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A Neighbor Coverage-Based Probabilistic Rebroadcast for Reducing Routing Overhead in Mobile Ad Hoc Networks Using Cluster Scheme

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***Abstract*—** Due to high mobility of nodes in mobile ad hoc networks (MANETs), there exist frequent link breakages which lead to frequent path failures and route discoveries. The overhead of a route discovery cannot be neglected. In a route discovery, broadcasting is a fundamental and effective data dissemination mechanism, where a mobile node blindly rebroadcasts the first received route request packets unless it has a route to the destination, and thus it causes the broadcast storm problem. In this paper, we propose a neighbor coverage-based probabilistic rebroadcast protocol for reducing routing overhead in MANETs. In order to effectively exploit the neighbor coverage knowledge, we propose a novel rebroadcast delay to determine the rebroadcast order, and then we can obtain the more accurate additional coverage ratio by sensing neighbor coverage knowledge. We also define a connectivity factor to provide the node density adaptation. By combining the additional coverage ratio and connectivity factor, we set a reasonable rebroadcast probability. Our approach combines the advantages of the neighbor coverage knowledge and the probabilistic mechanism, which can significantly decrease the number of retransmissions so as to reduce the routing overhead, and can also improve the routing performance.

Keywords—*MANET, Cluster, Routing Mechanism, Neighbor knowledge, Clustering Algorithm*

I. INTRODUCTION

The fundamental rule behind ad hoc network is multi-hop, in which messages are sent from the source to the destination of the nodes in the network. The communication between two ends of nodes can be done using intermediate nodes. The information can be transferred from intermediate nodes from source to the destination. The MANET is increasing which improve the performance like reduce overhead when network size is increase. Also used in mobility, limited energy and computational capacity of nodes. The clustering algorithm improves the performance in scalability, bandwidth usage and maintains stability and robustness of network.

In MANET there are different routing protocols such as reactive, proactive, hybrid. All the reactive protocols such as AODV, DSR, etc. used to establish route between source and destination [1]. Source node keeps on sending packets to the destination from all the nodes in the network until route establish between source and destination. In MANET every node acts as router which transfers information to other nodes.

- ***Characteristics:***
  1. Dynamic Topology
  2. No Centralized Controller
  3. Power Limitation
  4. Infrastructure less
  5. Power Limitation
- ***Application of Manets:***
  1. Used in Military applications
  2. Used in Collaborative and Distributed Computing
  3. Used in Emergency Operations
- ***Issues in Manets:***
  1. Issue in Distributed operation
  2. Issue in Hidden terminals
  3. Issue in Access deferral

Due to Mobility of node in MANETs, link breakages may occur which lead to path failure and route discoveries, which increase routing overhead and decrease also increase end-to-end delay [4]. Routing overhead reduce in route discovery is an essential problem in MANET. The Conventional routing protocols uses flooding method for route discovery. In this method they broadcast RREQ packet to network, but broadcasting technique induces retransmission of RREQ packet and causes

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the broadcast storm problem. The broadcast problem leads to packet collision in network [5].

II. RELATED WORK

Xin et al. [1], proposed NCPR protocol used to keep network connectivity and reduce retransmission, but disadvantage is that, node receive same RREQ packet again and again.

J. Kim et al. [2], proposed coverage area and neighbour confirmation with dynamic probabilistic broadcasting approach. With the coverage area concept we adjusted the rebroadcast probability.

H. Alaamri et al. [3], proposed new routing algorithm i.e. on-demand tree-based routing protocol, used to improve scalability of ad-hoc networks by using tree-based optimized flooding algorithm. This algorithm contains hop-by-hop routing mechanism. There is no previous knowledge about destination.

Ni et al. [4], proposed broadcasting scheme for finding the best route between source and destination. When link breakages occur in Manet broadcasting technique is re-applied. In broadcasting problem no. of times results in contention and collision.

