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Weighted Energy Efficient Cluster Based Algorithm in MANET

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ABSTRACT: A mobile adhoc network is a network in which nodes are dynamic in nature and has limited bandwidth and minimum battery power. For providing the scalable routing the nodes are divided into clusters, in clusters there should be a cluster head which contains all the information about its nodes, as in the flat routing every node perform the same role therefore network lifetime is less. The different schemes in clustering are based on different criteria. A cluster head is selected according to specific combination or metric such as identity, degree, energy, weight, mobility etc. Here, a new algorithm is proposed based on the existing algorithm "A novel weight based clustering algorithm for routing in MANET" the energy factor is included in the selection of cluster head. If the two nodes in the cluster are the candidates for the selection of cluster head then the energy of every node is calculated to select appropriate cluster head. This algorithm is named as "weighted energy efficient cluster based algorithm". The results of this algorithm are compared with the existing one. The results are calculated on four parameters. These are end to end delay, packet delivery ratio, energy and throughput. The throughput of the newly proposed algorithm is better than the existing WBA algorithm. And the other factors are compared which shows high rate of WBA algorithm

Keywords: Mobile Ad Hoc Network, Routing Protocols, Ah Hoc Applications.

1. INTRODUCTION

MANETs

Mobile ad-hoc networks (MANETs) are that kind of wireless networks that can be quickly deployed without pre-existing infrastructures. In MANETs each node acts as a host and router. They are used in different contexts such as medical, military or embedded applications.

In MANET, routing is one of the fundamental but challenging issues in mobile ad hoc networks. A several routing protocols have been proposed in the past several years, which can basically be classified into three types and these are proactive/table-driven, reactive/on-demand, and combination of both is hybrid.

Routing

To send packet in the network, routing is necessary. It is the process of selecting path. Routing can be done either in a flat or in a hierarchical structure. At first, in a flat structure, all nodes in the network are in same hierarchy level and thus they all perform the same role. This approach is efficient for small networks, but it has disadvantage that it cannot support heavy load,

when the number of nodes in the network increases. So, in large networks, the flat routing structure used to produce too much information flow which can flood the network.[1,2] Thereafter hierarchical routing protocols have been proposed so that routing can be easy in large networks. In this approach we divide the network into groups called clusters. [3]

This results in a network with hierarchical structure. Between clusters (inter-cluster) of a network and within clusters (intra- cluster) different routing schemes can be used. Every node maintains complete knowledge of locale information (within its cluster) but a little knowledge about the other clusters. Hierarchical routing is a solution for handling scalability in a network where instead of all the nodes some nodes are selected who will take the responsibility of data routing.

2.LITERATURE REVIEW

G.Jayakumar *et al.* [4] gives the descriptions of several routing schemes are provided proposed for ad hoc mobile networks. A review paper named 'ad hoc mobile wireless networks routing protocols-A review' presented by him. Classification of these schemes according to routing strategy is also described (table driven and on-demand).Comparison of these two, highlighting their features, differences and characteristics are presented. On doing the evaluation of these three routing protocols using the simulation the result was as follows. In case of throughput proactive protocol perform well, end to end delay, reactive protocol perform well, and in case of routing load, reactive protocol perform well.

Umamheshwari and G. Radhamani [5] also give 'A review on the clustering schemes of mobile adhoc network'. This paper provides various clustering schemes and also gives suggestion to improve those schemes. Various clustering schemes are described here are: LIC, HCC, k-CONID, Max min d-cluster, MobDHop, DMAC, PMW, WCA, CMBD, multihop clustering, iWCA. Then the comparison between all these schemes is shown. And a table is drawn which describes the characteristics and the basic point which is considered to select the cluster head. Clustering methods improve the stability, scalability routing and topology management of adhoc networking.

M. Alinci *et al.* [6] also representing a survey with 14 clustering schemes. 'Clustering Algorithm in MANETs: A review' present the different clustering schemes in MANETs. Clustering helps in reducing the complexity in management of information about the mobile nodes.

WBA algorithm

Algorithm by S. Pathak *et al* [7] gives 'a novel weight based clustering algorithm for routing in MANET'. With its main objective is to form a cluster that sustain for longer time. The algorithm consists of three phases these are pre clustering, cluster formation and cluster maintenance.

