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RESEARCH ARTICLE



Balance the Resource Consumption by using Head Selection Approach in Manets

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Abstract - Head selection model deals with the Head selection in the presence of egotistic nodes for intrusion detection in Mobile Ad-hoc Networks (MANETs). To balance the resource consumption among all nodes and prolong the lifetime of an MANET, nodes with the most remaining resources should be selected as the head. However, there are two main obstacles in achieving this goal. First, without incentives for serving others, a node might behave egotistically by lying about its remaining resources and avoiding being selected. Second, selecting an optimal collection of heads to minimize the overall resource consumption may incur a prohibitive performance overhead, if such a selection requires flooding the network. To address the issue of egotistic nodes, Head selection model present a solution based on mechanism design theory. More specifically, the solution provides nodes with incentives in the form of reputations to encourage nodes in honestly participating in the selection process. The amount of incentives is based on the Vickers, Clarke, and Groves (VCG) model to ensure truth-telling to be the dominant strategy for any node. To address the optimal selection issue, Head selection model propose a series of local selection algorithms that can lead to globally optimal selection results with a low cost. Head selection model address these issues in two possible application settings, namely, Cluster-Based Head selection (CBHS) and Cluster-Autonomous Head selection (CAHS). The former assumes given clusters of nodes, whereas the latter does not require any pre-clustering. Finally, Head selection model justify the effectiveness of the proposed schemes through extensive experiments.

Keywords: Head Selection; Egotistic node and Clusters

I. Introduction

A Network is a collection of hardware components and computers interconnected by communication channels that allow sharing of resources and information. Where at least one process in one device is able to send/receive data to/from at least one process residing in a remote device, then the two devices are said to be in a network. Networks may be classified according to a

wide variety of characteristics such as the medium used to transport the data, communications protocol used, scale, topology, and organizational scope.

A Wireless Ad-Hoc Network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity [4][9]. In addition to the classic routing, ad hoc networks can use flooding for forwarding the data. Wireless ad hoc networks can be further classified by their application, Mobile Ad-Hoc Networks (MANET), Wireless Mesh Networks (WMN) and Wireless Sensor Networks (WSN)

A Mobile Ad-Hoc Network (MANET) is a egotistic-configuring infrastructure less network of mobile devices connected by wireless links. Ad-hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of wireless ad hoc networks that usually has a routable networking environment on top of a Link Layer ad hoc network[18][11].

The nodes in each cluster select a Head node to serve as the IDS for the entire cluster. The Head-IDS selection process can be either random or based on the connectivity. Both approaches aim to reduce the overall resource consumption of IDSs in the network. However, the nodes usually have different remaining resources at any given time, which should be taken into account by a selection scheme. Unless sufficient incentives are provided, nodes might misbehave by acting egotistically and lying about their resources level to not consume their resources for serving others while receiving others services. Moreover, even when all nodes can truthfully reveal their resource levels, it remains a challenging issue to select an optimal collection of Heads to balance the overall resource consumption.

II. Related Work

The nodes in each cluster select a Head node to serve as the IDS for the entire cluster. The Head-IDS selection process can be either random or based on the connectivity. Both approaches aim to reduce the overall resource consumption of idss in the network. However, the nodes usually have different remaining resources at any given time, which should be taken into account by a selection scheme. Unfortunately, with the random model, each node is equally likely to be selected regardless of its remaining resources. The connectivity index-based approach selects a node with a high degree of connectivity even though the node may have little resources left[7][5].

With both selection schemes, some nodes will die faster than others, leading to a loss in connectivity and potentially the partition of network. Although it is clearly desirable to balance the resource consumption of idss among nodes, this objective is difficult to achieve since the resource level is the private information of a node. Unless sufficient incentives are provided, nodes might misbehave by acting egotistically and lying about their resources level to not consume their resources for serving others while receiving others services [6]. Moreover, even when all nodes can truthfully reveal their resource levels, it remains a challenging issue to select an optimal collection of Heads to balance the overall resource consumption.

A Mobile Ad-Hoc Network (MANET) is a egotistic-configuring infrastructure less network of mobile devices connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router [12]. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of wireless ad-hoc networks that usually has a routable networking environment on top of a Link Layer ad hoc network.

In CAHS, each node must be monitored by a Head node that will analyze the packets for other ordinary nodes. Based on the cost of analysis, nodes will cooperate to select a set of Head nodes that will be able to analyze the traffic across the whole network and handle the monitoring process. This increases the efficiency and balances the resource consumption of IDS in the network. Head selection mechanism provides payments to the selected Heads for serving others. The payment is based on a per-packet price that depends on the number of votes the selected nodes get.

