Reducing Routing Overhead in Mobile Ad Hoc Network by Using NCPR Protocol Along With Clustering Technique

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Abstract – There exists the link breakages in the Mobile Ad Hoc Networks (MANET's) because of high mobility of nodes in MANET. The link breakages in MANET can lead to the several path failure and route discoveries [1]. It is not possible to neglect the overhead of route discoveries. In route discovery, broadcasting is fundamental and defective data dissemination mechanism. Due to high mobility of nodes in MANET there is no static topology, which lead to the frequent link breakages while route discovery. Thus link breakage problem cause an interruption in data transmission that raises routing overhead issue, because of which end-to-end delay of network increases, whereas packet delivery ratio and throughput is decreased.

In this paper we propose a solution, to reduce the routing overhead by using NCPR algorithm and NCPR protocol along with clustering technique (NCPR-WC). Basically NCPR Protocol are used to find uncovered nodes in network.

Index Terms – MANET, Routing Overhead, Cluster, NCPR Protocol.

1. INTRODUCTION

Mobile ad Hoc Networks (MANET's) consist of a collection of mobile nodes which can move freely. These nodes can be dynamically Self-Organised into arbitrary topology network without a fixed infrastructure. One of the challenging tasks for MANET is to design of routing protocol which can give a better performance by reducing routing overhead. There are two existing routing protocol for MANET's viz. Ad Hoc On-Demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR). These two protocols can improve the scalability of MANET's by limiting the routing overhead, when a new route is requested.

However, frequent link breakages occurs in the MANET's due to node mobility. These link breakages can lead to frequent path failures and route discoveries, which can be responsible for increasing the overhead in routing protocol and reduce the packet delivery ratio and increase end-to-end delay. So Hence, reducing the routing overhead in route discovery is an essential problem in MANET's.

2. ROUTER

The Router is power tool with a shaped cutter, used in carpentry for making grooves for joints, decorative mouldings etc. In Packet Switched network such as the internet, a router is a device or in some cases, software in a computer, that determines the next, network point to which a packet should be forwarded towards its destination. Router is device that forwards data packets along network. A router is connected to atleast two networks, commonly two LAN's or WAN's or CISP network.

Routers are located at Gateways , the place where two or many networks are connected. Router links computer to the internet, so users can share the connection. Router acts as a dispatecher.

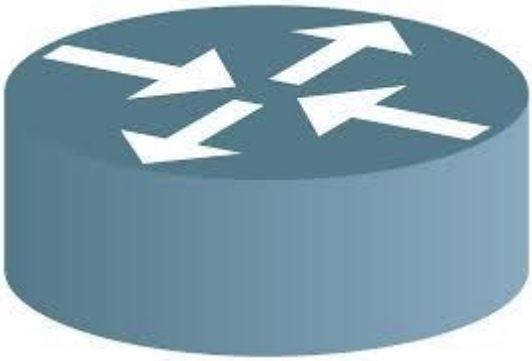

Fig 1 : Router

3. MANET

A Moblie Ad Hoc Network (MANET) is a contineuously self-configuring, Infrastructure less network of mobile devices connected wirelessely. Each device in a MANET is free to move independently in any direction and still therefore change its links to other devices frequently. MANET is generally a network having many free or autonomous nodes. MANET is type of Ad Hoc Network that can change locations and configure itself on the fly. Because MANET's are mobile, they use wireless connections to connect to various networks.

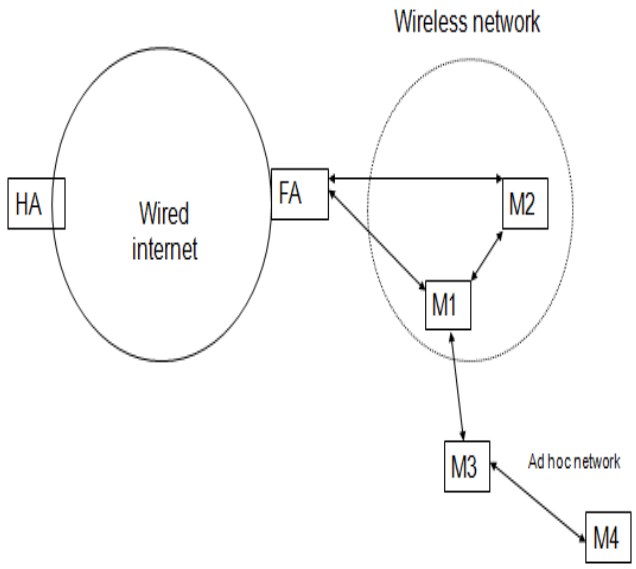

Fig 2 : MANET

4. NODE FAILURE

Individual nodes fail to operate when they loose touch with the cluster. This can occur due to various reasons. For instance, in the event of hardware failure or software crash, the loss of network connectivity or the failure of a state transfer.[4]

4.1. REASONS FOR NODE FAILURE

A compute node can fail for any of a variety of reasons. Failure is process in which a node in cluster is declared as unavailable.

