasing order of the failure probability. The average of the failure probability of all the neighbor nodes is set as the threshold failure chance. The nodes having failure probability greater than the threshold value are discarded. The remaining nodes are checked for the NPCR algorithm to transfer the data. This process maintains the performance and reduces the end to end delay.
DEFINITIONS

FP (u,v): Failure probability from node u to node v.

RREQ_v: RREQ packet received from node v.

R_v: id: the unique identifier (id) of RREQ_v.

U(u,x): Neigbor set of node u.

U'(u,x): The uncovered neighbors set of node u for RREQ whose id is x.

Timer (u,x): is Timer of node u for RREQ packet whose id is x.

[Note that, in the actual implementation of NCPR protocol, each and every different RREQ needs a UCN set and a Timer.]

1. if node_i receives a new RREQ from node_s then
   2. [Compute initial uncovered neighbors set U(node_i, R_v, id) for RREQ_v:
   3. TFP=0
   4. For l=1 to number of elements in U(node_i, R_v, id)
   5. TFP=TFP + FP(node_i, id)
   6. End For
   7. TFP= TFP/ number of elements in U(node_i, R_v, id)
   8. For k=1 to number of elements in U(node_i, R_v, id)
   9. If(FP(node_i, id)>TFP)
   10. U(node_i, R_v, id')= U(node_i, R_v, id') \{node_k\}
   11. End if
   12. End for
   13. U(node_i, R_v, id) = N(node_i) - (N(node_i) \cap N(node_s)) - \{s\}
   14. [Compute the retransmission delay T_R (node_i):
   15. T_R(node_i) = 1 - \frac{|N(node_i)|}{|V|}
   16. T_R(node_i) = MaxDelay \times T_R(node_i)
   17. Set a Timer (node_i, R_v, id) according to T_R(node_i).
   18. end if
   19. while node_i receives a duplicate RREQ from node_j before Timer (node_i, R_v, id) expires do
   20. [Adjust U(node_i, R_v, id):]
   21. U(node_i, R_v, id') = U(node_i, R_v, id') - (U(node_i, R_v, id) \cap N(node_j))
   22. discard (RREQ_j)
   23. end while
   24. if Timer (node_i, R_v, id) expires then
   25. [Compute there broadcast probability P_b (node_i):
   26. R_b(node_i) = \frac{|U(node_i, R_v, id)|}{|V|}
   27. P_b(node_i) = max\{0\} \times R_b(node_i)
   28. P_T (node_i) = P_b(node_i) \times R_T (node_i)

V. SIMULATION ANALYSIS OF MANET PROTOCOL

In this simulation we modify the AODV by introducing failure probability. NS-2 (Network Simulators-2) and OPNET (Optimized Network Engineering Tools) are the two very well-known simulators. NS-2 is open source software. The proposed technique is implemented in NS-2.35 Simulator in Linux environment. The .tcl file is executed and it generates a .nam file which can be viewed in Network Animator tool of ns2 simulator.

<table>
<thead>
<tr>
<th>No Of Nodes</th>
<th>Generated Packets</th>
<th>Received Packets</th>
<th>Packet Delivery Ratio (PDR)</th>
<th>Loss Rate</th>
<th>Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>21668</td>
<td>21344</td>
<td>98.5047</td>
<td>0.01199993</td>
<td>258.74</td>
</tr>
<tr>
<td>Proposed</td>
<td>22406</td>
<td>22041</td>
<td>98.371</td>
<td>0.00830135</td>
<td>230.151</td>
</tr>
</tbody>
</table>
TABLE II
Performance Analysis Of Existing And Proposed System On The Basis Of Various Parameters

<table>
<thead>
<tr>
<th>No Of Nodes</th>
<th>Generated Packets</th>
<th>Received Packets</th>
<th>Packet Delivery Ratio (PDR)</th>
<th>Loss Rate</th>
<th>Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Existing</td>
<td>19907</td>
<td>19341</td>
<td>97.1568</td>
<td>0.0160245</td>
<td>287.899</td>
</tr>
<tr>
<td>40 Proposed</td>
<td>22273</td>
<td>21844</td>
<td>98.0739</td>
<td>0.0133345</td>
<td>268.5</td>
</tr>
</tbody>
</table>

Fig. 3: Graph Analyzing The Results Of Proposed And Existing Scheme On The Basis Of Number Of Nodes For Packet Delivery Ratio (PDR)

Fig. 4: Graph Analyzing the Results Of Proposed And Existing Scheme On The Basis Of Number Of Nodes For Loss Rate

Fig. 5: Graph Analyzing the Results Of Proposed And Existing Scheme On The Basis Of Number Of Nodes For Latency
VI. CONCLUSIONS

Mobile Ad Hoc Networks (MANETs) are created on the fly. No fixed infrastructure is included in the configuration of the network some nodes in the network are expected to assist in the routing of packets, and all hosts are allowed to move freely through the network. The successful routing protocols provide means to deliver packets to destination nodes given these dynamic topologies. Network wide broadcasting, simply referred to as “broadcasting” is the process in which one node sends a packet to all other nodes in the network. Broadcasting is often necessary in MANET routing protocols. In this research, we have modified the AODV by introducing failure probability. The proposed modification is simulated using the NS2. The simulation results show that the PDR of the proposed system is increased and the latency i.e. end 2 end delay, energy consumption and loss rate is decreased.

REFERENCES


