Adaption of Routing Based on the Account of the Interference Through MANETs

Gowtham Kumar N[1] and Praveen Kumar Rao K[2]

[1]*Assistant Professor, Department of CSE, Kamala Institute of Technology & Science, Huzurabad, A.P, India.*
gowtham520@yahoo.com

[2]*Associate Professor & Head, Department of CSE, Kamala Institute of Technology & Science, Huzurabad, A.P, India.*
praveenkumar_k_rao@yahoo.co.in

***Abstract---* Mobile ad-hoc networks remove the dependence on a fixed network infrastructure by using every mobile station as a router, therefore extending the range of mobile nodes beyond that of their base transceivers through multi-hop. Due to the flexibility, self - reconfigurability and mobility, they have become one of the most efficient solutions to interconnect a large number of mobile devices. Finding shortest path in MANETs is a challenging task mostly for its rapidly changing topology. Already several routing protocols have been proposed and implemented for ad-hoc networks depending on hop count. This paper proposes an adaptive routing process based on taking the account of Interference among the nodes through the entire network. The main objective of this method is to reduce the overhead of maintaining a large routing table and also reduce the transmission latency of a packet in multi hop mobile adhoc networks by providing an adaptive interference routing algorithm.**

Key words : Mobile Ad-hoc Routing Algorithm, hop-count, Adaptive interference routing algorithm.

I.INTRODUCTION

Ad-hoc networks are the networks that don't have any fixed infrastructure. Ad-hoc networks are often mobile and that is why the term MANET (Mobile Ad-hoc Network) is used. There are many applications for ad-hoc networks like conferencing, emergency services, personal area networks, embedded computing, and sensor dust.

A MANET is a peer-to-peer network that allows direct communication between any two nodes, when adequate radio propagation conditions exist between these two nodes. If there is no direct link between the source and the destination nodes, multi-hop routing is used. In multi-hop routing, a packet is forwarded from one node to another, until it reaches the destination.

Each node in an ad-hoc network has to rely on each other in order to forward packets and there is a need to use a specific cooperation mechanism to forward packet from hop to hop before it reaches a required destination by using routing protocol. Examples of available routing protocols for ad hoc network are ad hoc on-demand distance vector (AODV) destination sequenced distance vector (DSDV) and dynamic source routing (DSR) The main concept of these routing protocols is to find the shortest path in the source-destination routes selection.

A mobile ad-hoc network consists of wireless hosts that may move often. Movement of hosts results in a change in routes. It has required some mechanism for determining new routes. A mobile ad-hoc network consists of wireless hosts that may move often. Movement of hosts results in a change in routes. It has required some mechanism for determining new routes.

Mobile nodes forming the ad-hoc networks are generally autonomous and they can move at their own free will. As a result dynamic topology structures have been formed of such networks. In the absence of a fixed infrastructure, discovering and maintaining routes under such dynamic conditions is a nontrivial task. Mobile ad-hoc network is an autonomous system of mobile nodes connected by wireless links; each node operates as an end system for all other nodes in the network. Therefore all nodes cooperate in carrying traffic. Wireless nodes or terminals that communicate with each other forms a multi hop packet radio network and maintains connectivity in a decentralized manner.

Mobile ad-hoc network is the uncharted frontier of contemporary networking technology. The self organized characteristic of such networks makes them particularly suited for the scenarios. In this network, quick deployment of communication is desired without depending on an existing infrastructure. Due to the limitation imposed by the transmission range of each node, such networks evolve into multi-hop networks.

In ad-hoc network, the communication between two nodes is made possible by a few intermediate nodes forwarding packets for them. Thus each node of a mobile ad-hoc network acts not only as a host but also as router, forwarding data packets for the other participating nodes. The nodes also need to actively participate in discovering new routes for their own requirements as well as for the benefit of other nodes.

