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Power Aware Cluster to Minimize Load In Mobile Ad Hoc Networks

Anitha.K.M [1], Shobana. S[2], Aileen Chris. P[3]
[1](*Final year ME(CSE) Student, Karpagam University, TamilNadu, India.*)
[2](*Final year ME(CSE) Student, Karpagam University, TamilNadu, India.*)
[3](*Asst. Professor, Department of CSE, Karpagam University, TamilNadu, India.*)

ABSTRACT : *Mobile ad hoc networks (MANETs) are popularly known to their mobility and ease of usage. These networks are a set of identical nodes that move freely to communicate among networks and they are represented as a set of clusters. However, their wireless and active natures cause them to be more susceptible to various types of security attacks and transmission energy consumption so that they drop out of the network easily. Now-a-days the major challenge of MANETS is to endow with the assurance to the secure network services and also to provide a nearby balance of load for the cluster-heads. To meet this confront, certificate revocation with load balancing is an important central component to provide security and energy conservation in the network communications. In this paper, we focus on load balancing clustering to widen the lifetime of the cluster-head for a maximum time before allowing it to withdraw so as to distribute the responsibility to other legitimate nodes in the cluster to act as a cluster-head along with the issue of certificate revocation process. For quick, accurate, secure certificate revocation and to conserve energy, we propose the CCRV with Load Balancing Clustering scheme where we can reduce the burden of the cluster along with secure certificate revocation. In particular, to minimize the transmission energy consumption, we use the master slave model to operate the network with longer lifetime and we propose load balancing mechanism to enhance the lifetime of the cluster-head.*

Keywords- *Certificate Revocation, Load Balancing, Master-Slave, Mobile Ad hoc Networks (MANETs).*

I. INTRODUCTION

Mobile ad hoc networks have received a great scope in recent years due to their dynamic topology, self-configuring and infrastructure-less network. The major issue addressed when discussing about MANET is the security and the energy consumption. Since energy consumption reduces the wireless networks' connection lifetime, this issue has to be taken into account with utmost care. Most of the previous work in the literature focuses on clustering nodes for routing purpose and also address on energy efficiency. Clustering MANET nodes has perceptible advantages with respect to overall network management.

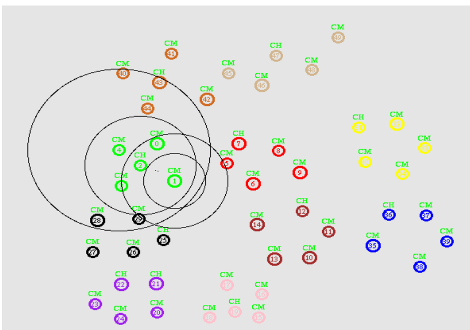

Fig 1. Node Clustering

Due to the mobility nature of the mobile ad hoc networks, these are powered by batteries. Communications or transmissions in the network cause the batteries to worn-out. Therefore, the amount of communications should be minimized to avoid a node in dropping out of the network. Cluster-head batteries can worn-out faster because they are involved in every communication within their cluster. Therefore, there is a need to allocate the responsibility of being a cluster-head to all nodes (load-balancing). In the case of periodic certificate revocation and monitoring of a malicious node, extra care is needed for the cluster-heads. The proposed scheme provides load balancing among cluster-heads while they are in the process of certificate revocation to assure a evenhanded distribution of load among cluster-heads and to safeguard them by minimizing their energy consumption.

In this paper, we propose a certificate revocation with load balancing scheme which takes into account of reducing the transmission energy consumption. The performance of the proposed scheme is evaluated in terms of both certificate revocation and balance of load in electing the cluster-head to minimize its burden. The reminder of the paper is structured as follows. In Section II, existing certificate revocation methods are reviewed, and their advantages and drawbacks are briefly described. Section III presents the detailed mechanism of our proposed load balancing scheme. The experimental analysis of the proposed scheme is evaluated and analyzed in Section IV, and Section V concludes the paper.

