



DESIGN AND DEVELOPMENT OF FUZZY BASED RELIABLE SCHEME FOR ENERGY EFFICIENCY IN MANET

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ABSTRACT

Ad hoc network plays a major role in wireless networks where it does not have any access point. Reliability is a major issue in Mobile Ad hoc Network (MANET) which influences the network performance. Links and nodes are the major part of ad hoc network. To keep network stable, links and nodes must be kept stable and reliable. Mobility of nodes affects the reliability of ad hoc network. In this research work, we designed and implemented the Reliability based Stable Scheme (RSS) to attain maximum throughput. Link reliability and node reliability are calculated based on capacity and mobility metrics. In this connection, a reliability model is created to attain maximum performance. Based on the analysis using simulation tool, the proposed scheme provides better results than existing schemes in terms of jitter, throughput, packet delivery ratio and Network reliability.

Keywords: MANET, reliability mode, link reliability, node reliability, jitter, throughput and packet delivery ratio.

1. INTRODUCTION

An ad hoc network could be a self configuring and Infrastructure less networks, during which every and each node will act as a router. The performance of mobile ad hoc network depends on the routing theme deployed and a few of the standard routing protocols don't work properly. During this variety of dynamic network, nodes square measure moving randomly and also the radio propagation conditions amendment are violated.

In MANET, multicast routing protocols deliver the information from source node to several destinations organized during a multicast cluster community. A serious issue and challenge during a network is to make sure the massiveness to path failures and resilience to the malicious attackers. Multicasting will support a large style of applications that square measure characterised by an in depth degree of collaboration. Thanks to the presence of the mobile nodes, the path, link and node failures happen or generally the malicious intruders could arise within the network to break whole network property. To make sure the strength and resilience to those failures and attackers, there's a necessity of stable scheme in ad hoc network.

Most of the researches believe that the node and also the link square measure flat to be failure and also the failure of node and link. It is not appropriate in ad hoc setting. In typical network, the causes of failure of node and link square measure tough and even unsure. It is more powerful to search out that is that the most significant. This is to calculate the node and link responsibility merely, the failure of node and link is assumptive. Recent analysis finds the quality to be the foremost important reality of link failure [1, 2], and also the whole responsibility is computed which supports the quality model. In fact, the restricted capability of wireless network is established, and also the outturn of the wireless network supplied to every node diminishes to zero because the range of nodes will increase [3].

The paper is organized as follows. Chapter 1 introduces the reliable scheme. Chapter 2 discusses the

related work. Chapter 3 introduces the proposed scheme. Chapter 4 conveys performance results of proposed and existing schemes. Last chapter concludes the work.

2. RELATED WORK

In paper [4], fuzzy value primarily based Multi Affected Quality of Service Routing was projected for best path choice supported information measure, finish to finish delay and range of intermediate hops. The trail with most lifespan and minimum fuzzy value was thought-about for best transmission. There was no stability of link gift during this work. Lifespan of the network depends on link and node stability. In [5], fuzzy primarily based intelligent agent routing was established to search out packet loss rate, best parameters, membership functions and repairing of path broken. The main limitation of this work is, responsibility inclusion was avoided. In general, network performance depends on responsibility of link similarly as nodes. Link property was conjointly not maintained during this routing. Fuzzy agglomeration [6] was developed for the multicast communication and locations of mobile nodes were updated by kalman filter mechanism. The potency of the longer term cluster had conjointly been determined with fuzzy agglomeration. It had been no determination of cluster head node stability and also the calculation of cluster head election responsibility wasn't enforced. In [7], fuzzy primarily based multi-constrained QoS node disjoint-multipath routing was projected to unit unsure metrics similar to information measure, link delay and packet loss rate. The most purpose of this work was to decide on path that ought to satisfy QoS criteria. Counting on link responsibility solely, packet loss rate will be with success reduced. However it had been not targeted during this work. In paper [8], mathematical logic management had been enforced with mesh primarily based routing protocol to induce the knowledge regarding battery standing and link quality. Future goal was the overhead reduction with be part of question flooding packet. The new packet



