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# Performance Evaluation in MANET by Using NCPR Scheme with Cluster Technique

**Rajesh S. Paranjape, S. S. Barde**

[1]*Department of Computer Engineering, SKNCOE, Pune, India*
[2]*Department of Computer Engineering, SKNCOE, Pune, India*

## ABSTRACT

MANET is the one of the type of special wireless network. In MANET there is no static topology due to high mobility of nodes, there exists frequent link breakages which leads to path failure and route discovery. Due to link breakage problem arises in data transmission that raise issue of routing overhead. This will also decrease Throughput and Packet Delivery Ratio.

It provides the necessary network functionality in the absence of fixed infrastructure. To overcome this problem in this paper propose a solution to reduce routing overhead and communication overhead and improving routing performance by using Clustering Technique. The NCPR protocol used to find Uncovered Nodes in the network. The problem in NCPR is nodes get same RREQ packet again and again. We propose solution, provide Cluster Technique which builds a stable cluster in NCPR to reduce routing overhead and improve routing performance. The Cluster having Distributed and Reactive nature we can improve efficiency of routing, packet delivery ratio and throughput. This will also reduce End-to-End delay in network.

**Keywords:** MANET, Cluster, Routing mechanism, Neighbor knowledge, clustering algorithm

## 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

***Address for correspondence:***
paranjapers@gmail.com

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

## 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 neighbour knowledge method.

## PROBLEM STATEMENT AND PROPOSED SYSTEM

### 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.

In this propose work we focus on following goals:

- Reducing Routing Overhead
- Increase Packet Delivery Ratio
- Network Lifetime
- Increasing Throughput
- Decrease End-to- End Delay

