Improve Link Failure Routing Protocol in Mobile Ad-Hoc Network

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Abstract- An ad hoc network is a mobile wireless network that has no fixed access point or centralized infrastructure as we discussed in introduction. Each node in the network also functions as a mobile router of data packets for other nodes. However, due to node mobility or node movement link broken in such networks are very often and render certain standard protocols inefficient resulting in wastage of power and loss in throughput. MANET supports multi hop routing where the nodes other than the source and the destination nodes also take part in packet forwarding from one end to the other end. This results in the energy consumption of the intermediate nodes even though they are not the actual sender or receiver of the data. The available battery power of the nodes decides the life time of the node as well as the whole network. Mobile ad hoc networking is a challenging task due to the frequent changes in network topology as well as the lack of wireless resources. As a result, routing in such networks experiences link failure more often. Hence, it is essential that a routing protocol for an ad hoc network considers the reasons for link failure to improve the routing performance. Link failure stems from node mobility and lack of network resources both resides in wireless medium and in nodes In this study we propose a power aware routing protocol which has a new aspect to find out path between source to destination according to to available power of node.

Keywords-Mobile Ad-Hoc Network,AODV,Link Failure Problem,ILFRP.

I. Introduction

A mobile ad hoc network is a dynamically self-organizing network without any central administrator or any infrastructure. If two nodes are not within the range of each other, other nodes are needed to serve as intermediate routers for the communication between the two nodes [1]. Moreover, mobile devices wander autonomously and communicate via dynamically changing network. Thus, frequent change of network topology is a tough challenge for many important issues, such as routing protocol robustness, and performance degradation resiliency[2]. Proactive routing protocols[8] require nodes to exchange routing information periodically and compute routes continuously between any nodes in the network, regardless of using the routes or not. This means a lot of network resources such as energy and bandwidth may be wasted, which is not desirable in MANETs where the resources are constrained [1][3]. On the other hand, on-demand routing protocols [8][9][10] don't exchange routing information periodically. Instead, they discover a route only when it is needed for the communication between two nodes. Due to dynamic change of net- work on ad hoc networks, links between nodes are not permanent. In occasions, a node cannot send packets to the intended next hop node and as a result packets may be lost. Loss of packets may affect on route performance in different ways. Among these packet losses, loss of route reply brings much more problems, because source node needs to re-initiate route discovery procedure. Therefore it is essential to capture the characteristics to identify the quality of nodes and hence the quality of links[7].

II. Related Work

In recent time there was various protocol proposed that was used to improve the problem the problem of link failure due to power or reliability reasons in mobile ad hoc network. The one that have proposed is The Dynamic Link failure and Power Aware Reliable Routing in Mobile Ad Hoc Networks[4]. In this method we denote two notations to define the reliable route ,NLF (Normalized Link Failure) and NNF (Normalized Node Failure). Also we addressed the necessity of reliability and related protocols providing redundancy with multiple path. Instead of establishing multiple path, we develop a new reliable single path routing protocol based on node's link failure frequency and battery drain used to forward packet. It can significantly reduce the path maintenance overhead and control message due to the most stable single route instead of multiple routes. And the 2nd method that have proposed is Maximum Battery Life Routing to Support Ubiquitous Mobile Computing in Wireless Ad Hoc Networks[5]. This method discover that if nodes in an ad hoc wireless network expend most of their power on communication-related applications, power aware routing protocols, like minimum battery cost and min-max battery cost schemes, can prevent nodes from being overused. This extends or increase the time until the first node powers down and increases the operation time before the network is partitioned. However, these power-aware routing protocols tend to select longer paths, which increases the average relaying load for each node and therefore reduces the

lifetime of most nodes. This investigations reveal that these two goals (to use each node fairly and extend their lifetimes) are not compatible. A trade-off between them is needed. Our proposed conditional max-min battery capacity routing (CMMBCR) scheme chooses a shortest path if all nodes in all possible routes have sufficient battery capacity. When the battery capacity for some nodes goes below a predefined threshold (g), routes going through these nodes will be ignored, and therefore the time until the first node power-down is increased. This method select longer path for communication which increase the average relaying load for each node and therefore reduce lifetime of most nodes. The another method that have proposed is ESAR - An Energy Saving Ad Hoc Routing Algorithm for MANET[6].ESAR is an on demand routing algorithm where the routes between the source and destination are determined and maintained when they require sending data among each other. The aim of this algorithm is to achieve minimum routing delay like AODV or maximum network lifetime like EEAODR(Energy Efficient Ad Hoc On Demand Routing). In this algorithm the actual distance between the source to destination as well as the minimum available battery power of a node in the path is considered to find the best path for packet routing. Backup paths are also stored for the purpose of routing when the best path is found suitable no more. These all methods have some disadvantages also so we proposed the new algorithm or protocol to improve the problem of Link Failure in MANET. The aim of this work is to improve the network failure by improving the Node information to utilization the power of node by using routing mechanism in MANETs. Link stability are assigned according to the transmission power needed to reach the destination node, along with the battery status of the sending and intermediate nodes. Our Objective is that choosing routes with maximum battery backup, will lead to better utilization of the power sources of the communicating devices.

