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Key Management Schemes in MANET- A Detailed Review

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ABSTRACT

A Mobile Ad Hoc Network (MANET) is a hotchpotch of nodes with mobility functionality, dynamically outlining the existing network usage based on temporary architecture. Within MANETs, the performance factors of the routing protocols under various conditions and environments play a demanding and critical role. The routing protocols are responsible for managing several resource-limited nodes. MANETs exits several routing protocols, one of the keynotes to be considered when designing a routing protocol is to notice that the routing protocol being implemented has a proportionate impact on network performance. In this paper, MANET uses different approaches and technologies. The various technologies used for MANET are brought together to find out which approaches are providing more value. The proposed (TSGKM) was simulated in NS2 and contrasted with the Novel Key Management Scheme (FTNKM) based on Fast Transmission.

I. INTRODUCTION

Over the last few years, due to the proliferation of affordable, readily available wireless devices, a massive expansion in the field of mobile computing has occurred. Recent second-generation (2G) cellular systems have achieved a high rate of penetration and enabled mobile connectivity worldwide. Mobile users can check emails and browse the internet. With 2 G upgrades, 3 G networks now deliver higher data speeds, infotainment, and location-based or customized services in mobile devices. This evolution motivates a novel alternative method, called an ad hoc mobile network [1]. The contact between the mobile nodes will support the network providing the essential role of control and administration. MANET's biggest advantages are flexibility, ease of installation and robustness. Mobile nodes are fitted with wireless radio, memory, power source, and processor. Wireless ad hoc networks have more unique features, and some drawbacks compared to wired networks [2]. MANET is specified with purpose-specific, autonomous, and dynamic characteristics. There is no master or slave relationship in a mobile ad hoc network, similar to fixed wireless networks. Costs associated with network creation are negligible due to the avoidance of fixed infrastructure. Each node serves as a communications router [3]. In multi-casting, a node can at any time, randomly join or leave a group. A node may concurrently become a member of multiple classes. It can serve as a forwarding agent for transmitting data to other groups. Multicasting technique where a several redundant messages should be sent to a collection of receivers [4] can be implemented. Routing protocols in MANET typically presume the nodes are truthful and cooperative. But an attacker may be acting as a router during routing and disrupting the routing process. It can communicate with any node. The battery power can be drained by an egoistic node. Such internal assaults are more vulnerable than external assaults [5]. Because MANET has no fixed infrastructure and a highly complex topology, monitoring of different attacks would be difficult. Therefore MANET is vulnerable to assault [6].

In MANET, all networking tasks, such as routing and packet forwarding, are carried out in a self-organizing way by nodes themselves. Of these reasons, it is very difficult to secure a mobile ad-hoc network [7]. Since multicast routing needs more channels for transmitting the data, it can be subjected to multiple attacks. Multicast transmissions in MANET will fulfil the basic security requirements such as confidentiality, authentication, and integrity [8]. IDS refer to the approach of tracking every node operation in a network [9]. IDS is used to detect various forms of attacks in a network and to defend the network against external attacks [10]. Throughout MANETs, support for group-oriented applications such as audio/video conferencing and one-to-many distribution of data throughout battlefield or disaster rescue scenarios is important [11]. A trivial solution is that each member should publish a public key and hold the respective secret key, such that the message can be encrypted independently under the public keys of all users. This trivial solution is highly inefficient, however, since the cipher text increases linearly with the group size, and the sender must hold the public keys of all group members [12]. By default, in MANETs the nodes have the mobility function that they do not transmit on networks, and nodes communicate and interact with each other through the interfaces wireless [13]. The Ad-Hoc Mobile Networks are independent, open Wi-Fi systems. MANETs consist of free-shifting cell nodes in and out of the network. Nodes are the devices or units that communicate in the network and are cell, i.e. mobile phones, tablets, non-public digital assistance, MP3 players, and private laptops [14]. Fuzzy logic is a computational model that gives the ambiguity and imprecision involved in human reasoning a logical system that is also known as indirect reasoning [15].

II. LITERATURE REVIEW

An optimized AODV protocol based on trust that detects packing drop attacks that occur during data transmission has been proposed. Using the Ant Colony Optimization (ACO) technique [16], a trust-based routing is performed and optimized. A scheme to strengthen current on-demand routing protocols by implementing the energy-conscious routing concept for the backbone. The proposed protocol is an improvement of the current routing protocol for Ad hoc On- Request Distance Vector (AODV), which provides considerably good routing services [17]. In DRMS nodes are monitored and observed for malicious and selfish behaviours. Because of these attacks, it reduces the risk of network performance degradation. However, no technique was provided for raising the energy consumption involved in packet forwarding [18]. An Optimized Multicast Backbone Routing for MANET was introduced in 2015. This improves node residual energy and provides stability by enhancing access to the network. This routing protocol achieves a greater packet distribution ratio [19]. With the problem of group access for wireless ad hoc networks in secure multicast communication. We have integrated the network topology (node location), the "power proximity" between network nodes, and the medium's path loss characteristics in key distribution tree design to conserve energy [20]. A novel anonymous distributed secure routing protocol in ad hoc mobile wireless networks. Their protocol 's purpose is not only to protect the privacy and private information of the communicating nodes, but also to protect the protection of the discovery of the route and to prevent certain malicious behaviours during the two-way conversation [21].

