

A NOVEL ROUTE REPAIRMENT APPROACH FOR CBR

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-----ABSTRACT-----

A Mobile Ad Hoc Networks (MANETs) consists of collection of mobile nodes which are dynamic in nature, forming arbitrary topologies with time. Path connecting source nodes with destination node may become unstable, go down at any time and hence route maintenance or Repairment is an important task to be performed regularly. As compared to other routing protocols Cluster Based Routing (CBR), a hierarchical protocol performs well in terms of bandwidth and energy conservation. In this paper cluster based routing has been discussed and a new route Repairment approach has been proposed for the same.

Keywords- CBR, Cluster, MANETs, Route, Routing, Topology

1. INTRODUCTION

Dynamically changing topology (Jiazi,2007) of the Mobile Ad hoc networks (MANETs) is an important feature but need to handle very carefully otherwise it may raise certain issues like overhead, resource constraints, congestion etc. In MANETS various reactive and proactive protocols provides mechanism for establishing route to destination node. Reactive routing is better than proactive as it performs routing only on demand of source node.

In MANET during reactive routing whenever a data packet is send to a destined node we have to carry out a route discovery process. In a route discovery a route request packet (RREQ) is flooded over the network where each and every node of the network participate which leads to huge bandwidth and energy uses. Finally it reduces network performance. In order to utilize our most scarce resources (energy, bandwidth etc), clustering provides the best solution. In Cluster based routing only two nodes participates in flooding (Jiang,1999) of route request packet (RREQ) i.e. Cluster Head (CH) and Gateway Node (GN). Lesser

the number of nodes participating in routing decision the more will be the increase in network performance.

According to Cluster Based network scheme, we have three types of mobile nodes in MANETs i.e. Cluster Head (CH), Gateway Node (GN), Member Nodes (MN). A clustered network has been shown in fig.1.

The paper is sectioned as follows: section 1 introduces the basic cluster based routing (CBR) in Mobile Ad hoc Networks. Section 2 describes the clustering mechanism. Section 3 discusses the previously designed cluster formation algorithm based on ant colony optimization. Section 4 proposes route repairment approach for cluster based routing protocol. Section 5 concludes the contents of paper.

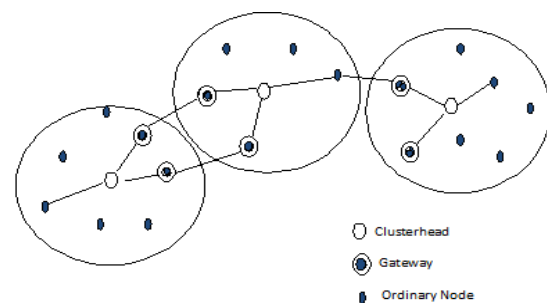


Figure 1 A Clustered Network (Atri, 2014)

2. CLUSTERING MECHANISM

Mobile nodes in ad hoc networks are clustered together for performing cluster based routing. According to concepts of clustering in MANETs, group of several mobile nodes forms cluster and out of these grouped nodes one node must be elected which leads the whole cluster known as Cluster Head (CH) and is responsible for the resource demand and distribution member nodes of the cluster. Remaining nodes of cluster are the ordinary member nodes also referred as Member Nodes (MN) except Gateway Node (GN) (Sharma, 2012), which are the nodes that act as a communication medium between the two clusters. To make a Clustered networks a mechanism need to be adopt which can partition the network and handle the topological changes. The nodes will be grouped to define set of clusters based on following clustering mechanism. (Aydin, 2010):

2.1 Cluster formation phase: In order to form clustered network, nodes need to be grouped based on certain cluster formation algorithm. This phase uses certain algorithm and partition the network into number of finite and managed clusters.

2.2 Cluster maintenance phase: As topology of the network changes continuously with time, routes between source and destination nodes may become stale, some nodes may go out of reach from cluster head contact, hence clusters requires maintenance from time to time. This phase deals with cluster reformation and route repairment.

3. CLUSTER FORMATION ALGORITHM

In cluster based routing (CBR) (Okano,2012), we need to partition the network into clusters. For this purpose numerous cluster formation algorithm exist, i.e. least cluster id (Wu,2010), Highest degree clustering (Lin,1997), weighted clustering algorithm (Jhani, 2011) etc Based on ant colony optimization (Chen,2013), a previously proposed cluster formation algorithm named as Ant colony Based Cluster

Formation (ABC) algorithm (Gill, 2014) has been discussed. Algorithm consists of two phases

- Cluster head selection Algorithm.
- Gateway node selection Algorithm.

The algorithm for cluster head selection can be explained as follows:

Step 1. Initially, each node will broadcast a forward ant packet with a hop limit of 1 (neighbor node). With every node accepting at most 1 forward ant and rejecting the forward ant packets received afterwards.

Step 2. Every node which will be getting a forward ant as in step 1 will produce a backward ant packet back to the source. Hence lead the formation of disjoint clusters as shown in fig 2.