## Proposed System

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

### *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 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.

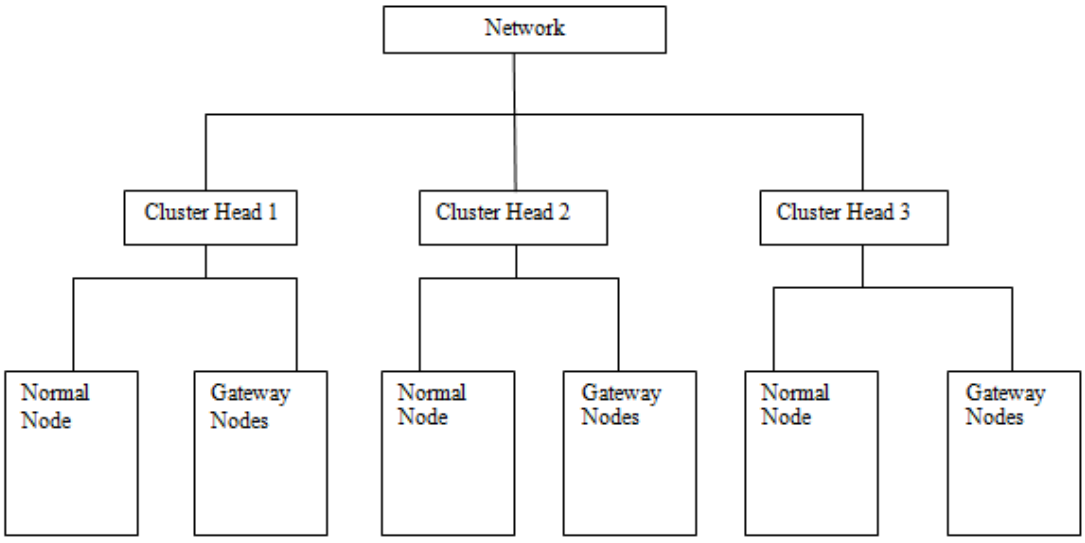


**Fig1.** *Structure of Nodes*

### *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.

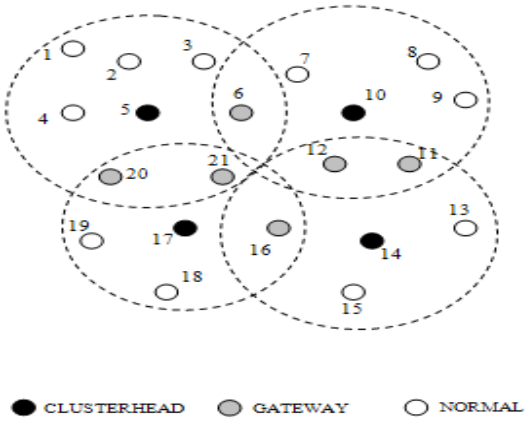


**Fig2.** *Cluster Formation*

**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.

***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

   If yes jump to step 8

   If not jump to step 9

8. Broadcast RREQ

9. Discard RREQ

10. RREP send to the source from destination

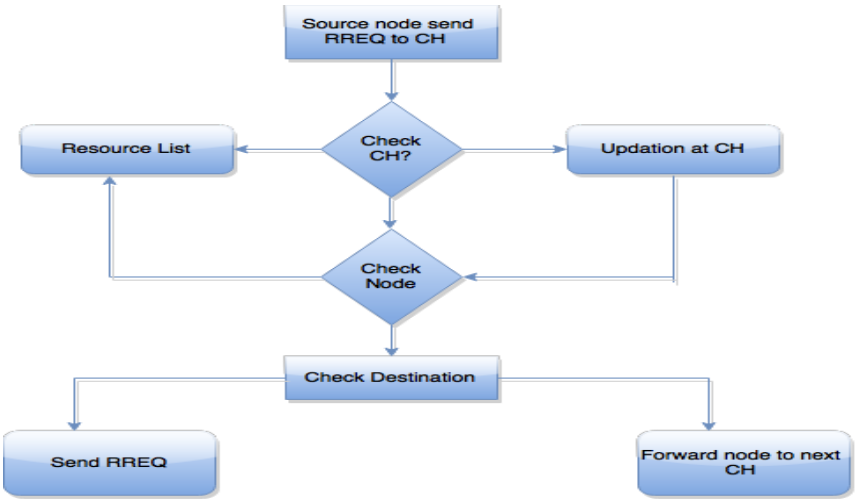


**Fig3.** *Cluster Head Selection*

## MATHEMATICAL MODULE

In the proposed system we develop some formulae for performance evaluation. The mobile ad-hoc can be modelled as graph i.e. G= (V, L) where V is set of all nodes and L be the links that exists between the nodes. We assume that links that exists between nodes is bidirectional $L_{ij}$ between the nodes i and j and distance between the nodes $dist_{ij} \leq t_{range}$.

| Node ID | Degree | Hop Count | E cons | CH | Gateway Address |
|---|---|---|---|---|---|

- Distance Calculated for each node

  Distance = $\frac{\sum \text{Dist}}{D_i}$

  $\sum$ Dist = sum of distance between the nodes & all its neighbors

  $D_i$ = Degree of connecting node

  $E\ cons$ = Energy consume by each node

  CH = Cluster head for corresponding node

- Compute the Transmission Power that utilized by each node

  $P_{avg} = \frac{\sum \text{Dist}}{D_i}$

  $P_{avg}$ = Avg. transmission power utilized by node

∑ Dist = sum of distance between the nodes & all its neighbors

$D_i$ = Degree of connecting node

- Calculate the weight of the node

W = α * $E\ cons$ + β * E $P_{avg}$

α, β are the weight factor

E$P_{avg}$ = Energy Consumed by avg. transmission power utilized by node

W = weight of the node

$E\ cons$ = Energy consume by each node

## ROUTING MECHANISM

The Routing Mechanism consists of three parts:

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

### 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.

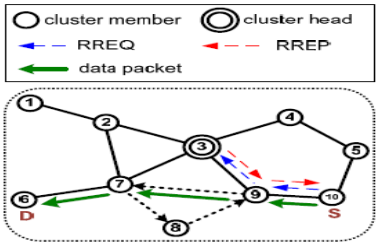


**Fig5.** *Intra Cluster Routing*

### 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.

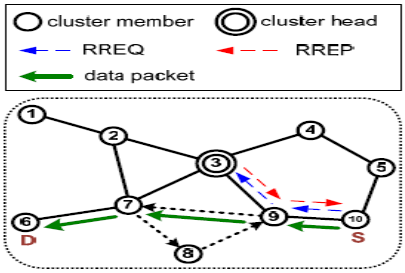


**Fig6.** *Inter Cluster Routing*

### 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.

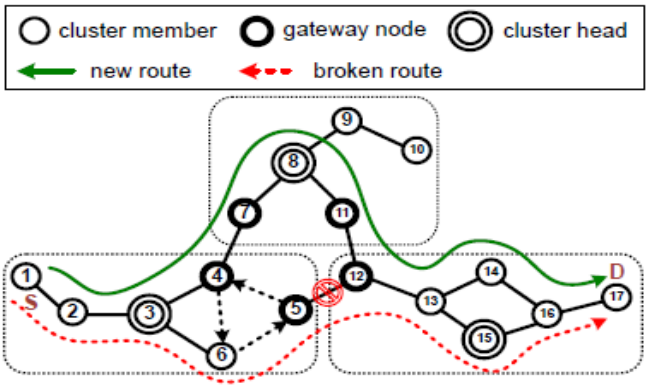


**Fig7.** *Route Maintenance*

❖ **Proposed Cluster Gateway Routing:**

- Route Maintenance:

  Every node in its routing table gets new entry using cluster code. Every node include

  Destination metric, CH1, CH2, Seq. no…

  If node gets any fresh route, then update in routing table.

- When node gets route entry in table for its required node then it will send packet.
- If node receive RREQ then

  Hop _ count = Hop _ count + 1

  If it has entry for destination then it sends RREP reply to source & exit.