Williams et al. [7], divides the broadcasting protocols into four types: simple flooding, probability based methods, area based method and neighbor knowledge method.

III. EXISTING SYSTEM

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.

Disadvantages of Existing System:

The existing broadcasting protocol tested analytically and experimentally, and showed that the rebroadcast is very costly and consumes too much network resource. The broadcasting incurs large routing overhead and causes many problems such as redundant retransmissions, contentions, and collisions.

IV. PROBLEM STATEMENT

There are some fundamental challenges to design mobility and protocol stacks for mobile ad-hoc network. These challenges are generated due to movement of nodes, frequent topology changes. Due to dynamic topology and distributed nature, information over network changes and increase control overhead. Due to increasing control overhead less packet delivery ratio and increase delay in network. This could result in "Broadcast-Storm Problem" and congestion is generated.

V. PROPOSED SYSTEM

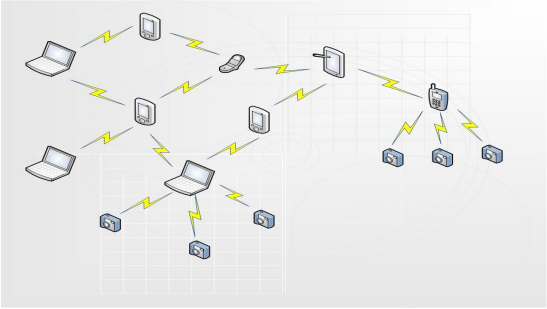

Fig. 1: System Architecture

In our proposed system we remove the drawbacks of previous algorithm, generating the new algorithm for listed above problem.

A. Effective Clustering Algorithm:

In MANET nodes are keeping moving and communicate with each other in wireless link. In clustering scheme the network is divided into chunk of nodes known as Clusters where one node in each cluster act as a Cluster head which is used for Routing.

Mainly we used creation of cluster and election of cluster head algorithm. The Cluster creation algorithm we check that node is in the communication range or not. If present in range then node will be added otherwise not added. For each node less distance is efficient.

The cluster information is maintained by each node. The cluster information is very important. This information keeps track of the all necessary

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information for clustering algorithm. When updating the information, a node can determine its own status by exchanging cluster information with its neighboring nodes. The cluster information is used for cluster maintenance and routing. Each node maintains neighbor tables that contain Unidirectional and Bidirectional neighbor table. The information stored in neighboring table.

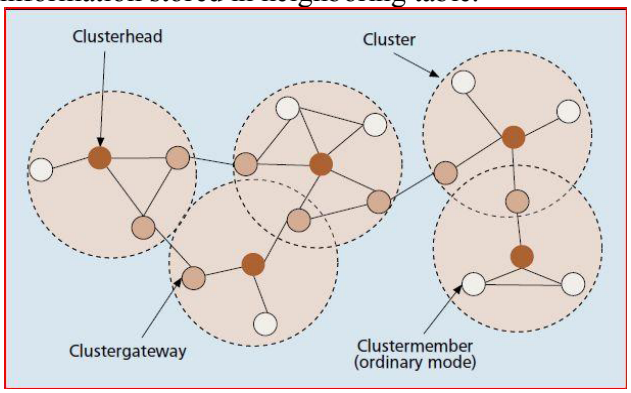

Fig. 2: Cluster Structure

Custer Formation:

In this method, every node in the network broadcast a hello packet which contains no. of neighbors, energy, hierarchical level & cluster head id. Initially id of cluster head, hierarchical level and no. of neighbors of nodes are blank.

a) Cluster Head:

The cluster is coordinator of the cluster. The cluster head forward the packets. Resource management function performed by cluster head for its members & for intra-inter communication. It acts as a base station in the structure. The cluster head shows in above figure with dark filled circle.

b) Gateway Node:

It is non-cluster head node. Gateway node contain inter cluster links. It can access neighboring clusters. It exchange the cluster related information. It acts as an access point between two clusters.

