ISSN:0975-9646

IEAACK-Secure Detection System for Packet-Dropping attack in MANETs

Ms. **Preeti Sharanvijay. Chikkshetty**
Dept. of Computer Science and Engg,
N.B.N. Sinhgad College of Engg. Solapur University, Solapur, India

Prof. **Abhijit. V. Mophare,**
Asst. Prof. in CSE Dept.,
N.B.N. Sinhgad College of Engg.Solapur University, Solapur, India

Abstract: MANET is a collection of wireless independent nodes along with transmitter and receiver that communicate with each other via bidirectional link. The self-configuring ability of nodes in MANET made it popular among critical mission applications like military use or emergency recovery. But due to the changing topology and open access MANET become vulnerable to problems (such as receiver collision, limited transmission power, false misbehavior report , packet dropping) To solve this problem we use three approaches of Intrusion Detection System (IDS) such as Watchdog, TWOACK, and AACK. We have proposed a new protocol design for MANET that is IDS based EAACK which consist of ACK, S-ACK and MRA for solving all the problems of Watchdog approach in IDS of MANET.

Keywords: MANET, AACK, IDS, DSR, EAACK, IEAACK

I. INTRODUCTION

Over the past decade, there has been a growing interest in wireless networks, as the cost of mobile devices such as PDAs, laptops, cellular phones, etc have reduced drastically. The latest trend in wireless networks is towards pervasive and ubiquitous computing - catering to both nomadic and fixed users, anytime and anywhere. Several standards for wireless networks have emerged in order to address the needs of both industrial and individual users. One of the most prevalent forms of wireless networks in use today is the Wireless Local Area Network (WLAN). In such a network, a set of mobile nodes are connected to a fixed wired backbone. WLANs have a short range and are usually deployed in places such universities, companies, cafeterias, etc. There is still a need for communication in several scenarios of deployment where it is not feasible to deploy fixed wireless access points due to physical constraints of the medium. For example, consider communication amongst soldiers in a battlefield, involving troops spread out over a large area. In this case, it is not only feasible to deploy a fixed wireless access point, but also risky since an enemy attack would bring down the whole network. This problem has led to a growing interest among the research community in mobile ad hoc networks, wireless networks comprised of mobile computing devices communicating without any fixed infrastructure.

By definition, Mobile Ad hoc NETwork (MANET) is a collection of mobile nodes equipped with both a wireless transmitter and a receiver that communicate with each other via bidirectional wireless links either directly or indirectly. Industrial remote access and control via wireless networks are becoming more and more popular these days. One of the major advantages of wireless networks is its ability to allow data communication between different parties and still maintain their mobility. However, this communication is limited to the range of transmitters. This means that two nodes cannot communicate with each other when the distance between the two nodes is beyond the communication range of their own. MANET solves this problem by allowing intermediate parties to relay data transmissions. This is achieved by dividing MANET into two types of networks, namely, single-hop and multihop. In a single-hop network, all nodes within the same radio range communicate directly with each other. On the other hand, in a multihop network, nodes rely on other intermediate nodes to transmit if the destination node is out of their radio range. In contrary to the traditional wireless network, MANET has a decentralized network infrastructure. MANET does not require a fixed infrastructure; thus, all nodes are free to move randomly. MANET is capable of creating a self-configuring and self-maintaining network without the help of a centralized infrastructure, which is often infeasible in critical mission applications like military conflict or emergency recovery. Minimal configuration and quick deployment make MANET ready to be used in emergency circumstances where an infrastructure is unavailable or unfeasible to install in scenarios like natural or human-induced disasters, military conflicts, and medical emergency situations.

II. LITERATURE SURVEY

Elhladi M. Shakshuki, Nan Kang and Tarek R. Sheltami[1],The migration to wireless network from wired network has been a global trend in the past few decades. The mobility and scalability brought by wireless network made it possible in many applications. Among all the contemporary wireless networks, Mobile Ad hoc NETwork (MANET) is one of the most important and unique applications. On the contrary to traditional network architecture, MANET does not require a fixed network infrastructure; every single node works as both a transmitter and a receiver. Nodes communicate directly with each other when they are both within the same communication range. Otherwise, they rely on their neighbours to relay messages. The self-configuring ability of nodes in MANET made it popular among critical mission applications like military use or emergency recovery.

G. Jayakumar and G Gopinathmk[2] Mobile ad hoc networks(MANET) represent complex distributed systems that comprise wireless mobile nodes that can freely and dynamically self organize into arbitrary and temporary adhoc network topologies, allowing people and devices to seamlessly internet work in areas with no preexisting communication infrastructure e.g., disaster recovery environments. Tactical networks have been the only communication networking application that followed the ad-hoc paradigm. Recently the introduction of new technologies such as Bluetooth, IEEE 802.11 and hyperlan are helping enable eventual commercial MANET deployments outside the military domain. These recent revolutions have been generating a renewed and growing interest in the research and development of MANET.

