New Proposed Classic Cluster Layer Architecture for Mobile Adhoc Network (cclam)

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Abstract

Organization, scalability and routing have been identified as key problems hindering viability and commercial success of mobile ad hoc networks. Clustering of mobile nodes among separate domains has been proposed as an efficient approach to address those issues. In this work, we introduce an efficient distributed clustering layer algorithm that uses location metrics for cluster formation and we divided cluster in layers to secure our ordinary nodes. Our proposed solution mainly addresses cluster stability and manageability issues. Also, unlike existing active clustering methods, our algorithm relieves the network from the unnecessary burden of control messages broadcasting, especially for relatively static network topologies. The efficiency, scalability and competence of our algorithm against alternative approaches have been demonstrated through algorithm.

Keywords: Secure Architecture Design , Updated Database, Master Node

1. INTRODUCTION

Wireless communication and the lack of centralized administration pose numerous challenges in mobile wirelessad-hoc networks (MANETs) [6]. Node mobility results in frequent failure and activation of links, causing a routingalgorithm reaction to topology changes and hence increasing network control traffic [2]. Ensuring effective routing and QoS support while considering the relevant bandwidth and power constraints remains a great challenge. Given that MANETs may comprise a large number of MNs, a hierarchical structure will scale better [5].

Hence, one promising approach to address routing problems in MANET environments is to build hierarchies among the nodes, such that the network topology can be abstracted. This process is commonly referred to as *clustering* and the substructures that are collapsed in higher levels are called *clusters* [12]. The concept of clustering in MANETs is not new; many algorithms that consider different metrics and focus on diverse objectives have been proposed [12]. However, most existing algorithms fail to guarantee stable cluster formations. More importantly, they are based on periodic broadcasting of control messages resulting in increased consumption of network traffic and mobile hosts (MH) energy. In this article, we introduce a distributed algorithm for efficient and scalable clustering of MANETs that corrects the two aforementioned weaknesses. The main contributions of the algorithm are: fast completion of clustering procedure, where both location and battery power metrics are taken into account; derived clusters are sufficiently stable, while cluster scale is effectively controlled so as not to grow beyond certain limits; minimization of control traffic volume, especially in relatively static MANET environments. The remainder of the paper is organized as follows: Section II provides an overview of clustering concepts and algorithms. Section IIINew Network Model and algorithm. IV Characteristics of Cluster and MN Finally, Section V concludes the paper and draws directions for future work.

II. CLUSTERING

In clustering old procedure, a representative of each subdomain (cluster) is 'elected' as a *cluster head* (CH) and a node which serves as intermediate for inter-cluster communication is called *gateway*. Remaining members are called *ordinary nodes*. The boundaries of a cluster are defined by the transmission area of its CH. With an underlying cluster structure, non-ordinary nodes play the role of dominant forwarding nodes, as shown in Figure 1.1.

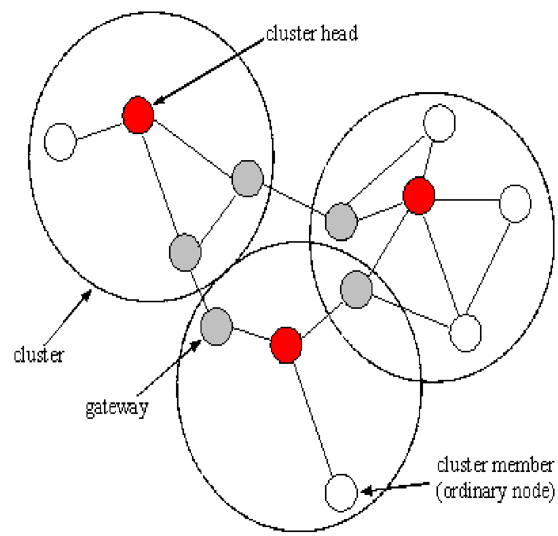

FIGURE 1: Cluster heads, gateways and ordinary nodes in mobile ad hoc networkclustering.

Cluster architectures do not necessarily include a CH inevery cluster. CHs hold routing and topology information,relaxing ordinary MHs from such requirement; however, theyepresent network bottleneck points. In clusters without CHs,every MH has to store and exchangemore topologyinformation, yet, that eliminates the bottleneck of CHs. Yi et al.identified two approaches for cluster formation, *active*clustering and *passive* clustering [10]. In active clustering,MHs cooperate to elect CHs by periodically exchanginginformation, regardless of data transmission. On the otherhand, passive clustering suspends clustering procedure untildata traffic commences [11]. It exploits on-going traffic topropagate "cluster-related information" (e.g., the state of anode in a cluster, the IP address of the node) and collectsneighbor information through promiscuous packet receptions.

