

# MOBILITY BASED STABLE ROUTING SCHEME FOR RELIABILITY IN MANET

Sreeleja N .Unnithan<sup>1</sup>, Vijitha S.<sup>2</sup>

<sup>1,2</sup> *Electronics and Communication Engg Dept, NSS College of Engineering, Kerala (India)*

## ABSTRACT

*Due to mobility of the node, the packet loss occurs often while the nodes are moving out of range, or the node has not enough either path and link stability or neighbour node stability. In this paper we propose modified stability scheme to make a correct balance between stability of path, link, neighbour node and total mobile nodes to extend the network lifetime. The main of the proposed work is to reduce the packet loss and provide high network lifetime using the stability model. The proposed scheme consists of three phases like determination of stability of neighbor node, link, path, and prediction of total network lifetime. By simulation results the proposed algorithm achieves better performance in terms of packet delivery ratio, delay, overhead, network lifetime, energy consumption than the existing method LAER scheme.*

**Keywords :** *Energy Consumption, Delay, Packet Delivery Ratio , Laer, Network Life Time*

## I INTRODUCTION

Mobile ad hoc networks could enhance the service area of access networks and provide wireless connectivity into areas with poor or previously no coverage. Some challenges that ad hoc networking faces are limited wireless transmission range, hidden terminal problems and packet losses due to transmission errors, mobility-induced route changes, and battery constraints. To enhance the prediction of the best overall performance, a network-layer metric has a better overview of the network. Ad hoc networking brings features like easy connection to access networks, dynamic multi-hop network structures, and direct peer-to-peer communication. The multi-hop property of an ad hoc network needs to be bridged by a gateway to the wired backbone. The gateway must have a network interface on both types of networks and be a part of both the global routing and the local ad hoc routing.

Rajendiran M et.al [1] proposed a new energy efficient algorithm with the aim to find a stable energy multicast host against host mobility. It is done by initially identifying the energy level of individual host in MANET and then transmitting the data packets. The proposed algorithm uses adaptive function for improving reliability and choosing a stable route. The basic steps used in designing the proposed algorithm are stated as follows. Individual node

energy levels were calculated. The proposed algorithm uses a power function for growing reliability and chooses a stable route direction. The objective is to define some factors that are necessary for growing reliability and to choose stable route direction.

Kai-Jie Yang and Yuh-Ren Tsai [2] proposed a new link stability prediction method based on current link-related or user-related information in shadowed environments. A more realistic user mobility model and a realistic propagation model are taken into consideration. According to the numerical and simulation results, it is found that the proposed method can accurately predict the link stability for different environment and mobility conditions. The prediction results can be regarded as a measure of the link stability, and can be applied to the applications, such as link performance prediction, system performance analysis, service quality prediction and route search. Furthermore, the impact of different mobility information on the accuracy of link stability prediction is also evaluated to assess the importance of the knowledge of mobility information.

Krunal Patel and Tejas Vasavada [3] evaluated the performance of stable and normal AODV routing under different mobility models like Random Way Point, Manhattan Model, Reference Point Group Mobility and Gauss Markov Model. Performance measures of interest were Packet Delivery Ratio (PDR) and routing overhead. It was found that RPGM results in better PDR and lowest routing overhead compared to other models. Manhattan model results in lowest PDR and highest routing overhead.

Suman halder et.al [4] introduced the novel mobility-aware routing protocol based on the well known Ad-hoc On Demand Distance Vector (AODV) routing protocol called: MA-AODV (Mobility Aware Ad-hoc On Demand Distance Vector) in an attempt to improve the handling of high mobility factor in ad-hoc networks. MA-AODV protocols performed periodic quantification of nodes mobility for the sake of establishing more stable paths between source/destination pairs, hence, avoiding the frequent link breakages associated with using unstable paths that contain high mobile nodes. The protocol reduce the topological changes, on the other hand it will also minimize the overhead of broadcasting messages. This protocol can be very efficient at the time of sending the large data where continuous connection among the source and destination is more preferable.