forwarding cluster was conjointly developed to satisfy QoS desires. The limitation of this work is, link stability wasn't maintained throughout packet transmission section. It will cause serious packet loss and high overhead. The author projected the mathematical logic primarily based Rate management ODMRP [9], to handles coinciding traffic flows while not dominating the offered information measure of networks. It is achievable during this work was high congestion throughout serious traffic flow happens. This work won't be appropriate for real time traffic sessions. A brand new routing technique [10] was developed supported quality, output and information measure. Numerous improvement techniques were conjointly prompt to supply stability index during this routing. However there was no well-tried model for stability enclosed within the paper. Fuzzy primarily based Reliable Multicast Routing Approach [11] was projected for VANET to make sure responsibility necessities. Protection primarily based Approach was conjointly developed to satisfy the responsibility necessities. This responsibility cannot be integrated in Edouard Manet in real time traffic eventualities. The author projected the fuzzy computer hardware [12] that found the priority index of the queued packets. It combines the input parameters similar to rate, ending time, and queue length for locating the priority index. While not fuzzy programming the packets square measure scheduled in First in First out (FIFO). Here the package agents were used for each in routing and fuzzy priority programming stages. Agents can cause undependability of the network. The choice of best methods in MANET supported multipath routing with fuzzy value in respect of the Fuzzy value Enabled Cluster primarily based Routing [13]. Responsibility primarily based performance metrics weren't targeted during this paper. During this paper [14], a multicast tree was made supported spanning tree idea whereas using a fuzzy controller. It used three inputs specifically link information measure, link delay and link responsibility for multicast tree construction. Reconciling mathematical logic primarily based Security Level Routing [15] was a secure finish to finish protocol to change discovers and finds the secure multicast route in Edouard Manet. Solely secure routes were targeted. There is a need to concentrate on stability with reliable multicast scheme.

The main aim is to arrive at a fuzzy multicast protocol which strikes a balance between reliable nodes and reliable links to ensure better network performance.

3. IMPLEMENTATION OF RELIABILITY BASED ROUTING SCHEME

The main aim of the proposed scheme is to attain maximum network reliability. In this scheme, there are two phases involved. i.e. Estimation of link reliability and Calculation of remaining energy. In first phase, link reliability is estimated based on packet loss rate and probability of link existence. In second phase, residual energy is estimated after route maintenance process.

Assumptions

Reliability is measured in terms of stability and mobility. The following assumptions are made to attain maximum network performance:

- All the nodes are mobile except source node and sink node.
- Mobile nodes are moving within the transmission range.
- Unique data transmission rate is followed among all mobile nodes.
- Only binary links are activated between the mobile nodes.
- Two metrics are calculated i.e. stability and mobility before the route discovery process begins.

Mobility model

Random way point mobility model is chosen in our proposed scheme. Node starts by varying in one location and moves to another location while varying the pause time. If it is expired, random destination and speed are uniformly distributed between 0 and MAXSPEED.

Algorithm for determining network reliability

The following steps illustrate network reliability estimation based on node reliability and link reliability.

- Step 1:** Choose the location of the node which should be less than transmission range.
- Step 2:** Establish the bidirectional link between source node and destination node in multi-hop manner.
- Step 3:** Estimate the link stability rate based on the calculation of packet loss rate. Packet loss rate is defined as the ratio of packets lost to the total travelling packets.
- Step 4:** If packets are reached through the destination without making more loss, it is considered as maximum stability.
- Step 5:** Links are existed with the probability of each link configuration i.e. $P(\beta_m = 1) = \beta^{\xi_j} (1 - \beta)^{\xi_j}$
- Step 6:** Calculate the mobility based on Link Expiration Time (LET).
- Step 7:** Neighbor nodes record the packet sending rate, packet receiving rate, packet loss rate and mobility in its routing table.
- Step 8:** The energy rate is calculated based on energy dissipation of all nodes. Approximate drain ratio is calculated from existing and new one. i.e.,

$$ER_{\chi} = \chi ER_{old} + (1 - \chi) ER_{new}$$

Where $0 < \chi < 1$, indicates more updated information.

The total energy is calculated for transmitting a packet is given by,



$$E_{mn} = \sum_{i=1}^{m-1} \alpha \times d_{i(i+1)}^n \times (\tau_{req} + \tau_{ack})$$

$$+ \sum_{i=1}^{m-1} \alpha \times d_{i(i+1)}^n \times (\tau_{req} + \tau_{ack} + \tau_{rts} + \tau_{cts})$$

In this equation, i is the one route and $i+1$ is the nearest multicast route, can be used if any link failures. τ_{rts}, τ_{cts} are propagation delays which occurs on Request To Send (RTS), and Clear To Send (CTS) packets.

Step 9: The model of network reliability is formalized based on packet loss rate, mobility and energy rate of links and nodes.

Step 10: Calculate the network reliability based on number of paths and nodes inside the network region. If no path exists, the reliability of the network configuration is zero.

Fuzzy logic based Network Reliability

In this module, network reliability is determined based on the input parameters i.e. mobility, packet loss rate and energy rate. The output metric is network reliability which implies that maximum or minimum.

4. PERFORMANCE EVALUATION

The simulation settings and parameters are summarized in Table-1.

Table-1. FRS simulation settings.

No. of Nodes	100
Area Size	1200 X 1200 sq.m
Mac	802.15
Radio Range	200m
Simulation Time	100 sec
Traffic Source	CBR & Poisson
Packet Size	80 bytes
Mobility Model	Random Way Point
Initial energy	85 J
Transmitted power	0.879 mw
Received Power	0.08 mw
Protocol	AODV

Performance metrics

The performance metrics are evaluated using simulation tool.

