Super Node Approach to Enhance Performance in Mobile Ad-hoc Network

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Abstract - *The implementation of MANET for commercial purposes is not an easy task. Unlike other communication networks, wireless Mobile Ad-hoc Networks encounter many severe problems concerning routing, scalability and network management when the size of network becomes large. As a solution to these problems, clustering schemes are introduced for mobile ad-hoc network in order to organize the network topology . Many clustering techniques have been developed so far. Clustering is a method which divides large network nodes into small number of nodes which is known as clustering .Clustering improves network capacity and reduces the routing overhead and brings more efficiency and effectiveness to scalability and high mobility. Every cluster has one cluster leader which has much responsibility such as cluster maintenance, routing table updates, and the discovery of routes within the network. The other node named as gateway node setup the communication between two clusters. In this present approach the election of cluster head (CH) and gateway node separately has been removed completely. In the proposed technique cluster head node and gateway node is replaced by a solo node which is known as super node(SN). All the functions and responsibilities of cluster leader and gateway node is handled by the super node. An algorithm table is introduced in such a way that if super node goes down or walk away due to any reason then in the absence of super node which node will overtake the task of super node. This unique approach is simulated and compared with existing approach with the help of Exata simulator. The proposed approach reduces overheads and hence improve the overall efficiency and performance of the network.*

Keywords: *MANET, performance, efficiency, super node, scalability*

I. INTRODUCTION

The World has been moved to wireless technology. Now days, new wireless technologies are becoming part of our daily lives. They have been in advance popularity with the use of several small and smart portable devices. For to connecting these devices with internet some type of fixed network is required such as access points or base stations which are not possible in many scenarios particularly when a person is not in the direct range of access point or base station. Thanks to wireless mobile ad hoc networks which solve these kinds of problems. Mobile ad hoc network are self-governing network having mobile nodes that are connected by multi-hop wireless links [32, 29]. The main idea of a MANET is that a network can be setup without the need for any central administration or prearranged infrastructure. In fact mobile ad-hoc networks present many challenges in front of the researchers because its mobility and dynamic nature. In addition to these bandwidth and nodes transmission power are scarce. Moreover scalability is very important issue to ad hoc network designers community because of large number of users and is an important matter with vital influence on capability and capacity. The scalability issue of MANET is addressed through a hierarchical approach that divides the large network into small networks (clusters). A cluster is fundamentally a subset of nodes of the network that satisfies a certain property. Clusters are analogous to cells in a wireless cellular network. By clustering the network becomes more manageable [32]. Ad-hoc networks are typically composed of nodes that communicate over wireless links without any central administration and , commercial interest in this type of networks continues to grow [2.25,26,27 32

II.RELATED WORK

Routing is one of the important issues in ad-hoc network. Routing in mobile adhoc network has three major objectives [7] ,first one maximum steadfastness by selecting several alternative path if a node depart the network, second ,through the traffic towards the routes which have least cost among different path and third selecting the nodes with best response time and throughput. In mobile ad-hoc network routing can be classified as proactive and reactive. In proactive routing routers are maintained constantly within the network. In reactive routing protocol the path are determined only on requirement. Cluster based routing [9] is a appropriate way for routing in MANET. As each cluster has one cluster manager and one or more gateway node to connect to other cluster in the

network [1] [11[21] . Clustering approaches present a number of benefits for the medium access layer and the network layer in MANET [21]. The implementation of clustering schemes allows a better performance for the Medium Access Control (MAC) layer by improving the spatial reuse, throughput, scalability and power consumption. On the other hand, clustering helps routing at the network layer by lessening the size of the routing tables and by decreasing transmission overheads updating of routing tables due to frequent change in network topology [1][23][20]. Clustering provides collective topology information since the number of nodes of a cluster is smaller than the number of nodes of the entire network [13][14]. Therefore, each node in a cluster only stores a small part of the total network routing information [9][22]. In clustering techniques nodes are chosen to participate different roles in the network. commonly, three types of nodes are reported in clustering techniques: ordinary nodes which are simply members of a cluster, other node is called gateways node which is able to listen to transmissions from another node which is in a different cluster and cluster head(CH) which manages the cluster[1] [22][27][30].