Step 3. After step 2 the Cluster Head can be decided by counting the number of backward ant received on each node in the cluster. The node with maximum number of backward ant packet will be the Cluster Head.

Step 4 Thus each node in the cluster can be assigned a Cluster Head id corresponding to the id of the cluster head decided from the step 3.

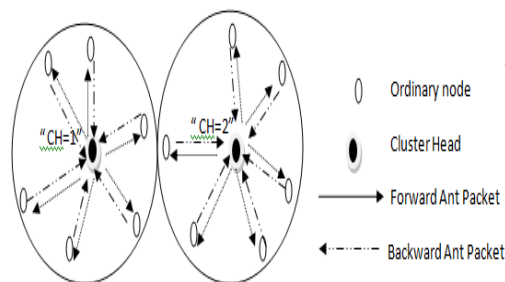


Figure 2 Formation of clusters.

The gateway node for inter cluster transmission of packets can be decided by using the following steps.

Step 1 The Cluster Head will broadcast a forward ant packet with a hop limit following condition

Cluster Head id (Sending node) != Cluster Head id (Receiving node)

Step 2 If the condition in the step 1 is met, then a backward ant is produced from the receiving node back to the source and the id corresponding to the source of backward ant will be set to the id of gateway nodes for transmitting packets between two clusters.

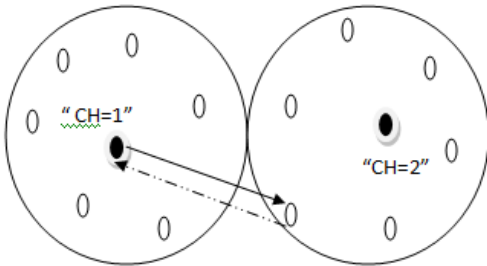


Figure 3: Gateway Node Selection

3. PROPOSED ROUTE REPAIRMENT APPROACH

In case of Cluster Based Algorithm, we need to consider the fact that the cluster formed initially may not remain valid for too long because the topology of the network changes dynamically. So we should have a certain mechanism to determine whether the inter cluster communication between two cluster head is still valid or not. The main reasons for a route between two cluster head becoming stale can be as follows:

- Either the failure of gateway node, i.e. Gateway node does not have sufficient energy with it to carry on the communication
- The second reason can be a change in the topology which may have occurred due to the mobility of the nodes of the network.

Thus both these situations may force us to redefine the clusters in the network by using a cluster formation algorithm. But before doing that we may try to explore other alternative if available for the communication between the two cluster heads, which forms the basis

of our proposed approach.

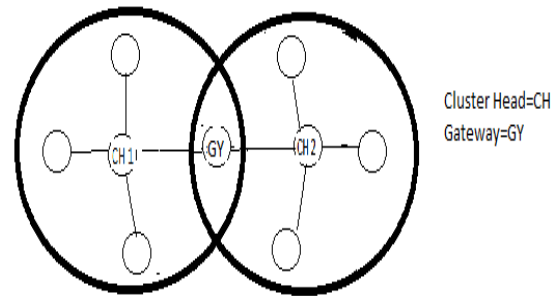


Figure :4 Gateway node Repairment locally

Thus the complete process may work as follows:

Step1. If the gateway node GY is not working for a possible communication between the CH1 and CH2 then it will return an error to the CH1. In order to deal with this situation CH1 may send a route discovery packet with CH2 as its destination and with HOP LIMIT field equal to 2 (the logic for setting the hop limit equal to 2 is that if the CH2 can be reached from CH1 through a route discovery packet of the hop limit equal to 2 then there is only node which is acting as the intermediate between the two cluster heads, this intermediate node can now be treated as the new gateway node).

Step2. If the Route Discovery Packet reaches the CH2 i.e. route to CH2 is discovered using the Route discovery packet, then set, the intermediate node between the two cluster heads as the new gateway.

Step3. If the Route Discovery becomes unsuccessful with the hop limit equal to 2 then it can be deduced that there do not exist any gateway node between the two cluster heads and thus the topology of network has changed and in order to deal with this situation we need to call here a previously discussed cluster formation algorithm, i.e. Ant colony Based Cluster head (ABC) selection algorithm so that new clusters

can be redefined according to new the topology of the network. Thus the above procedure may be used along with the Ant colony based cluster head selection algorithm to reduce the overhead problem further .The work done in this direction may deal with the inter cluster communication issues in future, but the applicability of the above procedure and its effect on the various metrics for performance measurement need to be checked.

5. CONCLUSION

Cluster Based Routing (CBR), a reactive routing protocol is beneficial for scalable and mobile networks. It performs well in terms of resource conservation. A dynamically changing network such as Mobile ad hoc networks uses clustering mechanism for routing packets to destined node. In this paper clustering approach along with previously designed cluster formation algorithm has been studied. Furthermore, a new mechanism for route repairment has been proposed.

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