

A New Source Routing Mechanism in Mobile Ad-Hoc Network

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Abstract -The inherent uncertainty in wireless mobile ad hoc networks (MANET), due to nodal mobility, unstable links, and limited resources, frequently renders routing paths unusable. Due to the unpredictable movement of mobile nodes, the network topology of a mobile ad hoc network changes frequently. It will directly cause the routes to be broken and greatly degrade the network performance. However, selecting an optimal path set is a NP hard problem.

In this paper, we propose source select rout (SSR) a novel Reliable Routing Algorithm in mobile ad hoc networks .In SSR source using fuzzy logic to select optimized path between the source and destination. We take into account three important factors as the selection parameters; which are the maximum distance between intermediate nodes, maximum relative speed between neighbor nodes, and total number of data transmission links in the intermediate nodes.

Simulation results demonstrate the superiority of the proposed technique over conventional MANET routing schemes.

Keywords—ad hoc networks; route stability; fuzzy logic;

I. INTRODUCTION

Mobile ad hoc networks (MANET) [1] have been receiving a lot of attention during the past few years due to the rapid expansion of mobile devices and the interest in mobile communication. A mobile ad hoc network is a special case of mobile network without any fixed links to support each node and provide connectivity to communicate with each other.

Each node acts as both host and router at a time and performs all the routing and state maintenance operations. The network topology of a mobile ad hoc network changes frequently and unpredictably due to the arbitrary movements of mobile nodes.

Furthermore, because the bandwidth of the wireless medium is less than that of the wired media, routing in mobile ad hoc networks is a challenging research problem. In recent years several routing algorithms [2]-[11] have been proposed, but most of these works only focus on routing hops or routing cost instead of providing reliable routes when selecting routes.

In Dynamic Source Routing (DSR) [12] the source node broadcasts to its local neighborhood a route request (RREQ) for the necessary destination .Any node receiving such a packet adds its own address to the route record and rebroadcasts the packet to its neighbor zone. However, the flooding nature of a route request can harshly influence the performance of a network, as several nodes may initiate floods concurrently, generating bursts of broadcast traffic through the network resulting in collisions and retransmission attempts that can cause congestion in a network. These algorithms will increase the probability of using potential unreliable routes. The direct consequence of using unreliable route is that routes will be broken frequently. In order to rebuild routes after routes broken, existing routing algorithms usually deposit the outgoing packets in the buffer, and packets will be dropped if buffer overflowed. Hence, frequent routes breaking will badly affect the utilization and throughput of ad hoc networks. For the reason that existing routing algorithms do not provide reliability, due to the special characteristics of MANET, the shortest path decided by the number of intermediate hops is not necessarily the most reliable or durable path since the topology of MANET is determined by many factors such as traffic pattern, link stability and nodal mobility. All of these factors are correlated. Thus, consideration of only one or two factors is not sufficient for choosing an optimal set of multiple paths.

A lot of research works show that Fuzzy Set theory, proposed by L. A. Zadeh, can process the inaccurate or uncertain information efficiently [13]. The inaccuracy of network information will be essentially considered, so that routing performance will be improved.

In this paper we propose Source Select Route (SSR) algorithm for routing in AD HOC network.

For selecting route, we use quality coefficient (QC) of route from output of Fuzzy logic block that is result of putting information of network topology and information of traffic network in inputs of Fuzzy logic block. In SSR, nodes use RSSI for finding distance between neighbor nodes and calculate relative speed with neighbor nodes.

With consider in information of network Topology, is prevented for choosing critical links and route stability increased. We try to balance network traffic that cause decreasing transmit delay and increase throughput.

Simulation results show that algorithm has better performance such as packet delivery ratio, end-to-end delay of data packets and Throughput as well as the route discovery frequency.

II. SOURCE SELECT ROUT PROTOCOL (SSR)

A. Overview of SSR

As general routing algorithm in ad hoc network selection of route is done by destination but in SSR source select optimum route .Intermediate nodes after receiving RREQ by using Received signal strength indication (RSSI) (that has right relation with distance between sender and receiver) calculate distance from previous node and put it to RREQ. When Destination receives first RREQ then constant window time will start. During this constant window time each RREQ that destination receives, it has sending route reply (RREP) without delay for source.