Problem Definition

If source A want to send data to the destination D then first of all source A must have a path between source to destination. If source have a path between source A to destination D then source does not knew how match amount of time this path remain alive. When source a send data packet to D then it may be deliver to destination or may be not deliver due to link failure and this link failure occur due to lake of power of the node. So we are proposing a power aware routing protocol that provides accurate power information of current path used by source for communication.

III. Proposed Work

Previously the works done on MANETs focused on various methods to remove the problem of Link failure with the energy saving methods and Improve the reliability of AODV protocol Or another several methods. This thesis improve the problem of Link Failure in Mobile Ad Hoc Network with the minimum power respectively in nature. The proposed algorithm is an efficient routing algorithm that improves the efficiency of link failure which improves the quality of services. Proposed scheme is an extended version of Link failure based on power failure. In this routing protocol, there are some parameters is use like TTL and minimum required power for communication. Route request packet can be send to the neighbor node based on the maximum required power. This protocol is use to improve the packet delivery ratio from source to destination because it provide the optimal and shortest path in terms of power, that improve the quality of service of this protocol. This approach provides solution of flooding and reduces the power conception. This proposed algorithm use AODV protocol to find out routes from source to destination with minimum available power.

In this algorithm following terms are used for calculation.

I. Broadcast ID:
The broadcast id is a number stored in packet header which is incremented before a new request is disseminated.
II. Source Address:
Source address is address of source node which is used to send the request between source and intermediate node.
III. Destination Address:
Destination Address is address of destination node which is used to receive the reply from the source or intermediate nodes.
IV. Available Power list:
This field contains the available power of the node which is used in current path for communication.

MINIMUM AVAILABLE BANDWIDTH

Minimum available bandwidth list is the parameters of packet header that contain all the available bandwidth value of current path. By using available bandwidth list this protocol calculate the minimum available bandwidth for communication on current path between sources to destination.

PHASES OF ILFRP

There are three phase in this protocol
    I. Route discovery
    II.Route Reply
    III. Route maintenance

1. ROUTE DISCOVERY

S is the source node which want to communicate with destination D with the help of intermediate nodes. Source node S initiate the RREQ request that packet contain the information like TTL, min_Power, broadcast id, source address, and destination address. All information is collected by source node before sending the RREQ packet to his neighbors. When source node neighbors receive the RREQ packet then first of all it check the destination address of RREQ, if destination address is the address of any one of the neighbor node and check it lies within the range of the network then it consume the packet and send RREP packet to the source node. If destination address is not equal to the neighbor node address then it check the value of TTL, if TTL is less than or equal to zero the node discard the RREQ, else the node calculate the minimum power from the source node. Then it check that node power is greater than or equal to the minimum power require for communication of source node or not. If node power is greater than or equal to minimum power then attach its own address to list of visited node and forward the RREQ packet to its neighbor nodes. If the route cannot find the minimum power, then node discard the RREQ packet. This process is follows by every node which receive the RREQ packet until the RREQ receive the by destination node. Above figure is an example of route discovery process of ILFRP which find the path between source need S and destination node D.

2. ROUTE REPLY PHASE

In route reply phase if destination receives the RREQ packet then it check the packet header destination address. If destination address is the address of node then it check the power of the node. If power is greater than or equal to the minimum power the destination consume the RREQ packet and sent RREP packet to source node via same path which path is use to receive RREQ packet from source to destination. Otherwise discard the RREQ packet. In Route Reply Phase reply is sent back from Destination to Source node.

3. ROUTE MAINTENANCE

In Ad-hoc network there is high mobility of nodes, links between nodes are likely to break. Thus, we need to maintain the routing path. When the node move outside to the reach of its neighbor then route from source to destination is break i.e RERR is occurred. In this case route maintenance process is use to maintain the route from source to destination. In this phase when a node does not receive a RREP packet it will break the path. In this case, the node sends a route error (RERR) packet to the source node. When the source node receives the packet, it will reconstruct a new path to the destination node..

Algorithm For ILFRP

```
IF ( TTL > 0)
{
    IF(Node_Id==Destination_Id)
    {
      Consume the RREQ packet;
      Calculate the  Power for all remaining
nodes
      Choose the node with Min Power ;
      Send RREP to source node;
    }
Else IF(Node_Id!=Destination_Id)
    {
      Enter remaining power into PL;
      Enter Node_Id into visited node list;
      Flood RREQ;
    }
}
Else
{
  Drop the Packet;
}
```

IV. SIMULATION

In order to validate the proposed protocol and show its efficiency we present simulations using MATLAB. MATLAB is a very popular network simulation tool. MATLAB is an interactive software package which was developed to perform numerical calculations on vectors and matrices.

Table 1(Simulation Environment Setting)

Parameter	Setting Value
Network area	150X150
Number of mobile nodes	10 to 35
Mobility model	Random
Node transmission range	20

The simulation environment settings used in the experiments are shown in Table4.1. The network area is 150 pixels x 150 pixels that include variable number of mobile nodes ranging from 15 to 35. The radio transmission range is assumed to be 20 pixels. The scenario of nodes mobility is generated randomly based on random way point model where a mobile node moves to a new position and pauses there for time period between 0 to 3 seconds, then it move to another position.

