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Assessment of Dynamic Source Routing Protocol and Connection Failure Prediction in Mobile Ad Hoc Networks

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ABSTRACT- Constant change characterises a mobile ad hoc network.This network does not rely on any fixed infrastructure but rather relies on the mobile nodes to dynamically construct a network as needed. Network topology changes may lead to connection dropouts, which can lead source routing protocols to send more route request (RREQ) packets. In order to enhance the on-demand source routing protocol, this paper proposes a link failure prediction mechanism (LFPM). Node mobility may cause connection failures; this LFPM can avoid them. We put the proposed method through its paces in the NS3 simulator. We performed throughput analysis, average end-to-end latency, normalised routing load, and comparisons to industry standards like dynamic source routing (DSR) to determine how well the proposed method performed.

Keywords: LFPM, MANET, and DSR.

I.INTRODUCTION OF MOBILE AD-HOC NETWORK

Without the need for preexisting internet infrastructure or other stationary stations, a MANET is comprised of a number of mobile devices that can communicate with one another to form a network as needed.

The term "massive autonomous network" (MANET) is used to describe a network of interconnected wireless nodes, also called "MSs," that may function independently and create a communication network in the form of a random communication graph. Because the destination is outside the source node's communication range, a multi-hop network allows the source node to interact with it via intermediary nodes; this is the case in a MANET [1] [3]. In extreme or short-lived contexts, such as disaster zones, catastrophic recovery regions, or even on the battlefield, MANET—a potentially game-changing technology—can provide connectivity without the need for permanent infrastructure [4]. Nevertheless, the disruption of established connections caused by link breakages is one of the primary problems in MANET [5, 6]. The reactive building of routes by flooding the network with route request (RREQ) packets is recommended by several MANET protocols [7], [8]. Consequently, MANET performance may be negatively impacted when the flooding method leads to substantial control overhead while connecting to the target destination [9] _ [13]. In addition, to enhance network efficiency, flooding activities should be selectively regulated by restricting the number of mobile nodes that broadcast RREQs [14] _ [16]. Because nodes may move around so often, the network's topology can change quickly, which in turn causes link breaks more often, which increases overhead and disrupts existing connections [17] _ [21].

LITERATURE SURVEY

In order to decrease the quantity of RREQ and control packets, Shobha and Rajanikanth [4]introduced an improvement known as relay routed DSR. During the flooding phase, this protocol gathers mobility information from nearby nodes. During the relaying phase, it utilises this information to choose which nodes should send RREQ signals.

Enhanced DSR was suggested by Sultana et al. [43] and Kaur Singh [44] to boost DSR performance by lowering the overhead of broadcasted RREQs. This is achieved through a multicast approach, wherein the forwarder nodes rebroadcast the received RREQs to neighbours who were not used in the route request option.Nevertheless, changes to the selected nodes impact flooding levels, and this impact may be substantial in the absence of an effective method for choosing advantageous forwarders according to, instance, geography.

In order to address the issue of link failure, Zahedi et al.[45] suggested a new method called modified DSR (MDSR). In this method, every node on the active route keeps an eye on the signals of the data packets received from its previous node. If the signal value constantly drops after a certain number of measurements, the node knows the link is about to break and sends a warning message to a source node, which then has to swap out the whole affected route, not just the affected link.The MDSR link failure prediction system, on the other hand, is sluggish and fails to detect route breaks in a timely manner.And when you're creating a brand-new route that's completely distinct from the existing one, it creates excessive control overhead.

In order to compute the link availability and decrease the broadcast of RRREQ packets, Malweetal.[46] suggested two methods.The first method is zone-based; in this method, the received signal intensity and two specified thresholds split each node's transmission range into an inner, middle, and outside zone, with only the nodes in the middle zone taking part in the route finding process.The second method is known as segment-based and it involves calculating the link availability ratio (LAR) for all nearby connections based on their current positions and angular sectors within the transmission range. Unfortunately, this technique has issues with route finding, such as packet looping and a large number of hops to the target.

