A Comparative Study on Weighted Clustering In Mobile Ad hoc Networks

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ABSTRACT

In networks, Mobile ad-hoc networks (MANETs) are a type of wireless networks that can be quickly deployed without preexisting infrastructures. MANETs which raise a new challenges in large scale network that contain a large number of nodes. To deal with the challenges in network, many clustering algorithms have been emerged. Weighted clustering identifies various concepts in quality of clustering. Weighted clustering which focus on the various methods to find the quality of the mobile ad hoc networks. We may have different algorithms that may be constant or dynamic based weight based clustering algorithm. A large variety of approaches for mobile ad hoc networks in weighted clustering have been developed by researchers which focal point on different performance metrics. This paper presents a survey on weighted clustering in mobile ad hoc network.

Index Terms: Clustering, weighted clustering, Mobile ad hoc network, cluster head formation

1. INTRODUCTION

MANETs which Stands for "Mobile Ad Hoc Network." A MANET is a type of ad hoc network which don’t have preexisting infrastructure, such that which is capable of changing locations and configure itself. Because MANETS are mobile, they use wireless associates to connect to a range of networks. MANETs can be a standard Wi-Fi connection, or any other medium, such as a cellular or satellite transmission. There are more number of challenges faced by an Mobile Ad hoc Networks which are Infrastructure less, dynamically changing topologies, Physical layer limitation, Limitations of Mobile Nodes, Network security.

The process which divides the network into consistent substructures, called clusters. Each cluster has a exacting node which is elected as cluster head (CH) based on a unambiguous metric or a combination of metrics such as uniqueness, degree, mobility, weight, density, etc. The cluster head plays the part of coordinator within its substructure. Each CH acts as a temporary base station within its cluster range and communicates with other CHs. A cluster is consequently composed of a cluster head, gateways and members node.

Cluster Head (CH): it is the coordinator of the cluster.
Gateway: is a common node between two or more clusters.
Member Node (Ordinary nodes): is a node that is neither a CH nor gateway node. Each node belongs entirely to a cluster independently of its neighbors that might reside in a different cluster.

2. SURVEY ON WEIGHTED CLUSTERING

These days, the researches of clustering algorithm of Ad Hoc networks focus on the weight based method, in which the assessment of each weight is calculated based on the importance of different factors (indexes). The methods of weighted mean
can be divided into two categories approximately; they are the stable weight method, and the dynamic weight method. In this paper, we present a comparative survey on various weighted clustering algorithm

2.1 An Efficient Weight-based clustering algorithm for MANET

Mohammad Reza Monsef et al, put forward an efficient weight-based clustering algorithm (EWBCA) for mobile ad hoc networks (MANETs). The main objective of the project is to form a new scheme for clustering in wireless AD HOC network and improve strategy in WCA. A set of rules called Scalable Weighted Clustering Algorithm (SWCA) was proposed by this paper which effectively joins each and every one of the system parameters with certain weighting factors according to the need of the system. The quality of the weight is computed according to the resulting four parameters: Number of Neighbors, Residual Power of Battery, Stability and Variance of distance with all neighbors. In proposed SWCA (Scalable Weighted Clustered Algorithm), there are two new models in clustering algorithms: node stability and load balancing models. It targets to boost the usage of resources like bandwidth and energy, preserve current cluster structure, curtail routing overhead and swell end-to-end throughput.

2.2 WCA: A Weighted Clustering Algorithm for Mobile Ad Hoc Networks

Mainak chatterjee et al, put forward a weight-based distributed clustering algorithm for mobile ad hoc network. The central goal of this paper is an on-demand distributed clustering algorithm for multi-hop packet radio networks. The proposed weight-based distributed clustering algorithm takes into contemplation of the idle degree, transmission power, mobility and battery power of mobile nodes. By exploitation the diameter of the graph the time required to identify the cluster heads is estimated. The author tries to hold onto the number of nodes in a cluster around a pre-defined threshold to facilitate the optimal operation of the medium access control (MAC) protocol. The cluster heads, operating in “twofold” power mode, join up with the clusters which aid in routing messages from a node to any other node in MANETs.

2.3 Load Balancing: An Approach Based on Clustering in Ad Hoc Networks

Rachida Aoudjit et al, put forward a load balancing: a progress based on clustering in ad hoc networks. The main aim of this paper is that One of the most serious matters in these networks is the significant differences in term of processing and energy capacity between the nodes, persuading a load imbalance. Thus, sharing the load between the overloaded and ideal nodes is necessary in ad hoc networks. The main objective is to minimize the total execution time of the tasks by distributing the workload among nodes in network. Another objective is to extend the overloaded nodes lifetime inducing a stability of the network. The two steps implicated are Clusters formation and Load balancing within each cluster.
2.4 A Framework for Load Sharing in Clustered Ad Hoc Networks

Ratish Agarwal et al, urged a framework for load sharing in clustered ad hoc networks. The purpose of this paper is cluster formation procedure in which, if the number of members of a cluster head exceeds the predefined threshold value, a technique of cluster division is proceed. This shows that the cluster heads from the burden of excessive members of nodes. This work provides a structure for load sharing in crowded clusters. Even though clustering provides a good technic to trim down the control overhead in scalable ad hoc networks but there is always a chance of formation of bottleneck at the cluster heads. The bottleneck which can degrade the performance of the network. The Proposed LSC subdivides the overwhelmed cluster in two clusters and the head of the new born cluster is chosen by considering the power consumption during communication and weight values of the nodes. The selected cluster heads can improve the efficiency in terms of PDF, throughput, E2E delay and Load balancing.