In pre clustering phase every node computed a *node_info()* packet which comprises node degree and bandwidth requirement of node. Node computes its weight as

w(i)=w1Di+ w2Bi

node degree is the number of neighboring nodes. The node that has the maximum number of neighbors will be considered as good to selected as clusterhead. Node degree will be computed by broadcast the hello packet to every node in the cluster. The nearby nodes which can be hear any HELLO packet records the node's details as its neighbor node. The node degree will be computed by counting the number of HELLO packets that it hears. A table is maintained by each node. The main aim to compute the node degree is to maximize nodes under a cluster and minimize number of clusters so that inter cluster communication cost can be reduced. So the node which has the highest degree will have maximum chances to being selected in the election of cluster head. The second parameter calculated is bandwidth. Bandwidth will be calculated on accounting the data transmission requirement. The node which has high demand for bandwidth is best to choose for cluster-head because it implies that it has its own task to do hence it will get less time to pass other data.

Cluster formation phase is the next phase that comes. Each node creates a table of neighbors. And after completing the response of *node_info()* packet the node declares a CH whose weight is highest. Match will be break by highest ID. Now CH needs to send *CH_advertisement* message. *CH_advertisement* message contains the calculated weight value of clustrehead and its ID. And all other nodes respond to this message through *cluster_join* message.

In cluster maintenance phase it sets a time limit that is when two CHs comes across each other than up to some time limit no changes will be made, when the time limit exceeds and the CHs are still in the same cluster range than the priorities of both the CHs will be calculated. This algorithm proposed the ICMS improved cluster maintenance scheme. The main aim of this algorithm is to enhance the lifetime of cluster head.

4. PROPOSED ALGORITHM

In this scenario, each node will calculate its weight based on some of its behavior. The weight of the node is calculated by summing the node degree and bandwidth. The node degree should be maximum and the bandwidth requirement should be minimum. Now the node with the highest weight is elected as the cluster head of that cluster. Expression for weight is given as:

Cluster formation

set Weight_Clustering_algorithm_app new_app x,y

At the source mode divide the message into equal length of packets and select a group I

Weight is calculated by receiving the information from neighbours

weight = max(Ni)+min(bi) // calculation of weight

set x lappend $node($cluster_head_node) //select that node a cluster-head

//calculate the residual energy if two or more nodes have same weight

If(CH>1)

{

If(Eres<Threshold value) // the threshold value is set that is compared with the residual energy

Set CH to the largest value ID

else

weight= mw(Ni) +min(bi)+ Eres // Receive node_infomation from all its neighbour

set y lappend$node($cluster_head_node) After then

Establish a route to destination where in the energy level of all the nodes is greater than its other node energy level.

Repeat the above steps in periodical interval t.

Calculation of residual energy:

$$Eres=E-Ec(t)$$

- E the initial energy of a node
- Ec energy consumed in periodical interval t
- Eres is residual energy of a node.

Energy consumption of a node after time t is calculated using the following equation.

$$Ec(t)=Nt*e+Nr*f$$

- Ec(t) energy consumed by a node after time t
- Nt number of packets transmitted by the node after time t
- Nr number of packets received by the node after time t.
- e and f are constant factor having a value between 0 and 1

Working of algorithm

Cluster formation:

The node received the neighboring information by sending the packet defining their weight. The weight value contains the node degree and bandwidth of the node. The node degree means the number of neighbors the node have. The node which has highest node degree is appropriate to select as cluster head. Bandwidth requirement is the parameter that defines the requirement of bandwidth to send a message. The node that has the less value of bandwidth will be appropriate to select as a cluster head.

