Reliable pair protocol for Link Stability in MANET

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***Abstract*- Mobile ad-hoc network (MANET) is one of the most interesting fields for research and development of wireless network .A challenging problem is how to route information reliably and efficiently from one node to another in moderate to high level of mobility. This paper considers instability due to mobility, and proposes a scheme to predict the link stability in mobile scenarios of MANETs. This paper presents a new protocol used for measuring link stability on basis of metric reliability pair factor. This paper also used to provide stable links on the basis of different factor like power of node, signal strength of node and distance between the nodes. Using these factors this protocol discovers the route between source and destination and follows that route for data transfer.**

Keywords- MANET, Reliability pair factor, signal strength

I. INTRODUCTION

An ad-hoc network, as the name suggests, is a network formed by nodes connected arbitrarily for some temporary time. The proliferation of cheaper, small and more powerful devices make MANET a fastest growing network. A Mobile Ad-hoc network (MANET) is a kind of wireless ad-hoc network having arbitrary topology (no fixed infrastructure) with mobility. Its intrinsic Flexibility, lack of infrastructure, ease of deployment, auto-configuration, low cost and potential applications make it an essential part of future pervasive computing environments.

Due to nodal mobility, the network topology may change rapidly and unpredictably over time Message routing is a problem in a decentralize environment where the topology fluctuates. Few examples which use the concept of ad hoc networking include students working with laptop for participation in an interactive lecture, soldiers communicating information for situational awareness on the battlefield and emergency disaster relief personnel coordinating efforts after a earthquake. MANETs can be a viable solution for communications and information access.

Routing imposing problems in MANET since mobility causes radio links to break frequently[1] .When any link of a path breaks, this path needs to be either repaired by finding another link if any or replaced with a newly found path. This rerouting operation cost the scarce radio resource and battery power while rerouting delay may affect quality of service (QoS) for applications and degrade the network performance.

Link stability [14] is a qualitative measurement of the capacity of link for how much time of span this link can survive in the environment condition.

Node mobility, limited battery and scarce Bandwidth resource makes the routing protocols designed for traditional networks impractical for use directly in MANETs.

It is necessary to find a new metric for measurement of stable and optimum path to minimize disruptions Caused by the dynamic nature of network. The most stable path is the path which has maximum route expiration time (RET) [2] during which all links along the path keep available , where bottleneck link is the link with minimum expiration time among all links along the whole path.

While considering the previous work by researchers the main promising factor which are responsible for the link stability are three main factors[3][4][5] listed below in the diagram.

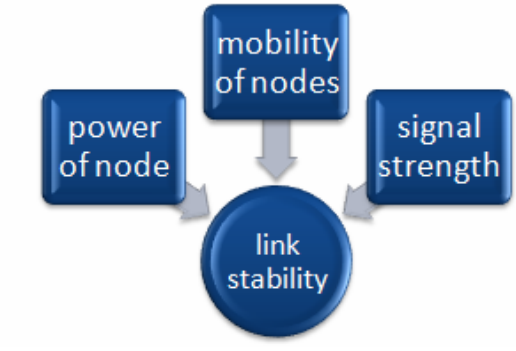


Fig 1

In this paper, we present an easy to implement but efficient method to select wireless links based on the value of reliable pair factor value between nodes. In this paper, we discuss the factors which are mainly responsible for link stability.

1.1 **Battery level-** In order to develop FRP , we need knowledge of remaining battery power of a

node. The battery at the end of certain time interval, it is calculated as the remaining power of a node that may not be same because as we transfer data along network this would cause in the decrement of device battery.

1.2 **Signal strength of node**-The received signal Strength at any node from its neighbor node affects FRP. Ds is the difference of two signal strengths received at a node at two different times.

1.3 **Distance between nodes-**We calculate the distance between two nodes after a certain time interval and further use this measured distance for the calculation of Frp.

The remaining part of our paper is organized as follows:-In section II, we will discuss the related work done in the field of link stability routing mechanism. In section III, we will discuss the problem statement .and in section IV we introduce our proposed model for link stability in MANET. In section V, we will do the comparative study of all the previous protocols given for link stability with our new proposed protocol and in section VI, we will conclude the paper and give the future scope of this paper.

