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A Review Paper on Route Maintenance in Stability Based Energy Aware Routing Protocol In MANET

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ABSTRACT
Mobile Ad hoc Networks (MANETs) are temporary formed, infrastructure-less networks. Due to the mobility in nature of mobile nodes, limited battery, congestion, as well as noise, the problem of link failure causes. The performance metrics degrades due to the unstable channel conditions, network connectivity, and mobility and resource limitations. The goal of this paper is to review papers that finds most reliable and energy aware route that is impervious to failures by topological changes by mobile node mobility or lack of energy and various route maintenance approaches in order to establish stable, long lasting route and reduce link failure and packet drops. Make before break mechanism used to achieve route maintenance that predicts link failure before it actually breaks and find alternate route towards destination to avoid unpredictable link failure. Performance increases by considering various parameters like signal strength, energy of node, congestion, noise instead of the minimum hop count approach of the default distance vector algorithm.
Keywords **-** AODV, Energy, MANET, Stable Route, Routing Protocols.

I. Introduction

MANETs [1] are composed of mobile nodes that form distributed systems without any fixed infrastructure or centralized administration. In these systems, nodes can be freely and dynamically self organized into arbitrary and temporary, "ad-hoc" network topologies, nodes communicate with each other directly or via intermediate nodes. Packets are transferred to neighboring nodes along with the path from the source node to the destination node is done by intermediate nodes.

In MANET each node works as a router and autonomously performs mobile functionality. The link connectivity changes continuously due to mobility, to reflect this routing information also needs to get changed continuously.

There are several paths from source to destination. It is responsibility of routing protocols find a route from source to destination and delivers the packet. The performance of MANETs is related to efficiency of routing protocols and efficiency depends on several factors like convergence time after topology changes, bandwidth overhead to enable proper routing, power consumption. In MANET, there are three types of protocols viz. proactive, reactive and hybrid. There are many routing protocols for MANETS that are classified into three different groups: global or proactive, on demand or reactive, and hybrid.

In proactive routing, the routes are automatically computed and stored in the routing table when the network is configured and are independent of communication. The routing tables are periodically exchanged and update the routing table accordingly. This increases the network overhead. They are also known as table driven routing. Another type of routing is reactive or on-demand routing. It finds route on demand, whenever a sender node wish to communicate, it starts finding route towards the destination. On demand routing protocol does not require the exchange of periodic routing table update and it does not have a map of the network. This reduces the network overhead.

Efficient routing protocols are needed for the network as the link failure is high due to the dynamic network topology and the packet drops as it travels through multiple hops. Routing protocols for static network are not suitable for MANET.

II. Literature Review

This section expose relevant research work related to stability based routing and route maintenance approaches.

Link life based routing protocol (LBR) [2] is stability-based routing protocol. It converts signal strength into distance using a free space propagation model assumption. LBR estimates link lifetime based on estimated distance and speed of nodes. When the source node initiates a route request, each intermediate node attaches its estimated link lifetime to the route request message. When the destination receives it, it starts calculating the path lifetime for that path. So, the destination can select a path that is expected to have the longest lifetime. In order to react to path breakage, proactive and reactive maintenance is proposed in LBR. In reactive

maintenance, the source node needs to reinitiate a route request to the destination, which results in increased delay and control overhead. In proactive maintenance, a backup path is found prior to path breakage. However, the estimated path lifetime is not valid when a path is broken. Therefore, the backup path may be unstable. The purpose of stable routing should be not only reducing routing overhead but also increasing packet delivery ratio.

Qin & Kunz [3] have dealt with the problem of link failure prediction by proposing an equation to calculate the exact time that a link breakage can occur. They named their method the link breakage prediction algorithm. In their idea, each node maintains a table that contains the previous hop node address, the value of the received packet signal power, and the time which this data packet has been received. After receiving three data packets, a node will calculate the link breakage time and compare it with a fixed threshold. If the node predicted that the link with its previous neighbor will have a link breakage soon, it will send a warning message to the source node of the active route to warn it about the link breakage probability. If the source still needs the route it will perform a route discovery process to establish a new route to the destination. Their idea has been implemented using DSR routing protocol.