The goal of the DSR with link life time (LLT) method suggested by Vijayalaxmiet. al. [21] is to decrease packet loss caused by connection failures.For each route that is found, it determines the latency and the length of its liveliness, which is termed route life time (RLT).The source node takes the RLT and latency into account when estimating the estimated number of packets that the route can handle. The destination node calculates the latency and includes it in the route reply (RREP) packet that is forwarded to the source node. Unfortunately, this technique isn't suitable for a high mobility model since it experiences significant delays as the number of nodes in a route rises.

EXISTING SYSTEM

on-demand routing protocols were developed to save bandwidth by minimizing the use of control messages throughout the network[35].A route to the destination is only searched when it is required by the higher protocol layers uses two mechanisms:route discovery and route maintenance; both the mechanisms operate when there’s a requirement for a route. However,new routes are mainly discovered by flooding the network with RREQ packets that infinitely move within the entire network. Thus, flooding operations should be selectively controlled to assure efficient and useful flooding within the network. Moreover, the frequent link breakages due to node mobility events affect the network performance, which increases the demand for an efficient link failure prediction.

PROPOSED SYSTEM

This paper proposes a mechanism called a Link failure prediction mechanism (LFPM). The function of this mechanism is to maintain the routes. This mechanism operates when there is a demand for a route.The link failure prediction mechanism (as for route maintenance) aims to predict the current link status to avoid failure

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conditions and reduce packet loss by utilizing mobility and location information.

SYSTEM DESIGN

5. LINK FAILURE PREDICTION MECHANISM

The ideas of link stability (LS) and link expiration time (LET) formed the basis of the LFPM. In this way, LFPM makes use of mobility data, node density, the time until the sender node's coverage region is no longer available, and the interval between hello messages. When two nodes are actively communicating along a route, the sending node should verify the integrity of the connection to the next hop at regular intervals, primarily during the Hello interval in Region 3. The sections that follow provide details on these factors.
The suggested LFPM makes use of both known threshold values and mobility data, with the latter being derived from GPS readings of each node and including their speed and direction.The next-hop node in Region 3 connection is going to break, which triggers the suggested LFPM. In order to create a new route to the desired destination in the event that the connection fails, the sender node will send an acknowledgment message (ACK) to the source node.

5.1 How far away

As a percentage, the remaining distance dr shows how far the next-hop node must travel before it can no longer receive data from the sender node. It is common practice to calculate the remaining distance in this way as the situation service makes it possible to understand the state of each node: The parent node is the one from which the information packets are received; using (2) and [50], get the distance d between next-hop node M and its parent node P.

• It is common practice to calculate the transmission range R of each node by taking the signal strength threshold value and the error probability, which is commonly shown as bit error and is considered to be 10-3[2], [51]. Figure 5 shows the remaining distance.

In equation (1), we have that d is equal to the square root of (x2 - x1)2 plus (y2 - y1)2. We have the coordinates of the parent here, which are (x1, y1).

«$d = f - d$ (2)»

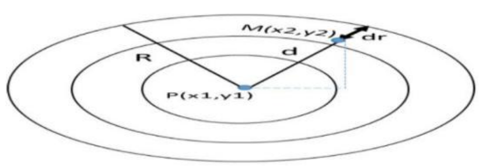

Fig 1. Remaining distance threshold

All nodes exchange a hello message with their one-hop neigh boring node to update one another. The nodes exchange the node status information and site information additionally to mobility information.within the network,each node maintains a neigh boring table that employs the ZRDM and holds all neigh boring node data (listed by ID, location,and direction). each node maintains a neigh boring table and classifies into three regions (region 1, region2, region 3). During the hello message interval(T), the sender node can receive the updated information about its neighbour's;therefore, involving this parameter within the link failure prediction model is important.

