Upgrading Performance of DSR Routing Protocol in Mobile Ad Hoc Networks

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Abstract—Routing in mobile ad hoc networks is a challenging task because nodes are free to move randomly. In DSR like all On-Demand routing algorithms, route discovery mechanism is associated with great delay. More Clearly in DSR routing protocol to send route reply packet, when current route breaks, destination seeks a new route. In this paper we try to change route selection mechanism proactively. We also define a link stability parameter in which a stability value is assigned to each link. Given this feature, destination node can estimate stability of routes and can select the best and more stable route. Therefore we can reduce the delay and jitter of sending data packets.

Keywords— DSR, MANET, Proactive, Routing

I. INTRODUCTION

MOBILE ad hoc network is a collection of wireless mobile nodes which dynamically form a temporary network without the use of any existing network infrastructure or centralized administration. Since the topology of network is constantly changing, the issue of routing packets between any pair of nodes becomes a challenging task. Ad hoc routing protocols can be classified into three main categories: Proactive, reactive and hybrid protocols.

In proactive routing the routing table of every node is updated periodically. This is not safe for the nature of MANET [1], because its bandwidth is very scarce and limited. In reactive routing or on-demand protocols, sending node searches routes to destination only when it needs to communicate with it. In on-demand method, source nodes use route discovery mechanism to obtain a route to destination [2]. Since route discovery mechanism can be associated with great delay, in this paper we try to defeat this extra delay in route discovery. We select DSR [3] routing protocols as delegate of on-demand protocols and then we study and identify delay maker factors.

We use NS2 [4], [5] for the implementation of theory and applying specific improvement in protocol code, simulation and comparison [6] of modified and original protocol.

II. IMPROVING THE FUNCTION OF DSR PROTOCOL

A. current status of DSR protocol

The function of DSR routing protocol is in this way: When two nodes which are not in wireless rang of each other, want to communicated with each other, if the source node has the related route to destination in its cache memory, it will insert The route in data packet headers and the packets will be sent from that specified route, and if it doest have the related route to destination, it should begin the route discovery process. In route discovery process, route request packet (RREQ) is distributed in network until these packets reach the destination from one route. In this manner, as soon as receiving the first route request packet, destination sends the route reply packet (RREP) to the originator of RREQ. if a link is broken because of the motion of middle nodes, a route error packet is sent to the destination and destination tests another route, this task is repeated until the reply reaches the goal. Therefore, only after making error in current route, destination seeks another route. This mechanism causes delay in packet delivery.

Figure2.1 shows route discovery in original states: as shown in figure 2.1 node number 1 starts to finding a path to node number 7, so it initiate route discovery by broadcasting RREQ packet in network. RREQ packet has an identifier and a route record and destination field. Intermediate nodes check destination field in RREQ and add its address on route record and rebroadcast the RREQ packet. Destination node by receiving the first RREQ from path 1-4-7 send the RREP packet to node 1 by reversing route record in RREQ and putting it in RREP. Then link 4-1 breaks and this causes a route error, after route error received by node 7 it test new path to send reply to node 1.we must remember at whole this time data packets are in send buffer of node 1 and waiting for a path to sent to node 7.

B. Link stability parameter:

Because we want expensive route discovery task spend less time, each node can have information about the quality and stability of existing links in a route, therefore, it can send the RREP packet from the most stable route.

This new mechanism requires that each node when sending or forwarding a route request packet, add a series of extra information that will result in the computation of the power of the link, to the header of packet.
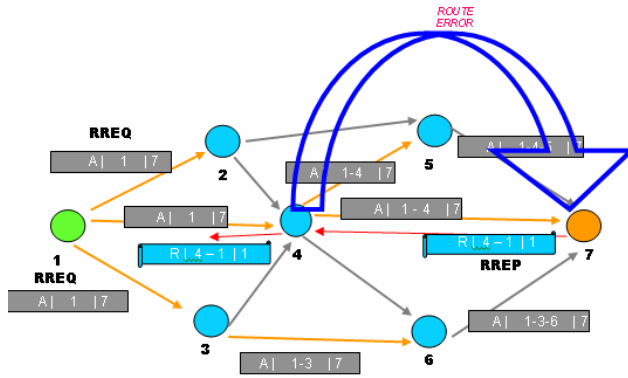
Figure 2.1

And since the route request packets are distributed in network, a packet can reach the destination from different routes with respect to link powers. In this way destination can select the best and most stable route.

Figure2.2 shows the route discovery process with link stability parameter. Source node (node 1) broadcast RREQ in the network. And also puts some information about its velocity vector in packet. When RREQ packet reaches the next node, with respect to relative velocity a link power quantity is assigned to that hop. Then next nodes put their velocity information in packet and rebroadcast it to other nodes. Finally, destination witch didn't reply to first request immediately, with examining the number of hops in existing routes and stability of routes, selects a route for sending the reply. As indicated in figure2.2, selected route is not necessarily the shortest route.
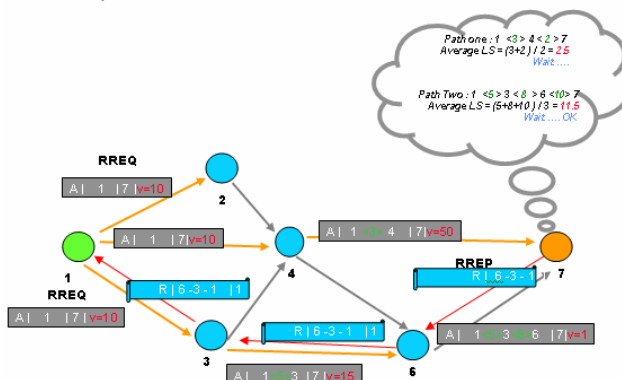

Figure 2.2

Our goal in this paper, is adding sufficient data structure to RREQ packet headers, requiring destination to wait for a limited time from receiving the first route request in route discovery process, computation of the stability of the hops by middle nodes and computation and selection of the most stable route by destination node and sending the reply from that route.

