A Novel Rebroadcasting method for reducing routing using area based Probabilistic model

M.Chitti
Mtech Student
Department of CSE
Gudlavalleru Engineering College

D.Ragavamsi
Assistant Professor
Department of CSE
Gudlavalleru Engineering College

Abstract:
MANET is a network consisting of a group of portable devices which communicates with each other without any dedicated infrastructure. Mobile nodes move in the network freely therefore there is no any fixed topology. Broadcasting mechanism is used for route discovery, where each node sends a received route request packet to other nodes in the network until it finds a path to the destination. Broadcasting causes many problems such as redundant retransmissions, collisions and contentions. To avoid these problems, a probabilistic rebroadcast protocol based on the coverage area method was proposed. Based on the coverage area and neighbor information a Rebroadcast delay and then a rebroadcast probability are calculated. Even though these mentioned protocols improve the scalability and reduce the routing overhead to an extent they are all on demand and cause broadcast collision problems. This paper explores routing protocols, and efficient transmission solutions in Mobile Ad hoc Networks (MANETS).In this proposed approach an optimized model for efficient data transmission was implemented. Experimental results show that proposed model performs well against a large number of data packets within the time and decrease the number of retransmissions so as to reduce the routing overhead, and also improve the routing performance.

Keywords - *Adhoc network, Retrasnmission,Broadcast, Probabilistic model.*

1.**INTRODUCTION**

AODV is an adhoc on demand reactive routing protocol which discovers the route to the destination only when a transmitter node requests for it.Also it finds the route with the help of routing table maintained in each node.It is one of the traditional routing protocols mainly for adhoc networks like VANETs and MANETs.DSR is also an adhoc reactive protocol but it varies from AODV in the sense that it is source routing.On-demand routing protocols have the potential to achieve high levels of scalability in mobile ad hoc networks.However, before these protocols can be realized two major issues need to be resolved. These are high levels of control overhead due to route request packets and also additional delay. There is a chance of broadcast storm problem also[8],[13].Several approaches have been proposed to reduce the routing overheads of on-demand routing protocols such asstable routing, multi-path routing, load balance routing, and routing based on previous knowledge[3]. There are many existing works related to the categorization of routing protocols.There are works related to route discovery in the absence of previous route information[9].Several techniques are used to reduce the overhead of HELLO packets to discover or gather the neighbor information[7],[5].

Mobile ad hoc networks (MANETs) consist of a collection of mobile nodes which can move freely. These nodes can be dynamically self-organized into arbitrary topology networks without a fixed infrastructure. One of the fundamental challenges of MANETs is the design of dynamic routing protocols with good performance and less overhead. Many routing protocols, such as Ad hoc On-demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR), have been proposed for MANETs. The above two protocols are on-demand routing protocols, and they could improve the scalability of MANETs by limiting the routing overhead when a new route is requested. However, due to node mobility in MANETs, frequent link breakages may lead to frequent path failures and route discoveries, which could increase the overhead of routing protocols and reduce the packet delivery ratio and increasing the end-to-end delay. Thus, reducing the routing overhead in route discovery is an essential problem.The conventional on-demand routing protocols use flooding to discover a route. They broadcast a Route Request (RREQ) packet to the networks, and the broadcasting induces excessive redundant retransmissions of REQ packet and causes the broadcast storm problem, which leads to a considerable number of packet collisions, especially in dense networks. Therefore, it is indispensable to optimize this broadcasting mechanism.

Broadcasting is an effective mechanism for route discovery, but the routing overhead associated with the broadcasting can be quite large, especially in high dynamic networks. The broadcasting incurs large routing overhead and causes many problems such as redundant retransmissions, contentions, and collisions. Thus, optimizing the broadcasting in route discovery is an effective solution to improve the routing performance. Existing approaches only considers the coverage ratio by the previous node, and it does not consider the neighbors receiving the duplicate RREQ packet, which will degrades routing performance as well increased routing overhead will alleviate network traffic.