There are different routing protocols have been developed for wireless ad-hoc networks. Depending on the type of information used for routing, they can be classified into different categories:

- Proactive Routing
- Reactive Routing
- Hybrid Routing Protocol

- Proactive Routing tries to keep up to date information about the entire network, therefore when there is a routing request, the request is fulfilled without any delay. Proactive routing was the first attempt at designing routing protocols for MANETs. These protocols periodically maintain and distributed route information to all nodes within the network.

- Reactive Routing Protocols attempt to reduce the amount of control overhead in network by determining routes to a destination only when it is required. This is usually achieved through a two-phase route discovery process by a source node. For large number of flows reactive protocols experience a significant drop in data throughput.

- Hybrid Routing Protocols combine both reactive and proactive routing characteristics to achieve high levels of scalability. Generally table-driven routing is used within a limited region, but on-demand routing is used to determine routes, which are not in the source node's limited region.

II.RELATED WORK

In this section we are presenting a brief comparison between some existing routing protocols. At first we have studied SDSS. SDSS [1] is a self-selecting route discovery strategy proposed by Mehran Abolhasan and Justin Lipman. The basic idea is to reduce the re-broadcasting of RREQ packets, by maintaining some criterion. In SDSS [1] the source node specified a utility metric in each RREQ. In SDSS-M (SDSS based on Mobility) [1], mobility is set as a criterion for selecting the nodes which are able to rebroadcast. In SDSS-R [1] reachability is defined in the context as the ability to forward route request packet to the destinations.

In PSS [1], each intermediate node selects its own utility metric. Two strategies are proposed. The first one is PSS-R [1] (PSS based on Reachability), where utility metric is calculated based on reachability. There is another case, where PSS is based on Mobility (PSS-M) [1]. Here, instead of using reach ability, node speed is used to determine the probability of dropping each control packet. Both SDSS and PSS aimed to reduce overhead for broadcasting. However, both protocols suffer from ambiguity in how the self selection works. SDSS [1] is a source initiated algorithm. However, the idea of source initiation is not clear.

Distance Routing effect Algorithm for mobility (DREAM) [3] is also a popular algorithm. It maintains a position database. This works on a proactive basis. The frequency of sending the control packets depends on its moving speed. The routing overhead is minimized taking into consideration the distance and mobility of the nodes. Here, each data packet is first flooded in the forwarding zone and then flooded in the entire network through the recovery procedure. Thus, there appears to be no reason to include the additional protocol complexity of DREAM [3] over simple flooding.

Power aware Location Aided Routing (LAR) [6] is a Modified Flooding Algorithm. It utilizes location information of mobile hosts using a GPS for route discovery. Flooding is restricted to a "request zone", defined by an "expected zone". The algorithm is not cost effective as each node has to carry a GPS. Another disadvantage is (especially for the first method), that protocols may behave similar to flooding protocols (e.g. DSR [5] and AODV [9]) in highly mobile networks.

Prediction Based Location Aided Routing (P-LAR) [4] is best suited for cluster based ad hoc networks. It uses the sectorized ad hoc mobility prediction technique with an enhanced sector cluster concept to obtain a discrete approximation of the user location. Thus there is no need for continuous location updates. This protocol maintains a high level of prediction accuracy for all types of mobile users with minimal control overhead. Prior knowledge of user movements can ensure route reconstruction procedures to be completed prior to route failure or in 'pseudo real-time'. However, requirement of knowledge of previous user movements make the thing complex.

Predicting when a route is going to be broken can reduce link failure due to mobility during data transmission. Alternative link before route failure can be experienced using FORP (Flow Oriented Routing Protocol) [8]. A Flow_HANDOFF message is generated and propagated via flooding after determination of a route, which is about to expire. After receiving a Flow_HANDOFF message, the source can determine the best route to handoff the flow based on the given information in the Flow_HANDOFF packet and then a Flow_SETUP message along the newly chosen route sends by the source node. FORP [8] minimizes the disruptions of real time sessions due to mobility, by attempting to maintain constant flow of data. However, it may experience scalability problems in large network, because it is based on pure flooding.