M.Rajendiran and S.K. Srivatsa [5] developed a multicast routing protocol based mesh networks that finds stable multicast path from source to receivers. In this model only the nodes that fulfill the delay requirements can flood the JOIN-QUERY messages. The contributing nodes are assumed to follow M/M/1 queuing systems. The queuing systems contain maximum value for queuing and contention delay which can be evaluated as the ratio of maximum queue size over the service time in a node. This model enhances link stability with contention delay and queuing system. The stable routes are found based on selection of stable forwarding nodes that have high stability of link connectivity. The link stability is calculated by using parameters link received power, distance between neighboring nodes and link quality. The performance of the proposed model is simulated over a large number of MANET nodes

with wide range of mobility with two well known mesh based multicast routing protocol. It is observed that the proposed model produces better throughput and reduced overheads.

Rajashekhar C et.al [7] proposed a scheme for information priority based multiple path multicast routing in MANETs that used reliable neighbor node selection mechanism. Neighbor nodes were selected that satisfy certain threshold of reliability pair factor to find non-pruned neighbours. Non-pruned neighbours were used to establish reliable multipath multicast routes with assigned priority levels using request and reply control packets along with node database comprising of neighbor and routing information. Prioritized multipaths carry various priority data to multicast destinations. Neighbour node selection was realized with the help of node power model and mobility model. Robust route maintenance mechanism was provided to handle link and node failure situations.

Jenifus Selvarani et.al [8] evaluated the performance of Hydra and Link stability based multicast routing protocol. The main goal of this paper is to compare both the protocols with some performance metrics. Hydra elects a core for the mesh of a multicast group among the sources of the group, so that only control packets from the core are disseminated towards the receivers of a group. Hydra accomplishes this by dynamically electing a core for the mesh of a multicast group among the sources of the group, so that only control packets from the core are disseminated towards the receivers of a group. Another mesh based multicast routing protocol that finds stable multicast path from source to receivers is also presented in this paper. Data packets are forwarded through the stable paths in a mesh, which are found based on selection of stable forwarding nodes that have high stability of link connectivity.

The paper is organized as follows. The Section 1 describes introduction about MANET, fundamental aspects of routing stability in MANET. Section 2 deals with the previous work which is related to the stability Section 3 is devoted for the implementation of prediction based link stability scheme. Section 4 describes the performance analysis and the last section concludes the work.

## II MATERIALS AND METHODS

In the proposed PLSS scheme, there are 4 steps to achieve the predictive stability in whole network. These steps are stability of neighbour nodes, path from source to destination, calculation of mobile node stability and network lifetime prediction for a particular path. Stability is the quality which asserts the network environment's consistency. In mobile ad hoc network, nodes are continuously moving from one place to another with a certain pause-time. Stability is an important parameter in such an environment. Here comes two types of stabilities Neighbour stability and Path stability. Neighbour Stability gives an idea of the neighbour's consistency in the network while Path stability gives an idea of the path's consistency from a source node to destination. Neighbour stability helps us to find out the stable neighbour being used as a next hop node. Path stability helps us to use always a stable path for sending packets.

## 2.1 Predicting Stability of Neighbour Nodes

There are two parameters taken in to the consideration of neighbor nodes stability. i.e Mobility, Link loss. Path mobility is measured using packets as follows: Suppose if there are two nodes A and B then the mobility of node PQ:

$$PQ_{mob} = \frac{\text{Num of packets measured from P to Q}}{\text{Num of packets measured from Q to P}} \quad (1)$$

The node link loss can be measured by using Signal to Noise Ratio. It can be measured by using bit error rate (BER) which is related to SNR as follows: Let F be the fading in the channel, given by :

$$F = \frac{P_{tr}}{d^2 J} \quad (2)$$

Where d is the distance between source transmitter and destination receiver.

J is the proportionality constant

$P_{tr}$  is the Transmitted power.

Let us assume  $J=1$ , after simplifying we get:

$$F = \frac{P_{tr}}{d^2} \quad (3)$$

Fading can be also represented as the difference between transmitted and received power of source and destination mobile nodes:

$$F = P_{tr} - P_{rr} \quad (4)$$

Signal to Noise Ratio (SNR) is given as ratio of transmitted power to the noise power. It is given by

$$SNR = \frac{P_{tr}}{N_o} \quad (5)$$

If channel is fading based, Noise power is also the fading power. So the Signal to Noise Ratio (SNR) in db can be represented as:

$$SNR = 10 \log\left(\frac{P_{tr}}{F}\right) \quad (6)$$

If we take it in to non logarithmic scale,

$$SNR = \frac{P_{tr}}{P_{tr} - P_{rr}} \quad (7)$$

When the noise power  $N_0$  or fading is more, Signal to Noise Ratio decreases and Bit Error Rate also decreases. This relationship is represented by following equation:

$$\begin{aligned} \text{Bit error rate } P_b &\propto \frac{1}{SNR} \\ P_b &= \frac{J}{SNR} \\ P_b &= \frac{1}{SNR} \quad \text{where } J = 1. \end{aligned} \quad (8)$$

From the link loss with signal to noise ratio and mobility of the nodes, the stability of neighbour nodes is easily measured. The neighbour node stability is estimated by the combination of mobility and link loss of the node.