II. Related Work

The activities performed in a network can be tracked using a log which will be useful at later point of time Since the protocol is purely neighbor Coverage based,neighbor information collection is significant steps involved in the algorithm.Each RREQ packet contains the Uncovered Neighbor List (UCN) and based on the UCN,each node decides to discard or rebroadcast the packet there by reducing the flooding of the packets.The scheme considers the information about the uncovered neighbors (UCN),connectivity metric and local node density to calculate the rebroadcast probability.The rebroadcast probability is based on the rebroadcast delay calculated .Based on the delay a timer is set in such a way that a node receives all the duplicate RREQ packets from its neighbor nodes. Implementation of Neighbor Coverage Probabilistic Routing Protocol takes into consideration the security concern also.During the process the protocol also checks for the presence of malicious nodes.Detection of the blackholes in AODV I existing in Mobile adhoc networks. But because of the Overhead, the need for black hole detection in NCPR is risen. Once the protocol is implemented,it can be evaluated with the traditional routing protocols. Once the network is set up for the simulation, the next step is configuring the mobile nodes which are the key components of an adhoc network. Configuring a node indicates assigning each node its name,IP address,port number, and its location.For further process to calculate or for identification these nodes can be stored into a database.While an RREQ packet is send from the source to discover a route,the actions can be tracked in a log.The RREQ packets,RREP packets are of constant sending rate to avoid collisions.The configuration should be done such that the neighbor information is highly significant in this implementation.Each node should know its neighbors. This can be obtained using periodic HELLO packets.But there is a great overhead in periodic HELLOpackets.Other techniques like sending the acknowledgment, in response to the RREQ packets,or considering the range of each node etc. can be used to identify its neighbors. Each node checks the incoming RREQ packetsto determine the UCN list and then calculate the rebroadcast delay. The main contributions of the base paper are as follows: A novel scheme to calculate the rebroadcast delay. The rebroadcast delay is to determine the forwarding order. The node which has more common neighbors with the previous node has the lower delay. If this node rebroadcasts a packet, then more common neighbors will know this fact. Therefore, this rebroadcast delay enables the information that the nodes have transmitted the packet spread to more neighbors, which is the key to success for the proposed scheme.

Traditionalnovel scheme to calculate the rebroadcast probability. The scheme considers the information about the uncovered neighbors (UCN), connectivity metric and local node density to calculate the rebroadcast probability.

The rebroadcast probability is composed of two parts:

- additional coverage ratio, which is the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors; and
- connectivity factor, which reflects the relationship of network connectivity and the number of neighbors of a given node.

Traditional Algorithms Used:

- Uncovered Neighbors Set and Rebroadcast Delay
- Neighbor Coverage-based Probabilistic Rebroadcast or reducing routing overhead

Drawbacks: Number of broadcasting process is very high. Redundant retransmissions problem, contentions, and collisions. energy loss is high.

In the existing system, the conventional on-demand routing protocols use flooding to discover a route. They broadcast a Route REQuest (RREQ) packet to the networks, and the broad-casting induces excessive redundant retransmissions of RREQ packet and causes the broadcast storm problem, which leads to a considerable number of packet collisions, especially in dense networks. Therefore, it is indispensable to optimize this broadcasting mechanism. Some methods have been proposed to optimize the broadcast problem in MANETs in the past few years. Williams and Camp categorized broadcasting protocols into four classes: "simple flooding, probability-based methods, area-based methods, and neighbor knowledge methods." For the above four classes of broadcasting protocols, they showed that an increase in the number of nodes in a static network will degrade the performance of the probability based and area-based methods. Kim indicated that the performance of neighbor knowledge, methods is better than that of area-based ones, and the performance of area-based methods is better than that of probability-based one.

Disadvantages in the existing system are:

- May overloaded in a common neighbor dense network leads to frequent link breakages and path failures occurs.
- Packet delivery does not take place in time, so reduce in packet delivery.
- Increase in end-to-end delay transmissions. The broadcast storm problem occurs due to number of packet collisions in dense networks.