II. RELATED WORK

Research in the field of ad hoc networking is gaining more attention from academia, industry, and government. As these networks give solution to many complex issues, there are still many open problems for research. It is still an open challenge to reduce path breakage and enhance the link stability in the time of communication in QoS routing in MANET. Researchers proposed several routing algorithms for mobile ad hoc networks [17, 8, 10, 12, 13, 14, 19, 21, 7, 3]. A comprehensive review on ad hoc routing protocols is given in [17, 18]. In this section, we briefly present routing protocols in MANETs.-

Reza Shamekh suggests a new metric which add to the routing table to enhance the link stability. Routing table stability parameter (RTSP)[9] in which each node, suggest fragile routes and thus provide an algorithm to select robust path to increase stability .The RTSP parameter is in inverse proportion to the frequency of node changes in routing table.

RTSP α 1/ no. of node change

Each node computes RTSP in a distribution mechanism and adds this metric to route request and reply packets.

Weiying Zhu focuses on the issue of reducing link breakage while data transmission. Ticket-based probing with stability estimation (TBP-SE)[10] as an enhancement for the multi-path Distributed QoS routing scheme. With this approach he calculates the relative stability of a link between two neighboring mobile nodes .TBP-SE increments the stability of selected paths in terms of average relative path stability, path breakage speed, and amount of data transfer taken before path breaking.

Chun-Yen Hsu gives the Long-lived Route Prediction (LRP) [8] scheme to discover stable routes, and it predicts the long-lived routes based on the history of link lifetime. LRP scheme can find stable routes to reduce the number of route re discovery, this scheme use longevity factor as an index of link stability.

N.Z.Ali [2] address the previous study on how measure link availability properly so that it can be used as a routing metric to reflect path reliability or availability of each link of this path. He uses three parameter to decide stability as link expiration time, node position prediction and link availability prediction.

LFPQR [19] predicts the link breaks during the route discovery process and establishes stable paths. Satyanarayana shows that LFPQR assure improvements in QoS parameters such as low packet delay and low packet loss at frequent network topology changes.

A. Laboid presents a scheme for enhancing QoS parameter like link's available bandwidth, Route's lifetime, estimated route's stability and node's congestion. QoS-ASR [6] search stable paths based on link's availability. For medium and high mobility, QoS-ASR improves the throughput in comparison to DSR.

III. PROBLEM STATEMENT

As already stated, the specific characteristics Of MANETs impose many challenges to network protocol designs on all layers of the protocol stack. Considering the work of Mr. Rajashekhar Birder "Channel Condition [16] and Mobility based Choice of Neighbor Node for Routing in MANET" .He gives a metrics for the finding link stability. this paper deal with the way it route the packets it calculate the reliability pair factor in the unicast pattern and route the data in unicast pattern. Unicastng can be done on the basis of decision factors. But the Problem which I analyze is that in this approach does not calculate the reliability pair factor of possible links and if the case that it ignore the link of high reliability factor then this technique result in the lower link stability degree. So we can enhance this with broadcast version of protocol that should be combined with the AODV protocol to the remaining strategy.

IV. PROPOSED APPROACH

We argue that routing is the core responsibility of the network layer and it should itself be capable to determine the quality of its own routes that it provides Neighbor node selection in MANETs with the help of various models such as node power model, mobility model and differential received signal power model The models are used to define a metric known as reliability pair factor of reliability pair. The scope of the referenced paper

is limited to the selection of neighbor nodes by forming reliability pair**.** Route establishment using reliability pair factor is an extension to the previous work which we are performing in this paper.

Power model- The battery power model is as follows. Let Wi_rem be the remaining battery power of node i. At the end of certain time interval, it is calculated as the remaining power of a node that may not be same since transmitting some number of packets during an interval causes little amount of drain in node's battery power.

1) Low range ($0 < Wi\_rem \leq Wi\_l$)
2) Normal range ($Win < Wi\_rem \leq Wi\_c$)

Wi_l is the low range of power of the node which is 25 % of total power of node.

Signal strength model- Once the distance between two neighborhoods exceed a certain extent, the transmission signal will not be received correctly by receiver. Thus, it will result in link failure .The received signal strength at any node from its neighbor node affects Frp. If a node receives a strong signal from a neighbor then the link between them **is** considered as stable, otherwise the link is considered as unstable. D_s are the difference of two signal strengths received at a node at two different times. The signal strength gets stronger and weaker if *Ds(t)* is positive and negative, respectively. If it becomes stronger, it means that two nodes would be closer and the link between them would have longer lifetime

$$D_{S(j,t)} = S_{(j,0)} - S_{(j,t)}$$

Mobility model- Let initial positions of nodes i and j have coordinate values (x1, y1) and (x2, y2), respectively. Suppose nodes i and j are moving with variable velocities in a particular direction decided by angles θ1 and θ2 with positive x-axis.