Simulation Results For Packet Delivery Ratio With Number Of Nodes

Figure 4.1 shows the packet delivery ratio with different number of node. It suggests that when the number of node increases then packet delivery ratio is also increases.
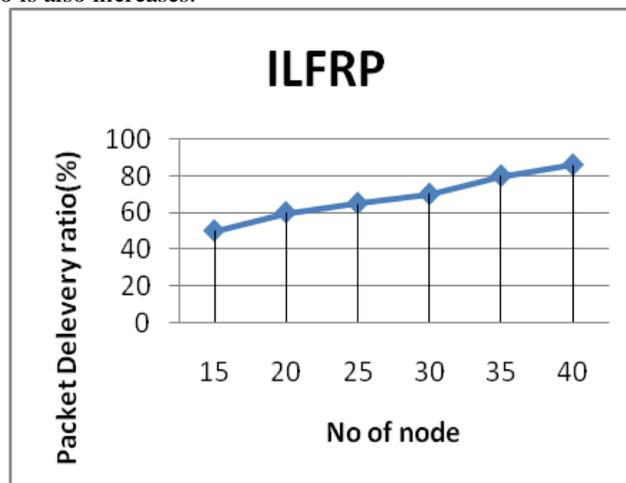

Fig 4.1 Chart between packet delivery rate and number of node

Simulation Result For Average Number Of Path With Number Of Mobile Nodes

Figure 4.2 shows the Mobility of nodes is increases then the average number of path increase. When mobile node reaches the maximum value then the path between the sources to destination is found for all nodes. But when no of node is increase then the average number of path is increase continuously.
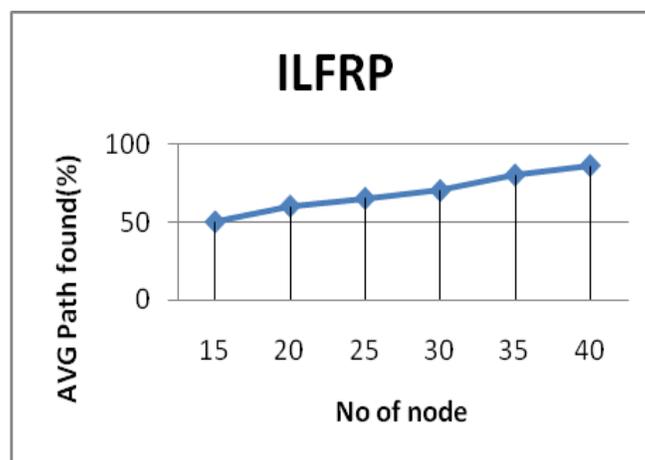

Fig 4.2 chart between Average path and number of node

Simulation Result For Packet Delivery Ratio With Number Of Nodes Between ILFRP And Shortest Path Protocol

Figure 4.3 show the compression between ILFRP and shortest path protocol in terms of packet delivery ratio (%) and different number of mobile nodes. When number of node increase then packet delivery ratio is increases in both the protocol but ILFRP provide more better packet delivery ratio than shortest path protocol.
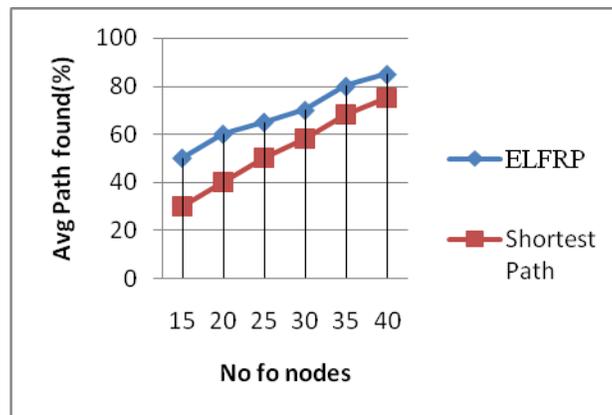
Fig 4.3 chart between average path found and number of node

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V. Conclusion & Future Work

In this thesis we outline the characteristics of ad hoc mobile networks and present previous work on different methods to resolve the problem of broken link in MANET. Most of the protocols have concentrated on how to quickly reorganize the ad hoc network during times of mobility and how to find the best route without increasing control overhead. However, since mobile hosts have limited battery resources, ad hoc mobile networks should consume battery power more carefully and efficiently to prolong network operation lifetime. In this thesis, I propose routing protocol is use to improve the link failure prediction in terms of power between source to destination. This routing protocol determine the minimum available power between source to destination. Then source node decided the path which has maximum available power between source node to destination node. By using the ILFRP protocol, improve the link failure problem due to power in between source to destination.

Future Perspective:

Our ILFRP(Improvement of Link Failure Routing Protocol) protocol only provides service in terms of link failure improvement due to power. But link failure is also occur due to transmission range and movement of nodes and congestion etc . So in future our proposed protocol can be reconstruct to generate new protocol in terms of transmission range and movement of nodes that will improve the problem of link failure in Mobile Ad Hoc Network.

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