Link-Stability and Energy Aware Routing Protocol in Distributed Wireless Networks

P.Yazhini , Rajadevi.R

Abstract--A mobile ad hoc network (MANET) is an autonomous collection of mobile nodes that communicate over relatively bandwidth constrained wireless links. Link changes occur frequently and there is a limited bandwidth that makes the communication challengeable. The existing routing protocol like DSR, AODV selects the shortest path between the source and destination. It won't check the stability of the link for flooding. So there is a chance of link failure. Recovering from the failure of the link in MANET leads to more energy consumption. The problem of link failure can be overcome by an approach called Link Stability and Energy aware routing. Link Stability and Energy aware routing algorithm is used. The Delivery Probability based Route Stability protocol describes the node mobility the energy efficiency in the network. Here the stability of the link is determined by the residual energy of the nodes in the network. So the chance of the link failure is reduced and the energy of the nodes is saved. The protocol performance has been evaluated in terms of Collision rate and Average energy consumption.

Index Terms- MANET, scalable routing, link stability, energy consumption.

1 INTRODUCTION

The construction of temporary networks with no wires, no communication infrastructure and no administrative intervention required. Such interconnection between mobile computers is called an Adhoc Network. In such environment, it may be necessary for the mobile computers to take help of other computers in forwarding a packet to the destination due to the limited range of each mobile host's wireless transmission.

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1.1 MOBILE ADHOC NETWORKS

A self-configuring infrastructureless network of mobile devices connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Mobile AdHoc Networks are an emerging type of wireless networking, in which mobile nodes associate on an extemporaneous or adhoc basis. MANET are both self-forming and self-healing, enabling peer-level communications between mobile nodes without reliance on centralized resources or fixed infrastructure.Each device in a MANET has two features:

- Free to move independently in any direction.
- Change its links to other devices frequently.

The primary challenge in building a MANET is "equipping each device to continuously maintain the information required to properly route traffic".

2 RELATED WORK

P. Bergamo, et al, proposed a distributed power control that has been designed as a way to improve the energy efficiency of routing algorithms in ad hoc networks. Each node in the network estimates the power necessary to reach its own neighbors, and this power estimate is used for tuning the transmission power.

De Rango et al, proposed energy efficient Optimization Link State Routing. This approach is based on the proactive info management and on the selection of Multipoint Relay (MPR) based on energy metrics, such as MMBCR and MDR.

Yamazaki.K, et al, proposed a prediction location-based routing scheme in order to increase the delivery ratio of GPSR and select the more stable route. However, such as for the previous listed contributions, energy is not considered in the packet forwarding.

Dongkyun, et al, proposed an on-demand protocol based on the MDR metric and using a route discovery mechanism and route maintenance, similar to Dynamic Source Routing (DSR). Based on the shortest path, the routing will be take place between the source and destination.

Kim, et al, proposed the path stability, in terms of the number of route transitions a routing protocol incurs to continue the data exchange. End-to-end delay of a source destination session is another considered performance metric, particularly for real-time applications. The idea of stability-delay tradeoff (SDT), as a measure of the efficiency of an MANET routing protocol, was introduced.

Meghanathan.N, proposed a Life-time Prediction-based Routing (LPR), focused on the minimization of the variances of the nodes remaining energies in the network. In this protocol, each node tries to predict the future energy expenditure, but its estimation depends on many factor such as node distances, residual power, hop count, and node mobility.

Maleki.K, et al, propose a formal model to predict the lifetime of a routing path,based on the random walk mobility and on the prediction technique. It considers a probability model derived through the subdivision into cells of the area where mobile nodes move and on the observations of node movements in these cells. Transition probabilities are calculated and a state-based model of the movement among the cells is considered. Each connection between a mobile node in a cell and the other mobile nodes among its neighbor cells is considered as the state of the wireless link. After this, through the assumption of independent link failure, the route breakage probability is derived.

3 PROBLEM STATEMENT

The idea of considering, consumption of energy and stability of the link is motivated by the observation that most routing protocols tend to select shorter routes, in this way high efficiency in using wireless bandwidth and increase path stability are ensured. However, such routes may suffer from higher consumption of energy because higher transmission ranges are needed. Due to high mobility of nodes in mobile ad hoc networks (MANETs), there exist frequent link breakages which lead to frequent path failures and route discoveries.

The overhead of a route discovery cannot be neglected when attempt a to recover the route. The link failure detection node broadcast a Route REQuest (RREQ) packet to the networks, and the broadcasting rise a high redundant retransmissions of RREQ packet and causes the broadcast storm problem, that leads to a considerable number of packet collisions in dense networks.

4 PROPOSED SYSTEM

Routes are pre computed and stored in a table, so that route will be available whenever a packet is available for transmission. The selection and maintenance of a multihop path, however, is a fundamental problem in MANETs. Node mobility, signal interference, and power drain make the network topology frequently change; as a consequence, the links along a path may fail and an alternate path must be found. Link stability refers to the ability of a link to survive for certain duration. The higher the link stability, the longer is the link duration. The main aim is to propose an optimization routing model within a MANET. This model attempts to minimize simultaneously the energy consumption of the mobile nodes and maximize the link stability of the transmissions, when choosing paths for individual transmissions.