5.1 *Determine the minimum number of nodes in the forwarding zone.*

Node density is computed because the number of nodes per area unit.if region 3 is that the FZ, the node density are going to be the amount of nodes in the region 3 is divided by the area of region of region 3.therefore,if the amount of nodes in FZ is N,then the node density for the whole FZ is as shown in table 1.

$ND_{min}=4/FZ_{area}$(3)

Thus,node density ratio represents the ratio of the minimum number of nodes that

5.2 *Link Stability*

Link expiry time(LET) plays a key role within the computation of LS,which is employed to calculate the time during which the connection between the two connected nodes can continue without interruption. Hence, LS and LET are often considered because the main terms within the design of LFPM due to their significance in determining LLT.

5.3 *Design of LFPM.*

LET for the two connected nodes is adequate to infinity if both nodes are moving at an equivalent speed and within the same direction. The worst-case scenario is that if one node has the utmost speed while the opposite has minimum speed and both nodes move in opposite directions. Therefore, LS between two nodes is proportional to the LET value. The shape of LS are often given as follows [54]:

$LS=1-e^{-LET/\alpha}$(4)

Here, α is constant; this value should be improved to reinforce the shape of LS and to predict link failure. This during this research, LET is modified by a mixture of the above parameters to assist find LS and for link failure prediction. Besides, LET should remember about when the hello message interval T is high, as described above, to avoid out-of- date information about the next-hop node. Therefore, LET is inversely proportional to the hello message interval. Thus, increasing T may negatively affect LET while reducing T enhances LET.

II. PERFORMANCE EVALUATION

To verify the effectiveness of the proposed mechanisms, a random number of sources nodes starting from 20 to140 nodes were simulated using network simulator 3 (NS3), as described in Table 1. Many researchers have validated their work on source routing protocols using NS3 [55]– [57].

TABLE 2.The setting of simulation parameters

PARAMETERS	VALUES
Number of nodes	20-140
Simulation area	300mx1500m 1000 m x1000 m 400 m x 800 m
Simulation time	200-1000s
Transmission range	250m
Mobility model	Random waypoint
Speed of the nodes	0 to 5 m/s 5 to 35m/s
Pause time	50-5000s
Propagation model	Free space model
Channel time	IEEE 802.11
Packet size	512 bytes
Traffic type	CBR/UDP

III. Results and Discussion

The performance of the proposed mechanisms was evaluated by comparing it with standard DSR in terms of throughput analysis, normalized routing load (NRL), and average end-to-end delay

7. *Evaluation of LFPM compared with DSR.*

LFPM is integrated into source routing to enhance its performance against the link breakages that result from the mobility in MANET. Thus, LFPM is evaluated by varying the node speeds from 5 to 35 m/s to see the impact of accelerating topology changes during sending packets on the active route. consistent with the planning of LFPM, after a lively route is made, if the next-hop node is in Region 3, the sender node starts computing LS to avoid link breakages.

The simulation parameters set during this scenario are as follows: the pause time is about to 0 s, which suggests that the nodes are moving without a stop during the simulation time that's set to.

7.1 Evaluation of LFPM in terms of Average End to End delay.

Indeed, the end-to-end delay is that the summation of the delivery delay of each packet when travelling from source to destination divided by the amount of received packets. Fig 7.1 illustrates that at different speed values, the proposed LFPM

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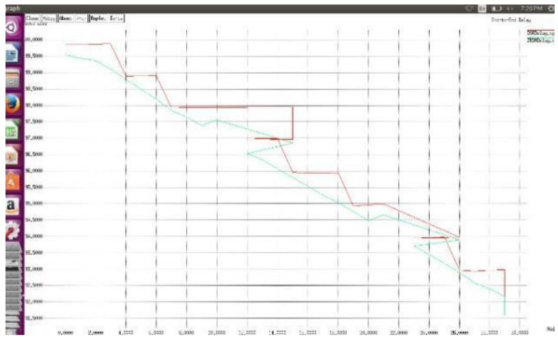
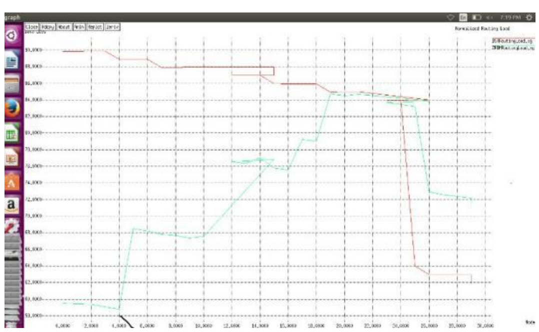