2.5 Dynamic Entropy Based Combination Weighted Clustering Approach for High-Speed Ad hoc Network

Jianli Xie et al, put forward a dynamic entropy based combination weighted clustering approach for high-speed ad hoc network. The paper urged that the change of dynamic topology in high-speed Ad hoc network, which decreases the cluster stability (network stability) and which rises the cluster maintenance costs. To solve this problem, the author proposes a dynamic entropy based combination weighted clustering approach (DECW). In the cluster maintenance, there will be change of cluster head, to evade the frequent cluster head; the author announces a new Monte Carlo optimization. DECW which has the better performances than that of CBMD and ECUM clustering algorithms in terms of the average number of CHs, the average cluster head, the number of inter-cluster relocation, and the numbers of CH updating. Also, it shows that DECW approach has the finer applicability in large-scale and high-speed network environments.

2.6 A Weighted Clustering Algorithm Using Local Cluster-heads Election for QoS in MANETs

Vincent Bricard et al, intended a weighted clustering algorithm using local cluster-heads election for QoS in MANETs. The main goal of this paper is to suggest a new distributed Weighted Clustering Algorithm with Local cluster-heads election (WCA-L) which is located on an on-demand distributed clustering algorithm for multi-hop packet radio networks. The multi-hop packet radio networks, which is also specified as mobile ad hoc networks (MANETs). The task can be done using clustering techniques whereas the association and dissociation of nodes to and from clusters perturb the stability of the network topology, and thus reconfiguration of the system is frequently inevitable. In this paper the author propose a new distributed Weighted Clustering Algorithm together with Local cluster-heads election (WCA-L), where to limit the overhead induced by broadcasts on the total network throughout elections in network, we reflect that an isolated normal node can become itself cluster-head and form its retain cluster. To change the range of an election to an particular area where minimum two cluster-heads are in one-hop neighbors. This present that (WCA-L) algorithm guarantees a better immovability of the foremost set and a better quality of service than WCA.

2.7 An Efficient Weighted Clustering Network For Ad Hoc Network

Basant Kuamr Verma et al, put forward an efficient weighted clustering network for ad hoc network. The main aim of this paper is to rise the network scalability and efficiency network clustering approaches are implemented in network. The proposed WCA routing partakes buffer length, connectivity, mobility, remaining energy and fresh route information for cluster induction. The presented weighted clustering algorithm is able to scale the network ability and performance using their clustering notion. The clustering plot helps to improve network scalability, performance in terms of battery power and packet delivery ratio.
The urged WCA algorithm which include two different modules first the prime calculation and in addition the cluster head selection. The algorithm used in WCA is Weight Calculation Algorithm and cluster head algorithm.

### 2.8 An On-Demand Weighted Clustering Algorithm (WCA) for Ad hoc Networks

Mainak Chatterjee et al, recommended an on-demand weighted clustering algorithm (WCA) for ad hoc networks. The design of this paper is propose a weighted clustering algorithm (WCA) which takes into examination the ideal degree, transmission power, mobility and battery power of a mobile node. The cluster heads, which form a foremost set in the network, determine the topology and are responsible for its constancy. On-demand execution of WCA aims to sustain the stability of the network, thus lowering the computation and communication costs associated with it. The performance of WCA in terms of the number of cluster heads, reaflliation frequency and dominant set updates. Several heuristics have been proposed to choose cluster heads in an ad hoc network. These take in Highest-Degree heuristic, Lowest-ID heuristic and Node-Weight heuristic. The WCA has the flexibility of assigning different weights and takes into account a combined effect of the ideal degree, transmission power, and mobility and battery power of the nodes. The algorithm is executed only when there is a need, i.e., when a node is no longer able to attach itself to any of the existing cluster heads. Our algorithm performs significantly better than both of the Highest Degree and the Lowest-ID heuristics.

### 2.9 Energy Efficient Clustering Scheme for Prolonging the Lifetime of Wireless Sensor Network With Isolated Nodes

Jenq-Shiou Leu et al, put forward an energy efficient clustering scheme for prolonging the lifetime of wireless sensor network with isolated nodes. The paper urges a new regional energy aware clustering method using isolated nodes for WSNs, called Regional Energy Aware Clustering with Isolated Nodes (REAC-IN). In REAC-IN, CHs are selected based on weight. Weight is firm accordance with the residual energy of each sensor and the regional average energy of all sensors in each cluster. Improperly designed distributed clustering algorithms can cause nodes to become isolated from CHs. Such isolated nodes communicate with the sink by consuming plenty amount of energy. To prolong network lifetime, the regional average energy and the distance between sensors and the sink are used to determine whether the isolated node sends its data to a CH node in the former round or to the sink. The REAC-IN protocol presented in this paper improves the cluster head selection process and solves the problem of node isolation.