Goff et al. [4] have studied the link breakage problem in the DSR routing protocol. They defined a region they named it the preemptive region, and they also defined a threshold which they named it the preemptive threshold, they defined this threshold as the signal power of the received packets at the edge of the preemptive region. When a node enters the preemptive region it will send a warning message to the source node of the active route in order to inform it that a link breakage will soon occur. So if the source is still interesting with the route, it will generate a route discovery process to establish a new route without that soon to be broken link.

In [5] authors have proposed a stable, weight-based, on-demand routing protocol. The "weight" carried in the protocol messages used to select stable routes is based on three components: Route Expiration Time (RET), which is the predicted time of link breakage between two nodes due to mobility, Error Count (EC), which captures the number of link failures due to mobility, and Hop Count (HC). The authors have assumed that all nodes are synchronized via a Global Positioning System (GPS), so that two adjacent nodes may predict the RET. While the proposed scheme may combat against link breaks due to mobility, link breaks due to the draining node energy is a factor that also must be accounted for when computing weights for stable routing.

In [6], the authors have proposed a stable route selection scheme based on Link Expiration Time Threshold (LETth). The Link Expiration Time (LET) is computed based on a prediction of neighbor mobility. LET computation needs to know the position of the neighbors, and hence requires periodic topology updates.

In [7], N. Sharma and S. Nandi propose route stability based QoS routing (RSQR) extension of QoS routing with throughput and delay constraints, in which the link and route stability are measured using received signal strength. Based on the threshold values the links are classified as stable or unstable link. The signal strength based admission control always enhances the performance of the routing.

SQ-AODV [8]-- authors proposed Stability-based QoS-capable Ad-hoc On-demand Distance Vector protocol, is an enhancement AODV protocol in which residual node energy is used for route selection and maintenance. It also proposed a novel make- before-break mechanism that finds an alternate route when energy of node goes below threshold. It provides stable routes by accounting for the residual life-time calculated using the current Average-Energy-Drain-Rate (AEDR)) at intermediate nodes and the duration of the session at the route selection stage. This minimizes packet loss and session disruptions. SQ-AODV proactively re-routes sessions, without losing any packets, this provides near-zero packet loss and superior QoS performance.

In SINR based [9] method protocol maintains multiple path and calculate maximum signal strength of each route when the source node got the reply from destination then it select the route which have maximum signal strength among the multiple route. If the primary path is unavailable, the next one of the alternate path is immediately used for data transmission.

This paper proposed EBL (A Routing Protocol for Extend network life time through the Residual Battery and Link Stability in MANET) [10]. The EBL considers distance among neighbor nodes, Residual Battery Capacity and Link Stability. EBL considers distance among neighbor nodes, Residual Battery Capacity and Link Stability. EBL is able to increase the Lifetime of Network through minimizing the whole energy consumption and distribute the traffic load. a route is selected in consideration of Residual Battery Capacity, Link Stability and distance vector to prevent unbalanced energy consumption of nodes.

Li et al. [11] have studied the link prediction in the AODV routing protocol by establishing a signal intensity threshold which is Pr-THRESHOLD. If the received signal intensity is lower than the threshold, the upstream node will calculate the distance between it and the sending node through the intensity of the received packet signal, and estimate the relative velocity between it and the sending node

through the time difference of the neighboring received data and the intensity of the packet signal. Then, according to the relative position and the relative velocity with the sending node, a node can estimate when to send a RRER to the sending node to warning it about a link failure. When the source node received this RRER message, it will start its restored process searching its routing table and find another route to the destination.