Ex : Broken node hardware, A broken network, Software bugs or Inadequate software resources.

4.2. TO TEST NODE FAILURE

1. Stop the cluster service on the node :

This prevents clients from accessing cluster resources through that node.

In this event, all resources owned by this node fail over to other nodes in the server cluster.

2. Turn off the power on the node

This tests the ability of the server cluster to fail over all the resources that were owned by powered down mode.

3. On one node, unplug the network cables for all new enabled for intracluster communications.

A. ROUTING OVERHEAD

Routing is process of building maps and giving directions. MANET is formed by mobile nodes that have limited battery and CPU power, since there is expected to route (or relay) packets on behalf of other nodes. This is true irrespective to routing protocols they use in the networks.

In MANET's the network topology changes frequently and unpredictably due to arbitrary mobility of nodes. This failure leads to frequent path failures and route reconstructions, which causes an increase in the routing control overhead.

Impact Of Routing Overhead In A Real Time MANET Environment

Mobile Ad Hoc Network are highly dynamic network. Quality of Service (Q.S) routing in such network is usually, limited by the network breakage due to either node mobility or energy depletion of the mobile nodes. Another issue that effects the Q.S routing is Routing Overhead.

Routing Overhead means how many extra messages were used to achieve the acceptance rate of improvement.

B. ROUTING PROTOCOLS

Routing Protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on the computer network.

Routing Algorithm determine the specific choice of route. Each router has a priori knowledge only of network attached to it directly.

PROTOCOLS

1. Interior Gateway Protocol (IGP)
2. Exterior Gateway Protocol(EGP)
3. Distance Vector Protocol
4. Etc

1.NCPR ALGORITHM

Neighbor Coverage Based Probabilistic Rebroadcast (NCPR) protocol is a robust method for reducing routing overhead. NCPR protocol combines both neighbor coverage and probabilistic methods[1]. In order to effectively exploit the neighbor coverage knowledge, we need to novel rebroadcast delay to determine a rebroadcast order and then we can obtain a more accurate additional coverage ratio.

REBROADCAST DELAY

We proposed a scheme to calculate rebroadcast delay. The rebroadcast delay is to determine the forwarding order. The node which has more common neighbors will know this fact. Therefore this rebroadcast delay enables the information about the nodes which have transmitted the packet to more neighbors, which is the key success for the proposed scheme.

REBROADCAST PROBABILITY

Here we have proposed a scheme to calculate the rebroadcast probability. The scheme considers the information about the uncovered neighbors, connectivity metric and local node density to calculate the rebroadcast probability.

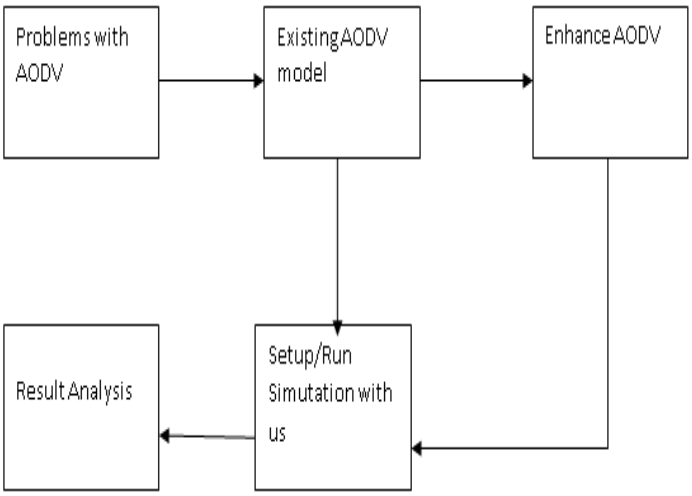

Fig 3 : Flow Diagram of Protocols

AODV routing protocol creates routes on demand. In AODV, a route is created only when requested by a network connection and information regarding this route is stored only in the routing tables of those nodes that are present in the path of the route. AODV is a reactive protocol based upon the distance vector algorithm. The algorithm uses different types of packets to discover and maintain links. Whenever a node wants to try and find a route to another node it broadcasts a RREQ to all its neighbors. In this protocol, each terminal does not need to keep a view of the whole network or a route to every other terminal. Nor does it need to periodically exchange route information with the neighbor terminals. Furthermore, only when a mobile terminal has packets to send to a destination does it need to discover and maintain a route to that destination terminal. In AODV, each terminal contains a route table for a destination. A route table stores the information such as : destination address and its sequence number, active neighbors for the route, hop count to the destination, and expiration time for the table. The expiration time is updated each time the route is used. If this route has not been used for a specified period of time, it is discarded.

ALGORITHM

PREQx : PREQ Packet received from node x.