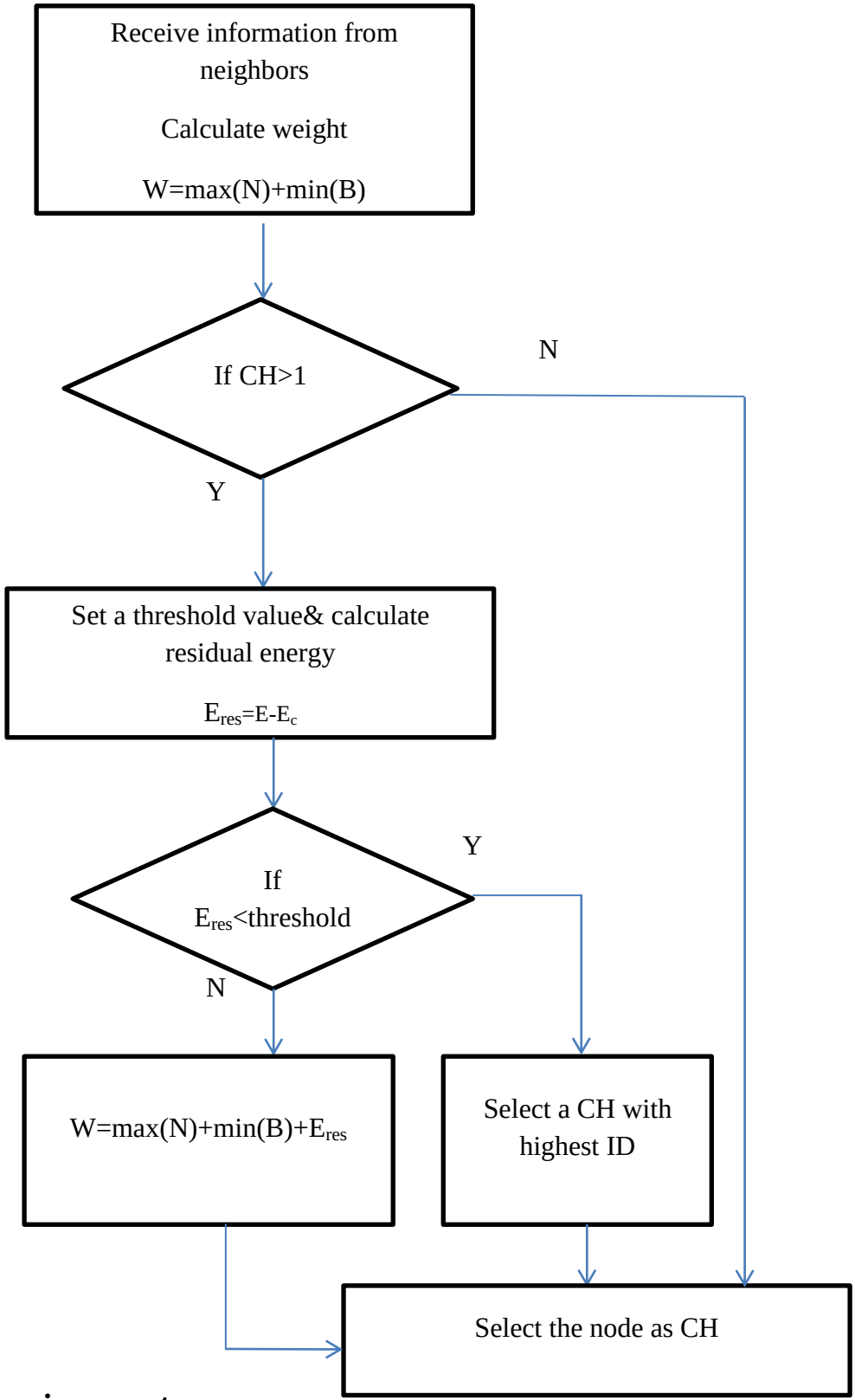
Cluster maintenance:

If the two nodes that have the same value then the selection of cluster head will follow a different procedure. The residual energy of every node is calculated. The method for the calculation of residual energy is shown in the algorithm. A threshold value is set that will be compared with the residual energy.

