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Dynamic Role Assignment in Loose-Virtual-Clustering-Based Networks for Power Efficient MANETs

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Abstract- There are several issues in MANET which directly hampers power efficiency. MANETs with high power nodes can improve network lifetime, scalability,connectivity and robustness. However the power heterogenousity in MANET affects the throughput severely. To improve power efficiency in MANETs,here,we have developed Dynamic Loose Virtual Clustering algorithm(DLVC).Assigning roles dynamically increases the lifetime of nodes and hence the lifetime of network.

Keywords: Dynamic Role Assignment, Loose Clustering, MANET.

I. INTRODUCTION

Mobile ad hoc Network is gaining popularity day by day. It is a self creating infrastructure-less network of mobile devices. MANET comprises of many nodes with heterogeneous power. In such a heterogeneous network, different nodes have different transmission power.[2]

Power efficient routing protocols maximize life time of network. Power efficiency of Mobile Adhoc Network includes Stability, Scalability, Manageability and Mobility of mobile nodes in the network. These are following issues which occur mainly in network.

- Frequent Link breakage among nodes
- Restricted bandwidth
- High mobility of nodes in network
- Nodes out of Battery[2]

To overcome above mentioned issues, the concept of clustering has been used widely.From a routing perspective, clustering splits data transmission into intra-cluster(within a cluster) and inter-cluster (between cluster heads and every cluster head and the sink) communication. This separation saves a considerable amount of energy since the radio unit is the major energy consumer in a sensor node. Here, each member node have to communicate with their respective cluster head, which relays data to other nodes.[6]

A. Clustering In Manet

In a clustering scheme, the mobile nodes in a MANET are divided into different virtual groups, and they are allocated geographically adjacent into the same cluster according to some rules with different behaviors for nodes included in a cluster from those excluded from the cluster. Clustering of network is the division of network into different virtual groups based on certain rules. Basis on the closeness and other factors different nodes are grouped into a structure called cluster see Fig. 1. In this figure four clusters are shown; C1, C2, C3 and C4 and each cluster has its clusterhead CH1,CH2, CH3 and CH4. A node which connects two clusters called gateway node (GN). The two major characteristics of a clustering architecture are as follows.

- Each cluster can have only one cluster head.
- Each node in a cluster is either a cluster head or an adjacent node to cluster head.
- A node which belongs to one or more clusters is called a gateway.
- Remaining nodes are called ordinary nodes.
- The transmission area of cluster head defines the boundary of that cluster.
- Communication between any two adjacent cluster heads goes through the common gateway.
- Any two nodes of same cluster are at most two hops away from each other.

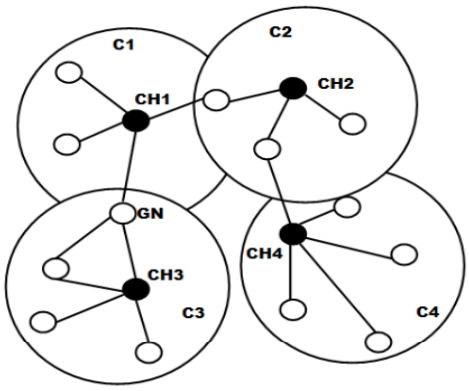

Fig 1: Clustering architecture

B. Types of Clustering

- Strong Clustering :Here, Each node should play a certain role (CH,Gateway,Member)
- Loose Clustering : (Proposed Technique)
  - In this, loose coupling relationship is established between the nodes
  - It is adaptive, Flexible and Efficient
  - The node with highest energy will be declared as cluster head.

C. Advantages of clustering

- In clustering, the system capacity is increased by reusing the resources .Also the retransmission quality can be improved.
- Clustering in routing is the set of cluster head and gateway. It can normally form virtual backbone for intercluster routing and spreading routing information is restricted in the set of nodes as a result it has communication coordination.
- Clustering makes network smaller, compact and more stable in each mobile terminal. When node resides for small change then cluster need to update the information not whole network .In this way information proceed and stored by each node is greatly reused.
- As a number of nodes present are lower in cluster than the presence of number of nodes in network so in this clustering process assist aggregation topology information.
- Clustering network is stable and efficient only mobile nodes residing in the cluster are required to modify their data structure.
- Clustering decreases the transmission overhead incurred for the updating of routing tables after topological changes.

