# Design of A Competent Broadcast Algorithm for Reliable Transmission in CEAACK MANETs

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**Abstract –A MANET (Mobile Ad hoc Network) is an ad hoc network which is capable of data transmission between mobile nodes. Due to the evolution of technology MANET faces several challenges in terms of reliability, battery power and bandwidth. MANETs generally suffer from link breakages. Though it has no fixed infrastructure to boast of, it still faces the usual challenge of any other fixed infrastructure network. Route discovery is one of the major challenges faced in a MANET since almost all the nodes are mobile in nature. Broadcasting is an important activity in MANETs, as it involves dissemination of route information to all nodes concerned. Broadcasting can easily transfer into high flooding and congestion if the forwarding nodes are not properly identified. In this paper we have tried to propose a new cluster based broadcast algorithm that tries to take advantage of the additional coverage area and tries to improve the packet delivery ratio in CEAACK MANETs.**

**Index Terms – MANET, Cluster Head, Cluster broadcast Algorithm, Clustering Architecture, Forwarding Cluster Head.**

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## 1. INTRODUCTION

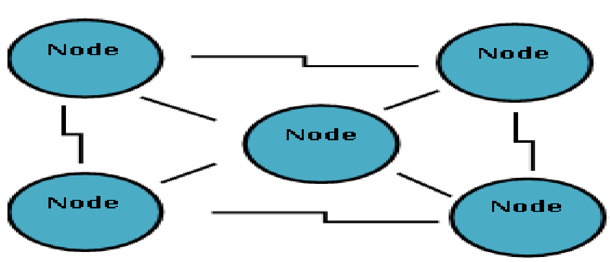


Fig 1.MANET

A MANET is a collection of autonomous nodes which communicate among themselves. These nodes are mobile in nature and have the tendency of moving in and out of the communication range. In other words, a MANET is a network where the nodes are not fixed and, the network itself does not have a fixed infrastructure. MANETs by nature are self-configuring networks.

Due to their dynamic nature, routing is a major challenge posed in these networks. The nodes are mobile and the path between a pair of nodes is constantly changing. Routing a packet successfully from th source to the destination is one of the many challenges faced by MANETs. To initiate a transmission, a path has to be successfully established from the sender to the destination using an effective route discovery process.

Different routing protocols are used based on the network requirements. These routing protocols can be broadly classified into three major categories.

- Proactive Routing Protocol
- Reactive Routing Protocol
- Hybrid Routing Protocol

### 1.1. Proactive Routing Protocol

Basically these are table driven protocols which expect every node in the network to maintain up to date route information. The major overhead in these type of protocols is one or more route tables are maintained by every node and have to be constantly updated. When there is a change in the route information, a node updates all the other nodes by broadcasting to all the other nodes. The route information is necessary in establishing a perfect connection between the sender and the receiver.

Examples of Proactive routing Protocols

- Distance vector (DV) protocol
- Destination Sequenced Distance Vector (DSDV) protocol

- Wireless Routing protocol
- Fisheye State Routing (FSR) protocol

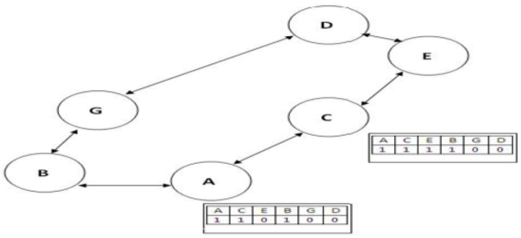


Fig 2 .Proactive Routing Protocol

1.2. Reactive Routing Protocol

Reactive protocols are dynamic routing protocols that discover routes on demand. Route discovery is initiated only if no route exists between the source and the destination. If a previous route exists, it is reused if necessary. Route discovery is carried out only when two or more nodes wish to communicate and a route does not exist between these nodes. Reactive routing protocols perform two major functions:

- Route discovery
- Route Maintenance

1.2.1. Route discovery

A route discovery process is initiated only on demand. The sender node checks its route cache and if a route to a destination has not been discovered yet, a "new route "discovery process is initiated. The packet to be transmitted contains the address of the intermediate nodes (along the destination route) in addition to the destination address.

1.2.2. Route maintenance

Route failures are part of any network that is involved in transmission of data. Link breakage is a common problem faced by Ad hoc networks due to their dynamic topology. To counter link breakage problems, an acknowledgment mechanism is employed as part of the route maintenance procedure.