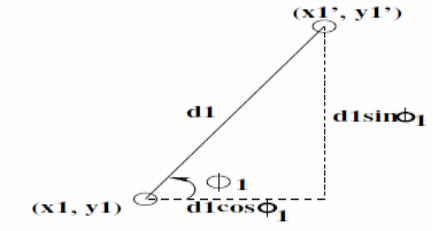
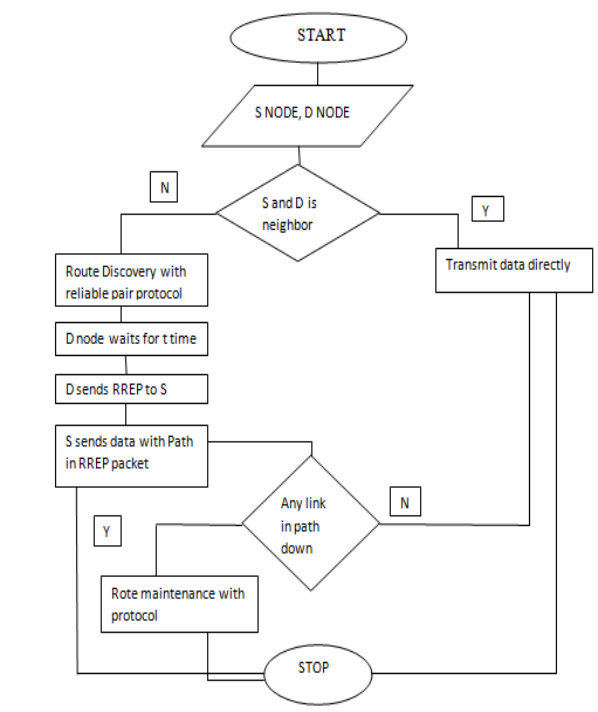


Figure 2. Finding new coordinates after mobility

$$X_1' = X1 + d1\cos\theta 1$$
$$y_1' = y1 \pm d1\sin\theta_1$$

Calculating the new co-ordinate of the node distance that has been traversed by the node can be calculated. In this way distance between nodes can be calculated.

FLOW CHART OF PROTOCOL:



S node=Source node, D node =Destination node
N node= neighbor node, I node =intermediate node
$F_{RP}(R)$ =value of reliable pair factor corresponding to RREP

Algorithm of Reliable Pair Protocol

Input: Source node(S), destination node (D)

If (source node S need to send data to destination node D)

{

If (S and D is neighbor node)

{Transmit data directly}

Else

{

Route Discovery with reliable pair protocol

D sends route reply (RREP) to S

S sends data with path in RREP packet

}

If (Any link in path become down)

{Route Maintenance with reliable pair protocol}

}

ROUTE Discovery-When a source node needs to communicate to a destination node, it checks its routing table for a route. If none exists, the reliable pair protocol uses broadcast route discovery approach to create a route to the destination. While making route discovery it broadcast the RREQ packet. Global Position System (GPS) technique is used for the device location information and also to estimate link expiration time. Suppose A is source

node and G is the destination node .firstly A check if any route is available to G or not .If it is finding a route then use it to send the data using that path .When there is no such route found then it broadcast the RREQ packet in network.

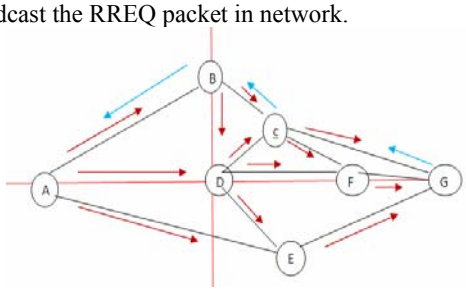


Fig-3

Few more fields are added to calculate the reliability pair factor. A flood RREQ packet to B, D, E. these nodes B, D, E calculate the value of reliability pair factor of the links AB, AD, AE. And further make flooding broadcast to C, F, E .Like previously they also process the value of F_{RP} and make a summation of the new value to previous F_{RP} value and then in the same way they flood to the destination G .Destination node check its cache for the path which has highest value of reliability pair factor. As a result, the proposed *RREQ* forwarding strategy is algorithmically simple and helps the destination node select reliable routes with the highest route quality Red color line stands for RREQ and blue color line stands for RREP.