NCPR

Neighbor coverage based probabilistic rebroadcast protocol is combination of both neighbor coverage and probabilistic method. In the neighbor coverage knowledge, we need a rebroadcast delay to determine the rebroadcast order, and then we can obtain a more accurate additional coverage ratio [1]. This is calculated the rebroadcast delay and rebroadcast probability with the help of coverage ratio and connectivity factor:

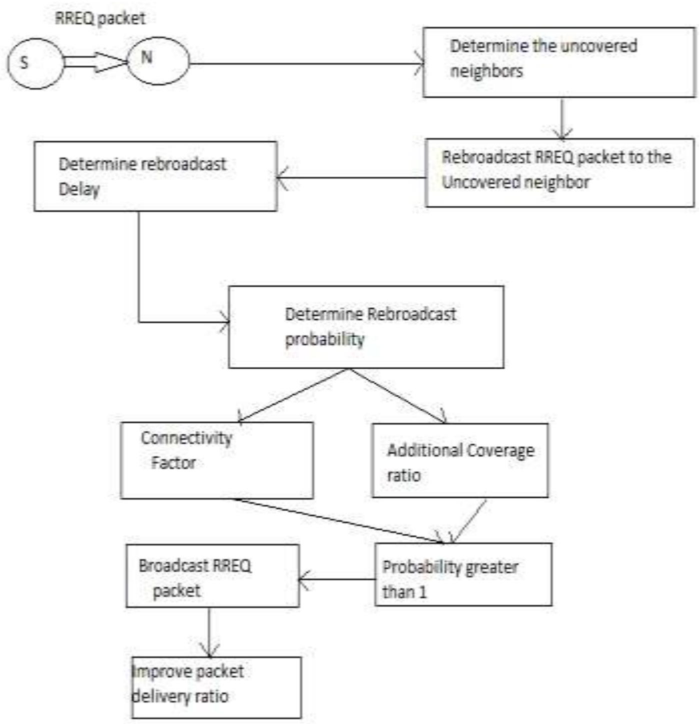

Fig 1: System Architecture of NCPR

Rebroadcast Delay The rebroadcast delay is to determine the forwarding order. The node which has more common neighbors with the previous node has the lower delay. If this node rebroadcasts a packet, then more common neighbors. **Rebroadcast Probability** The information about the uncovered neighbors of connectivity metric and local node density is to calculate the rebroadcast probability. The rebroadcast probability is composed of two parts: a) Additional coverage ratio, which is the ratio of the number of nodes that should be covered by a single broadcast to the total number of neighbors b) Connectivity factor, which reflects the relationship of network connectivity and the number of neighbors of a given node.

III.PROPOSED APPROACH

Motivation of the protocol comes from the need to optimize broadcasting. In this section we combine the advantages of two mechanisms:

a) neighbour coverage knowledge

b) Probabilistic mechanism

The main objectives of this proposed protocol are:

1) To reduce the routing overhead caused by the hello packets

2) To reduce the overhead of rebroadcasting

The protocol is divided into following sections:

1) To calculate uncovered neighbor set and delay in rebroadcasting the packet.

2) Calculate precisely the neighbor knowledge and rebroadcast probability.

Advantages No of broadcasting is low. Path failure is very low Remove redundant retransmissions problem, contentions, and collisions. Remove duplicates packets Increase node energy level Improve the data transmission routing performance.

- Increase in packet delivery ratio.
- Decrease in the average end -to -end delay transmissions.
- Reduce in Frequent link breakages and path failures leads to good routing performance when the network is in high density.
- Routing and mobility management should be maintained.

Proposed Algorithm:

$Rreq_p$: packet request

Src_{nc} :nearest neighbor set of the node .

N_{id} :unique identification of $Rreq_p$

Procedure:

If a node n_i receives a request from the node n_j then

Step 1: In the inter and intra network communication, one or more nodes try to request the packet to the cluster head node(source node) for rebroadcasting. This may cause due to network overhead, routing error and network attack.

Compute the initial nearest covered set for $Rreq_p$

Compute the nearest cover set from the cluster head to the requested node which are common nodes or non-common nodes . We will get non common nodes in case of inter networking.

$$destlist := getIds(1,(1...n));$$

Store all the common and non common nods ids in the list

For each pair of destlist id do

For each pair of ids ,that is, requested node and the cluster head node(source node)

Let A=First id;

A will consider the source id information

B=Secondid;

B will hold the broadcast message to the requested node information.This node is consider from the common list or non common list.

A sends a broadcasting information along with message and node B decides to rebroadcast the message to other nodes.