Passive clustering eliminates major control overhead ofactive clustering, still, it implies larger setup latency whichmight be important for time critical applications; this latency isexperienced whenever data traffic exchange commences. Onthe other hand, in active clustering scheme, the MANET isflooded by control messages, even while data traffic is notexchanged thereby consuming valuable bandwidth and batterypower resources.

Recently multipoint relays (MPRs) have been proposed toreduce the number of gateways in active clustering. MPR hostsare selected to forward broadcast messages during the floodingprocess [7]. This technique substantially reduces the messageoverhead as compared to a typical flooding mechanism, whereevery node retransmits a message when it receives its firstcopy. Using MPRs, the Optimized Link State Routing (OLSR)protocol can provide optimal routes, and at the same timeminimize the volume of signaling traffic in the network [1]. Anefficient clustering method should be able to partition aMANET quickly with little control overhead. Due to thedynamic nature of MANETs, optimal cluster formations arenot easy to build. To this end, two distributed clusteringalgorithms have been proposed: Lowest ID algorithm (LID)[10] and Highest Degree algorithm (HD) [10]. Both of thembelong to active clustering scheme.

In LID algorithm, each node is assigned a unique ID.Periodically, nodes broadcast the list of nodes located withintheir transmission range (including themselves) through a'Hello' control message. The lowest-ID node in aneighborhood is then elected as the CH; nodes which can'hear' two or more CHs become gateways, while remainingMHs are considered as ordinary nodes. In HD algorithm, the highest*degree* node in a neighborhood, i.e. the node with thelargest number of neighbors is elected as CH. Figure 2compares LID vs. HD algorithm approaches.

LID method is a quick clustering method, as it only takestwo 'Hello' message periods to decide upon cluster structureand also provides a more stable cluster formation than HD. Incontrast, HD needs three 'Hello' message periods to establish aclustered architecture [3]. In HD method, losing contact of asingle node (due to MH movement), may cause failure of thecurrent CH to be re-elected. On the other hand, HD method canget fewer clusters than LID, which is more advantageous inlarge-scale network environments.

In current clustering schemes, stability and cluster size arevery important parameters; however, reducing the number ofclusters does not necessarily result in more efficientarchitectures. A CH may end up dominating so many MHs thatits computational, bandwidth and battery resources will rapidlyexhaust. Therefore, effective control of cluster size is anothercrucial factor.

Summarizing, both LID and HD algorithms use exclusivelylocation information to form clusters and elect CHs. In a morerecent approach, Li et al proposed Vote-based Clustering (VC)algorithm, where CH elections are based not purely on locationbut also on the battery power level of MHs [3]. In particular,MHs with high degree (large number of neighbors) andsufficient battery power are elected as CHs. However,simulations have shown that the combination of position andpower information in clustering procedure results in frequentCH changes, i.e. overall cluster structure instability [3]. In aMANET that uses cluster-based services, network performancemetrics such as throughput, delay and effective managementare tightly coupled with the frequency of clusterreorganization. Therefore, stable cluster formation is essentialfor better management and QoS support.In addition, LID, HD and VC algorithms share a commondesign characteristic which derives from their active clusteringorigin. Cluster formation is based on the periodic broadcast of'Hello' signaling messages. In cases where MHs are relativelystatic (e.g. in collaborative computing, on-the-fly conferencing,etc), periodic 'storms' of control messages only occur toconfirm that cluster structure established in previous periodsshould remain unchanged. These unnecessary messagebroadcasts not only consume network bandwidth, but valuablebattery power as well.

III. New Network Model

In clustering my procedure, a representative of each subdomain (cluster) is 'elected' as a *Master Node(MN)* and a node which serves as intermediate for inter-cluster communication is called *gateway*. Remaining members are called *ordinary nodes*. The boundaries of a cluster are defined by the transmission area of its CH. With an underlying cluster structure, non-ordinary nodes play the role of dominant forwarding nodes, as shown in Figure 1.2.

In this Clustering procedure I have in divided Cluster in to three Core Cluster Layers such as (1) Core Cluster (2) Core Cluster Layer 1 (3) Core Cluster Layer 2.