R. Rivest, A. Shamir, and L. Adleman[4],An encryption method is presented with the novel property that publicly revealing an encryption key does not thereby reveal the corresponding decryption key. A message is encrypted by representing it as a number M, raising M to a publicly specified power e, and then taking the remainder when the result is divided by the publicly specified product, n, of two large secret prime numbers p and q. Decryption is similar; only a different, secret, power d is used, where e _ d _ 1 (mod (p - 1) _ (q - 1)). The security of the system rests in part on the difficulty of factoring the published divisor, n.

III. PROPOSED APPROACH FRAMEWORK AND DESIGN

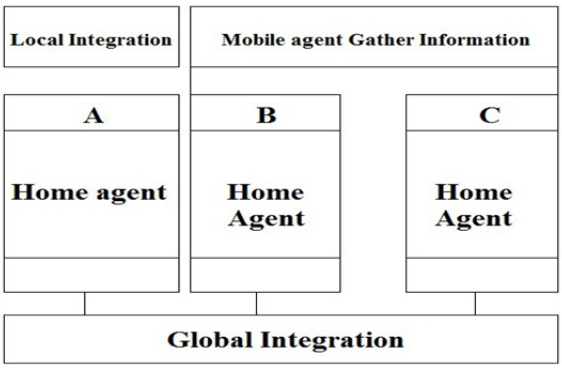


Fig.3.1: Proposed System Architecture

Current node: If an attacker sends any packet to gather information through this system, Home agent calls the classifier construction to find out the attacks. If an attack has been occurred, it will filter the respective system from the global networks.

Home agent: It is present in every system and it collects information about its system from application layer to network layer.

Neighboring node: In this any system in the network transfer any information to some other system, it broadcast through intermediate system. Before it transfer the message it send mobile agent to the neighboring node.

Data collection: This module is used for each anomaly detection subsystem to collect the values of features for corresponding layer in a system. Normal profile is created using the data collected during the normal scenario and attack data is collected during the attack scenario.

Data process: Data preprocessing is a technique to process the information with the test train data. The audit data is collected in a file and it is smoothed so that it can be used for anomaly detection. In the entire layer anomly detection system, the above mentioned preprocessing technique is used.

Local integration: This module concentrate on self system and it find out the local anomaly attacks. Every system under that wireless network follows the same methodology to provide a secure global network.

Global integration: Global integration module is used to find the intrusion result for entire network. The aim of this module is to consider the neighbor node(s) result for taking decision towards response module.

DSA Algorithm: In EAACK, Digital Signature is used to prevent the attackers from acknowledgment packets. All the parts of EAACK scheme (ACK, S-ACK, MRA) are acknowledgement based detection schemes. They all are relay on the ACK packets to detect malicious node in MANET network. Thus it is extremely vital to ensure that all acknowledgement packets in EAACK are authentic and contaminated. In another way, if the attackers are insolent enough to forge acknowledge packet all the three schemes will be vulnerable. To overcome this problem, we use Digital Signature Algorithm (DSA) [7] in IDS. To ensure the integrity of IDS, EAACK requires to all the ACK packets to be digitally signed before they are send out and verified when they are accepted by the receiver.

Step 1: A fixed length message is digested by using hash function H for every message m, mathematically this can described as:

$$H(m) = d$$

Step 2: The sender Alice needs to apply its own private key $P_{r\text{-}Alice}$ on the message digest d and produces result signature Sig_{Alice}, which is attached to message m and Alice's private key. $S_{Pr\text{-}Alice\ (d)} = Sig_{Alice}$

The sender Alice is obliged to always keep her private key $P_{r\text{-}Alice}$ as a secret without concealed to anyone else. Otherwise, if the attacker Eve gets this secret private key, she can intercept the message and easily forge malicious messages with Alice's signature and send them to Bob. As these malicious message signed by Alice, Bob sees them as legit and authentic messages from Alice. Thus, Eve can attacks on the entire network and generate malicious attacks to Bob.

Step 3: Alice can send message m along with the signature Sig_{Alice} to Bob via an unsecured channel. Bob then decrypts the received message m' against the pre agreed hash function H to get the message digest d'. This process can be generalized as,

$$H(m') = d'$$

Step 4: Bob can verify the signature by applying Alice's public key $P_{k\text{-}Alice}$ on Sig_{Alice}, by using

$$S_{Pr\text{-}Alice}(Sig\text{Alice}) = d$$

Step 5: If d == d' then it is original message m' transmitted through an unsecured channel is indeed sent from Alice and the message it itself is intact.