The nodes that do not get any vote from others will not receive any payment. The payment is in the form of reputations, which are then used to allocate the Head's sampling budget for each node. Hence, any node will strive to increase its reputation in order to receive more IDS services from its corresponding Head. In CBHS, the whole network is divided into a set of clusters where a set of 1-hop neighbor nodes forms a cluster. Here, let's use the scheme to cluster the nodes into 1-hop clusters. Each cluster then independently selects a Head among all the nodes to handle the monitoring process based on nodes' analysis cost.

The design of incentives is based on a classical mechanism design model, namely, Vickrey, Clarke, and Groves (VCG). The model guarantees that truth-telling is always the dominant strategy for every node during each selection phase. On the other hand, to find the globally optimal cost-efficient Heads, a Head selection algorithm is devised to handle the selection process, taking into consideration the possibility of cheating and security flaws, such as replay attack[15][14].

In both selection schemes, some nodes will die faster than other node. Leading to the loss in connectivity and potentially the partition of network. Nodes may act egotistically without giving the true information about the resource consumption.

Head selection model propose a solution for balancing the resource consumption of IDSs among all nodes while preventing nodes from behaving egotistically. To address the egotistic behaviour, Head selection model design incentives in the form of reputation to encourage nodes to honestly participate in the selection scheme by revealing their cost of analysis.

III. Key Idea

The algorithm decreases the percentage of Heads, single-node clusters, and maximum cluster size, and increases average cluster size. Last but not least, have to address these issues in two possible settings, namely, Cluster- Autonomous Head selection (CAHS) and Cluster-Based Head selection (CBHS). In the former, the Heads are selected according to the received votes from the neighbor nodes. The latter scheme selects Heads after the network is formulated into multiple clusters. In both schemes, the Heads are selected in an optimal way in the sense that the resource consumption for serving as IDSs will be balanced among all nodes overtime.

To design the Head selection algorithm, the following requirements are needed,

- To protect all the nodes in a network, every node should be monitored by a Head
- To balance the resource consumption of IDS service, the overall cost of analysis for protecting the whole network is minimized.

In other words, every node has to be affiliated with the most cost-efficient Head among its neighbors. Head selection algorithm is executed in each node taking into consideration the following assumptions about the nodes and the network architecture,

- Every node knows its (2-hop) neighbors, which is reasonable since nodes usually maintain a table about their neighbors for routing purposes.
- Loosely synchronized clocks are available between nodes.
- Each node has a key pair for establishing a secure communication between nodes.
- Each node is aware of the presence of a new node or removal of a node.

When a new node is added to the network, it either launches its own IDS or becomes an ordinary node of any Head node. To include a new node to the IDS service, four messages are needed, Hello, Status, Join, and Acknowledge. Hello is sent by a new node *n* to announce its presence in the network. This Hello message is similar to the one presented in the previous section. Upon receiving the Hello, all the neighbors of the new node reply with a Status message.

When a node is disconnected from the network due to many reasons, such as mobility or battery depletion, then the neighbor nodes have to reconfigure the network. Whenever a node dies, its neighbors are aware of it. At first, a Dead (*n*) message is circulated to all neighbors' to confirm the removal of node *n*. On receiving the Dead (*n*) message, the neighbor node *k* checks whether node *n* is its Head node or not. If node *n* is the Head node of node *k*, then node *k* announces a new selection and updates its reputation table.

A .Node creation and assigning properties

A Mobile Ad-Hoc Network (MANET) is a egotistic-configuring infrastructure less network of mobile devices connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a

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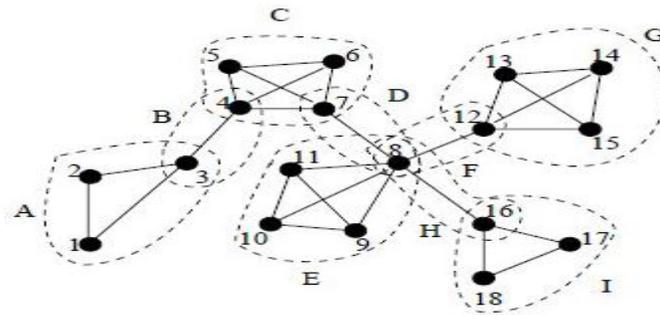


Fig 1.Cluster Head in Manet

B. Selecting Head

In CAHS, each node must be monitored by a Head node that will analyze the packets for other ordinary nodes. Based on the cost of analysis, nodes will cooperate to select a set of Head nodes that will be able to analyze the traffic across the whole network and handle the monitoring process illustrated in fig 1. This increases the efficiency and balances the resource consumption of IDS in the network. Selection mechanism provides payments to the selected Heads for serving others.

The payment is based on a per-packet price that depends on the number of votes the selected nodes get. The nodes that do not get any vote from others will not receive any payment. The payment is in the form of reputations, which are then used to allocate the Head's sampling budget for each node. Hence, any node will strive to increase its reputation in order to receive more IDS services from its corresponding Head. In CBHS, the whole network is divided into a set of clusters where a set of 1-hop neighbor nodes forms a cluster. Here, use the scheme to cluster the nodes into 1-hop clusters. Each cluster then independently selects a Head among all the nodes to handle the monitoring process based on nodes' analysis cost.