D. Disadvantages of clustering

- In clustering, several control messages are exchanged which requires a considerable amount of energy and bandwidth.
- In some clustering scheme re-election of clusterhead required called as ripple effect, it results in degradation of upper layer protocols.
- Cluster structure consists of two sets cluster formation and cluster maintenance. Cluster formation presuming mobile nodes as stable, mobile node gain some precise information from its neighboring nodes when it becomes clusterhead. As this is assumption is not practical because mobile nodes are movable in MANET.
- Their needs completion of round to complete cluster formation scheme of clustering, as with the increasing of number of round then there is also increase in static period for mobile nodes.
- For quick cluster formation, mobile nodes will not be able to determine its position at particular time these lead to require different requirement for algorithms to finish for different network topologies.

In this paper, we develop a dynamic loose-virtual-clustering-based (DLVC) routing protocol for power heterogeneous MANETs. In the existing clustering schemes, each node in the network should play a certain role (e.g., cluster head, member, or gateway) . We define this as a strong coupling cluster. In a strong coupling cluster, the cost of constructing and maintaining a cluster may significantly increase and affect the network performance. In our clustering, a loose coupling relationship is established between nodes. Based on the DLVC, clustering is adaptive to the density of high-power nodes.[1]

II. LITERATURE SURVEY

In [1], the LVC algorithm is proposed to eliminate unidirectional links. Here transmission range, bandwidth and reliability is increased by using high power nodes. The packet forwarding can be optimized by avoiding data packet forwarding through high power nodes.Hence,the network throughput can be improved to a great level. The mobile adhoc networks have nodes with different powers and hence we have to consider this power heterogenousity while inspecting scalability, connectivity and robustness.To deal with this issue,in this paper, LVC algorithm and LRPH protocol is proposed.

In [2], Clustering of network is defined as the division of network into different virtual groups based on certain rules. various clustering terminologies have been discussed here. A node which connects two clusters called gateway node (GN). The two major characteristics of a clustering architecture are as follows.

- Each cluster can have only one cluster head.
- In a cluster,a node can be a cluster head or an adjacent node to the cluster head.

In [3], Energy conservation is addressed. In heterogenous mobile adhoc networks, there are two types of nodes: powerful nodes(i.e. nodes) and normal nodes(i.e.B nodes).Here a cross layer designed Device-Energy-Load-Aware relaying framework ,named DELAR,is proposed to achieve energy conservation.

In [4], The concept of Multiclass (MC) position-aided routing protocol for power heterogeneous MANETs is proposed. The basic concept of MC is to divide the entire routing area into cells and to select a high power node in each cell as the backbone node (B-node). Here, HMAC(Hybrid MAC)is designed to deal with routing. Based on the cell structure and HMAC, MC achieves better performance. However, a fixed cell makes MC to work well only in a network with high density of high-power nodes. But the disadvantage of MC is that it works well only in network with high density of high power nodes.

III. PROBLEM DEFINITION

In the existing clustering schemes, each node in the network should play a certain role (e.g., cluster head, member, or gateway) which is called a strong clustering mechanism.It results into an inflexible clustering.Also, the existing routing protocols in power heterogeneous MANETs are only designed to detect the unidirectional links and to avoid the transmissions based on asymmetric links without considering the benefits from high-power nodes. [1]

Our proposal considers both the advantages and disadvantages of high-power nodes.

- Loose virtual clustering is adaptive to the density of high-power nodes.
- A dynamic clustering mechanism focuses on power Heterogeneousity in MANET

IV. RESEARCH METHODOLOGY

In proposed Technique, we are using Dynamic Role Assignment.

- Roles:

- Cluster Head(CH1)
- Cluster Head(CH2)
- Source
- Router
- Sink

Here, the cluster heads are assigned on rotation basis. In MANET, every transmission should go through cluster head. After each transmission,cluster head loses some amount of energy. At one point of time, cluster head loses almost all its energy and dies. As the cluster head is not available for transmission, ultimately the network dies.To choose clusterhead,different parameters have been used here. The main parameter is energy.The node with highest energy will be chosen as cluster head.Energies will be compared after each transmission.

