

Comparative Analysis of Novel Weight Based Cluster Algorithm and Energy Efficient Cluster Based Algorithm in MANET

Sanehi Sirohi¹, Manoj Yadav²

Student at Guru Jambheshwar University of Science & Technology, Hisar, India¹

Assistant Professor at Guru Jambheshwar University of Science & Technology, Hisar, India²

Abstract: MANETs is a fast developing research area with a vast spectrum of applications. For better communication we have to make routing easy. Adhoc routing protocols can be divided into flat and cluster based routing. Clustering can be done on taking accounts the key factors like mobility, energy, weight, ID, etc. In clustering a cluster head is selected which have the information of all the nodes of cluster. Unlike flat routing not all of the nodes have to know about each node, if the cluster head communicate with the cluster head of other cluster they get all the details necessary for routing. Here we compare the performance of two algorithms energy efficient cluster based SEEC algorithm and weight based weight based WBA algorithm. Their performance is compared on the basis of four factors these are delay, energy, packet delivery ratio and throughput.

Keywords: Mobile Ad hoc NET works, cluster head, clustering algorithms, LEACH.

I. INTRODUCTION

Mobile ad-hoc networks (MANETs) are a specific kind of wireless networks that can be quickly deployed without pre-existing infrastructures. In MANETs each node plays a role of host and router also. 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 large number of routing protocols have been proposed in the past several years, which can basically be classified into three different groups these are proactive/table-driven, reactive/on-demand, and combination of both is hybrid.

A. Routing

To send packet in the network routing is used. It is the process of selecting path. Routing can be done either in a flat structure or in a hierarchical structure. In a flat structure, all nodes in the network are in same hierarchy level and thus have the same role. This approach is efficient for small networks, but it has disadvantage that it cannot support the scalability when the number of nodes in the network increases. So, in large networks, the flat routing structure used to produce excessive information flow which can saturate the network.[1,2] Thereafter hierarchical routing protocols have been proposed to make routing easy in large networks. In this approach we divide the network into groups called clusters. [3]

B. Clustering

Cluster based structure (hierarchical structure) in network topology has been used to improve the routing efficiency in a dynamic network. Several clustering schemes have

been proposed. These schemes have different characteristics and are designed to meet some positive goals and removing disadvantages of flat routing, depending on the context in which the clustering is used. Since a cluster structure is a typical hierarchical architecture which is very beneficial for large or dense network. Cluster based Routing protocols can be used for the routing in MANETs. A typical cluster structure is shown in fig. 1. Clustering reduces the routing overhead and increases the network capacity also which brings more efficient and effective routing in MANET. Every clustering algorithm consists of two mechanisms, cluster formation and cluster maintenance.

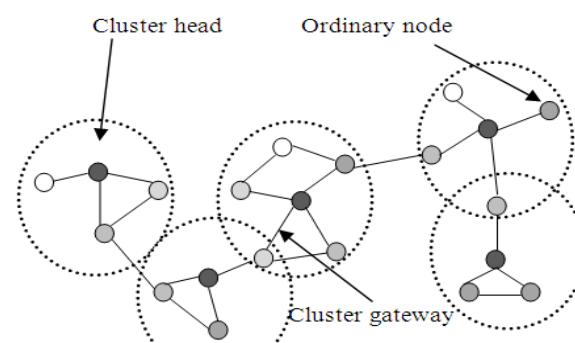


Fig: 1. Cluster structure

In cluster formation, cluster heads are selected from every cluster to form the hierarchical network. [4] Clustering focuses on dividing the networks into clusters and to choose a specific node as a Cluster Head. Cluster head



(CH) is a node which contains all the information of the nodes present in that cluster and very few information about other clusters. The Head node may be selected based on a specific metric or a combination of metrics. The parameters may include the ID of a node, weight and density of a node, degree or mobility of a node etc. The other nodes in a group will communicate with the cluster Head for any information. The cluster Head in a group may communicate with the Cluster Head of another cluster hence decreasing the huge unnecessary traffic flow. If a node hears two or more Cluster Heads then it will be the gateway. A cluster is therefore composed of a cluster head, gateways and member nodes. Thus clustering in MANET improves the efficiency of cluster and reduces the chances of interference thereby increasing the network throughput. [4]

II. RELATED WORK

Mayank Gupta et al. [5] presented a review of different routing protocols. Also, the routing protocols DSR, AODV and DSDV are compared on various parameters using the simulator. DSR have minimum packet loss than AODV and DSDV. Similarly the result for packet receives DSR get the better packet received ratio than DSDV and AODV. To facilitate the communication within the networks routing protocols is used to discover routes between nodes. Bandwidth and power constraints are the important factors that are considered here.

G. M. Abdulsahibet al. [6] the LEACH [Low-Energy Adaptive Clustering Hierarchy] protocol which is clustering protocol is compared with the other non-clustering protocols AODV, DSDV and OSLR. And the performance is calculated on the basis of four parameter these are end to end delay, throughput, packet delivery ratio and normalized control overhead. It is found that the LEACH protocol performs better in every field.