A routing protocol called Power Efficient Reliable Routing protocol for mobile Ad hoc networks was proposed. This algorithm applies the following three metrics for path selection: 1) the estimated amount of total energy to transmit and process a data packet; 2) the residual energy; 3) the path stability. A residual energy

metric of each forwarding node is used to select link stability path over dynamic route discovery.

4.1 Path stability value based prediction technique

It proposes an algorithm to predict the link lifetime in MANETs by the path stability value. The algorithm recursively computes the nodes mobility states, modeled as a nonlinear system, using periodically measured node current stability value as inputs. The technique is utilized to compute the remaining link lifetime.

A host or node willing to send a message to a recipient or any host in the multihop path, it uses a prediction technique to choose the best next hop or forwarding node for the message. The use of this technique is at strategic network locations to allow predictions of future network congestion.

4.2 Identification of stable link by residual lifetime of link

It is very evident that two major factors such as mobility and energy efficiency need to be considered to assure better network performance. Especially while considering QoS in MANET, nodes should not loss its power during transmission or the links should not expire due to mobility in the middle of the transmission. So the target is to choose a more stable path considering higher link stability and less cost along predicted higher life path. The coefficient $R_{(i,j)}a_{(i,j)}$ is defined as the ratio between the sum, on all links with age equal or greater than $a_{i,j}$, of the products of the age and the number of links with age equal to a, over the total number of links with age greater or equal to $a_{i,j}$.

The expected residual lifetime of a link is determined by:

$$R_{(i,j)}a_{(i,j)} = \frac{\epsilon_{a=a_{ij}}^{A_{max}}\ a.d[a]}{\epsilon_{a=a_{ij}}^{A_{max}}\ d[a]} - a_{i,j}\ \forall(i,j) \in A$$

A_{max} - maximum observed age of the link

$A_{i,j}$ - age of the link between the node i and j

d[a] -the number of links with age equal to a

The stability of the link at a time t is represented as:

$$S_{i,j} = \frac{d_{i,j}^{avg}}{R_{i,j}(a_{i,j}) \cdot k}\ \forall(i,j) \in A \qquad (2)$$

$d_{i,j}^{avg}$ - Average distance between the source and destination

$R_{i,j}(a_{i,j})$ - residual lifetime of a link

K - Scaling factor

So it combines the idea of link stability calculation based on mobility prediction and best path in terms of cost and lifetime along with QoS support.

5 SIMULATION RESULTS

5.1 Collision rate

The situation that occurs when two or more nodes attempt to broadcast the message along the same path at the same time. The result of a collision is a packet loss. It is increasing due to more number of nodes broadcast the hello packets at the same time. So there will be variations in the collision rate as in fig.1

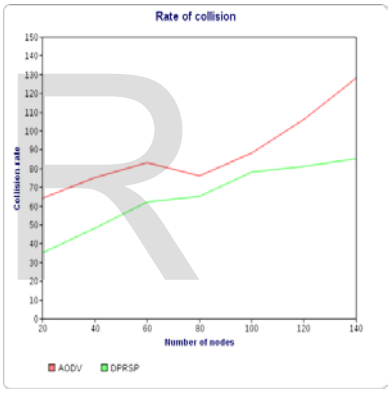

Fig -1: Rate of Collision

5.2 Energy consumption

Energy consumption is becoming an increasingly important issue in an adhoc networks. It is increasing, due to the failure of the link in the networks. Instability nodes in the network will cause more energy consumption. So higher the number of instability nodes in the network, increase the consumption of energy as in fig.2

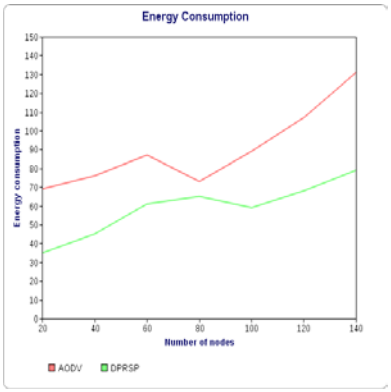

Fig -1: Energy Consumption

6 CONCLUSION

Thus the work studied the duration and availability probabilities of routing paths in MANETs—a fundamental issue to provide reliable routes and short route disruption times. It focused on the Random Direction mobility model and derived both exact and approximate expressions for the probability of path duration and availability.

It used these results to determine the optimal path in terms of route stability; in particular, it showed some properties of the optimal path and provided an approximate yet accurate expression for the optimal number of hops.

In the future work, adaptive routing for delay-tolerant communication in intermittently connected mobile adhoc networks will be carried out. So by collecting and considering the neighbor context information's periodically, the next hop is selected as best forwarding node which reduces link failures further than the LAER routing.

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