IV. SYSTEM DESIGN

EAACK is consisted of three major parts, namely, ACK, secure ACK (S-ACK), and misbehavior report authentication (MRA). In order to distinguish different packet types in different schemes, we included a 2-b packet header in EAACK. According to the Internet draft of DSR, there is 6 b reserved in the DSR header. In EAACK, we use 2 b of the 6 b to flag different types of packets. Please note that, in our proposed scheme, we assume that the link between each node in the network is bidirectional. Furthermore, for each communication process, both the source node and the destination node are not malicious. Unless specified, all acknowledgment packets described in this research are required to be digitally signed by its sender and verified by its receiver.

A. ACK: As discussed before, ACK is basically an end-to-end acknowledgment scheme. It acts as a part of the hybrid scheme in EAACK, aiming to reduce network overhead when no network misbehavior is detected

B. S-ACK: The S-ACK scheme is an improved version of the TWOACK scheme proposed by Liu et al. The principle is to let every three consecutive nodes work in a group to detect misbehaving nodes. For every three consecutive nodes in the route, the third node is required to send an S-ACK acknowledgment packet to the first node. The intention of introducing S-ACK mode is to detect misbehaving nodes in the presence of receiver collision or limited transmission power.

C. MRA: The MRA scheme is designed to resolve the weakness of Watchdog when it fails to detect misbehaving nodes with the presence of false misbehavior report. The false misbehavior report can be generated by malicious attackers to falsely report innocent nodes as malicious. This attack can be lethal to the entire network when the attackers break down sufficient nodes and thus cause a network division. The core of MRA scheme is to authenticate whether the destination node has received the reported missing packet through a different route.

D. MAC : As discussed before, EAACK is an acknowledgment-based IDS. All three parts of EAACK, namely, ACK, S-ACK, and MRA, are acknowledgment-based detection schemes. They all rely on acknowledgment packets to detect misbehaviors in the network. Thus, it is extremely important to ensure that all acknowledgment packets in EAACK are authentic and untainted. Otherwise, if the attackers are smart enough to forge acknowledgment packets, all of the three schemes will be vulnerable. Here we use MAC encryption technique.

V. BASIC SYSTEM IMPLEMENTATION

Resources Required

Hardware Requirements:

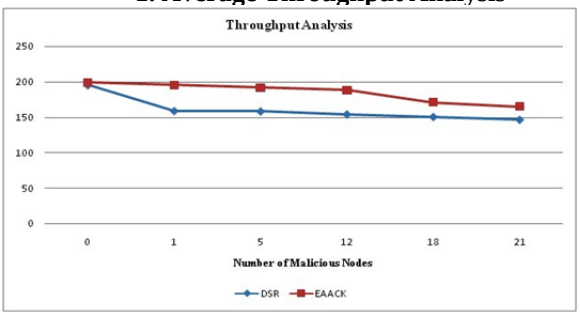
Processor : Pentium Iv 2.6 Ghz
Ram : 512 Mb Dd Ram
Monitor : 15” Color
Hard Disk : 20 Gb

Software Requirements:

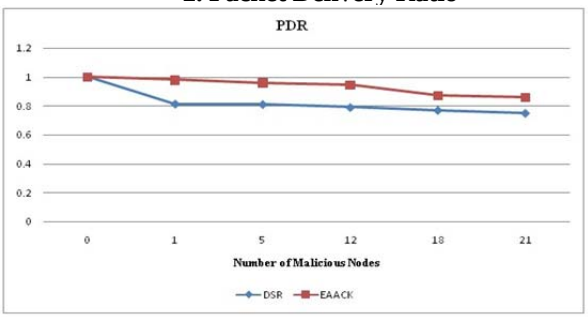
Front End : Ns3
Tools Used : Vmware Workstation
Operating System : Ubuntu