M. Alinciet al[7] gives clustering algorithms in MANET: A review, in which several clustering algorithms are reviewed on the basis of mobility, connectivity, energy based and weighted clustering schemes. These algorithms are based on the important issues like stability of cluster, maximizing the network lifetime, energy consumption of mobile nodes and maintenance. All the characteristics of the algorithms are summarizing in a table. Their advantages and disadvantages are also described.

Dr. M. B. Muruganet al [8] gives Energy based cluster head selection algorithm in MANET. In this paper EBCHS routing protocol is proposed which is modified version of CBRP. This protocol is used to select the cluster head in better way. That is if any new node enters into the cluster and the energy of the cluster head of that cluster reached to its minimum level than the new node will be the new cluster head of that cluster if the new node will have maximum energy level. And if within cluster the energy of CH becomes low than the new node will be the CH. This algorithm works better than the existing one and gives better throughput.

V. Bricard-Vieu et al [9] gives A Weighted clustering algorithm using local cluster-heads election for QoS in MANETs. This paper gives an improved algorithm of WCA[10]. In WCA the problem occurs when the ordinary node of the cluster can-not able to use its CH as forwarder and its handover fails an election occurs in that case. In WCA-L whenever a node does not come to the range of any cluster head then that node becomes itself cluster head and forms its own cluster hence no election process is needed. This algorithm gives better stability of dominant set and better quality of service. But it does not perform well in low density network.

A. WBA algorithm

Algorithm by S. Pathak et al [11] gives a novel weight based clustering algorithm for routing in MANET with the objective 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 includes node degree and bandwidth requirement of node. Node computes its weight as $w(i)=w1Di+w2Bi$

where $w1$ and $w2$ are two weight factors associated with node degree and bandwidth requirement respectively.

Cluster formation phase is the next phase that comes. Each node creates a table of neighbors. And after completing the reception of node_info() message the node declares a CH whose weight is highest. Match will be break by highest ID. Now CH needs to send CH_advertisement message. 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 upto some time limit no changes will be made, when the time limit exceeds and the CHs are still in the same range than priorities of both the CHs are calculated. The priority factor is calculated by the addition of maximum degree of CH and battery life.

B. SEEC Algorithm

A. Royet et al[12] gives efficient cluster based routing in MANET in which "Signal and Energy Efficient Clustering" SEEC algorithm is proposed. The aim of this algorithm is to prevent the death of cluster head when the cluster head reaches to a certain level. In this algorithm cluster-head maintains two tables 'routing table' and 'neighbor table'.

During the cluster formation phase each node sends a HELLO packet with some parameters including ID, signal strength, power level. All other nodes will receive the HELLO packet and compares the parameter the node which has the highest signal strength will declare itself as a cluster head. The tables sort the energy level and power level in descending order and when the signal strength of the cluster head becomes low then threshold value then the next element will be the new cluster head.

III. COMPARISONS PARAMETER[6] AND RESULTS

The performances of both the algorithms are compared and the results are shown in the graph. The green line shows the result of SEEC algorithm and red line shows WBA algorithm results. All the graphsshow the number of nodes on the X-axis and the analyzing parameter on the Y-axis.

A. End to end delay:

End to end delay means the time taken by the packets to reach the destination nodes. 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. From the given figure it is shown that the delay of the SEEC algorithm for higher number of nodes is high. And for smaller number of nodes delay is same. Therefore WBA algorithm is better in case of delay. The results are shown in fig. 2.

B. Throughput:

It is the ratio of correctly received data packets during the communication. Its units can be datapackets, second, time slot. The graph of throughput is same for higher number of nodes. For smaller number of nodes we should prefer SEEC algorithm. The results are shown in fig. 3.

C. Packet delivery ratio(pdr):

It is the ratio of total number of data packets delivered and the numbers of data packets send. The results are shown in fig. 4. The packets transfer on the given number of nodes is almost same.

D. Energy:

The energy consumed by the nodes during the transmission. The energy consumed by the number of nodes in both the algorithms is shown. As seen energy consumed is more

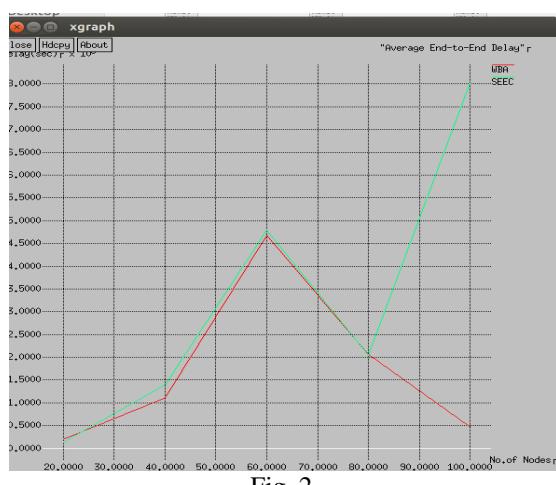


Fig. 2

IV. CONCLUSION

From the above comparison the throughput of SEEC algorithm is better than WBA. But WBA is better in case of energy and packet delivery ratio. The delay is same for both of the algorithms. So our results shows that the WBA algorithm is better than SEEC algorithm. We will try to improve the throughput of WBA algorithm in future.