Computation of the stability of one link is done in this way: if two nodes move with velocity of V1 and V2 respectively and there is a distance vector of X between them, their distance in time T equals with X+T(V2-V1) [7],[8]. Since the radius of

wireless range of each node is known, given the velocity vector it can be computed that in what time the link between two nodes will be broken, and by this rule we can assign a value to link stability between two nodes.

Specified improvements in DSR protocol code in NS2 which exists as open source is made, and then a traffic and mobility scenario is created to simulate two ad hoc networks with original DSR routing protocol and modified DSR routing protocol. We compare the protocols with average end to end delay and packet delivery fraction or PDF metrics.

Since our modification didn't affect the main functionality of DSR and its on-demand structure, from view of PDF metric the modified DSR acts almost same as original DSR.

Packet delivery delay in modified DSR is less than original DSR. The average delay in original DSR is 0.029 seconds which is reduced to 0.01 seconds in modified DSR and also maximum delay in packet delivery is reduced from 2.088 to 0.27 seconds. Figures 2.3 and 2.4 shows the frequency distribution of packets delay in two protocols.
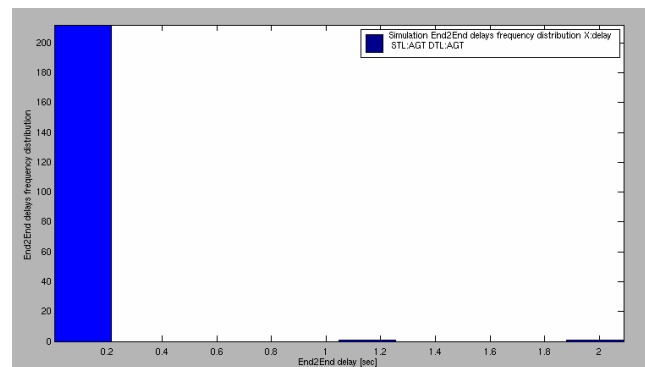

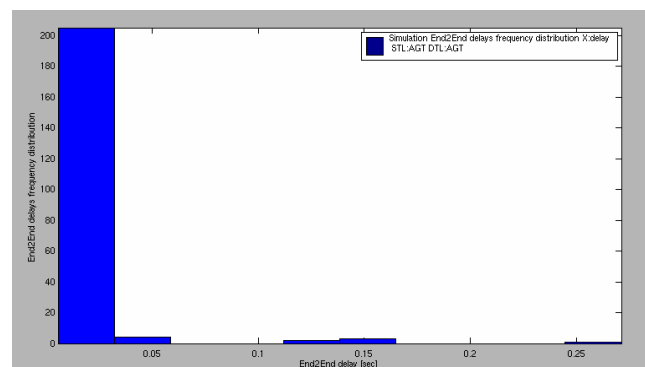
Figure2.3 delay frequency distribution in original DSR

Figure2.4 delay frequency distribution in modified DSR

It becomes clear from the following diagrams that the jitter of received packets is reduced considerably.
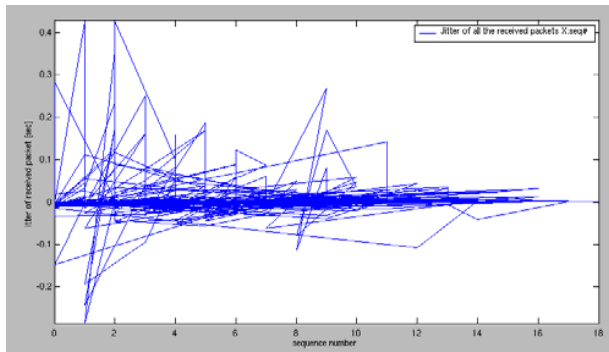
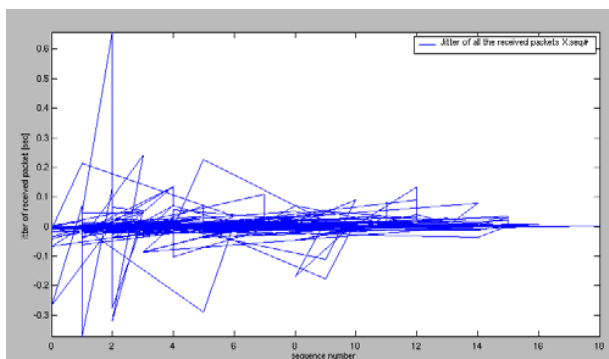Figure 2.5 jitter of received packets in original DSR

Figure 2.6 jitter of received packets in modified DSR

C. Simulation Model

CMU's wireless extension to ns-2 (incorporated in the current release ns-2.1b9a) provides the implementation of the DSR, AODV, DSDV, TORA routing protocols.

Random traffic connections of TCP and CBR can be setup between mobile nodes using a traffic-scenario generator script. It can be used to create CBR and TCP traffics connections between wireless mobile nodes.

For the simulations carried out, traffic models were generated for 50 nodes with CBR traffic sources, with maximum connections of 10,20,30,40 at a rate of 8kbps.

Mobility models were created for the simulations using 50 nodes, with pause times of 0, 5, 10, 15 seconds, maximum speed of 20m/s, topology boundary of 500x500 and simulation time of 17.5 seconds.

III. CONCLUSION

By defining link stability parameter in DSR routing protocol we maintain base functionality of it and we inject proactive features to it, which was very useful in reducing the delay of packet delivery and preventing the formation of error packets and optimal use of bandwidth.

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