Each intermediate node by receiving RREP find changes distance with previous node and calculate own speed in ratio with previous node, and put this speed to RREP , Source with receiving RREP, put information (Information of nodes mobility and route traffic is recorded in RREP) of determinate route in inputs variables of Fuzzy then calculate path 's QC from output of Fuzzy, Source after calculate QC start transmit data to destination, with receives next RREP that have higher path's QC , source change transmit data route to new path . In figure 1 node 1 is source and 6 is destination, node 1 broadcast RREQ and destination receives 3 RREQ from different path and transmits 3 RREP to source figure 2. Table1 shows QC of paths .Source after receiving RREP1 starts to transmit data , with receiving RREP2 source compares QC of path 2 with QC of path 1 so there is no change in path of transmit data then with receiving RREP 3 with higher QC, path of transmit data changes to route 3.

Table1

RREP	QC
RREP1	0.67
RREP2	0.45
RREP3	0.82

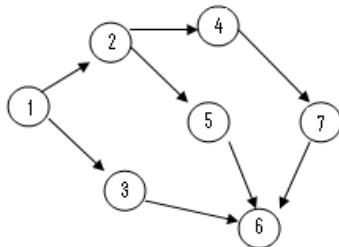


Figure 1

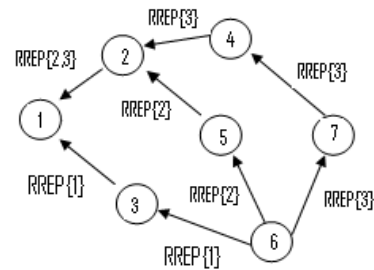


Figure 2

B. Fuzzy logic

Fuzzy systems are used to approximate functions. The fuzzy can be used to model any continuous function or system. The advantages of fuzzy logic are conceptually easy to understand, flexible, tolerant of imprecise data, can model nonlinear functions of arbitrary complexity, can be built on top of the experience of experts, can be blended with conventional control techniques and based on natural language.

The quality of fuzzy approximation depends on the quality of the rules. The result always approximates some unknown non linear function that can change in time. Fuzzy systems theory or "fuzzy logic" is a linguistic theory that models how we reason with vague rules of thumb and commonsense. The basic unit of fuzzy function approximation is "if then" rules. A fuzzy system is a set of if- then rules that maps input to output.

C. Fuzzy input parameter

Source uses three parameters for selecting route In SSR , these three are as inputs variable of fuzzy logic block and quality coefficient (QC) is output of Fuzzy logic block

1-Maximum distance:

Each node obtains it's distance with previous node by RSSI of receiving RREP, and put distance in RREP. Source after receives RREP calculate maximum distance between two neighbor nodes and considers it as fuzzy input variable, it caused to prevent establish critical path.

2-Maximum speed of two nodes in relation to each other:

Speed of two nodes in relation to each other is equaled the difference distance between two neighbor nodes in the duration between sending RREQ and receiving RREP .

In figure 3 the arrow shows the direction of nodes mobility. Describe $x(i,j)$ the distance between i and j when i sending RREQ and j receiving RREQ , $y(i,j)$ is distance between i and j when j sending RREP and i receiving RREP and Δt is time interval between sending RREQ by i and receiving RREP by i , therefore relation speed of two node (ΔV) is :

$$\Delta V(i,j) = (y(i,j) - x(i,j)) / \Delta t$$

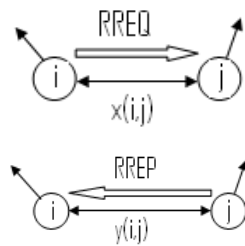


Figure 3

If two nodes are far from each other then $\Delta V > 0$, if the mobility of each two nodes should be in the same direction and with the same velocity distance between two nodes is Constance and $\Delta V=0$ and if two nodes close each other $\Delta V < 0$. By considering this parameter can select stable route against mobility of nodes, for example the probability of breaking link with positive relative speed is higher than the link with negative relative speed between two nodes.