## 2.2 Predicting Stability of Path in Whole Network

Similarly, if there are 'n' numbers of nodes then mobility of path PS is measured as follows:

$$\text{Mob of path PS} = \text{Mob of PQ} * \text{Mob of QR} * \text{Mob of RS} \quad (9)$$

And the link loss of the path AD is measured as follows: Link loss of path PS = link loss of PQ + link loss of QR + link loss of RS. Therefore, by using the two parameters the mobility and link loss, the stability of the path is measured as follows:

$$S_p = \frac{M_p + LL_p}{H_c} \quad (10)$$

Where  $S_p$  = Stabilitypath

$M_p$  = mobilitypath

$LL_p$  = link loss path

$H_c$  = Number of hop count

We also proposed stability of path from stability of link by following calculations. When the distance between two nodes becomes larger than the transmission range the nodes will be disconnected. For transmission range  $T_r$  link stability  $L_{sb}$  between any two nodes overtime period  $t$  can be calculated by:

$$\begin{aligned} L_{sb} &= \frac{T_r}{\sqrt{\left\{ (p_1' - p_2') + t(n_1 \cos \theta_1 + n_2 \cos \theta_2) \right\}^2 \\ &\quad + \left\{ (q_1' - q_2') + t(n_1 \sin \theta_1 + n_2 \sin \theta_2) \right\}^2 }} \end{aligned} \quad (11)$$

Note that  $L_{sb}$  is the link stability of individual links between any two nodes and for a path it is a concave parameter and it is same as the minimum link stability along the path. For a path from source to destination path stability  $P_{sb}$  is given by:

$$P_{sb} = \min (L_{sb} (1), L_{sb} (2), L_{sb} (3), \dots, L_{sb} (N)) \quad (12)$$

Where 1,2,3...N is the number of links along the path.

### 2.3 Proposed Packet Format

Source Address	Dest. Address	Path Lifetime	Node Stability	SNR	BER	Hop count
2	2	4	4	2	2	1

**Fig.1 Proposed Packet format**

In fig.1, the packet format of proposed algorithm is shown. Here the first two fields source and destination address occupies 2 bytes. The third field occupies 4 byte field which is the path life time of a node. In next field, Node stability fills 4 bytes. SNR occupies 2 bytes field. BER occupies 2 bytes field. Finally the Hop count occupies 1 byte field for calculating number of hops from cluster node.

## III RESULTS AND DISCUSSION

We use NS3 to simulate our proposed PLSS algorithm. In our simulation, 200 mobile nodes move in a 1200 meter x 1200 meter square region for 50 seconds simulation time. All nodes have the same transmission range of 250 meters. The simulated traffic is Constant Bit Rate (CBR). Our simulation settings and parameters are summarized in table 1.

**Table1. Simulation and settings parameters**

No. of Nodes	200
Area Size	1200 X 1200
Mac	802.11
Radio Range	250m
Simulation Time	80 sec
Traffic Source	CBR
Packet Size	80 bytes
Mobility Model	Random Way Point
Propagation model	Two Ray ground
Packet Rate	5 pkts/s

### 3.1 Performance Metrics

We evaluate mainly the performance according to the following metrics:

**Control overhead:** The control overhead is defined as the total number of routing control packets normalized by the total number of received data packets.

**Packet Delivery Ratio:** The packet delivery ratio (PDR) of a network is defined as the ratio of total number of data packets actually received and total number of data packets transmitted by senders.

**Normalized Path Discovery:** Normalized path discovery is defined as the number of RREQ packets generated per data packet.

**End-to-End Delay:** The End-to-End delay is defined as the difference between two time instances: one when packet is generated at the sender and the other, when packet is received by the receiving application.

The simulation results are presented in the next part. We compare our proposed algorithm PLSS with LAER [15] and in presence of stability environment.