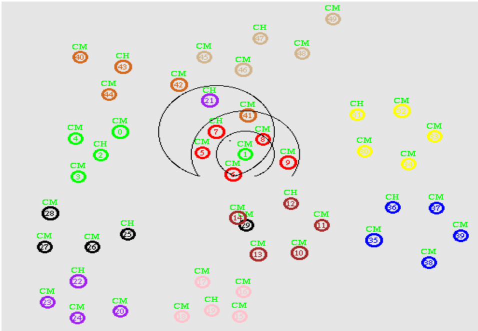

Fig 2. Cluster Structure.

II. RELATED WORK

Various kinds of load balancing schemes had been addressed earlier but without certificate revocation technique. On the other hand, numerous certificate revocation techniques have been proposed to enhance network security but balancing the load of a cluster and conserving the energy is still a challenging task.

In this section, we briefly review numerous methods that have been used for certificate revocation and various clustering schemes and present an idea of how we can conserve the energy by reducing the cluster-head's burden thereby enhancing the lifetime of the cluster-head. In URSA [3], they used a voting based mechanism in which the certificates of any node that joins the network, is issued by the neighboring nodes in that network. Two neighboring nodes receive their certificates from each other and also exchange certificate information about other nodes that they know. Nodes that shares the same certificate information belongs to the same network. When the number of accusations against the node exceeds a certain threshold, the certificate of a suspected node is revoked. Since URSA communicates among their neighbors, they do not require any special equipment such as Certificate Authorities (CA). So this leads to high operational cost and the major issue of false accusation has not been addressed.

Another scheme proposed for the certificate revocation [4], also uses the voting based mechanism where all the nodes in the network are allowed to vote together. In URSA, no Certification Authority (CA) exists in the network, instead each node monitors the behavior of its neighboring nodes. The primary difference from URSA is that nodes vote with variable weights. The load of a node is considered in terms of the reliability and trustworthiness of the node that is derived from its past behaviors in the network. When the weighted sum from voters against the node exceeds a predefined threshold, the certificate of an accused node is revoked. By doing so, the accuracy of certificate revocation can be improved. However, since participation of all nodes in each voting takes place in this scheme, the communications overhead used to exchange voting information is relatively high, and it enhances the revocation time also.

The method proposed in [4] introduces a time session to refresh the certificate information of each node. The accusation count is reset at the end of each session. Therefore, while this scheme is able to mitigate the damage caused by false accusations, the performance can be largely degraded by the increase of malicious nodes.

The objective of the DS-based clustering schemes is it forms an inter-cluster routing backbone in a network by selecting a small number of mobile nodes as dominating nodes to form the DS. Both schemes form 1-hop clusters with dominating nodes serving as cluster-heads. Chen's algorithm[7] can form smaller number of clusters, that results in a lesser amount of cluster overlap architecture by relaxing the direct connection requirement between dominating nodes when compared with Wu's algorithm[6]. DS-based clustering is more feasible for static networks or networks with low mobility. Wu's algorithm could be completed in just two rounds while Chen's needs a larger and non-constant number of rounds.

In Low-Maintenance Clustering, LCC[8], 3hBAC[9], and Lin's[10] algorithm are considered to be active clustering schemes, as they require precise cluster- related control message exchange among nodes. Also, they need stationary motion period of the mobile nodes for the initial cluster construction because their cluster-heads are required to bear a specific characteristic, i.e. highest connectivity, in their local area. These schemes need a non-constant number of rounds to complete the cluster formation since not all the cluster-head claims can be declared at the same time, because some mobile nodes can serve as cluster-heads only after they can confirm some neighbors' status.

According to the above discussion, all the security based research works concentrate mainly on recovering the falsely accused node which is very essential for a secure communication but did not address the lifetime of the cluster-head which plays a vital role in revocation process with other nodes in the network. Various energy-efficiency based research works did not address the certificate revocation process. In this paper, we propose a load balancing clustering scheme which can achieve reduced transmission power along with the certificate revocation process with prompt revocation, lower operational traffic, and mitigate damage from false accusations.

III. THE ENVISIONED SCHEME

We are combining CCRV with Load balancing clustering (LBC) provide a nearby balance of load on the elected cluster-heads.