There are two types of gateway nodes:

1) Ordinary gateway node which lies within the transmission range of two cluster heads. The cluster head use hops that away from its neighbor and transmits them between the nodes.
2) Distributed gateway node uses the hops that away from its neighbor and both clusters can communicate with each other.

c) Ordinary node:

These nodes are members of cluster. It takes part in topology. It can be act as cluster head or gateway node when requirement is there.

B. Modified Cluster Head Selection Algorithm:

The proposed algorithm uses architecture of cluster for routing functionalities. Below are steps that consider in our proposed algorithm.

When node receives RREQ request then it does following steps:

1. Create cluster in the network
2. Calculate the each node in the cluster
3. Elect the Cluster Head(CH) in each cluster which contain maximum no. of neighbors
4. Each Cluster Head(CH) keep nodes information & its neighbors to forward the packet to neighboring CH
5. Source node sends RREQ request to all CH that are located in the cluster
6. After receiving RREQ then CH forward RREQ to each CH in the network
7. Check destination node in the network
   a. If yes jump to step 8
   b. If not jump to step 9
8. Broadcast RREQ
9. Discard RREQ
10. RREP send to the source from destination

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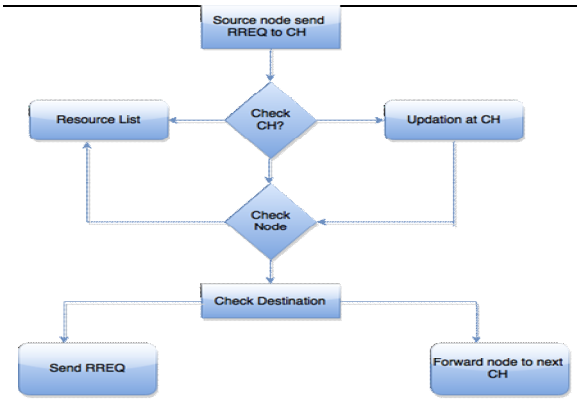

Fig 3: Cluster Head Selection

- ***ROUTING MECHANISM:***

The Routing Mechanism consists of three parts:

i. Intra Cluster Routing
ii. Inter Cluster Routing
iii. Route Maintenance

1. Intra Cluster Routing:

In this method cluster head checks whether the destination node is present within cluster or not. If present then it sends RREP reply packet with ID which present in the packet. Now, node forwards the all data packet or information to the destination.

2. Inter Cluster Routing:

In this method cluster head checks whether the destination node is present within the cluster or not. If present then send packet to the destination. If node is not present within the cluster head range then it finds the destination location and sends RREQ packet to the gateway node, find the direction to the destination.

3. Route Maintenance:

The failure of link event can be occur when forwarding the data packets from source to destination. It initiates the route recovery mechanism to find the destination.

VI. EXPERIMENTAL RESULTS PERFORMANCE EVALUATION:

The Eclipse tool is used to evaluate the performance. The java platform is used to evaluate the performance parameters. When we started the tool we taking the 40 nodes were placed randomly in the clustered oval. In each oval contain the Cluster Head (CH), Gateway Node and Normal node. The clustering algorithms are used. The routing mechanism also used to reduce the overhead i.e. we used intra- cluster and inter cluster routing.

A. Analysis of cluster performance:

1) Number of clusters: The less number of cluster form by using cluster algorithm, the lower overhead contain.

2) Number of role changes: The cluster can contain min. no. of role changes which provides better stability and lower maintenance.