To design the Head selection algorithm, the following requirements are needed, to protect all the nodes in a network, every node should be monitored by a Head and to balance the resource consumption of IDS service; the overall cost of analysis for protecting the whole network is minimized. In other words, every node has to be affiliated with the most cost-efficient Head among its neighbors.

C. Updating the Head (Deleting & Adding a node)

When a new node is added to the network, it either launches its own IDS or becomes an ordinary node of any Head node. To include a new node to the IDS service, four messages are needed: Hello, Status, Join, and Acknowledge. Hello is sent by a new node n to announce its presence in the network. This Hello message is similar to the one presented in the previous section. Such networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of wireless ad-hoc networks that usually has a routable networking environment on top of a Link Layer ad hoc network.

The payment is based on a per-packet price that depends on the number of votes the selected nodes get. The nodes that do not get any vote from others will not receive any payment. The payment is in the form of reputations, which are then used to allocate the Head's sampling budget for each node. Hence, any node will strive to increase its reputation in order to receive more IDS services from its corresponding Head in fig 2.

When a node is disconnected from the network due to many reasons, such as mobility or battery depletion, then the neighbor nodes have to reconfigure the network. Head selection model assume that whenever a node dies, its neighbors are aware of it. At first, a Dead (n) message is circulated to all neighbors to confirm the removal of node n. On receiving the Dead (n) message, the neighbor

node k checks whether node n is its Head node or not. If node n is the Head node of node k, then node k announces a new selection and updates its reputation table.

To protect all the nodes in a network, every node should be monitored by a Head and to balance the resource consumption of IDS service, the overall cost of analysis for protecting the whole network is minimized. In other words, every node has to be affiliated with the most cost-efficient Head among its neighbors.

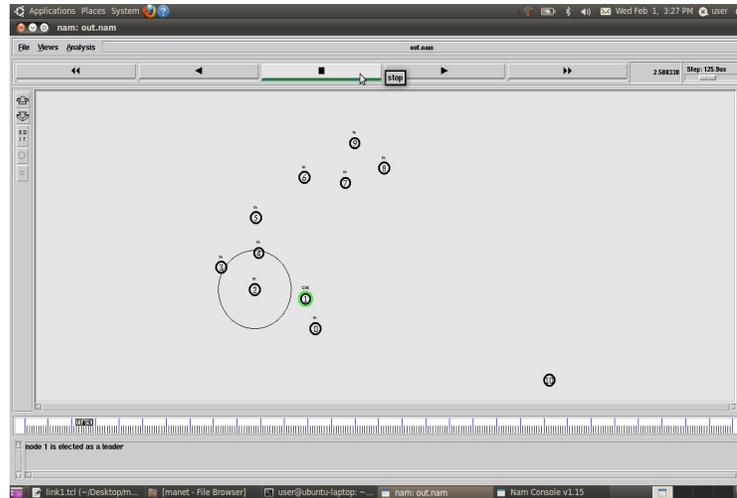


Fig2.Heads Communication to Clusters

D. Head Response Message

At the end of the selection, nodes are divided into two types, Head and ordinary nodes. Head nodes run the IDS for inspecting packets, during an interval, based on the relative reputations of the ordinary nodes. To protect all the nodes in a network, every node should be monitored by a Head and to balance the resource consumption of IDS service, the overall cost of analysis for protecting the whole network is minimized. In other words, every node has to be affiliated with the most cost-efficient Head among its neighbors. The enforce re-selection every period since it is unfair and unsafe for one node to be a Head forever. Even if the topology remains same after specific time, all the nodes go back to initial stage and select a new Head according to the above algorithms. After being selected, Head has to serve for the node that has voted for it. Each selected Head will get payment in the form of reputation. Each node voted for the Head will be served in the form of reputation.

IV. Network Simulation

In communication and computer network research, network simulation is a technique where a program models the behavior of a network either by calculating the interaction between the different network entities (host/routers, data links, packets, etc.) using mathematical formulas, or actually capturing and playing back observations from a production network. The behavior of the network and the various applications and services it supports can then be observed in a test lab, Various Attributes of the environment can also be modified in a controlled manner to assess how the network would behave under different conditions. When a simulation program is used in conjunction with live applications and services in order to observe end-to-end performance to the user desktop, this technique is also referred to as network emulation.