Examples of Reactive routing Protocols

- Dynamic Source Routing (DSR)
- Ad-hoc On- demand Distance Vector (AODV)

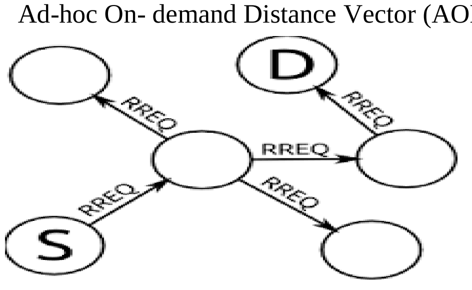


Fig.3 Reactive routing Protocol

1.3. Hybrid Routing Protocol

Hybrid routing protocols combine the best features of proactive reactive routing protocols. Based on the network scenario the best features of reactive and proactive protocols are combines to improve the overall network performance.

A lot of issues are faced by MANETs only during the routing process. Frequent path failure is a common occurrence among the mobile nodes which might move in and out of range. The major overhead in MANETs occur due to the repetitive route discovery processes which are initiated due to link failures. Subsequently, the packet delivery ratio suffers. It becomes necessary to reduce the overhead incurred during the route discovery process.

## 2. RELATED WORK

Broadcasting algorithms can be classified broadly into two. They are

- Probabilistic
- Deterministic

Though probabilistic broadcasting algorithms provide good stochastic results, they do not cover the entire network. The deterministic groups of algorithms guarantee full coverage of the network. The status of the nearby nodes is determined usually by sending a dummy "hello" message. a typical neighbor designating broadcast algorithm fine tunes its process by forming a 1-hop subset of nodes from the sender. When the 1-hop neighbor subset receives the packet to be forwarded, it further simplifies the process by forming a 2 – hop subset of nods form the sender. A non-forwarding node is one that has not been chosen by the sender in forwarding the packet.

In clustered environment, essential factors like node degree, battery power, transmission power, and node mobility are considered in selecting the cluster head. The Efficient Management Algorithm for Clustering (EMAC) is a typical example of how this process is initiated. A node is selected as a contender for the cluster head based on the lifetime of their links, rather than its mobility. The nodes energy, mobility and other factors are also taken into consideration while electing a Cluster Head. This algorithm ensures that the nodes know their location in the network.

## 3. CLUSTERING TECHNIQUES IN MANET BROADCASTING

Due to the number of nodes involved in MANETs, clustering is adopted to increase efficiency of the network. The nodes are divided into clusters based on their common characteristics. A cluster Head is elected to manage the cluster activities. These activities include

- Clustering process

- Routing Table updations
- Route discovery and Maintenance

Nodes that are not cluster heads are the cluster members. Each of these cluster members communicate within and outside their cluster via the Cluster Head. The cluster head in turn routes all communication via the Base Station. If the destination node is within a cluster the Cluster Head takes responsibility of delivering the data to the destination. If the destination node is outside the cluster, the data is routed by the cluster head via the Base Station.

The clustering technique has been proposed in order to reduce the number of acknowledgements that are usually a part of ad hoc networks. The number of nodes involved in packet transmission is also reduced by this principle. Transmission of data is also possible between clusters. Communication between clusters happens only through the cluster Heads using the Base station as an intermediary. The clustering technique aims at reducing the routing overhead incurred in a common ad hoc network.

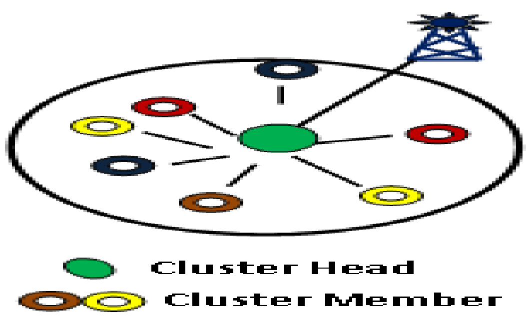


Fig.4 Cluster Model

## 4. PROPOSED SYSTEM

In this paper we have proposed a Cluster based broadcast mechanism, which groups the network nodes into a number of overlapping clusters. The path between the clusters is recorded and is used primarily in the algorithm. It increases the lifetime of the routes and decreases the amount of routing control overheads. The CH needs to communicate with all of its members and also with the members of other clusters as well. Communication with the members of other clusters can be carried out through the respective CHs or via the Base Station.

Communication in a clustered MANET involves three steps. The CH receives data from all its members, compresses it and then transmits this data to the BS or other CHs as required.

A CH is elected based on its ability to conserve energy and stay within the communication range for a longer period of time. A number of nodes are selected to take part in the cluster Head election .when a CH moves out of range, the next contender satisfying the CH requirements is designated as the next CH.