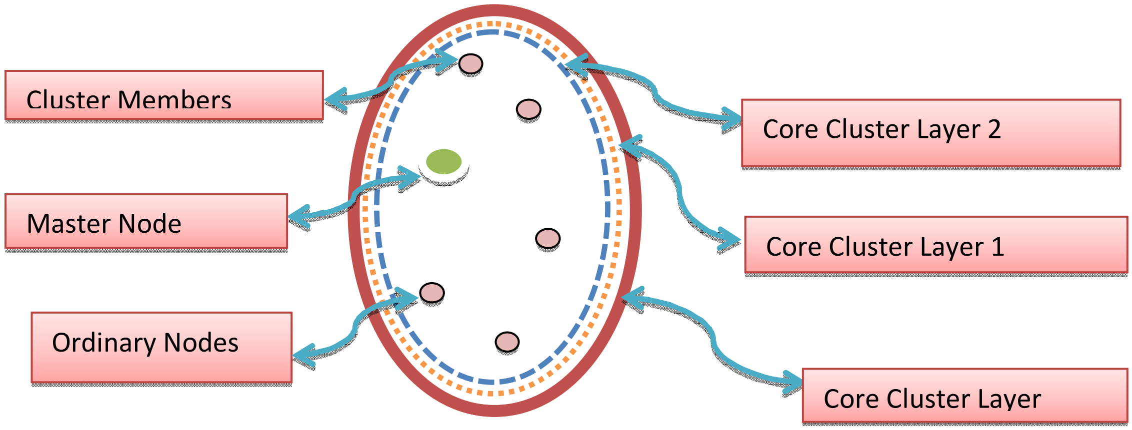

FIGURE 2: Cluster Layers , Master Node and ordinary nodes in mobile ad hoc networkclustering.

MANET can be divided into several overlapped clusters. And Cluster can be divided in to three layers. A cluster comprises of a subset of nodes that communicate viatheir assigned MN. The network is modeled as an undirectedgraph $G(V,E)$ where V denotes the set of all MHs (*vertices*) inthe MANET and E denotes the set of links or *edges* (i, j) where$i, j \in V$.

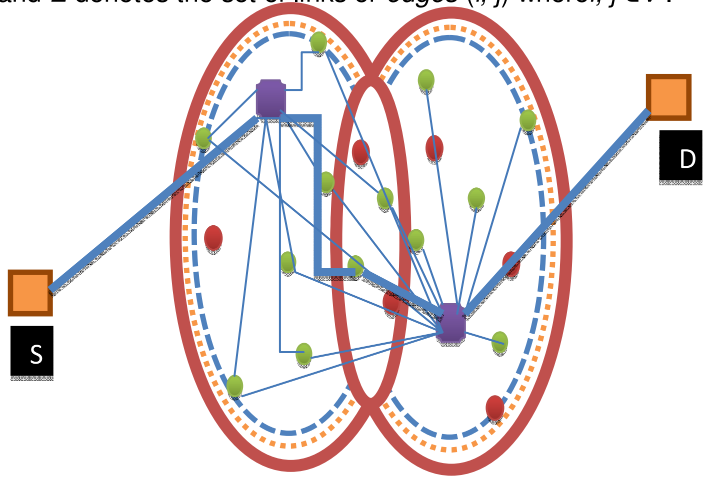

FIGURE 3: Working Model Of New Cluster Layer Manet

In this architecture i decided to assign one MASTER NODE (MN). Which will contain several tables such as:-

I. Node_Table :- Contain unique ID of Nodes.(NUI)

Node Number	NUI
1	1X00N1
2	1X00N2
3	1X00N3
4	1X00N4
5	1X00N5
6	1X00N6

TABLE 1

II. Node_Table1 :- Contain information of free nodes and busy nodes.

FREE NODE	BUSY NODE
1	5
8	11
4	6
7	2
9	10
3	12

TABLE 2

III. Ms_Node_Table :- Contain unique IDs of every Master Node with their Cluster information.(MNUI)

IV.

Cluster	MNUI
Cl1	Ms000X0120MN00001x1
Cl2	Ms000X0120MN00001x2
Cl3	Ms000X0120MN00001x3
Cl4	Ms000X0120MN00001x4

TABLE 3

V. TNUI_Node_Table :- Contain time being assigned IDs for every Nodes which will change every short period of time by Master Node.