Network reliability rate: It is the combination of node reliability rate and link reliability rate. Node reliability rate means nodes which are genuine through the entire communication process. Link reliability rate means the fault tolerance of link which reaches within the transmission range.

Packet delivery ratio: It is the ratio of Packets received to the packet sent.

Jitter: It is the packet interval which causes some amount of delay during transit period.

Throughput: It is the number of packets received at the destination per second.

5. RESULTS

We compared our proposed scheme FRS with existing schemes PTSRP [16], REEDDRE [17]. Fig.1 shows the result of Packet delivery ratio Vs number of nodes. No. of nodes is varied as 10, 20, ...100. It is clearly shown that proposed scheme achieves more packet delivery ratio than existing schemes.

In Figure-2, Throughput is compared to all the schemes. The proposed scheme scores maximum throughput than others. It is because of high stable links.

Figure-3 shows comparison of jitter for all the schemes while varying the pause time as 5, 10... 25 ms. When time is increased, the mobility will also get increases. It leads to high jitter. But compared to previous schemes, the proposed scheme achieves less jitter.

In Figure-4, speed is varied up to 30m. From the results, the proposed scheme achieves more network reliability than others while increasing the density of nodes.

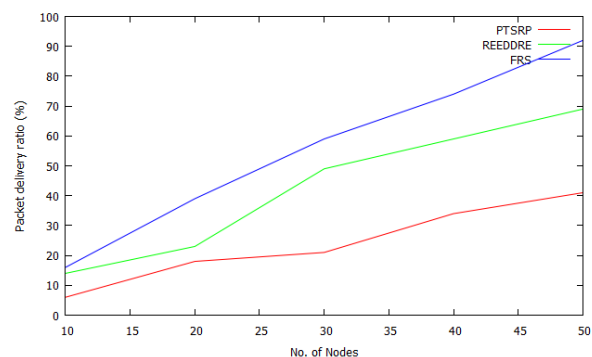


Figure-1. Packet delivery ratio vs. no. of nodes.

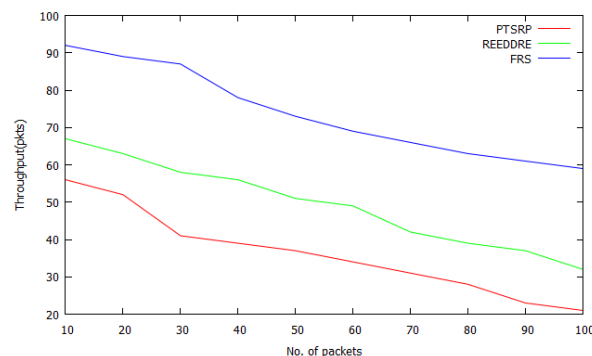


Figure-2. Throughput vs. no. of packets.

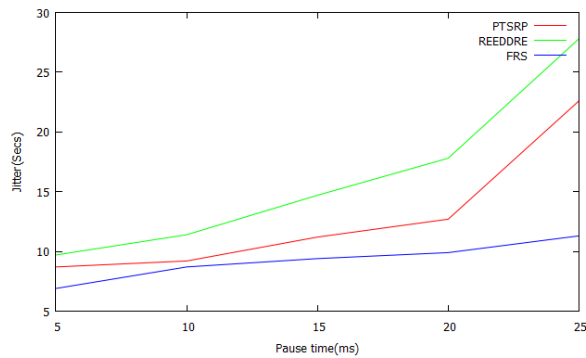


Figure-3. Jitter vs. pause time.

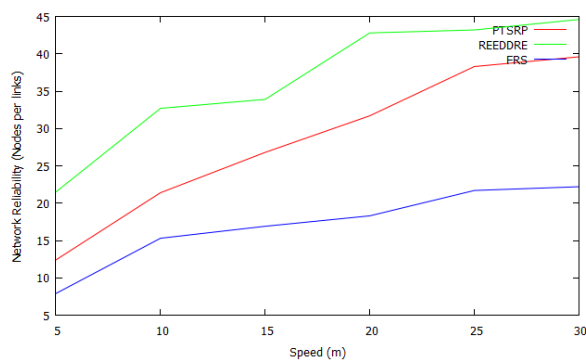


Figure-4. Network reliability vs. speed.

6. CONCLUSIONS

In this research work, Fuzzy based reliable scheme for providing network reliability in MANET. There are some parameters of node and link used to provide maximum network reliability. Based on the extensive simulation results, the proposed work achieves better results than existing schemes. In future, it is planned to proposed authentication in backbone routing method to provide data integrity between nodes. It is planned to choose some symmetric cryptographic schemes to attain less complexity.

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