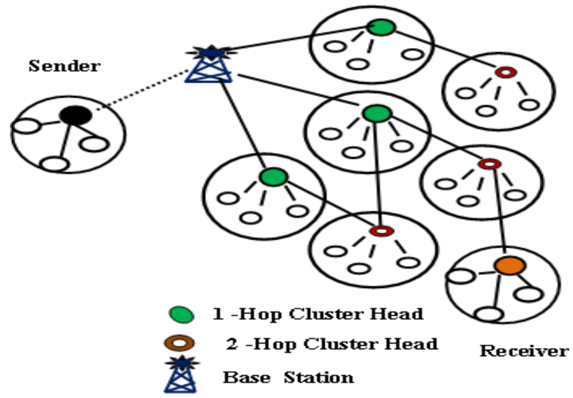


Fig.5 Architecture of Cluster with DCB

### 4.1. Working Principle of the Cluster with Dual coverage Broadcast Algorithm

The proposed algorithm uses the principle of dual coverage to improve its packet transmission. It also tries to reduce the number of acknowledgements usually involved in packet transmissions .An ACK packet is expected only when it is definitely needed by the sender to verify packet delivery.

When a cluster member wishes to send a packet it does not act on its own, but sends the packet to its cluster head. When the cluster head receives a packet that is to be transmitted, it checks the destination. If the destination is outside the cluster, it forwards the packet t to the base station. The base station receives the packet to be transmitted, records the destination address and sets about forming a subset of clusters that are one hop away from the base station. Once the subset is determined by the base station, the packets are forwarded to the cluster heads of the one hop subset of clusters.

The cluster heads of the one hop subset receive the packet from the base station, record the packet details and in turn form a subset of clusters that are two hops away from the base station. They retransmit the packet to the cluster heads of the two hop subset of clusters. The forwarding cluster heads retransmit the packets as if the packets have originated from them. When the packets are retransmitted by the one hop subset of cluster heads, this information is heard by the base station and is treated as an acknowledgement by the base station. The base station now waits for a definitive time, and, if some forwarding cluster heads do not retransmit, the base station decides that there is a transmission failure. The base station again resends the packet to its one hop subset of clusters. All those cluster heads that have retransmitted in the one hop subset, send back an ACK packet to the base station, further confirming the fact that they have retransmitted. Subsequently they drop the duplicate packets.

The cluster heads of the one hop subset, which have not retransmitted, continue the process as explained above. Sometimes there may be a few non forwarding cluster head nodes in the one hop subset. These cluster heads would not have re transmitted, simply because the destination address of the packet may not cover their route. In order to inform the BS that these cluster heads are non-forwarding nodes, a NACK is sent after a certain time period. The base station need not waste its time in retransmission of the packets to the non-forwarding cluster heads repeatedly.

A blue print of the proposed algorithm has been given to further explain the working principle of the algorithm.

4.2. The proposed Cluster with Dual coverage broadcast algorithm

P : Broadcast Packet

BS : Base Station

CH : Cluster Head

FCHSP : (Forwarded Cluster Head Selection Process) for Selecting CH for packet retransmission

***Step: 1*** If the source is not a cluster head, it just sends the broadcast packet P to its cluster head, which in turn send it to the BS

***Step : 2*** When a BS receives the broadcast packet P from its upstream cluster head sender for the first time, it executes the FCHSP procedure:

***Step: 3*** It chooses subset of 1 hop forward CH nodes, to forward the packet to all the 1 hop CH in its coverage set, and broadcast P

***Step: 4***

**If** (1 – hop CH node receives P from BS) **Then**

4.1 Each 1- hop CH node records the broadcast packet details P.

4.2 A subset of 2-hop clusters (from the BS) is formed by the 1-hop cluster head Packets are retransmitted by the 1-hop cluster heads to the new subset (2-hop) of cluster heads as a sender.

4.3 The retransmission is overheard by the BS and is accepted as the Acknowledgement for the forwarding of packets

**End if**

***Step: 5***

**If (**Forwarding 1-hop cluster heads) **Then**

**If** (No Acknowledgment (within a time interval for BS) **Then**

Transmission Failure and

Retransmit packet p

**Else**

CH sends an ACK to BS to

Confirm the reception and

re transmission of packet

P and drops the duplicate

Packet P from BS

**End if**

**Else**

Non forwarding 1-hop cluster heads will indicate to the BS by sending a NACK packet while other 1-hop Cluster heads which have not retransmitted(due to network problems) will retransmit.

