ENERGY AWARE ALGORITHM SATISFYING LINK STABILITY IN MANETS

[1]Rachna Jain, [2]Dr. Indu Kashyap
Department of computer science, Manav Rachna International University, Faridabad.

***Abstract*-Mobile ad hoc networks are self-organizing topology of mobile nodes. Since nodes are mobile at any time which makes routing a difficult process. We are devising a new technique that take into consideration energy aware route which tries to maximize network lifetime by selecting the link with maximum "persistence probability". We try to minimize the disruptions during life of MANET. Our algorithm is trying to trade off balance between energy weights and stability factor.**

***Keywords*- MANET, Energy Weight, Stability Factor**

1. INTRODUCTION

Mobile ad hoc networks (MANETs) are collections of various nodes in the form of hand held devices, mobile units etc. These units communicate with each other in absence of any infrastructure. These networks do not have any central controller. Adhoc Networks are dynamic changing topologies so link stability becomes important criteria. Link stability is dependent on many parameters such as strength of signal at time of transmission, strength of carrier signal, what is relative speed between any two nodes at the time of link formation, for how much time link is established and how much battery power is there. Network lifetime is affected by how stable is the link that is formed between two nodes. There are mainly two types of routing protocols. One is table-driven or proactive such as DSDV, OLSR and reactive or on-demand routing protocol such as AODV, DSR. ZRP is hybrid structure combining advantages of both proactive and reactive routing protocols.

II. RELATED WORK

Location based Link Stability and Energy Aware Routing (LAER) protocol for distributed wireless networks is proposed that uses a greedy scheme for data forwarding [1]. There is taken into consideration two weighted parameters.w1 and w2. As sum of two parameters is unity; In Energy saving applications more weightage is given to energy parameter w1 while where end to end delay or link stability is important more weightage is given to w2.

Link stability [2] is defined as a measure of how stable the link is and how long the communication will endure.

In [3] Paper if there is heavy traffic on any single route then that route will die first. So Author has used the concept of traffic splitting in MANET. In it first the route which satisfies the various constraints such as stability of link in the network, power aware etc. If the path does not satisfy the routing constraints then we will use multiple disjoint paths using the Traffic Splitting algorithm.

In [4] the node that is not involved in direct communication activities overhears other nodes and wastes battery power so it can be put into sleep state by RTS/CTS exchanging at MAC layer.

In [5] routing selection standard of given protocol QRPAM is the shortest routing to meet the bandwidth condition. If it satisfies bandwidth constraints then data will be accepted else data will be rejected.

III. ENERGY AWARE ROUTING

Since intermediate node involved in routing has to accept data as well as forward it towards destination. So power of any node becomes important as sending data between any two nodes can be in multi-hop fashion. We have to Control the power involved in transmission of data, reception of data as well as idle power means power wasted when data is not meant for that node. We have to balance the transmission power so that minimum energy is consumed in routing.

As per [11] in basic model energy and power is proportional to inversely squared distance between two nodes given as in (1).Here we are considering both power consumed to forward a packet from node i to node j at the source node $Pij(t)$ as well as power dissipated at the destination node (t) .

$$Pij(t) = cij * fij \quad (1)$$

where fij is Rate of data sent from source node to destination node.cij is the cost associated per bit of power consumption of link from node i to node j. and it is modeled as:

$$cij = \propto * \tilde{\beta} * dij^{\eta} \quad (2)$$

$\propto$ is distance independent term considering various network parameters. η Shows value of path loss index $2 \leq \eta \leq 4$. dij is the last observation of distance of link between node i and node j. $\tilde{\beta}$ is distance dependent term which considers reciprocal movement of a node.

$$\tilde{\beta} = \{\beta * dij(avg)\} / dij^{0} \quad (3)$$

where dij^{0} is the distance between any two nodes when first time link is established between those nodes, $dij\ (avg)$ is the distance travelled averagely between any two nodes at any time t, whereas β is the parameter accounting physical distance between nodes in any network.

The power wasted in the reception is time independent and it is modeled as:

$$Qij = \rho * fij \quad (4)$$

where ρ denotes the amount of energy dissipated to receive one bit of information. We are assuming that ρ is constant and equal for every node.

If we start from node i then following two conditions must be satisfied by node j

(a) j has enough energy to receive the information sent from node i,

(b) j is able (in terms of energy) to transmit the information toward another relay node.

Since conditions (a) and (b) must be satisfied, two constraints have been introduced in our proposed model. Let Tij be the time required to send a packet of information from node i to node j and let $Eres(i)$ denote the residual energy of the node i , the first constraint is stated as follows:

$$Tij \times Qij \leq \delta \times Eres(j) \quad (5)$$

Where δ is a parameter between 0 and 1 ($0 < \delta < 1$) as this parameter will avoid the selection of a node for which energy required to receive a message is less than residual energy of node. So it means after reception at least (1- δ) ×100% of the energy is available for further transmission after reception of data. It is important to ensure that node i should be able to send information to neighbor j without going down so another constraint becomes:

$$Tij \times Pij\ (t) \leq Eres(i) \quad (6)$$

It is assumed that residual energy is a known parameter. The choice of a neighbor node by considering only transmission and reception power is not adequate to guarantee the correct management of a MANET, for two main reasons. First of all, this strategy can lead to always selecting the links with the minimum value of the dissipated power, that is, the shortest links. How-ever, the shorter the links selected, the higher the number of hops and the number of messages exchanged among all mobile nodes. Secondly, it can lead to always selecting the same nodes (i.e.), the ones that are the extreme of the links that are characterized by a low value of transmission and reception power), with a consequent non-uniform energy consumption among all the nodes of the network. So in [11] propensity has been introduced as:

$$PRj = Eres(j) / Ej^{0} \quad (7)$$

Where Ej^{0} is initial energy of node j. PRj represents the propensity of node j to receive information from another node, given its residual energy at time t. From the definition of the propensity of a node, it is evident that if, at time t, the node j has never been used PRj is equal to one; on the other hand, a value of $PRj < 1$ means that node j has already transmitted and/or received information and thus it is less favorable to receive information.