In case of intersected common nodes the following case will follows

$S_{A\cap B}(\mathrm{A}) :=$ area of the intersection region.

$$S_{A\cap B}(\mathrm{A}) := 4 * \int_{A/2}^{r} \sqrt{r^2 - p^2}$$

$$S_{A\cap B}(\mathrm{A}) := 4 * \int_{A/2}^{r} \sqrt{r^2 - A^2/4 - 2*\mathrm{r}^2} * \sin^{-1} A/2r$$

In case of non common region:

$$S_{A\cap B}(\mathrm{A}) := 4 * \int_{A/2}^{r} \sqrt{(r/2)^2 - A^2/4 - 2*(\mathrm{r}/2)^2} * \sin^{-1} A/r$$

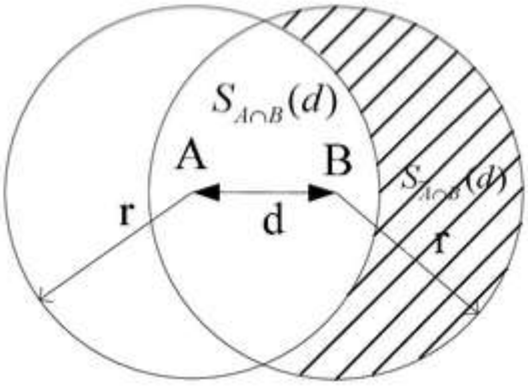

Fig 2: Area Overalapping Constraint

In case of non intersected regions such as: Source node broadcast the packet to the common nodes within the bounded region as shown , them three nodes will compute the distance and highest probability rate for data transmission. The node which has highest probability rate and the distance is choosen to broadcast the message to the destination node.

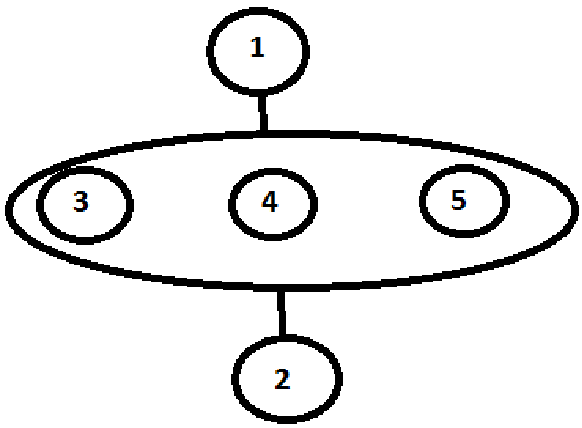

Fig 3: General Neighborhood Relationship

If packet is received within the area then
already computed node with highest probability
Resend the packet
Else
Compute the probability for common and non common
nodes
Find the probability to resend the packet
Compute
d= $\max(0, r-(r-transrate)/S_{A\cap B}(\mathrm{A})$;
Prob:= $(e-e^{(1-S_{A\cap B}(\mathrm{A})/\mathrm{e}-1})\,/\,prob(A)$;
If the message is duplicate them
Update distance dis
Compute new probability as (1-prob);
End if
End if
exit

Algorithm Description

In this proposed approach, each node communicates with other nodes in the network. During the communication, if any node fails to receive the message from the source node then it sends request packet to the source node for retransmission. Source node finds the common nodes to the retransmission node. For each common node, it finds the nearest area of the source node to the retransmission node. After finding the area of the common nodes, it calculates the probability of to each common node for quick retransmission. Finally, the common node which has highest probability it will be selected to retransmit packet to the requested node.

Performance Analysis

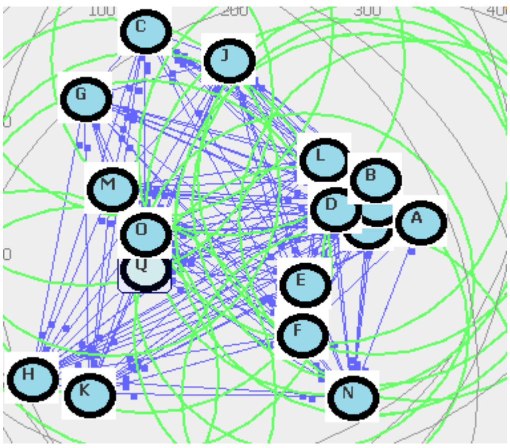

Fig 4 :Adhoc communication mechanism

Rebroadcasting Area 34.89004
ReBroadcasting Probability 0.98160
Number of CBR Connections :16
10:44:14 Q326 : NODE INFO : P received
MAC collision Rate :0.18035
Normalized Routing Overhead :0.74405
Packet Delivery Ratio 0.90903
Avg Time Delay (%) :51.27672
Rebroadcasting Area 30.01857
ReBroadcasting Probability 0.94199