Node NUI	Node TNUI
1X00N1	TNOOOXOU00N0X1
1X00N2	TNOOOXOU00N0X2
1X00N3	TNOOOXOU00N0X3
1X00N4	TNOOOXOU00N0X4

TABLE 4

VI. TMNUI_Node_Table :- Contain time being assigned IDs for every Master Node which will changed by Master Node every short of time and share with every Nodes.

MNUI	TMNUI
Ms000X0120MN00001x1	Ms000X01T20MN0001x1
Ms000X0120MN00001x2	Ms000X01T20MN0001x2
Ms000X0120MN00001x3	Ms000X01T20MN0001x3
Ms000X0120MN00001x4	Ms000X01T20MN0001x4

TABLE 5

VII. Cl_Node_Table :- Contain information of all Nodes available at Clusters range include common Cluster nodes. Common Nodes will contain by both cluster table. This table will contain by Master Nodes and all Nodes.

CL1	CL2	CL3	CL4	CL5
Nodes Available in Cluster 1	Nodes Available in Cluster 2	Nodes Available in Cluster 3	Nodes Available in Cluster 4	Nodes Available in Cluster 5

TABLE 6

VIII. Defaulter_Node_Table :- Contain defaulter nodes information. When Ordinary Nodes will go out of range again and again that time that Node will consider as defaulter Node and that Node ID will destroy permanently so that if any attacker will try to use those IDs MANET can easily identify and stop attackers.

Cluster	TNUID
1	TNOOOXOU00N0X1
5	TNOOOXOU00N0X3
8	TNOOOXOU00N0X4

TABLE 7

IX. Routing_Table:- Contain information of entire routing tables by which route our packets are moving.

Route	Source Node TNUI& Destination Node TNUI	Used TMNUI	Used TNUI	Gateway TNUI	Used Route TNUI
1	x,y,z,…	x,y,z,…	x, y, z, ……	x,y,z,…	x,y,z,…
2	x,y,z,…	x,y,z,…	x, y, z, …	x,y,z,…	x,y,z,…

TABLE 8

Cluster Characteristics

X. All Clusters are having limited range and depending on Master Nodes range.
XI. Clusters can collapse with each other.
XII. Collapsed area will call common Cluster.
XIII. Cluster will maintain three separate layer to secure Master Node position.
XIV. Those three layer will called as (1) Core Layer (2) Core Cluster Layer 1(3) Core Cluster Layer 2.

Master Node Characteristics

1. All Master Nodes will be dynamic.
2. Every Cluster should have one Master node.
3. All Master nodes should maintain all database tables.
4. Only Master Nodes can change Time Being assigned Unique Id for Nodes and Master Nodes.
5. After changing of TNUI of every nodes and own every master nodes will share all changed new updated database.
6. After changing of TMNUI Master Nodes will share the update with every nodes and every master nodes of each cluster.
7. After every updation Master Nodes will verify with all shared Nodes and Master Nodes.
8. If any Nodes cross cluster layer 2 instant one message will go to Master nodes available on that Cluster.
9. Master Node will send one MSG to that Nodes and inform him that he is going out of range.
10. If that Node will not listen and continuing to go out of Cluster Layer 1 then again Master Node will send him warning that not to move out of rang otherwise your will become defaulter Node.
11. After crossing of Core Cluster Layer MN will send a request to all MN that any node has entered in your area.
12. If that Node entered in other Cluster area then that's Node responsibility to update himself with new Clusters MN.
13. If all MN will reply that no updating that time that node will become defaulter and that will go to Defaulter_Node_Table.

Conclusion and Future Work

As I proposed in this paper about new architecture of MANET and Cluster layers and their (MN &Clusters)characteristics. By using of Cluster layer architecture we can save our MANER from all attackers and upcoming malicious drafts. This solution gives us an opportunity to identify attacker's type and nodes position. By using of this architecture we can identify how many nodes are free and busy in our cluster and by suing of nodes position we can identify which node node going out of range and which one is new node in our cluster.

After acceptance of this proposed design pattern. I am going to explain new proposed algorithm with their real time simulation for this design and going to explain how this new design is better than existing model by comparing all drawbacks of existing model of MANET.In this paper I have added 5 new table and future the number of tables can be increase as per the requirement.

In my next work is to simulate and test this model with all existing attackers and secure MANET.

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