$$F_{RP} = K\frac{Min(W_i^{rem}, W_j^{rem}) + D_S}{d_{(ij,t)}}$$

F_{RP} reliability pair factor between two nodes
Wi^{rem}–value of remaining power of node i
D_s is the value of diffrential signal strength at two diffrernt times of a node
$D_{(ij,t)}$ is the distance of two nodes i and j at time t
K is constant

ALGORITHM FOR ROUTE DISCOVERY

Step (1) Source node broadcast RREQ packet to N node
N nodes check RREQ header
N nodes extract RREQ header and store following fields
1. Power of S **2**. (X,Y) co-ordinate of S **3.**signal strength of S
Step (2) if (N node=D node)
Step (2.1) {
D node waits for Δ t time
No of RREQ of (D node) ≥ 1
Each RREQ has value of F_{RP}
$F_{RP}(R) = \max(F_{RP})$
D node send RREP packet
}
Else {
Step (2.2)
{
N node extracts the RREQ header and store following field
1. Power of N nodes 2. Distance (N, S) 3.(X,Y) co-ordinate of N node
N node calculate reliability pair factor

$$\frac{\min(P_{S\_P\_n}) + D_S}{d_{(S,N)}} = F_{RP}$$

N node updates value of F_{RP}
N nodes add value of F_{RP} with RREQ header and rebroadcast to N nodes
$F_{RP1} = F_{RP}$ +new F_{RP}
}
}
Step (2.3) if N node (N node(S)) ≠ null
Repeat step 2.2
Else
Go to step 2.1
}

Header fields of RREQ packet are shown in the diagram-

Route Request ID					
Source IP					
Destination IP					
Source Sequence Number					
Destination Sequence Number					
TYPE	HOPCOUNT	JRGDU	Xnode	Ynode	Power node
DIFF SIGNAL STRENGTH OF NODE X					Frp

ROUTE REPLY –As destination node make a decision that which path is most reliable and heaving high link stability and low link breakage. Then G make a ROUTE REP to the path of high stability .As RREQ packet contain the X, Y co-ordinate so path is saved. When destination node send ROUTE REP packet then source node have the information of the stable path and now it is able to communicate the data along that path.
Header fields of ROUTE REP packet are shown in the diagram-

SOURCE IP ADDRESS			
DETINATION IP ADDRESS			
DESTINATION SEQUENCE NUMBER			
LIFE TIME			
TYPE	R A	HOPCOUNT	ROUTE PATH

ROUTE MAINTENANCE-In the routing of mobile ad hoc networks (MANET), frequent link breaks occur in the path due to random motion of nodes and link failures can also take place which violate the quality of service (QoS) requirements which arises the need of route maintenance. In this protocol destination node have more than one value of reliability pair factor .Each value corresponding

to a path i.e. destination node have more than one path in memory so if link failure occur while communication taking place then destination can swap previous path to the new path which have reliability pair factor less than previous one .With this approach it does not have overhead of re Route Discovery

Suppose communication is taking place by route (A-D-F-G) path in fig-3. Suppose the node which goes down is F .Data packet are transferred from D-F but F cannot send packet further in network .so F send a RRER message to D . At this point of time D check its cache to find the stored value of F_{RP} and corresponding path and send the data with that path.

IV. PERFORMANCE ANALYSIS

The following performance metrics will be considered for comparison of the proposed approach

Packet Delivery Ratio: It is defined as the total number of data packets received divided by total number of data packets sent at all the mobile nodes present in the simulation.

Routing Overhead: It is defined as the ratio of the AODV packets to the data packets sent and received by all the mobile nodes.

End-to-End Delay: It is defined as the delay for sending packets from source node to the fixed host.

Simulation Results: We will implement our proposed mechanism by using network simulator ns-2.31[14].

VI. CONCLUSION AND FUTURE SCOPE

Wireless ad-hoc networks has now become one of the most vibrant and active field of communication and networks. This reliable pair protocol enhances the link stability as it selects path which satisfied RREQ condition. The main characteristics of our proposed mechanism are that it takes into account the $F_{RP.}$ As a consequence, mobile ad hoc networks are expected to become an important part of the future 4G architecture, accessing information and communicating anytime, anywhere and from any device. Despite the enormous efforts and progress to date, much work remains in the understanding and characterization of wireless communications channels

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