VI. RESULTS

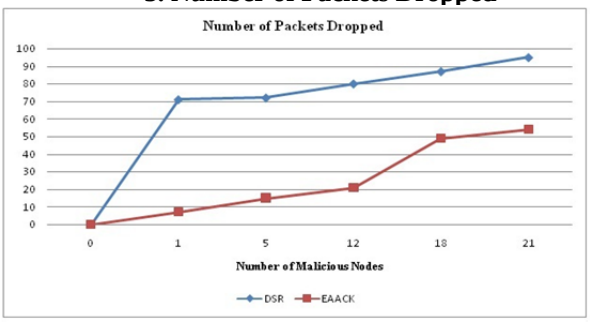
1. Average Throughput Analysis



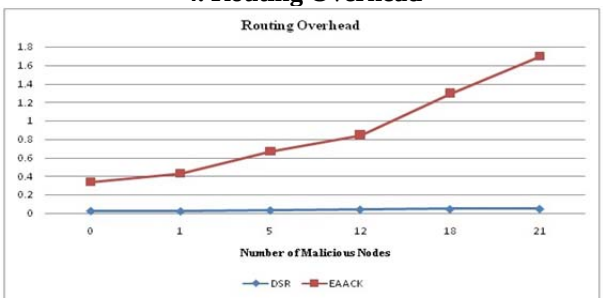
2. Packet Delivery Ratio



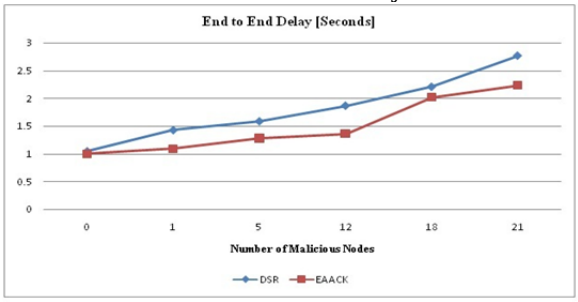
3. Number of Packets Dropped



4. Routing Overhead



5. End to End Delay



VII. CONCLUSION

In this paper we have studied various IDS's in MANET, with their merits and demerits. Our proposed IDS IEAACK scheme removes the weakness of watchdog approach (such as receiver collision, limited transmission power etc) and provides a secure end to end acknowledgement for all the nodes. Also we studied the digital signature algorithm is used to provide authentication of data and validating the sender. In the future, we plan to follow hybrid cryptography techniques to reduce the network overhead caused by digital signature.

REFERENCES

[1] Elhladi M. Shakshuki, Nan Kang and Tarek R. Sheltami," EAACK—A Secure Intrusion-Detection System for MANETs", *in IEEE Transactions ON Industerial Electronics*, vol. 60, NO. 3, MARCH 2013.

[2] G. Jayakumar and G Gopinath,"Ad hoc mobile wireless networks routing protocol-A review*", J Comput, Sci*., vol. 3, no.8, pp.574-582,2007.

[3] N. Nasser and Y. Chen," Enhanced *intrusion detection systems for discovering malicious nodes in mobile ad hoc network"*, in *Proc. IEEE Int.Conf. Commun.*, Glasgow, Scotland, Jun. 24–28, 2007, pp. 1154–1159.

[4] R. Rivest, A. Shamir, and L. Adleman,"A Method for Obtaining Digital Signatures and Public-key Cryptosystems. In the Communications of ACM" , vol .20,pp 120-126,1978.

[5] D. Johnson and D. Maltz," Dynamic Source Routing in *ad hoc* wireless networks", in *Mobile Computing*. Norwell, MA: Kluwer, 1996, ch.5, pp. 153-181.

[6] A. Patwardhan, J. Parker, A. Joshi, M. Iorga, and T. Karygiannis."Secure Routing and Intrusion Detection in Ad hoc Networks", *In the Proceedings of 3rd International Conference on Pervasive Computing and Communications, pp. 191-199, 2005.*

[7] N. Kang, E. Shakshuki , and T. Sheltami ," Detecting misbehaving nodes in MANETs", in *Proc. 12th Int. Conf. ii WAS*, Paris, France, Nov. 8-10,2010, pp. 216-222.

[8] K. Liu, J. Deng, P. K. Varshney, and K. Balakrishnan, "An acknowledgment-based approach for the detection of routing misbehavior in MANETs", *IEEE Trans. Mobile Compu.,vol. 6, no.5, pp. 536-550,May 2007.*

[9] T. Sheltami, A. Al-Roubaiey, E. Shakshuki, and A. Mahmoud ," Video transmission enhancement in presence of misbehaving nodes in MANETs" *Int. J. Multimedia Syst.*, vol. 15, no. 5, pp. 273–282, Oct. 2009.

[10] A. Singh, M. Maheshwari, and N. Kumar, "Security and trust management in MANET ", in *Communications in Computer and Information Science*, vol. 147. New York: Springer-Verlag, 2011, pt. 3, pp. 384-387.

[11] B. Sun "Intrusion detection in mobile ad hoc networks", Texas A&M Univ., College Station, TX, 2004.

[12] Prof. Anushka K. Rajyalakshmi G. V., "Secure Adaptive Acknowledgment Algorithm for Intrusion Detection System", *International Jouranal of Engineering Research in Management & Technology(IJERMT),* India, ISSN: 2278-9359,vol.2, issue 7.

[13] [13] S. Marti, T. J. Giuli, K. Lai, and M. Baker, "Mitigating routing misbehavior in mobile ad hoc networks", in *Proc. 6th Annu. Int. Conf. Mobile Comput. Net.* , Boston, MA, 2000, pp. 255–265.

[14] [14] R.H. Akbani, S. Patel , D.C. Jinwala, "DoS Attacks in Mobile Ad Hoc Networks: A Survey", *The proceedings of the Second International Meeting of Advanced Computing &Communication Technologies(*ACCT), pp. 535-541, Rohtak, Haryana, India. 2012. – here1