3.1. Load Balancing Clustering

In Load Balancing Clustering [11], once a node is elected a cluster-head it stays as a cluster-head up to some maximum specified amount of time. Each mobile node has a variable, virtual ID (VID), and the value of VID is set as its ID number at first. Primarily, the nodes with the highest IDs in their local area win the cluster-head role. Fig 3 shows a sample load balancing clustering. When a cluster-head exhausts its duration time, it resets its VID to 0 and becomes a non-cluster-head node and shares the information in the warning list and black list to the newly elected cluster-head which is not a malicious node. When two cluster-heads move into same transmission range, the one with higher VID is elected as a cluster-head. A cluster-head must possess both characteristics: highest ID and normal node or legitimate node. When a cluster-head quits, a non-cluster-head with the largest VID value and also acting as a normal node in the neighbourhood can continue the cluster-head function. The newly chosen mobile node is the one whose previous total cluster-head serving time is the shortest in its neighbourhood, and this should guarantee good energy level for being a new cluster-head.

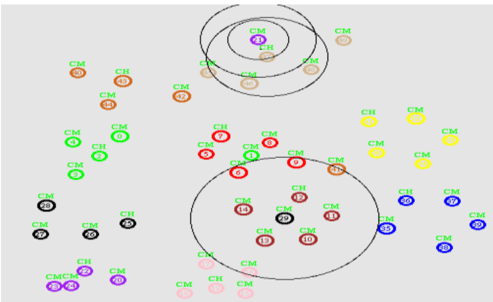

Fig 3: Sample Load Balancing Clustering.

3.2. Energy conservation in clustering

To achieve energy conservation in clustering [12], two node types: master and slave are used. The master nodes are the cluster-heads and the slave nodes are the cluster members. A slave node must be connected to only one master node, and it is not allowed to have a direct connection between slave nodes. Master nodes are selected in advance, and can only serve a limited number of slave nodes. To minimize the transmission energy consumption summed by all master slave pairs and to serve as many slave nodes as possible in order to operate the network with longer lifetime and better performance. The channel allocation procedure also follows the received signal strength. The drawback of this scheme is paging process before each round of communication consumes a large amount of energy. The scheme can be executed with less computing power at high speed using the single-phased scheme.

IV. EXPERIMENTAL ANALYSIS

Our simulated network consists of 20, 30 and 40 mobile nodes in an area of 10 by 10 m^2. The nodes are separated in the network in different locations. The mobile nodes then start separating themselves and forms into clusters. There should be atleast three CMs under each CHs to communicate with them. The CMs starts sending the packets through the CHs to a particular destination. If the CH suffers from heavy load then the packets are sent to the destination through the CMs and they choose a CM to act as a CH. Each mobile node is uniformly randomly distributed in the simulation area. Fig 4 and 5 shows the end-to-end latency and the packet delivery ratio of the proposed scheme.