A. Ordinary nodes :

Ordinary nodes are members of a cluster which do not have neighbors belonging to a different cluster [1].

B. Gateway nodes

Gateway nodes are nodes in a non-cluster head state located at the periphery of a cluster. These types of nodes are called gateways because they are able to listen to transmissions from

C. Cluster heads

Most clustering approaches for mobile ad hoc networks select a subset of nodes in order to form a network backbone that supports control functions. A set of the selected nodes are called cluster head (CH) and each node in the network is associated with one. Cluster heads are connected with one another directly or through gateway nodes [1]. The union of gateway nodes and cluster heads form a connected backbone. This connected backbone helps simplify functions such as channel access, bandwidth allocation, routing power control and virtual-circuit support [18].another node which is in a different cluster [24]. To accomplish this, a gateway node must have at least one neighbor that is a member of another cluster [21].

III.PROBLEM FORMULATION

The existing clustering technique cluster head (CH) and gateway approach which is shown in fig 1 and proposed super node (SN) approach

is s shown in figure 2 , both the approaches have been simulated and compared for reliability/quality of service with the help of Exata cyber simulator..

Fig1: CH& gateway scenario

IV. SIMULATION ENVIRONMENT

Exata Cyber simulator is used to simulate and compared for both the approaches. Exata is a comprehensive suite of tools for emulating large wired and wireless networks. It uses simulation and emulation to predict the behavior and performance of networks to improve their design, operation, and management. Exata cyber provides a cost-effective and easy-to-use alternative to physical test beds that typically have high equipment costs, complex setup requirements and limited scalability. It creates a digital network replica that interfaces with real networks and applications.
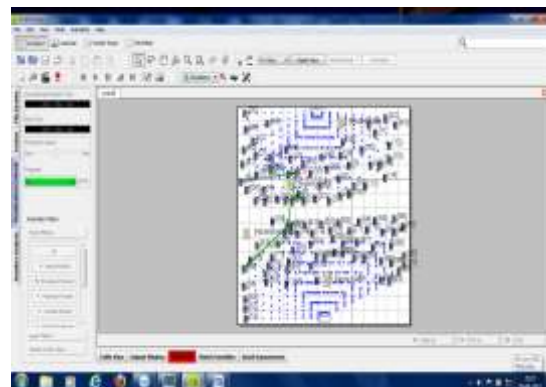

Fig2: Super node scenario

A. Problem Definition

The network consists 105 mobile nodes with AODV routing protocol enabled, and all nodes are randomly distributed with the mobility of (0-10)m/sec. In existing approach Node 35 and 85 are Cluster head and nodes 5 and 8 are gateway nodes. In super node approach node number 35 and 85 are super node nodes and sending CBR file

B. Simulation Setup:

With the help of Exata cyber simulator, firstly we configure the profile for mobile ad-hoc network. There are three important configurations for standard application, mobility and placement, network layer and Routing algorithm.

Mobility configuration, related to description about the mobility of mobile nodes, and for this we set the three important parameters

Table 1
Mobility configuration

S. No	Parameter	Value
1	Speed	0-12 m/s
2	Pause Time	0 s
3	Start Time	15 sec

V. VALIDATION

In the result analysis of CBR server with cluster head & gateway, and super node the end to end delay are trade off for overall performance of the network and as shown in Fig 3 and Fig4
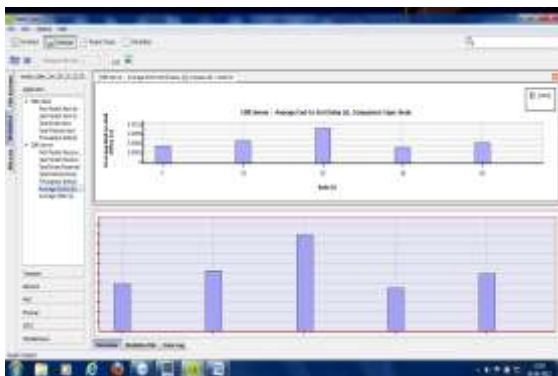