**End if**

## 5. EXPERIMENTAL ANALYSIS

The effect of the DCB algorithm on the network was studied by simulating it using a network simulator. The network simulator employed was NS2.Values were supplied to the program to study the effects of applying the algorithm to the network .In addition, the network behavior was analyzed when the algorithm was not applied to it. The results have been summarized in order to understand the network behavior before and after applying the algorithm. Two major aspects of the network were analyzed, namely, energy and packet delivery.

### 5.1. Packet Delivery Ratio

The packet delivery ratio is very high in clustered MANETs with DCB when compared to a normal clustered MANET. On applying the algorithm it can be seen that it improves the rate of packet delivery to a greater extent than a clustered MANET. Improved packet delivery is directly proportional to the overall throughput of the network.DCB with clustered MANETs promises near successful delivery of all the packets.

The number of acknowledgements that usually are part of any type of network is drastically reduced and importance is given to the successful delivery of packets which is the major focus of any network.

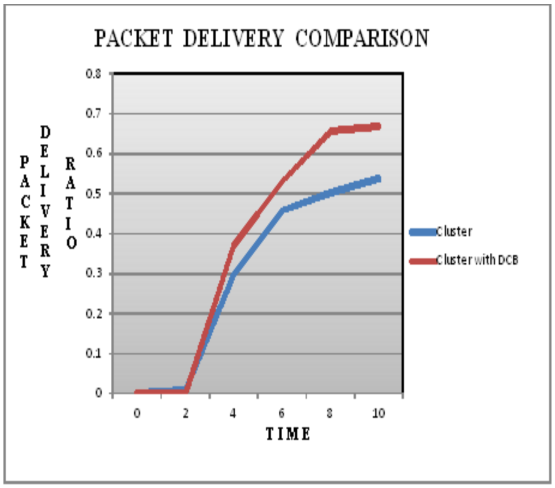


Fig.6: Packet Delivery Ratio

### 5.2. Energy

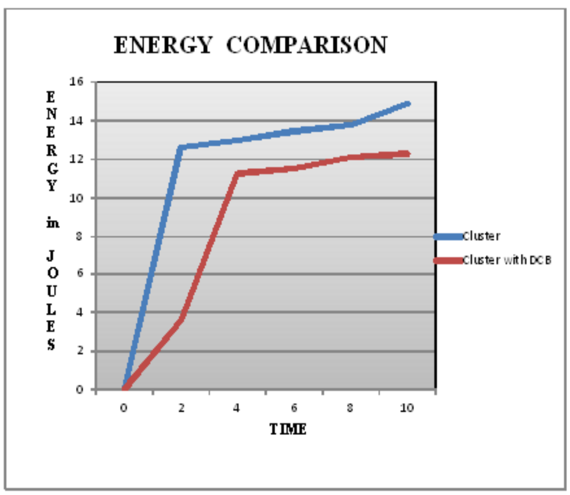


Fig.7 Study of Energy

Fig.7 represents the graphical analysis of energy in a cluster oriented MANET, before and after applying the DCB algorithm. The energy spent in a MANET without applying the DCB algorithm is high when compared to the MANET where DCB is applied. In a MANET with DCB the energy lost is only negligible since this loss of energy is reflected in a positive manner in all the other aspects of a network such as packet delivery ratio and throughput. The energy lost in applying the algorithm is very less. Energy is spent in forming the node subsets which are one hop and two hops, respectively, away from the base station. The normal clustered MANET spends more energy but it does not in any way improve the packet delivery. On the other hand there is no necessity in Clustered MANET with DCB to maintain route information table at all times. Route discovery happens only if there is no route available and, if a route exists previously it is reused by the network. The energy spent in clustered MANETs with DCB is collectively spent in either finding routes or in forming the subsets of nodes. The loss in energy can be justified in clustered MANETs with DCB since it is usefully utilized to form subsets of nodes and improve the forwarding of packets.

## 6. CONCLUSION

The proposed dual-covered broadcast algorithm is simple and provides a high delivery ratio while suppressing broadcast redundancy. This is achieved by only requiring some selected forwarding nodes among the sender's 1 hop neighbor set to forward the packets. The dual covered forwarding node set selection process provides some redundancy to increase the delivery ratio for non-forwarding nodes so that retransmissions can be remarkably brought down. The DCB algorithm provides a good mechanism in reducing the ACK packets, which are delivered only to ensure that there is no failure in packet delivery. In order to confirm the non-forwarding nodes, the NACK packet mechanism is used, so that the base station need not repeatedly send packets. The future work will focus on improving the strategies of the DCB algorithm, by bringing in the concept of providing security, which is a much discussed issue in MANETs.

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