If the residual energy is less than the threshold value then select the cluster head according to their ID. The node which has the highest ID will

be the cluster head. If the node that has the residual energy higher than the threshold then again the weight will be calculated with the addition of residual energy. The node which has the highest weight will be the new cluster head

FLOW CHART OF THE PROPOSED ALGORITHM



5.Simulation environment

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Table 1: Simulation Table

Area	500*500
Protocol	LEACH
No. of nodes	20,40,60,80,100
Simulation model	NS2
Traffic	TCP
Simulation time	10 sec
Antenna type	Omnidirectional
Phy. Layer protocol	Wireless phy 802.11
DL layer protocol	MAC 802.11
Queue type	Drop tail/priqueue
Number of clusters	4

6.RESULTS:

The results are shown in the graphs. The calculation of the performance is calculated on the basis of four parameters. These are end to end delay, energy, throughput and packet delivery ratio. These parameters are compared with the existing weight based algorithm. The new algorithm is produces high throughput then the earlier one for heavy number of nodes. But in the case of packet delivery ratio, delay and energy the existing algorithm produces better results**.**

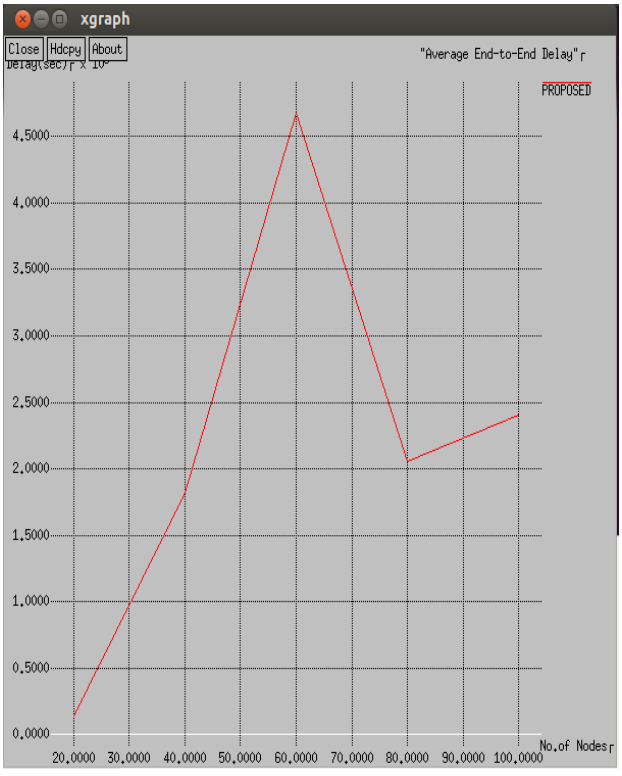

Fig. 1. End to end delay

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1. **End to end delay**: The time taken by the packets to reach the destination nodes is called end to end delay. The end to end delay must be low for better performance. Units of end to end delay are secs. The delay function is analyzed in the graph. It goes on increasing when the number of nodes increases.

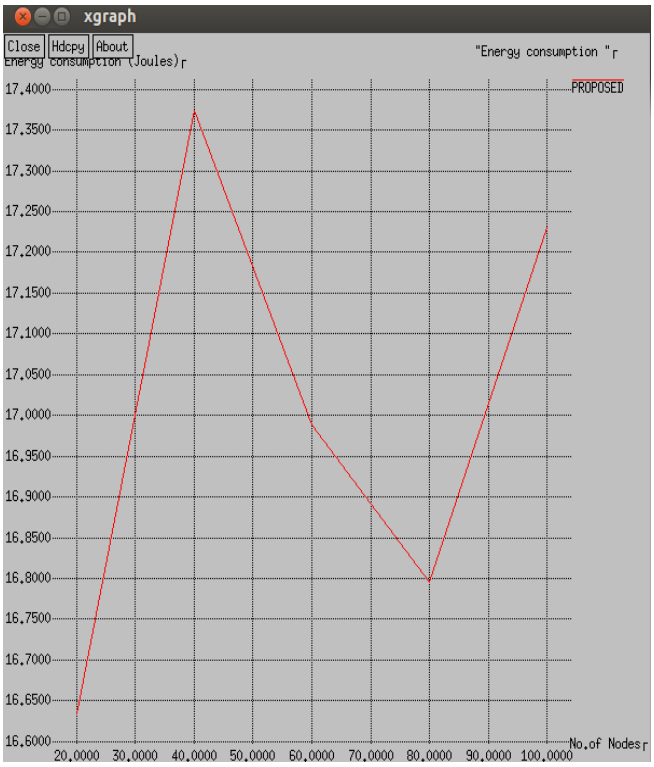

Fig. 2. Energy consumption

2. **Energy consumption**: The energy consumed by the number of nodes in all the three algorithms is shown in the graph. It should be as low as it can be. Hence for large number of nodes the proposed algorithm gives better results but the best results can be obtained by the WBA algorithm. The consumption of energy is shown in the graph.