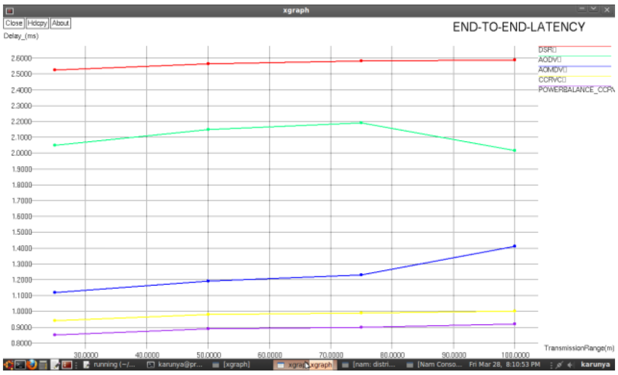

Fig 4. End-to-End Latency

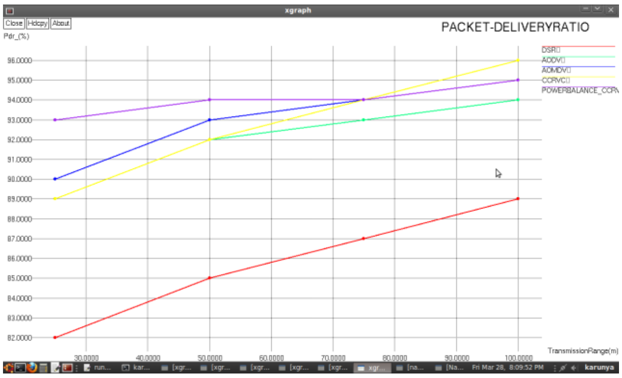

Fig 5. Packet Delivery Ratio

V. Conclusion

We have presented the CCRV with load balancing scheme, an effective and efficient mechanism to reduce the call drop rate by giving priority to the slave nodes that receive single paging signal in the channel allocation. We have combined the load balancing scheme with certificate revocation mechanism in order to reduce the transmission power where the cluster-heads play a vital role in the process of revoking the certificate of the attacker node. The proposed schemes can be implemented and executed in real time. The transmission power and the packet delivery rate for the proposed schemes produces approximate optimum results. Hence, the proposed schemes are suitable for periodic or event-driven cluster reconfiguration. The optimization problems were formulated as signomial optimizations and linear optimization, which were efficiently solved using generalized geometric programming and linear programming, respectively. For tractability purposes, the analysis for the stochastic model is necessarily approximate, as it relies on several simplifying assumptions. Simulations were conducted to verify the adequacy of this analysis and demonstrate the substantial benefits of the proposed schemes in terms of prolonging the coverage time of the network.

References

[1] K. Park, H. Nishiyama, N. Ansari, and N. Kato, *"Certificate revocation to cope with false accusations in mobile ad hoc networks," Proc. 2010 IEEE 71st Vehicular Technology Conference: VTC2010-Spring, Taipei,Taiwan, May 16-19, 2010.*

[2] J. Clulow and T. Moore, *"Suicide for the Common Good: A New Strategy for Credential Revocation in Selforganizing Systems," ACMSIGOPS Operating Systems Reviews, vol. 40, no. 3, pp.18-21, Jul.2006.*

[3] H. Luo, J. Kong, P. Zerfos, S. Lu, and L. Zhang, "*URSA: ubiquitous and robust access control for mobile adhoc networks," IEEE/ACM Trans. Networking, vol. 12, no. 6, pp.1049-1063, Oct. 2004.*

[4] G. Arboit, C. Crepeau, C. R. Davis, and Maheswaran, *"A Localized Certificate Revocation Scheme for Mobile Ad Hoc Networks," Ad Hoc Network, vol. 6, no. 1, pp. 17-31, Jan. 2008.*

[5] S. Bandyopadhyay, and E. J. Coyle, *"An energy efficient hierarchical clustering algorithm for wireless sensor networks," in Proc. IEEE INFOCOM 2003, Apr. 2003.*

[6] J. Wu and H. L. Li, *"On Calculating Connected Dominating Set for Efficient Routing in Ad Hoc Wireless Networks," Proc. 3rd Int'l. Wksp. Discrete Algorithms and Methods for Mobile Comp. and Commun., 1999, pp. 7–14.*

[7] Y.-Z. P. Chen and A. L. Liestman, *"Approximating Minimum Size Weakly-Connected Dominating Sets for Clustering Mobile Ad Hoc Networks," in Proc. 3rd ACM Int'l. Symp. Mobile Ad Hoc Net. & Comp., June 2002, pp. 165–72.*
[8] C.-C. Chiang *et al., "Routing in Clustered Multihop, Mobile Wireless Networks with Fading Channel," in Proc. IEEE SICON'97, 1997.*
[9] J. Y. Yu and P. H. J. Chong, *"3hBAC (3-hop between Adjacent Clusterheads): a Novel Non-overlapping Clustering Algorithm for Mobile Ad Hoc Networks," in Proc. IEEE Pacrim'03, vol. 1, Aug. 2003, pp. 318–21.*
[10] C. R. Lin and M. Gerla, *"Adaptive Clustering for Mobile Wireless Networks," IEEE JSAC, vol. 15, Sept. 1997, pp. 1265–75.*
[11] A. D. Amis and R. Prakash, *"Load-Balancing Clusters in Wireless Ad Hoc Networks," in Proc. 3rd IEEE ASSET'00, Mar. 2000, pp. 25–32.*
[12] J.-H. Ryu, S. Song, and D.-H. Cho, *"New Clustering Schemes for Energy Conservation in Two-Tiered Mobile Ad-Hoc Networks," in Proc. IEEE ICC'01, vo1. 3, June 2001, pp. 862–66.*