TABLE 1

Iteration1		Iteration2		Iteration3	
Roles1	E1	E2	Roles2	E3	Roles3
CH1	100	92	CH2	92	CH1
CH2	95	95	CH1	85	SOURCE
SOURCE	90	88	SOURCE	87	CH2
ROUTER	85	84	ROUTER	83	ROUTER
SINK	80	80	SINK	79	SINK

Also to minimize the distance, we can move the cluster head to the edge of the cluster.NS2 provides a new tool for modifying the simulation environment by modeling motion in the wireless network simulation. Syntax:The sample movement file has the following movement statement

$ns_ at 0.40000000000s "$node_(0) setdest 100.000000 400.00000 1000.02215"

This line specifies that at time 0.40000s, node0 starts to move towards the destination (100,400) at a speed of 1000m/s.

A. Algorithm

Setup NS2
Input No.of Nodes
For each node n
Setup X
Setup Y
Setup Size
4. Enter No.of Communications
5. For each Communication
Set src
Set dest
Connect src-dest
Start CBR at 1sec
Stop CBR at 2 sec
Move nodes from src to dest
6. Plot graphs

B. Routing Algorithm

For routing purpose,We have used AOMDV(Ad-hoc on-demand Multipath Distance vector) routing algorithm.

AOMDV:

- In each route discovery, find multiple routes between source and destination.
- Use alternate routes on a route failure.
- New route discovery needed only when all routes fail.
- Fewer number of route discoveries.
- Reduction in delay and routing overhead.

V. RESULT AND SIMULATION

In order to evaluate the performance of proposed algorithm DLVC,we simulate a network of mobile nodes.The simulator used here is NS2.In our simulation,we have considered 30 mobile nodes in the area about 300*300.Here all nodes are capable of moving in all possible directions.Each node has its own speedwhich varirs randomnly. Here,we have divided the total number of nodes into 3 clusters each having 10 nodes. We are showing graphical results of our work done in comparison with previous work done.Various network performance metrics are adopted in comparison such as **Delay, Energy, Throughput, Jitter**.The graphical result shows both conditions,Before application of the algorithm and after application of the algorithm.The improvement can be easily seen

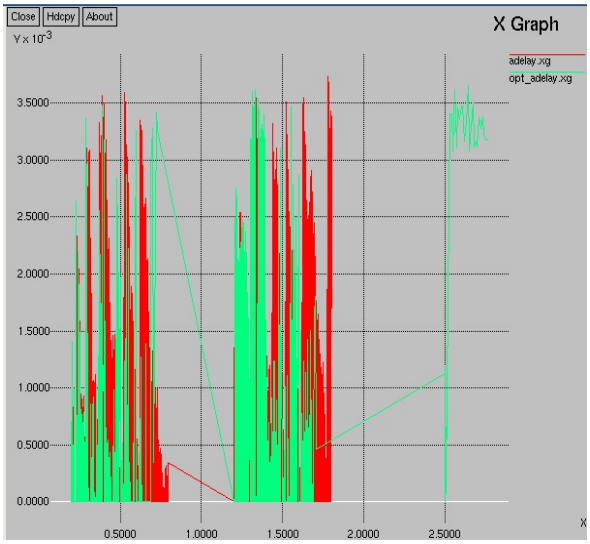

Fig. 2 : Time Versus Delay Graph

Above graph shows variation of Time(X axis) versus Delay (Y axis).The red coloured graph shows readings before applying algorithm.The green colour variations shows the improvement after the application of algorithms.The Delay parameter decreases on applying the algorithm.