V. Conclusion

The unbalanced resource consumption of IDSs in MANET and the presence of egotisticish nodes have motivated us to propose an integrated solution for prolonging the lifetime of mobile nodes and for preventing the emergence of egotisticish nodes. The solution motivated nodes to truthfully select the most cost-efficient nodes that handle the detection duty on behalf of others. Moreover, the sum of the selected Heads is globally optimal. To achieve this goal, incentives are given in the form of reputations to motivate nodes in revealing truthfully their costs of analysis. Reputations are computed using the well-known VCG mechanism by which truth-telling is the dominant strategy. Head selection Model also analyzed the performance of the mechanisms in the presence

of egotisticish and malicious nodes. To implement Head selection mechanism, devised a selection algorithm with reasonable performance overheads. Moreover, able to decrease the percentage of Heads, single-node clusters, and maximum cluster size, and increase the average cluster size. These properties allow us to improve the detection service through distributing the sampling budget over less number of nodes and reduce single nodes to launch their IDS. The future directions include cooperation with large-scale intrusion detection systems, the development of distributed ID wrappers, and efforts to improve the trust-worthiness and safety of the kernel-resident ID module.

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REFERENCES

- [1] T. Anantvalee and J. Wu, (2006) "A Survey on Intrusion Detection in Mobile Ad Hoc Networks," Wireless/Mobile Network Security, Springer.
- [2] L. Anderegg and S. Eidenbenz, (2009) "Ad Hoc-VCG: A Truthful and Cost-Efficient Routing Protocol for Mobile Ad Hoc Networks with Egotisticish Agents," Proc. ACM MobiCom.
- [3] F. Anjum and P. Mouchtaris, (2007) "Security for Wireless Ad Hoc Networks". John Wiley and Sons, Inc.
- [4] S. Basagni,(2012) "Distributed and Mobility-Adaptive Clustering for Multimedia Support in Multi-Hop Wireless Networks," Proc. IEEE Int'l Vehicular Technology Conf. (VTC).
- [5] S. Basagni,(2011) "Distributed Clustering for Ad Hoc Networks," Proc. IEEE Int'l Symp. Parallel Architectures, Algorithms, and Networks (ISPA).
- [6] M. Bechler, H. Hof, D. Kraft, F. Pahlke, and L. Wolf, (2011)"A Cluster-Based Security Architecture for Ad Hoc Networks," Proc. IEEE INFOCOM.
- [7] P. Brutch and C. Ko, (2010) "Challenges in Intrusion Detection for Wireless Ad-Hoc Networks," Proc. IEEE Symp. Applications and the Internet (SAINT) Workshop.
- [8] S. Buchegger and J.L. Boudec, (2012)"Performance Analysis of the CONFIDANT Protocol (Cooperation of Nodes—Fairness in Dynamic Ad-Hoc Networks)," Proc. ACM MOBIHOC.
- [9] K. Chen and K. Nahrstedt,(2006) "iPass: An Incentive Compatible Auction Scheme to Enable Packet Forwarding Service in MANET," Proc. Int'l Conf. Distributed Computing Systems.
- [10] B. DeCleene, L. Dondeti, S. Griffin, T. Hardjono, D. Kiwior, J. Kurose, D. Towsley, S. Vasudevan, and C. Zhang, (2011) "Secure Group Communications for Wireless Networks," Proc. IEEE Military Comm. Conf. (MILCOM).
- [11] J. Feigenbaum, C. Papadimitriou, R. Sami, and S. Shenker, (2012) "A BGP Based Mechanism for Lowest-Cost Routing," Proc. ACM Symp. Principles of Distributed Computing (PODC).
- [12] J. Feigenbaum and S. Shenker, (2010) "Distributed Algorithmic Mechanism Design: Recent Results and Future Directions", Proc. AMM Int'l Workshop Discrete Algorithms and Methods for Mobile Computing and Comm. (DIAMM).
- [13] N. Gura, A. Patel, A. Wander, H. Eberle, and S.C. Shantz, (2004)"Comparing Elliptic Curve Cryptography and RSA on 8-Bit CPUs," Proc. Workshop Cryptographic Hardware and Embedded Systems (CHES).
- [14] S. Gwalani, K. Srinivasan, G. Vigna, E.M. Beding-Royer, and R. Kemmerer,(2007) "An Intrusion Detection Tool for AODV-Based Ad Hoc Wireless Networks," Proc. IEEE Computer Security Applications Conf. (CSAC).
- [15] Y. Hu, A. Perrig, and D.B. Johnson,(2009) "Ariadne: A Secure On-Demand Routing Protocol for Ad Hoc Networks," Proc. ACM MOBICOM.
- [16] Y. Huang and W. Lee,(2010) "A Cooperative Intrusion Detection System for Ad Hoc Networks," Proc. ACM Workshop Security of Ad Hoc and Sensor Networks.
- [17] L. Hurwicz and S. Reiter, (2008), Designing Economic Mechanisms, first ed. Cambridge Univ. Press.
- [18] J. Green and J. Laffont,(2009), Incentives in Public Decision-Making. Springer.