An optimized flooding mechanism[12] used in mobile ad hoc networks (MANETS) that employs several mechanisms (neighbor coverage, power control, neighbor awareness and local optimization) to limit the broadcast storm problem, reduce duplicate packet reception & lower power consumption in both transmission and reception. The effect of mobility is ignored. N. Sadagopan, F. Bai, B. Krishnamachari and A. Helmy [7] several studies have done on the effect on mobility on routing path. No broadcast protocol uses the notion of stable link to evaluate the stability of neighbor set in order to better decide the forwarding status of each node. It is difficult to establish a direct connection between forwarding probability and node mobility. In [10], a stable zone and a caution zone of each node have been defined based on a node's position speed, and direction information obtained from GPS. Stable zone is the area in which a mobile node can maintain a relatively stable link with its neighbor nodes since they are located close to each other. Caution zone is the area in which a node can maintain an unstable link with its neighbor nodes since they are relatively far from each other. As this method is GPS based, cost overhead is high. There is no rigorous analysis on the impact of mobility on the selection of these two zones.

Hybrid routing protocols have the potential to provide higher scalability than pure reactive and proactive protocols. This is because they attempted to minimize the number of re broadcasting nodes by defining a structure, which allows the nodes to work together in order, organize how routing is to be performed. Zone Routing Protocol (ZRP) [2] was the first hybrid routing protocol with both a proactive and a reactive routing component. This routing protocol is proposed to reduce the control overhead of proactive routing protocols and decrease the latency caused by routing discover in reactive routing protocols. ZRP [2] defines a zone around each node consisting of its neighbour hood (e. g. k=3). In ZRP, the distance and a node, all nodes within hop distance from node belong to the routing zone of node. This is formed by two subprotocols, a proactive routing protocol: Intra-zone Routing Protocol (IARP) [2] is used inside routing zones and a reactive routing protocol: Inter-zone Routing Protocol (IERP) [2] is used between routing zones, respectively. A route to a destination within the local zone can be established from the proactively cached routing table of the source by IARP [2]; therefore, if the source and destination is in the same zone, the packet can be delivered immediately. Most of the existing proactive routing algorithms can be used as the IARP [2] for ZRP [2]. DGRP [1] is a localized location based greedy routing protocol. It uses a location, speed and direction of motion of their neighbour's to select the most appropriate next forwarding node. It uses two forwarding strategies greedy and perimeter. With location information of one hop neighbour it also uses their speed and direction of motion.

By help of a location prediction method it can predict location of next 1-hop neighbour. In the next section we are going to propose a new routing protocol and try to reduce the problems of previously discussed routing protocols.

III.NEW ROUTING PROTOCOL

The main disadvantage of proactive routing protocol is the maintenance of a large amount of current information about network in the form of routing table. This requires a large amount of network capacity. The reactive routing protocols result in larger time delay since a route has to be established whenever required (on-demand). A large amount of network band width is occupied for flooding as well. Hybrid protocols are not very commonly used. In our proposed new topology, our aim to remove the disadvantages of reactive and proactive routing protocols.

In this new routing protocol, we have combined the advantages of reactive and proactive routing protocols. The main objective of this newly implemented routing protocol is, it will reduce the overhead of maintaining a large routing table and also reduce the time delay for finding the route. It assumes for any given instance; each node in the network maintains a list of its neighbours. One node maintains information about another node if and only if it is in its communication range.