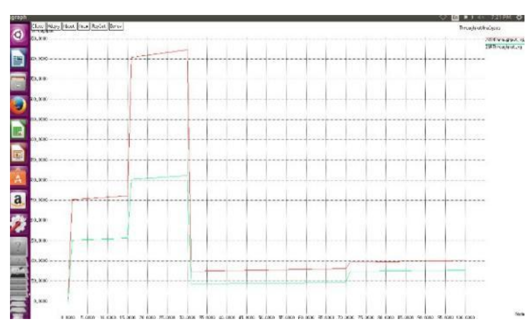
achieved better delay than that at 10, 20, 25, and 35 m/s. The results show that LFPM achieved 7.45 ms delay at 10 m/s while DSR imposed packet delay at 18.13 ms, which is a smaller amount by about 10.68 ms. Upon link failure pre- diction, LFPM triggers the node to get a mistake packet to be sent to the source node to point that that a link breakage along this route will happen shortly. Thus, the connection won't be interrupted, and no further delay is imposed on the transferred data.

Fig 7.1 Average end to end delay compared with DSR.

7.2 Evaluation of LFPM in terms of NRL.

As shown in Fig 7.2, at a node speed of 5 m/s, LFPM reduced NRL from 17.73% obtained in DSR to 8.44%, showing about 51% reduction. When the speed of nodes increases, the probability of frequent link breakages also increases, thus increase the amount of route error messages sent back to the source node to make a replacement





path. Thus, increasing the amount of latest RREQs by flooding the network with RREQ packets will exponentially increase the routing overhead. Therefore, using the proposed ZRDM helps to scale back unnecessary retransmission, particularly from the neighboring nodes located in Region 1 and Region 2.

Fig 7.2 Normalized routing load compared with DSR.

CONCLUSION AND FUTURE WORK

Standard DSR, as well as additional upgraded works supported DSR such as RDSR, zone-based DSR, and segment-based DSR, are compared to two mechanisms proposed in this project: ZRDM and LFPM. In order to assess ZRDM's efficacy as a route discovery approach, we calculate the routing overhead as a function of the number of nodes.

In terms of lowering routing overhead, the NRL findings demonstrate that ZRDM works well. The proposed route discovery process in ZRDM is responsible for these enhancements. The coverage area is divided into three zones, with Region 3 receiving top priority. This region is responsible for supplying the minimum number of nodes within the FZ, which in turn reduces the amount of RREQ retransmissions sent by nodes near the sender. Further, by making use of the nodes near the border, the number of hops to the destination may be minimised, resulting in reduced latency. The purpose of LFPM is to maintain routes such that link breaks do not result in significant packet loss. Rapid topology changes and a high likelihood of connection failure are outcomes of LFPM evaluations that include raising the nodes' speeds. In order to determine how well it performed in comparison to standard DSR, the test included changing the node's speed. Both average end-to-end latency and NRL were found to have significantly decreased. In order to help the source node choose a new route in the event of a link loss, LFPM employs mobility information and LS principles. In addition, two recent enhancement efforts that supported DSR are compared with the suggested techniques. The findings shown that calculating link breakages based on signal strength is inefficient due to the possibility of unreliable signal measurement accuracy, which might lead to a wrong forecast of link failure. In addition, it is not easy to tell which way a neighbouring node is moving or how fast it is moving. Thus, LFPM outperforms previous research in predicting the likelihood of link failure and, by extension, the LLT required for two nodes to maintain a connection.

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