3- Total number of data link in intermediate node:

In general Hub count is the useful parameter for selecting optimum route .In SSR the total number of transmitted data link is assumed as input variable, total number of transmitted data link is equal with hub count and number of data link is routed by intermediate nodes. In figure 4 node 1 is source and 7 is destination ,there are two routes between source and destination 1- $\{1,2,3,6,7\}$ 2- $\{1,4,5,7\}$.Assume 3,4,5, router 1,2,2 data links respectively. Hub count in path 1 is equaled to 3 and path 2 is equaled to 2 but total number of data transmitted link by intermediate node in path 1 is equaled 4 links and path 2 is 6 links .If routing base on hub count route 2 is selected but traffic in 4 and 5 occasion increase transmit delay and probability of fill send buffer of nodes and packets will drop. Consider lower total data link case selected route have lower hub count and low traffic in route and balanced traffic in network.

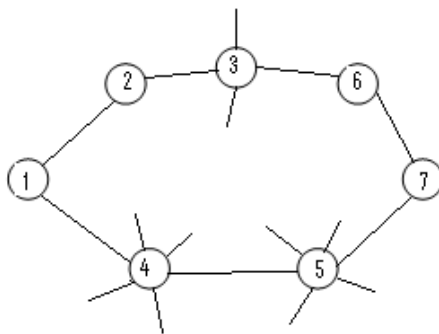


Figure 4

For each route, the whole Fuzzy logic evaluating diagram is illustrated in Figure. 5. While MAX Distance, MAX relative speed and data link number constitute the input fuzzy variables, quality coefficient preference degree denotes the fuzzy output. Based on the customized membership functions, input variables are fuzzified and converted into fuzzy sets. Then, by employing the IFTHEN rules, the fuzzy inference

engine maps input fuzzy sets into output fuzzy set. Note that for the fuzzy inference engine, the algebraic product operation is used for implication.

Hence, the Centroid Defuzzifier [14] is exploited to generate the crisp output for every route, based on fuzzy output and membership functions of quality coefficient.

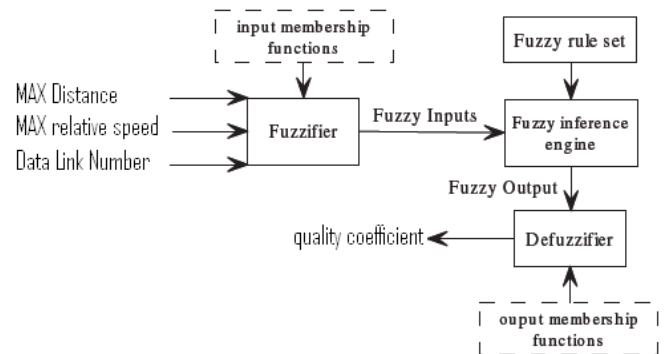


Figure 5

III. PERFORMANCE EVALUATION

A. Simulation Environment and Methodology

In order to verify the correctness of our approach and to see the performance in real application scenario, we establish a pure ad hoc network with 50 nodes distributed over 800m x800m area in the simulation platform. A random waypoint mobility model was used: each node randomly selects a position, and moves toward that location with a speed ranging from just above 0 m/s to 20 m/s. When the node reaches that position, it becomes stationary for a programmable pause time; then it selects another position and repeats the process. The simulation was repeated with different seed values. Each node has a radio propagation range of 150 meters and channel capacity is 2 Mb/s. The source-destination pairs are spread randomly over the network. Continuous Bit Rate (CBR) traffic sources were chosen, as the aim was to test the routing protocols. Source nodes and destination nodes were chosen at random with uniform probabilities. The sending rate used was 4 packets per second with a packet size of 256 bytes.

B. Performance Metrics

The following metrics are used in computing the Performance. The metrics were derived from one suggested by the MANET working group for routing protocol evaluation.

A. End-to-end delay:

It includes delays caused by buffering and wireless transmission during route discovery, queuing at the interface queue, retransmission delays at the MAC, propagation and transfer times.

B. Packet delivery ratio:

Packet delivery ratio is the ratio between the number of packets originated by the “application layer” CBR sources and

the number of packets received by the CBR sink at the final destination.

C. Route Stability:

Route stability is a very important performance parameter for a routing protocol. Route stability can be measured in terms of number of route failures.

D: Throughput:

It is the amount of digital data transmitted per unit time from the source to the destination. It is usually measured in bits per sec.

C. Simulation Results

We present below the performance of the proposed routing algorithm in comparison with DSR. Figure 6 provides a comparison between SSR and DSR schemes in terms of packet delivery ratio. As expected, SSR performs much better than DSR which is due to its ability to select a set of stable and least congested routes thus having the lowest amount of congestion loss and few route failures. In Figure 7 shown number of route failures, the broken number of SSR decreases compare to DSR because in SSR route establish by Consider speed of nodes mobility and distance between neighbor nodes. SSR balanced network traffic and prevent to congestion then the average end-to-end delay is the lowest compared with DSR Figure 8.