In this paper [12] every node maintains the RSSI table , RSSI table contain the signal strength value of node's neighbor, with the help of this RSSI table node predict that his neighbor node is moving away from us, after predicting the link failure it performs following steps:

i) Dropping: If the quality of link is severely damaged or the link is already broken, then this method drops the packet.

ii) Relaying: In this technique, a node can become a relay node when both sender and receiver are in its neighbor table and forward the data between source and destination, if the link is fail between source and destination.

iii) Selective forwarding: In this technique, the intermediate node drops the packet if it comes from bad links.

In [13] authors consider joint metric of link stability and energy drain rate into route discovery, and on the local topology knowledge, which results in reduced control overhead and balanced traffic load. A link stability and energy aware routing (LAER) proposed the model that reduces the energy consumption of the node and also maximize the link stability of the transmission. To account the energy consumption and link stability of mobile nodes, a bi-objective integer programming (BIP) mode was formulated.

This Paper proposed a novel scheme to enhance the route maintenance process in Route Stability and Energy Aware Routing (RSEA-AODV) [14] protocol that keep track of stability and energy metrics during route discovery, through cross layer approach. In this work, we propose a novel "make-before-break" mechanism, to enhance the route maintenance in RSEAAODV. This mechanism finds an alternate route for data transfer, when there seems any possibility for link break due to mobility, energy drain and congestion, through cross layer approach. At some fixed interval it continuously check the status of established route, if any node is in critical battery state or receiving weaker signal or interface queue length increases beyond the threshold then it starts finding alternate route before it actually breaks. This mechanism increases packet delivery ratio and reduces the number of packet drops and delay incurred.

In this paper [15] authors proposed a method which measures signal strength between nodes and compare with RSSI threshold values. If RSSI is greater than threshold value then it is accepted for further processing otherwise it is discarded. It increases the lifetime of the network by selecting a strong route to the destination can. Stable route in MANETs is a route that is established for an acceptable period for transmission.

In (Surya & Santhi, 2012) [16], a priority energy aware routing protocol is proposed, it selects the highest priority path based on energy, reliability pair factor and distance, their proposed routing protocol increases the speed of reliable data transferring and decreases the end to end delay by making an optimum balance in the energy consumed by the mobile nodes.

Table: Performance comparison of various protocols

Name of Protocol	**Route Selection**	**Route Maintenance**	**Description**
RSEA-AODV[14]	Based on Signal Strength and Residual Energy, So, stable and energy aware route establishment	Uses make-before-break approach by considering signal strength, energy of node and congestion parameters	Provides better performance in highly dynamic networks. Slightly high delay In case of low or nil mobility.
SQ-AODV [8]	Stable route by accounting residual life-time and duration of session	Uses make-before-break by considering energy of node	Reduces control overhead in the network. But it does not consider effect of mobility and fading
EBL[10]	It considers Residual Battery, Distance, Signal Strength in route establishment	It reserves alternate route with residual battery capacity and	Increase the Lifetime of Network through minimizing the energy consumption and

			distribute the traffic load
LBR [2]	Stable route by selecting a path that have the longest lifetime by estimating link lifetime	Uses reactive and proactive route maintenance approach.	It reduces routing overhead and increases packet delivery ratio
LAER [13]	Scalable routing based on link stability and energy drain rate	Not Considered	Outperforms in terms of control overhead , balanced in traffic load and longer link duration

III. CONCLUSIONS AND FUTURE WORK

MANET suffers from unpredictable route failure due to mobility, limited battery, congestion as well as noise. It is responsibility of routing protocol that stable and long lasting route and also maintain route to avoid unpredictable link failure. AODV is reactive routing protocol which considers minimum hop count to established route between source and destination. So possibility of link failure is more. So by considering various parameters like received signal strength, energy of nodes, queue length and noise in route establishment as well as in route maintenance, performance of MANET increases. It reduces routing load, end to end delay, number of packet drops and also increases packet delivery ratio. Make before break mechanism reduces number of packet drop by establishing new route before it actually breaks. The future work includes designing routing protocol that consider all parameters in route establishment and route maintenance approach that affects performance in MANET.

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