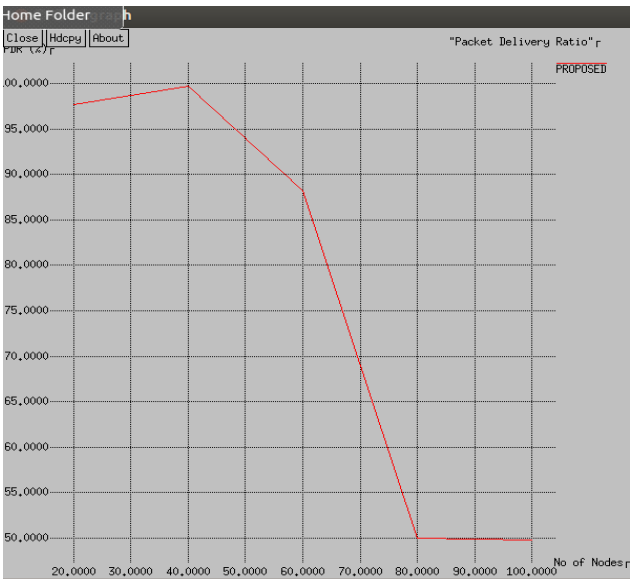

Fig. 3 packet delivery ratio

3. **Packet Delivery Ratio**: It is the ratio of total number of data packets delivered and the numbers of data packets send. The packet delivery ratio is shown in the graph. The PDR is small for large number of nodes in the new algorithm.
4. **Throughput**: It is the ratio of correctly received data packets during the communication. Its units can be data packets, second, time slot. When the number of nodes is increased the throughput is also increased and it is increasing for the high number of nodes. It is observed that throughput increased then the existing algorithm.

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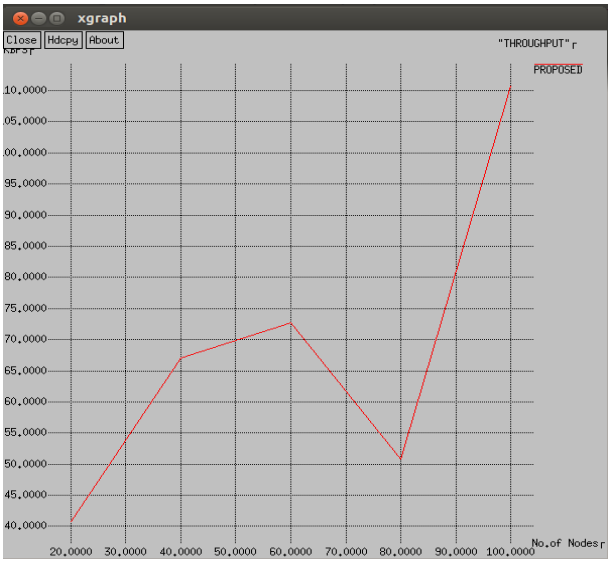

Fig. 4. throughput

CONCLUSION AND FUTURE WORK

A lot of work is done earlier in clustering field. Clustering is beneficial for large networks. The different schemes are proposed on taking account the different metrics. The new algorithm is proposed here in which the weight of node is calculated on the basis of node degree, bandwidth and energy. The parameter energy is added to the existing Weight Based Algorithm (WBA) proposed in "A novel weight based clustering algorithm for routing in MANET". Our main work is to save the energy of nodes. Here I have used the residual energy factor that is when the two nodes will have the same weight calculated the residual energy of all the nodes should be calculated. The results are shown of the above proposed algorithm. The results are calculated on four parameters. These are end to end delay, packet delivery ratio, energy and throughput. From the proposed algorithm it can be concluded that the proposed algorithm is better in case of the throughput for high number of nodes then WBA algorithm. This algorithm gives better throughput as compared to the existing WBA algorithm, but it is not good in energy saving. I will try to improve its energy in future. The delay should also be improved so that the formation of cluster and the communication between clusters should not take much time.

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