The propensity PRj is used, in conjunction with the power transmission, to define the coefficient mij that is used in the first objective function of the proposed model, to characterize a node from an energetic point of view.

More specifically, mij can be represented as

$$mij = Pij / PRj \quad (8)$$

The coefficient has been defined as the ratio between the power Pij dissipated to send information from node i towards node j and the propensity PRj of node j .The rationale of defining the coefficient mij is that the objective function has to be minimized. In addition, the higher the value of PRj , the higher the propensity of node j to receive information, whereas, the higher the value of, the lower the advantage of selecting node j .

IV. LINK-STABILITY CONSIDERATIONS

To enable mobile devices to make smart decisions in relationship of the stability, a practical method, Link Stability is introduced. A link is said to be there if a node has entered into the transmission radius of any other node and if it comes out of that radius link is said to be broken. We are considering the link with maximum persistence probability [12] because we want to minimize any sort of disturbance during duration of link. We are observing lifetime of a link s in an array d of length N + 1 . Thus, lifetimes in a−0.5; a+0.5 would be counted as lifetimes of a time units, a ∈ {0,...,N}. Terms describing link ages are to be converted into discrete values to this domain. If we know the connection time in advance then we can select a link for any given time by the formula

$$P(a) = \frac{\sum_{t=a+s}^{N} d[t]}{\sum_{t=a}^{N} d[t]} \qquad (9)$$

The main consideration while using this formula is that we have to choose connection time very carefully. It should not be very short or very long since in both the cases probability of failure is high.

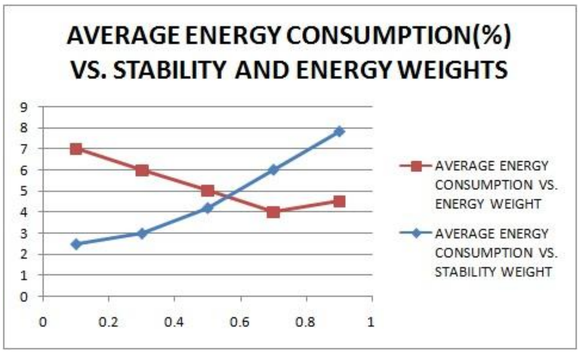
We can define the stability co-efficient as directly proportional to its persistence probability

$$nij \;\; \alpha \;\; P(a) \qquad (10)$$

We will maximize this objective function because our goal is to minimize the disruptions during a link life-time.

V. MATHEMATICAL MODEL

We will select the path from source node to destination by minimizing the energy involved in a link and maximizing the duration of link by increasing the persistence probability of that link.



REFRENCES

[1] F. De Rango, F. Guerriero, P. 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.

[2] Ch. Niranjan Kumar and N. Satyanarayana, "*Multi-path Stable QoS Routing for Real-time Traffic Applications in MANET*", International Journal of Computer Applications (0975 – 8887, Volume 72– No.8, May 2013 .

[3] Ch. Niranjan Kumar and N. Satyanarayana ,"*Multipath QoS Routing for Traffic Splitting in MANETs* " Procedia Computer Science 48 (2015) 414 – 426

[4] S. Singh and C. S. Raghavendra, "*Power Efficient MAC Protocol for Multihop Radio Networks*," in International Symposium on Personal, Indoor and Mobile Communications, 1998.

[5] Sarma, N.; Sukumar Nandi. (2010); *Multipath QoS Routing with Route Stability for Mobile Ad Hoc Networks,* IETE Technical Review, 27: 380-397.

[6] S. Zheng, Layuan Li and Yong Li," *A QOS Routing Protocol for Mobile Ad Hoc Networks Based on Multipath* " journal of networks , vol. 7, no. 4, pp.691-698,April 2012

[7] Chakrabarti S, Mishra, A. (2001)"*QoS issues in ad hoc wireless networks.* IEEE Communication Magazine, 142–148.

[8] Lim G., Shin K., Lee S., & Yoon, H. "*Link Stability and Route Lifetime in Ad hoc Wireless Networks*",Proceedings of the 2002 International Conference on Parallel Processing Workshops, IEEE Computer Society,Washington,DC,USA,p. 116, 2002.

[9] Q. Song, Z. Ning, S. Wang, A. Jamalipour, *Link stability estimation based on link connectivity changes in mobile ad-hoc net-works*, Journal of Network and Computer Applications 35 (6) (2012) 2051 – 2058.

[10] A. Zadin and Thomas Fevens, "*Maintaining Path Stability with Node Failure in Mobile Ad Hoc Networks* "Procedia Computer Science 19 (2013) 1068 – 1073.

[11] F. Guerriero , F. De Rango, S. Marano, E. Bruno, "*A biobjective optimization model for routing in mobile ad hoc*

networks" Applied Mathematical Modelling 33 (2009) 1493–1512

[12] Michael Gerharz, Christian de Waal, Peter Martini, Paul James, "*Strategies for finding stable paths in mobile wireless ad hoc networks*" IEEE 2003.