Numberofnodes	BroadCastingArea	CollisionRate
50	14.6	0.045
60	17.36	0.0561
70	19.36	0.059
80	26.46	0.017
100	35.65	0.092

Table 1: Number of nodes with collision rate

In this experiment, different number of nodes are tested and then broad casting area ,collision rates are tested.

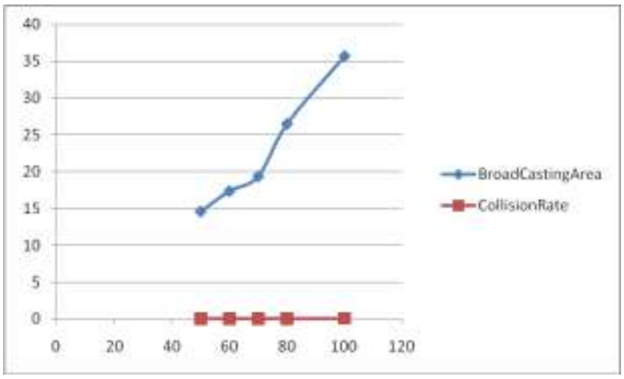

Fig 5: Graph showing broad casting area and collision rate

Numberofnodes	PDR	Probability
50	0.98	0.96
60	0.97	0.98
70	0.984	0.978
80	0.96	0.982
100	0.99	0.995

Table 2: number of nodes along with packet delivery ratio and probability computations.

In this experiment, different number of nodes are tested and then packet delivery ratio, probability values are tested.

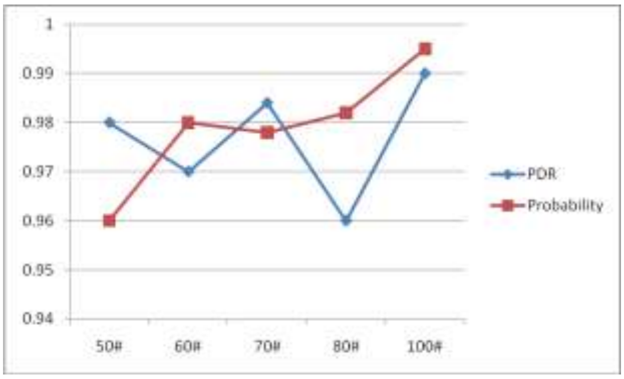

Fig 6:Graph representing the PDR and Probability values

Number of Connections	Collision Rate	NRO	PDR	AvgTime Delay	Rebroadcasting Area
20	0.013	0.73	0.92	45	10.45
40	0.079	0.79	0.958	56.36	32.44
60	0.024	0.81	0.963	59.34	23.55
80	0.13	0.763	0.983	49.56	35.44

Table 3: Overall experimental performance metrics

Conclusion

The current proposed method deals with a secure routing protocol to reduce the broadcast storm problem and the routing overhead in the ad-hoc networks. To avoid these problems a probabilistic rebroadcast protocol based on the coverage area method was proposed. Based on coverage area and neighbor information, a Rebroadcast delay and then a rebroadcast probability are calculated. Mobile nodes in this dynamic network can move freely without fixed topology. Broadcasting mechanism is used for route discovery, where each node sends a received route request packet to other nodes in the network until it finds a path to the destination. Broadcasting causes many problems such as redundant retransmissions, collisions and contentions. Due to the redundant rebroadcast, the proposed protocol mitigates the network collision and contention, so as to increase the packet delivery ratio and decrease the average end-to-end delay .The simulation results also show that the proposed protocol has good performance when the network is in the traffic in heavy load. Experimental results show that proposed model performs well against a large number of data packets within the time.

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