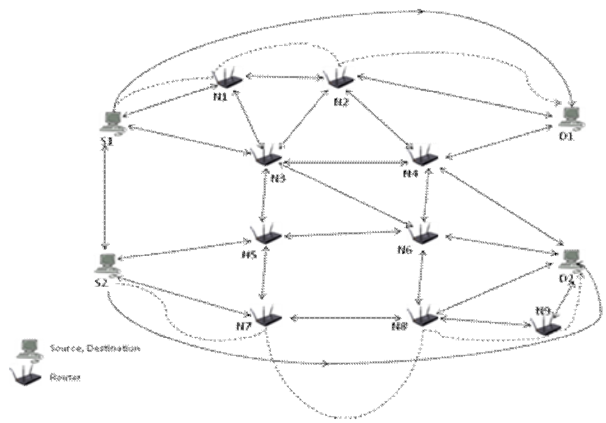

Figure 1 : Ad-hoc Network Topology

Figure 1 shows an ad-hoc network topology. Sender S1 wants to send a packet to receiver R1, S2 to R2. Using the hop count as metric, S1 could choose three different paths with three hops, which is also the minimum. Possible paths are (S1, N3, N4, R1), (S1, N3, N2, R1), and (S1, N1, N2, R1). S2 would choose the only available path with only three hops (S2, N5, N6, R2). Taking interference into account, this picture changes. To calculate the possible interference of a path, each node calculates its possible interference (interference is defined here as the number of neighbors that can overhear a transmission). Every node only needs local information to compute its interference.

In this example, the interference of node N3 is 6, that of node N4 is 5 etc. Calculating the costs of possible paths between S1 and R1 results in the following:
C1 = cost (S1, N3, N4, R1) = 16, C2 = cost (S1, N3, N2, R1) = 15, and C3 = cost (S1, N1, N2, R1) = 12.

All three paths have the same number of hops, but the last path has the lowest cost due to interference. Thus, S1 chooses (S1, N1, N2, R1). S2 also computes the cost of different paths, examples are C4 = cost(S2, N5, N6, R2) = 16 and C5 = cost(S2, N7, N8, N9, R2) = 15. S2 would, therefore, choose the path (S2, N7, N8, N9, R2), although this path has one hop more than the first one.

With both transmissions taking place simultaneously, there would have been interference between them as shown in Figure. In this case, least interference routing helped to avoid interference. Taking only local decisions and not knowing what paths other transmissions take, this scheme can just lower the probability of interference. Interference can only be avoided if all senders know of all other transmissions (and the whole routing topology) and base routing on this knowledge.

The neighbor information vector is of the format {node_id, node_speed}. The node_speed has to be updated whenever needed. Obviously, those nodes which travel at high speeds send update packets more frequently. This leads to:

Mt ∞ On ………………………………(i)

Where, Mt is Mobility of a particular node at a particular time, On is overhead for maintaining information of that particular node. Thus from eqn.(i), we can conclude that in order to minimize the overhead of maintaining information about each node, only the node with less mobility has to be considered. This is possible only when the source node is aware of the mobility of each node.

Mobility means the rate of position change of a mobile node with respect to time.

At time T1, source node broadcast a request_message.

The message format is: {Source_ID, Message_ID, Sending_Time, Source_Add} Where, the Source_ID is source node's identifier. Combination of Source_ID and Message_ID is unique identifier of message. By this unique identifier a neighbour node can uniquely identify a message and can understand if it is a new message or if it sends already a reply to this corresponding message. In Sending Time field time of sending message is stored. In this case it is T1. In the source address field the source node's address is stored.

After receiving this message, each neighbour node sends a reply_message mentioning its own position at that time instance. After a certain time period, it again sends a reply message indicating its current position.

A source node can maintain every neighbour node's position in the position_table vector {Node_ID, Node_Posn, Time}. In this table the node_id means the identifier of that node, whose position is stored.

NODE POSITION TABLE

NODE_ID	NODE_POSN	TIME

ALGORITHM

Let S is source node, wants to send a message and source node contained Node ID,Node Position and the Time at which it sends he message

Step 1: [Construct Local Neighborhood Graph].

Each sensor broadcasts its id and location.Each sensor s compiles a list L(s) of all ids and locations that it hears. Let A(s), the adjacency list for s, comprise all sensors a € L(s) such that there is no b € L(s). located in the interior of the intersection region of the radius |sa| circles centered at s and a.

Step 2: [Construct Best Support Path]

Let the length of a path be the maximum weight of its edges. Let x and y, respectively, be the sensors closest to the points u to v. Run the Adaptive based routing algorithm to determine a shortest path P(x, y), in the local neighborhood graph, from x to y. (u, x), P(x, y), (y, v) is a best support path from u to v.