### 2.10 Relative Weight Based Clustering in Mobile Ad Hoc Networks

Sharmila Anand John Francis et al, planned a relative weight based clustering in mobile ad hoc networks. The paper propose A novel clustering protocol that retains a powerful analytical hierarchy process methodology, a mathematical model to compute relative weights for all the mobile nodes to pick appropriate cluster heads in the network. This novel clustering algorithm develops the stability of the network to a great extent by reducing cluster head changes. The performance metrics deliberated for evaluation are Cluster Number, Reaflliation Count ,Number of Dominant set updates, Cluster head Changes the relative weights are measured, stable cluster heads are chosen and its lifetime increases with decrease of cluster head change, thereby decreasing the overhead incurred due to cluster head change.

**Table 1: Comparison of different weight-based algorithms**
<table>
<thead>
<tr>
<th>S.NO</th>
<th>TITLE</th>
<th>RESOURCES</th>
<th>SELECTION OF CLUSTER HEAD</th>
<th>NETWORK LIFETIME</th>
<th>STABILITY</th>
<th>TRANSMISSION RANGE</th>
<th>CONCLUSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An Efficient Weight-based clustering algorithm for MANET</td>
<td>Journal of computing</td>
<td>Node with highest weight</td>
<td>Minimum</td>
<td>Uses less energy and increase in throughput.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WCA: A Weighted Clustering Algorithm for Mobile Ad Hoc Networks</td>
<td>Cluster Computing</td>
<td>Node which have smallest weight</td>
<td>Modest Stable</td>
<td>0m - 70m</td>
<td>Number of reaffiliations has been increased.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Load Balancing: An Approach Based on Clustering in Ad Hoc Networks</td>
<td>Journal of Computing and Information Technology</td>
<td>Node which has less in energy</td>
<td>Increased</td>
<td>0m-300m</td>
<td>Better management of the energy by reducing load imbalances in ad hoc networks.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Dynamic Entropy Based Combination Weighted Clustering Approach for High-Speed Ad hoc Network</td>
<td>International Journal of Future Generation Communication and Networking</td>
<td>Based on Monte Carlo optimization method</td>
<td>Increased</td>
<td>50m-300m</td>
<td>DECW approach has the better applicability in large-scale and high-speed network environments.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A Weighted</td>
<td>IEEE</td>
<td>Based on</td>
<td>Better</td>
<td>25m-75m</td>
<td>Better stability of</td>
<td></td>
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</table>


<table>
<thead>
<tr>
<th>Clustered Routing Algorithm Using Local Cluster-heads Election for QoS in MANETs</th>
<th>GLOBECOM</th>
<th>Weighted Clustering Algorithm with Local cluster-heads election (WCA-L)</th>
<th>Stability</th>
<th>the dominant set and a better quality of service</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>An Efficient Weighted Clustering Network For Ad Hoc Network</td>
<td>International Journal of Research in Computer Engineering and Electronics</td>
<td>Clustered routing algorithm</td>
<td>Improve stability</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Higher throughput, high packet delivery ratio and the less end to end delay.</td>
</tr>
<tr>
<td>8</td>
<td>An On-Demand Weighted Clustering Algorithm (WCA) for Ad hoc Networks</td>
<td>IEEE</td>
<td>Based on WCA algorithm</td>
<td>Maintain stability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WCA has the flexibility of assigning different weights, effect of the ideal degree, transmission power, mobility and battery power of the nodes.</td>
</tr>
<tr>
<td>9</td>
<td>Energy Efficient Clustering Scheme for Prolonging the Lifetime of Wireless Sensor Network With Isolated Nodes</td>
<td>IEEE COMMUNICATIONS LETTERS</td>
<td>Based on REAC-IN protocol</td>
<td>Extend lifetime</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>REACIN to improve the lifetime and stability of a network</td>
</tr>
<tr>
<td>10</td>
<td>Relative Weight Based Clustering in Mobile Ad Hoc Networks</td>
<td>International Conference on Computer Modelling and Simulation</td>
<td>Node with Lowest-ID</td>
<td>Increased</td>
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<td></td>
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<td>Stable cluster heads are chosen and its lifetime increases</td>
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</table>
3. Conclusion

Clustering is the finest solution for mobile ad hoc network to adapt itself for its dynamic nature. Selecting Clusterhead can be selected by computing quality of weighted nodes, which may depend on connectivity, mobility, battery power etc. It also illustrates that there are many techniques that can be followed for formation of clustering and calculating the weights of the nodes. This paper presents a review of weighted clustering algorithms in which comparative table shows multiple metrics have been taken to find the quality of nodes for selecting them as clusterheads, performance metric, load balancing and network lifetime has been increased.

REFERENCE


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