- Else

  Select other gateway connect its cluster with other cluster

  Forward RREQ to all another gateway connect with it

  Set tmp _ src addr = own addr

  Tmp _ dest addr = gateway addr

  Forward RREQ to Tmp _ dest addr using routing table

  If no other gateway connects then do nothing

## 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.

### *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.

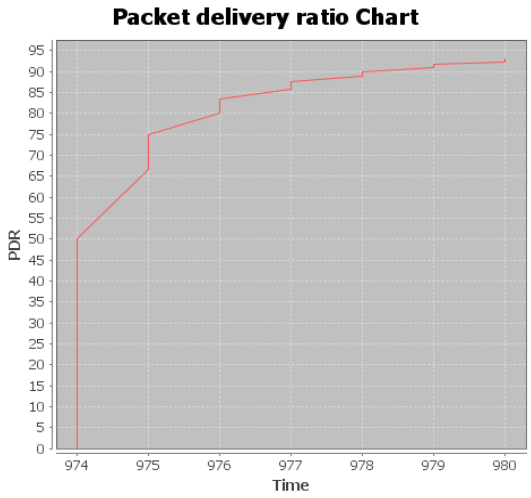


**Fig1.** *Packet Delivery Ratio*

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

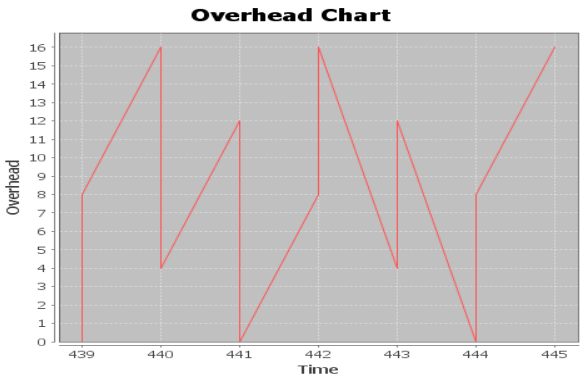


**Fig2.** Control Overhead

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

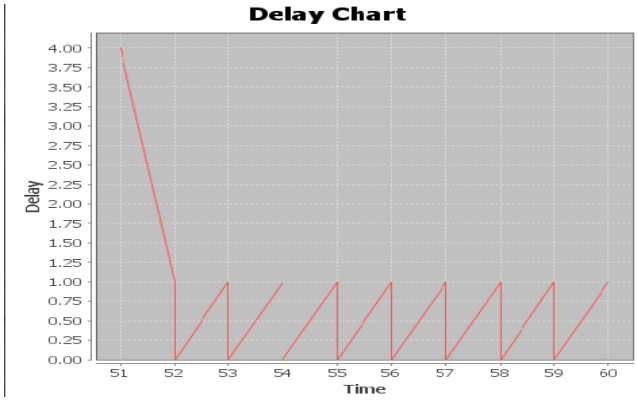


**Fig3.** *Delay*

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

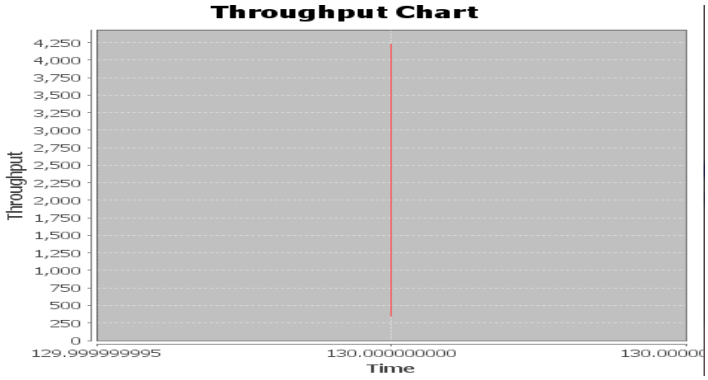


**Fig4.** *Throughput*

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

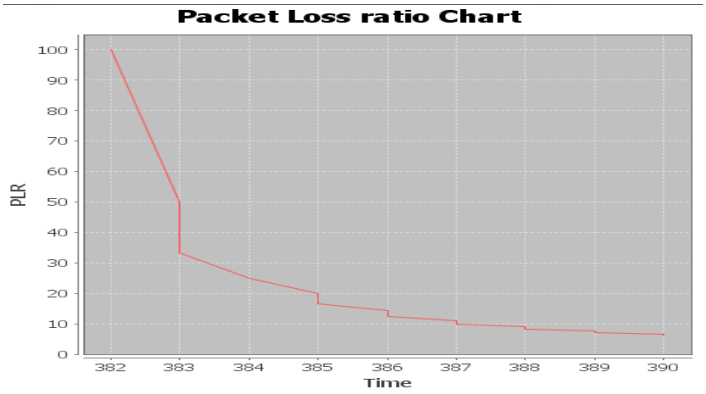


**Fig5.** *Packet Loss Ratio*

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

## 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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## AUTHORS' BIOGRAPHY

**Rajesh Paranjape** received Bachelor degree in Computer Technology from the SRTMU, Nanded, Maharashtra, India in 2013. He is pursuing Master degree in Computer Network from the Savitribai Phule Pune University, Pune, Maharashtra, India.

**Prof. S. S. Barde** received Master degree in Computer Engineering. He is Assistant Professor in Computer Engineering Department, SKNCOE, Pune, Maharashtra, India.