Fig3: Average end to end delay for   Sper node approach

Fig4: Average end to end delay in proposed super node approach

B. Analysis for Average Jitter with CH & G and Super Node Approach

In the result analysis of CBR server with cluster head & gateway, and Super node the average jitter is less in   proposed approach showing overall performance of the node as shown in the fig5 and fig6 and also less node is participating hence less overheads

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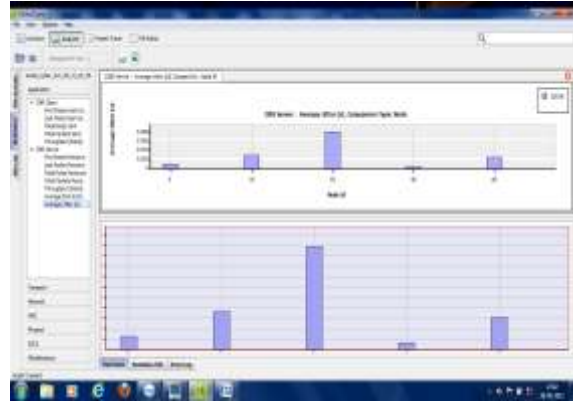
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Fig5 : Average jitter forpproach CH & G

Fig6: Average jitter for proposed approach

C. Analysis for number of packets dropped in CH & G and Super Node Approach

In the result analysis of CBR server with cluster head & gateway, and super node, the   number of packets dropped in   presented approach is less and overall performance of the network is very much improved as shown in the Fig7 and Fig 8
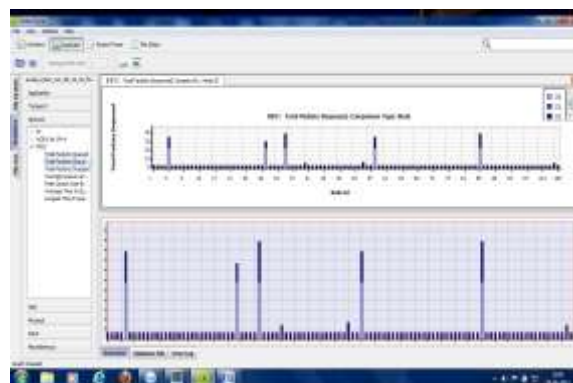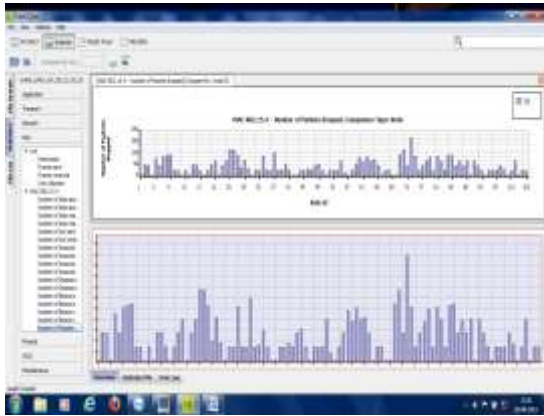

Fig7 :Mac 802.11.4 no. of pkt dropped in existing approch

Fg8: Mac 802.11.4 no. of packet dropped in propose Approach

VI.CONCLUSION

Mobile ad hoc network is taking huge momentum in modern life because of its affordable device cost and reasonably priced services and user-friendliness. The proposed super node approach reduces the election of cluster head (CH) and election of gateway separately. The approach provides incremental quality of service in terms of end to end delay, jitter and number of packets dropped.

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