Do a binary search in L to find the maximum value max for which there is a path P from source to destination that uses no edge with c(u, v) < max. For this, when testing a value q from L, we perform a depth- or breadth-first search beginning at the source. The search is not permitted to use edges with c(u, v) < q. Let P be the source-to-destination path with lifetime max. The weight of (u, x) is |ux| and that of (y, v) is |yv|. SW(u, v) is the maximum of the edges weights in the best support path.

Overlay the sensing region with a weighted undirected graph G. The vertices of G are points in the sensing region and its edges are straight lines. The weight of an edge is the exposure of that edge. The minimal-exposure path from u to v is estimated to be the shortest path in G from the vertex of G closest to the point u to the vertex of G closest to the point v. Its exposure is the length of this shortest path.

Step 3:[Wrap UP]

If no path is found in Step 2, the unicast isn't possible. Otherwise, use the path P corresponding to max.

IV.PERFORMANCE ANALYSIS

The main objective of this algorithm is to reduce the overhead of maintaining route information for mobile ad-hoc network. For this reason, in the place of maintaining information about all mobile nodes we have maintained information only about the next neighbor node.

We have depicted a relation between number of nodes and time required for route finding. From that it is clearly seen that when the number of nodes in the network are increased then the required time for route finding also increased. But it is not very regular change. When the node number increases from 6 to 10 the required time increases more than the case where the node number change from 10 to 14. From this we have reached the conclusion that a network, where there are large numbers of mobile nodes, then using Mobile Ad-hoc Network Interference based Routing Protocol, we are capable to reduce the time complexity, there is a comparison between number of nodes and hop-count for finding route from source to destination. Here we have also observed that if the number of nodes increase, initially hop count also increase. But after a certain value, hop count fixed in a certain range. There is a comparison between hop-count and interference among nodes for finding route from source to destination. Here we have also observed that even if the Hop count increase, due to less interference between nodes the packet reaches destination efficiently.

A.Throughput

The throughput resulted from both hop based routing and Adaptive bases Interference routing protocol has been presented in Figure-2. The result demonstrates that this routing protocol has higher throughput than the hop based routing protocol by on average 23%. This returns to that local repair in this protocol acts in trials by broadcasting first RREQ packet with TLL = LR_TTL_START (equal to 2 in the experiment). This reduces the routing overhead which by its turn resulted in increasing throughput.

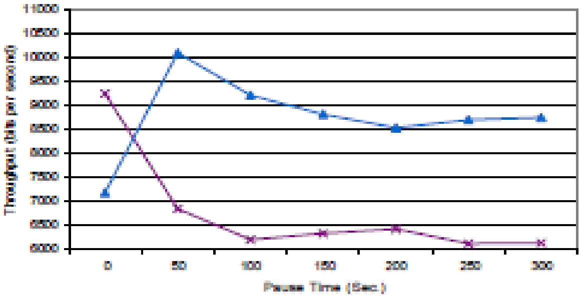

Figure-2:Throughput between hop-based and Interference based routing protocol

B. Average End to End Delay

The average end to end delay resulted from both hop based and adaptive interference based routing protocols has been presented in Figure-3. From the figure, it can be demonstrated that this routing protocol has average end to end delay lower than the hop based routing protocol by on average 28%. This demonstrates the effect of local repair trials and especially as the network size grows up, where the trials of local repair reduce routing message overhead and by its turn free bandwidth channels and this led to transfer data packets faster.