Rs.id : The unique identifier (id) of PREQx

N(u) : Neighbor Set Of node u.

U(u,v) : Uncovered neighbors set of node u for PREQ whose id is v.

Timer (u,v) : Timer of node u for PREQ packet whose id is v.

A) Rebroadcast Delay

1: If node ni receives a new PREQ from previous node s

2: Use neighbor list table to see uncovered neighbors set and compute U(ni,Rs.id)

3: U(ni,Rs.id) = [N(ni)∩N(s)]-{s}

4: compute the rebroadcast delay Td(ni)

5: Tp(ni) = 1-|N(s)∩N(ni)|/|N(s)|

6: Td(ni) =MaxDalay × Tp(ni)

7: Set a timer(ni,Rs.id) according to Td(ni)

8: End if

B) Rebroadcast Probability

10: while ni receives a duplicate RREQj from nj before Timer(ni,Rs.id) expires do

11: {Adjust U(ni,Rs.id):}

12: U(ni,Rs.id)=(ni,Rs.id)−[U(ni,Rs.id)∩N(nj)]

13: discard(RREQj);

14: end while

15: if timer (ni,Rs.id) expires then

16: compute rebroadcast probability prc(ni)

17: Ra(ni) = |U(ni,Rs.id)|/|N(ni)|

18: Fc(ni) = Nc/|N(ni)

19: prc(ni) = Nc/|N(ni)

20: if random (0,1) <= prc(ni) then

21: broadcast (PREQ's)

22: else

23: discard (PREQ's)

24: end if

25: end if

5. CLUSTERING ALGORITHM

Mainly two cluster creation and cluster head election algorithms have been proposed for mobile Ad Hoc Network (MANET) that assume link steadiness, mobility, connectivity, cluster and weight are therefore closely related to our work.

- **Lowest Id Clustering Algorithm (LID)**

Each node is given a distinct id and it periodically broadcasts the list of its neighbors (Including itself). A node which only hears nodes ID higher than itself is a "Clusterhead" (CH). The

lowest id node that a node hears is its clusterhead, unless the lowest id specifically gives up its role as a clusterhead (Deferring to a yet lower ID node). A node which can hear two or more clusterheads is a "Gateway". Otherwise, a node is an ordinary node.

- **K-Means Algorithm(KMA)**

Clustering Based on K-means is closely related to a no of other clustering and location problems. These include the Euclidean K-Medians (Or the multisource weber problem) in which the objective is to minimize the sum of distances to the nearest center and the geometric K-center problem, the objective is to minimize the maximum distance from every point to its closest center.

CLUSTER FORMATION

The proposed work divides a network into several two hop clusters where in each cluster[3]; A node can play one of five roles : cluster head, ordinary node, secondary cluster head, undecided node or gateway.

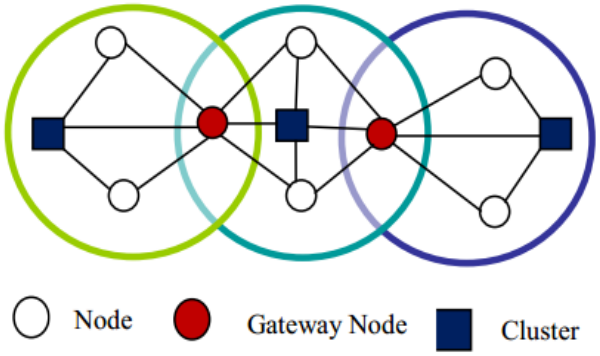

Fig 4 : Cluster Formation

NCPR-WC ALGORITHM

The proposed NCPR-WC scheme uses clustering architecture and NCPR functionalities for routing.[2] Below are some steps that consider in NCPR-WC protocol algorithm.

Step 1: Create clusters in network.

Step 2: Calculate mobility of each node in cluster.

Step 3: Elect Cluster Head in each cluster, by using mobility index (CH = lowest mobility index).

Step 4: Every cluster head has a K-hop cluster table, containing all network k-hop CHs alive. Each CH then informs neighboring CHs that it is alive by forwarding a Head Alive message.

Step 5: Source sends RREQ to all CHs in network by using NCPR protocol.

Step 6: After receiving RREQ, CHs forward RREQ to each CH in their network.

Step 7: Check node = Destination? If yes jump to 8, If not jump to 9.

Step 8: Broadcast RREQ.

Step 9: Discard RREQ.

Step 10: RREP send to source from destination.

6. CONCLUSION

In this paper we discussed a probabilistic rebroadcast for reducing Routing Overhead in Mobile Ad Hoc Network (MANET's). This neighbor coverage Knowledge includes additional coverage ratio and connectivity factor. Because of less redundant rebroadcast, the proposed protocol mitigates the network collision and contension, so as to increase the packet delivery ratio and decrease end-to-end average delay and hence by reducing the routing overhead, Quality of Service (Q.S) routing in MANET's maintained.

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