Figure 2 shows the results of average end-to-end delay for varying the speed from 20 to 100. From the results, we can see that PLSS scheme has slightly lower delay than the LAER scheme because of stable routing.

Fig. 3, presents the energy consumption while varying the stability weight. The Comparison of LAER, PLSS energy consumption is shown. It is clearly seen that energy consumed by PLSS is less compared to LAER.

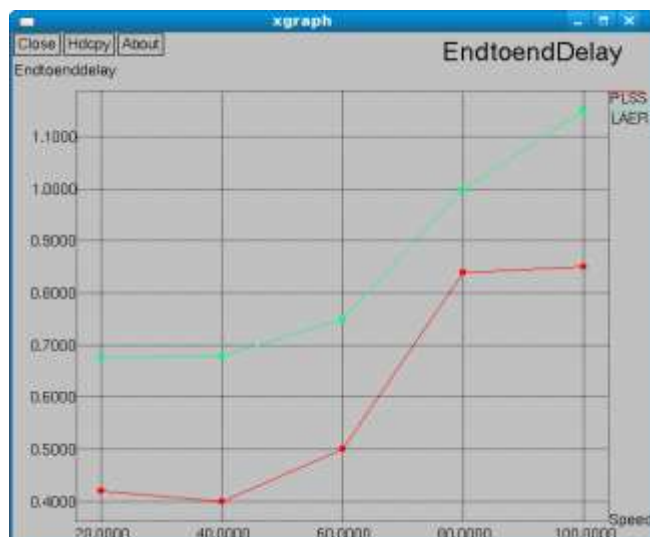


Fig. 2. Speed Vs End to end Delay

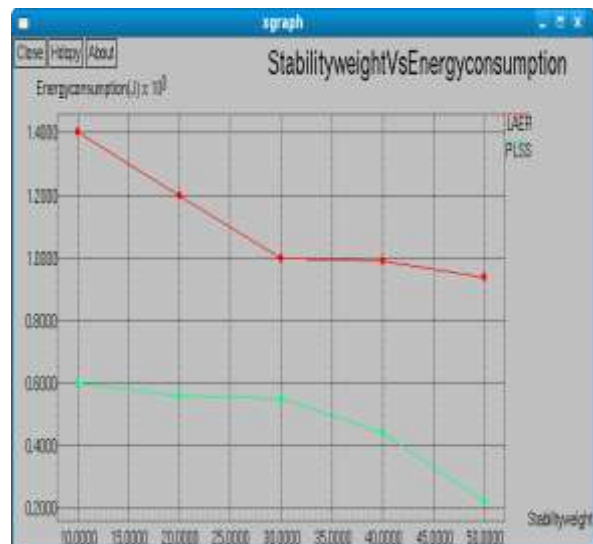
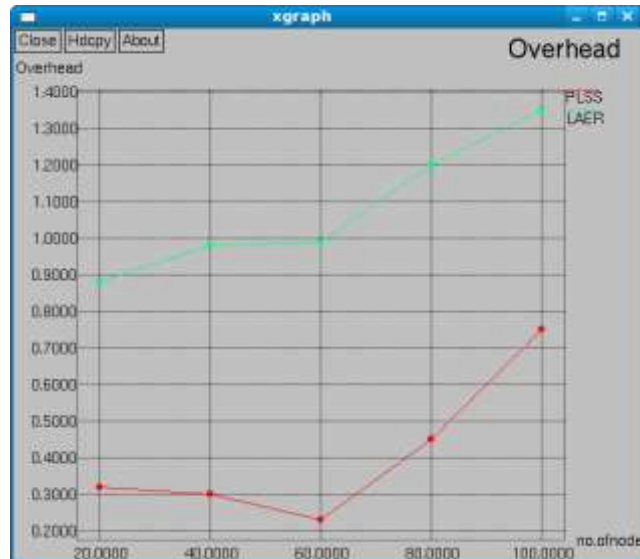


Fig. 3. Stability Weight Vs Energy Consumption

Fig. 4, presents the comparison of overhead. It is clearly shown that the overhead of PLSS has low overhead than LAER scheme.