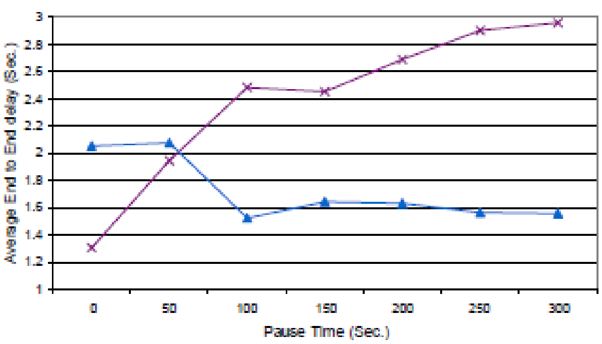

Figure-3: Average End to End Delay between hop-based and Interference based routing protocol

Adaptive based Interference based routing protocol has average route length lower than the hop based routing protocol by on average 4.8%. This result demonstrates that local trials in AIB have a good impact on path length especially when the network size gets larger.

V.CONCLUSION

A new routing protocol has been proposed for reducing the overhead of maintaining a large amount of data about mobile nodes, for routing. It stores information only about those neighbour nodes. So a large amount of overhead has been reduced by minimizing the routing table. Some result analyses are also incorporated to show, in which way the proposed algorithm work. The main aim of this algorithm is to reduce the routing overhead. This algorithm takes traffic into account at each node instead of hop count, so that packet must pass through the nodes which have less interference. In future work, the proposed algorithm will be tested in a high mobile network.

REFERENCES

[1] Mehran Abolhasan and Justin Lipman, "Efficient and Highly Scalable Route Discovery for On-demand Routing Protocols in Ad hoc Networks," IEEE conference on local computer networks 30th anniversary (LCN'05), 2005.

[2] Kyoung-Ja Kim and Hyun-Woo Koo, " Optimizing Power-Aware Routing using Zone Routing Protocol in MANET", IFIP International Conference on Network and Parallel Computing Workshops, pp:670- 675, 2007.

[3] Ajay Vikram Singh 1, Prof. M. Afshar Alam 2 and Prof. Bani Singh, "Mobility Based Proactive and Reactive Routing Algorithm in Mobile Ad hoc Networks (MANETs)", International Journal of Computer Science and Information Technologies, Vol. 2 (4) , 2011, 1793-1797

[4] Rei-Heng Cheng & Chiming Huang" Efficient Prediction-Based Location Updating and Destination Searching Mechanisms for Geographic Routing in Mobile Ad Hoc Networks" Journal Of Information Science And Engeneering 28, 115-129 (2012)

***[5]** G.Lavanya, A. Ebenezer Jeyakumar**"** An Enhanced Secured Dynamic Source Routing Protocol for MANETS" International Journal of Soft Computing and Engineering (IJSCE),ISSN: 2231-2307, Volume X, Issue-4, September 2011*

*[6] Anamika" Power Aware Location Aided Routing in Mobile Ad-hoc Networks**"**International Journal of Scientific and Research Publications, Volume 2, Issue 12, December 2012 1 ISSN 2250-3153*

[7] N. Sadagopan, F. Bai, B. Krishnamachari, and A. Helmy (2003), "Paths:analysis of path duration statistics and their impact on reactive MANET routing protocols," in Proc. of MobiHoc.

[8] Robinpreet Kaur & Mritunjay Kumar Rai" A Novel Review on Routing Protocols in MANETs" Undergraduate Academic Research Journal (UARJ), ISSN : 2278 – 1129, Volume-1, Issue-1, 2012

[9] C. Perkins, E. Belding-Royer and S. Das "Ad hoc On-Demand Distance Vector (AODV) Routing." RFC 3561, IETF NetworkWorking Group, July 2003.

[10] W.I.Kim, D.H. Kwan, and Y.J,suh (2001). A reliable root selection algorithm using global positioning systems in mobile ad hoc networks,in Proc of ICC.

[11] Theofanis P. Lambrou and Christos G. Panayiotou Woodward, "A Survey on Routing Techniques supporting Mobility in Sensor Networks", 2009 Fifth International Conference on Mobile Ad-hoc and Sensor Networks

[12] Suman Banik, Bibhash Roy, Parthi Dey, Nabendu Chaki, 5Sugata Sanyal"QoS Routing using OLSR with Optimization for Flooding ",International Journal of Communication Technology Research ISSN-2223-4985,Vol.1,No.4,p.p 164-168 August 2011.