As shown in Figure 9, SSR always gains a higher aggregate throughput than that of DSR. That means the Fuzzy estimate solution can get better performance than the minimum hops solution.

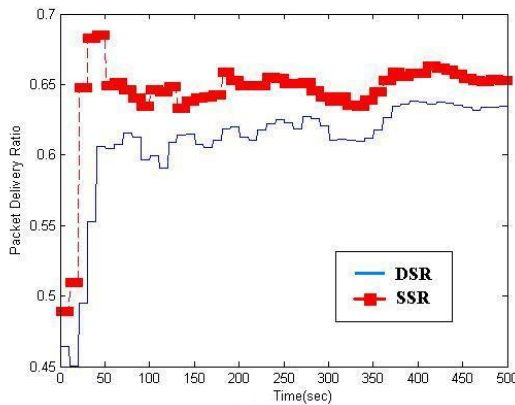


Figure 6

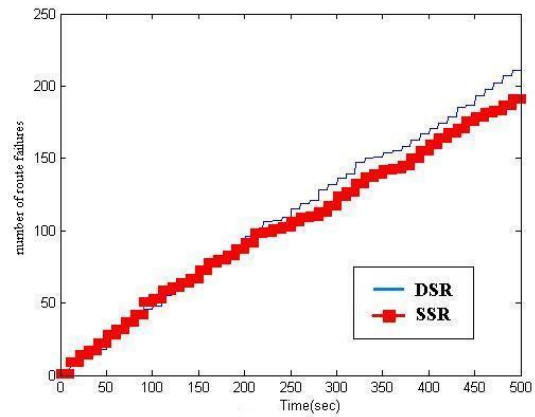


Figure 7

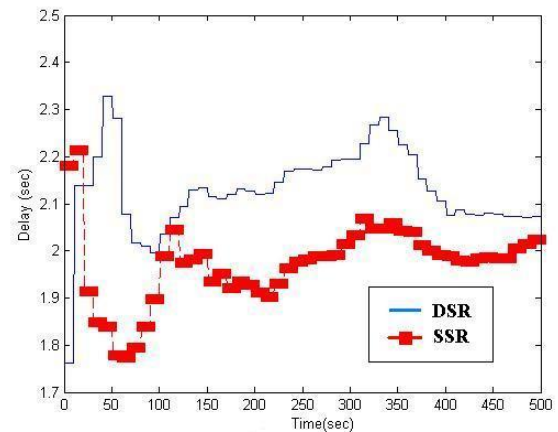


Figure 8

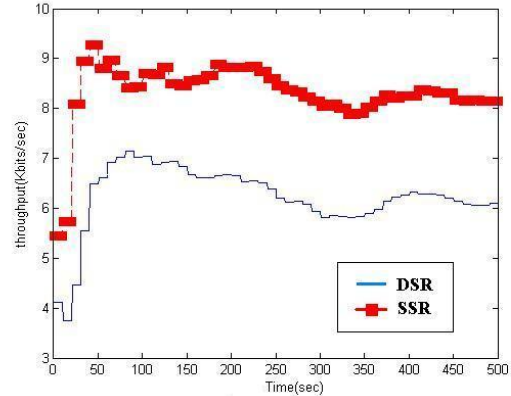


Figure 9

IV. CONCLUSIONS AND FUTURE WORK

Mobile ad hoc networks are full of uncertainties because of dynamic topologies, dynamic traffic and different application contexts. As a well recognized decision making technique, Fuzzy logic offers a natural way of representing and reasoning the problems with uncertainty and imprecision. Fuzzy logic is a suitable way to be applied in the mobile ad hoc network routing decision. Innovation in the paper is source select rout

by using impotent parameter. Simulation results show that the SSR algorithm improved the performance of MANET networks dramatically. The SSR algorithm was integrated to DSR protocol. The algorithm can be applied to other routing protocols for mobile ad hoc network to improve the performance of routing.

Futures we will present novel algorithm base on flexibility in changing data transfer route of SSR and expect improve route maintenance and decrees rout failure in network.

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