**Fig. 4. No. of nodes Vs Overhead**

#### IV CONCLUSION

In MANET, mobile nodes are moving randomly without any centralized administration. If these nodes are not having reliable stability of neighbor nodes, links, paths from source to destination, it will suffer more loss in link. In this paper, we have developed a prediction based stability scheme with stability models which attains stability in link, path and neighbor nodes. In the first phase of the scheme, stability of neighbor nodes is achieved using mobility and stability of paths. In second phase, stability of path is achieved. It uses three factors called mobility factor, link stability, link loss to favor packet forwarding by maintaining stability for each path. In third phase, stability of total mobile nodes is reached using the threshold signal strength value. In fourth phase, we predicted the network lifetime of the whole network. By simulation results we have shown that the PLSS achieves good packet delivery ratio, more network lifetime while attaining low delay, overhead, minimum energy consumption than the existing scheme LAER scheme while varying the number of nodes, node speed, throughput and stability weight.

#### REFERENCES

- [1] M. Rajendiran, S.K. Srivatsa, "An Improved Routing Algorithm to Enhance Energy Efficiency in Multicast Ad Hoc Networks", European Journal of Scientific Research Vol.72, No.1, 2012, pp. 97-106.



- [2] Kai-Jie Yang and Yuh-Ren Tsai, "Link Stability Prediction for Mobile Ad Hoc Networks in Shadowed Environments", IEEE Global Telecommunications Conference, 2006. pp.1-5.
- [3] Krunal Patel and Tejas Vasavada, "Performance Evaluation of Stable AODV Routing Protocol under Different Mobility Models", International Journal of Computer Applications (0975 – 8887) Volume 43– No.8, April 2012, pp.13-16.
- [4] Suman Halder, Partha Pratim Meta and Sukla Banerjee, "Mobility Aware Routing Protocol In Ad-Hoc Network", CS & IT-CSCP 2012, pp.17-31.
- [5] M.Rajendiran, S.K. Srivatsa, "Route efficient on demand multicast routing protocol with stability link for MANETs", Indian Journal of Science and Technology, Vol. 5, No. 6, June 2012, pp.2866-2871.
- [6] G N V Prasad, V. Siva Parvathi, Dr.K.Nageswara Rao, "Link stability based multicast routing scheme in Manet", International Journal Of Advanced Engineering Sciences And Technologies (IJAEST), Vol.8, Issue 2, pp.169-176.
- [7] Rajashekhar C. Biradar, Sunilkumar S. Manvi, "Information Priority Based Multicast Routing in MANETs", International Journal of Wireless & Mobile Networks (IJWMN) Vol. 3, No. 3, June 2011, pp.177-192.
- [8] A.Jenifus Selvarani, R.Lakshmi Priya & L.Joslin Edward, "Comparative Analysis of Hydra and Link Stability based Multicast Routing Protocols in Mobile Ad Hoc Networks", International Journal of Computer Applications (0975 – 8887), Volume 23– No.6, June 2011, pp.25-30.
- [9] Akbari Torkestani, Meybodi M R "A Link Stability-based Multicast Routing Protocol for Wireless Mobile Ad hoc Networks", Journal of Network and Computer Applications, Volume 34, Issue 4, July 2011, pp. 1429-1440.
- [10] M.S.Kakkasageri, S.S.Manvi, A.K.Sinha, "Agent based multicast routing in MANETs", National conference on Communications, 2012, pp.1-5.
- [11] Sunil Taneja & Ashwani Kush, "Energy Efficient, Secure and Stable Routing Protocol for MANET", Global Journal of Computer Science and Technology, Volume 12 Issue 10 Version 1.0 May 2012, pp.25-37.
- [12] Giriraj Chauhan and Sukumar Nandi, "QoS Aware Stable path Routing (QASR) Protocol for MANETs", First International Conference on Emerging Trends in Engineering and Technology, 2008, pp.202-207.
- [13] Arash Dana and Mohamad Hadi Babaei, "A Fuzzy Based Stable Routing Algorithm for MANET", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 1, January 2011, pp.367-371.
- [14] Ramalakshmi R and Radhakrishnan S, "Improving Route Discovery using Stable Connected Dominating Set in MANETS", International journal on applications of graph theory in wireless ad hoc networks and sensor networks (GRAPH-HOC) Vol.4, No.1, March 2012, pp.15-25.
- [15] Floriano De Rango, Francesca Guerriero and Peppino Fazio, "Link-Stability and Energy Aware Routing Protocol in Distributed Wireless Networks", IEEE Transactions On Parallel And Distributed Systems, Vol. 23, No. 4, April 2012, pp.713-726.