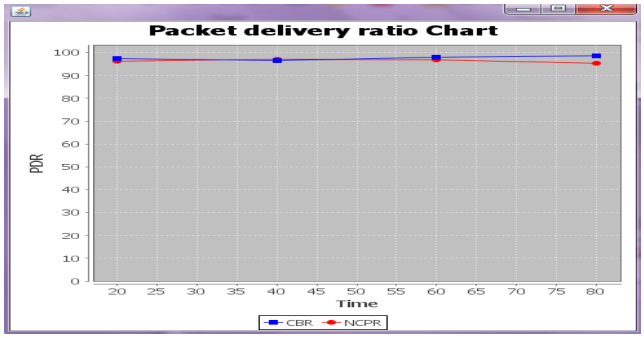

Fig 4: Packet Delivery Ratio

Packet delivery ratio: It is the ratio of data packet deliver to the destination from the source.

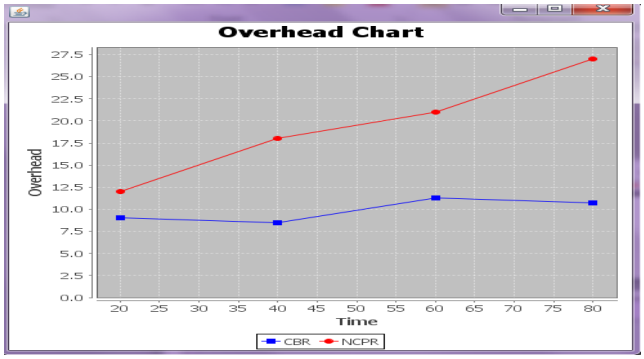

Fig 5: Control Overhead

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Control overhead: This provides the scalability to the network. It also indicates no. of data successfully receive by destination nodes.

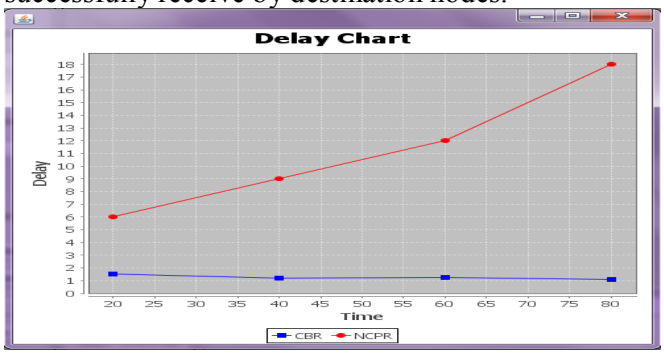

Fig 6: End-to-End Delay

End-to-End delay: The average time it takes data packet reach to the destination.

Throughput: It indicates no. of data received successfully by the all destination.

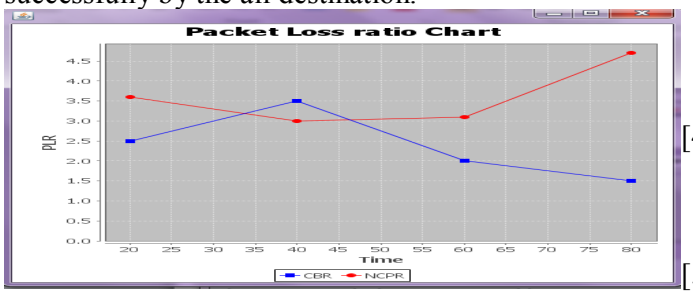

Fig 7: Packet Loss Ratio

Packet Loss Ratio: It is calculated by difference between no. of data packet sent by source and no. of data packet received by destination.

VII. CONCLUSION

Reducing routing overhead is very challenging task in MANET. In MANETs, when network's size exceeds a certain threshold decreases the performance, resulting in many routing algorithms performing only when network's size is small. To overcome reduce routing overhead, and increase in End-to-End delay it is mandatory to make network organization smaller and manageable. The scheme is used for integrated routing and message delivery in clustered networks. The proposed clustering architecture was evaluated using experiments. The proposed technique shows that the algorithm builds stable clusters with low communication overhead due to its localized, distributed and reactive nature. Which will not only reduces the routing overhead, it will also decrease End-to-End delay and increase Packet Delivery ratio with improving efficiency.

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