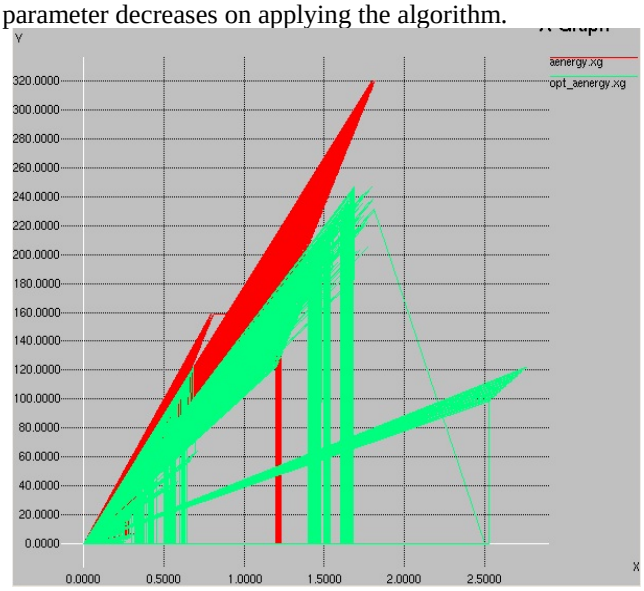

Fig. 3 : Time Versus Energy Graph

Above graph shows variation of Time(X axis) versus Energy (Y axis).The red coloured graph shows reareadings before applying algorithm.The green colour variations shows the improvement after the application of algorithms.The energy consumption is less and hence our proposed algorithm is more energy efficient .

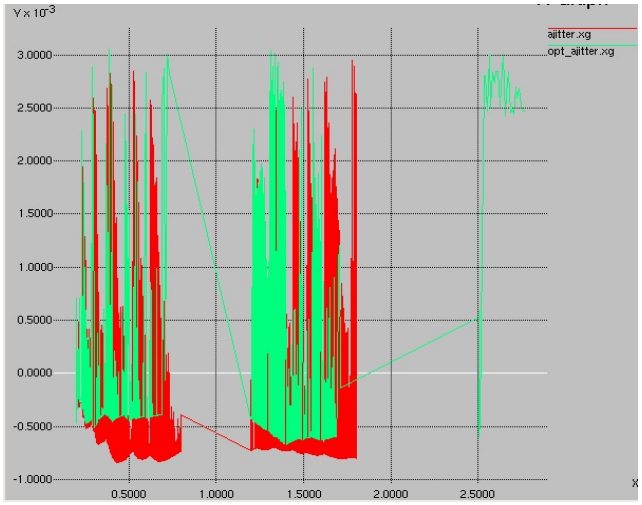

Fig. 4 : Time Versus Throughput Graph

Above graph shows variation of Time(X axis)versus throughput (Y axis).The red coloured graph shows readings before applying algorithm.The green colour variations shows the improvement after the application of algorithms.The throughput parameter increases on applying the algorithm.

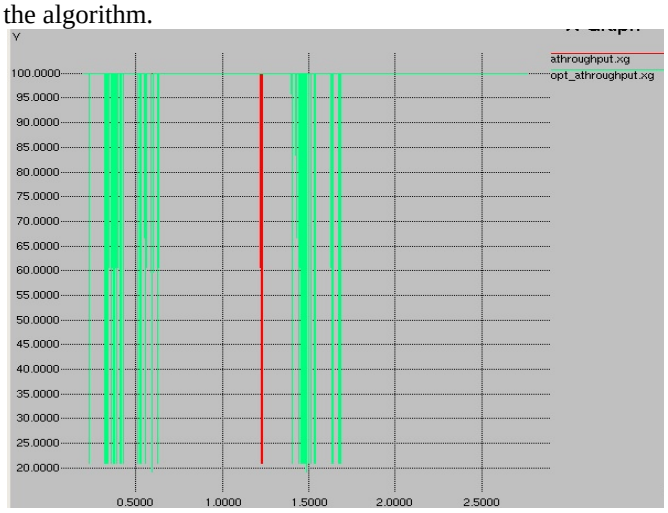

Fig. 5 : Time Versus Jitter Graph

Above graph shows variation of Time(X axis)versus Jitter (Y axis).The red coloured graph shows readings before applying algorithm.The green colour variations shows the improvement after the application of algorithms.The jitter parameter decreases on applying the algorithm

VI. CONCLUSION

In this paper, we have proposed a dynamic clustering mechanism to deal with power heterogeneous MANET.It will make clustering more efficient and flexible.The proposed system will enhance protocol to Work well in dynamic clustering environment. The overhead incurred during clustering is less .The channel space utilization and network throughput can be largely improved.

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