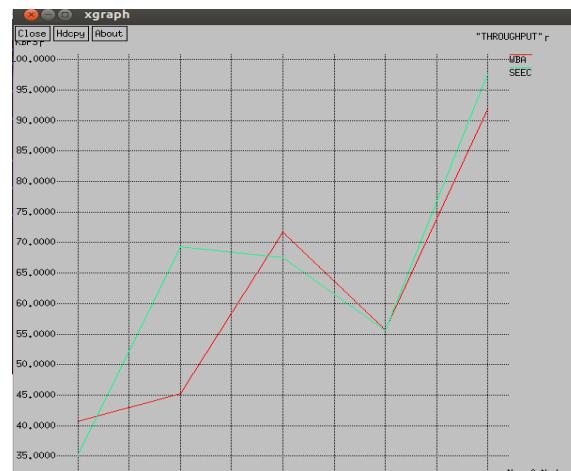


Fig. 3

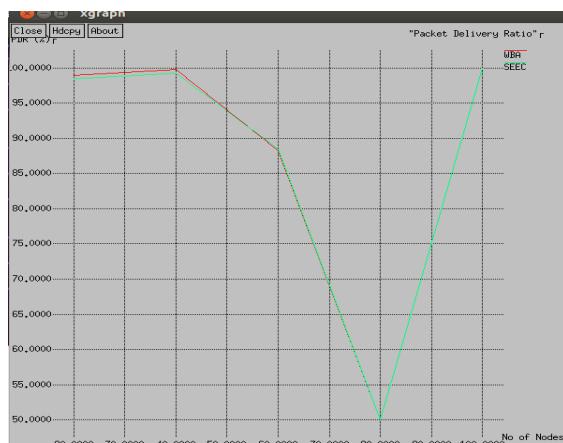


Fig. 4



Fig. 5

in SEEC algorithm for both higher number of nodes and smaller number of nodes. The results are shown in fig. 4.

REFERENCES

- [1] X. Hong, K. Xu, and M. Gerla, "Scalable routing protocols for mobile ad hoc networks," *IEEE Netw.*, vol. 16, no. 4, pp. 11–21, Jul. 2002.
- [2] Lee, Ben, Chansu Yu, and SangmanMoh. "Issues in scalable clustered network architecture for mobile ad hoc networks." in *Handbook of Mobile Computing*, 2004.
- [3] A. Bentaleb, A. Boubetra, and S. Harous, "Survey of Clustering Schemes in Mobile Ad hoc Networks," *Commun. Netw.*, vol. 05, no. 02, p. 8, May 2013.
- [4] V. Preetha, Dr. K.Chitra "Clustering & Cluster Head Selection Techniques in Mobile AdhocNetworks" in International Journal of Innovative Research in Computer and Communication Engineering, pp.vol. 2, Issue 7, July 2014.
- [5] M. Gupta, S. Kumar "Performance Evaluation of DSR, AODV and DSDV routing protocol For Wireless Adhoc Network" in IEEE International Conference on ComputationalIntelligence & Communication Technology, 2015
- [6] G. Muttasher Abdulsahib, O. I. Khalaf, N. Sulaiman, H. F. Zmez, and H. Zmez, "Improving Ad Hoc Network Performance by using an Efficient Cluster Based Routing Algorithm," *Indian J. Sci. Technol.*, vol. 8, no. 30, Nov. 2015.
- [7] M. Alinci, E. Spaho, A. Lala, and V. Kolici, "Clustering Algorithms in MANETs: A Review," presented at the Complex, Intelligent, and Software Intensive Systems), Ninth International Conference on, pp. 330–335, 2015
- [8] M. B. Murugan and K. C. Priya, "Energy Based Cluster Head Selection Algorithm in MANET," *Int. J. Sci. Eng. Comput. Technol.*, vol. 5, no. 8, p. 312, 2015.
- [9] V. Bricard-View et al "A weighted clustering algorithm using local cluster head elections for QoS in manet" in IEEE
- [10] M. Chatterjee, S. K. Das, and D. Turgut, "WCA: A weighted clustering algorithm for mobile ad hoc networks," *Clust. Comput.*, vol. 5, no. 2, pp. 193–204, 2002.
- [11] S. Pathak and S. Jain, "A novel weight based clustering algorithm for routing in MANET," *Wirel. Netw.*, pp. 1–10, Nov. 2015.
- [12] A. Roy, M. Hazarika, and M. K. Debbarma, "Energy Efficient Cluster based routing in MANET," 2012, pp. 1–5.