Artificial Neural Networks (ANN) to make multicast routing in MANETs efficient and stable. The approach considers the selection of input variables for ANN, evaluating the optimal number of neurons for Multicasting's hidden Layer collection with supporting node routing function [22]. A novel scheme for protecting delay sensitive data against erroneous packet injection attacks on network-coded multicast. In particular, they proposed an efficient authentication mechanism based on the null-space properties of coded packets, to enable recipients to detect any high-probability bogus packets [23]. A self-organized hash-based, secure routing scheme is used for ad hoc multicast networks. For main distribution, it uses the Diffie-Hellman group form. Authentication of the route and credibility, both by generating local flag codes and global hash values is ensured [24].A suggested Hierarchical Cooperative IDS on MANETs which incorporates the features of anomaly-based identification techniques and signature-based techniques to guarantee an accurate and scalable IDS. In MANET various techniques of machine learning (ML) were used to provide effective IDS [25]. A distributed, cooperative MANET IDS focused on trust ties. The Network monitors the attacks locally and internationally. Whenever an anomaly is observed, a message of warning was transmitted among the network nodes. The nodes watch adjacent nodes of suspicious activities [26]. A research has been made on Stable MANETs for an Intrusion Detection System (IDS). This research introduces IDS strategies according to IDS distributed architecture [27].

A pyramidal security model to safeguard the exchange of knowledge a multi-security level is used within one cooperation domain[58]. A pyramidal security model as a popular function includes a collection of hierarchical security groups and multicast groups [28]. A secure construction of multicast tree is used with the help of the Bacterial Foraging Optimization (BPO) algorithm to build a secure construction of multicast tree in MANET[59]. During routing, the proposed algorithm uses the public routing proxy to conceal sender and receiver identity from other nodes to maintain confidentiality [29]. A two-step, secure multicasting authentication method is used in MANETs. A Markov chain model was used to evaluate the confidence value of one-hoe neighbors based on historical confidence values [30]. A MANET intrusion detection method and compared IDSs to identify nodes that were misbehaving[56]. The author described the Intrusion Detection Systems Architecture that has been implemented for MANETs until now and then presented and compared the current intrusion detection techniques in MANET [31]. A theoretical online fuzzy risk assessment is used for distributed intrusion prediction and prevention (DIPPS) systems[57]. This program senses potential intrusions and avoids them. DIPPS can foresee possible intrusions within a distributed network [32].

An improvement of the MANET Intrusion Detection Watchdog / Pathrater model is proposed[55]. In promiscuous mode, if the message is not transmitted within a certain timeframe, the participating nodes are permitted to listen to the nodes they have communicated to, and then the node is suggested to be marked as a misbehaving node [33]. A new intrusion-detection system called Enhanced Adaptive ACKnowledge (EAACK) developed specifically for MANET[54]. The results showed good output against Watchdog, TWOACK, and AACK in cases of collision with the receiver, reduced transmitting capacity, and false reporting of misbehaviour [34]. A novel method is used for detecting attacks on port scanning using Fuzzy logic. To improve the efficiency of port scanning detection a fuzzy logic controller is designed and integrated with Snort. Experiments are performed in wired as well as wireless networks [35]. A Monitoring Device used for Co-Operative Intrusion in MANET. This system can be divided into three modules, based on Normal and Attack mode packet transfer [36]. A Grammatical Approach used for Detecting Attack on MANETs. The author investigates the implementation of a learning technique focused on artificial intelligence to explore this challenging design space [37]. A Divulged IDS (DIDS) consists of rules for detecting intrusions, constructed from activity logs. The information obtained from the logs of various devices was correlated [38].

A new scheme for detecting such malicious behaviour, based on statistical process control (SPC) borrowed from the industrial field in the context of quality management [39]. A confidence setting scheme for MANETs aimed at improving the reliability of packet transmission over multi-hop routes in the presence of potentially malicious nodes [40]. An overlay network solution incorporating mechanisms for routing and

reliability is proposed. It has two main components: protocol EOR and protocol RTCP[53]. The Emergency Overlay Routing (EOR) protocol is a reactive protocol built into architecture for the store-carry-forward [41]. A time-slotted distributed protocol to improve ad-hoc network transmissions. It is done by using the well-known multiple-output (MIMO) computer cooperative technique [42]. An Optimized and Reliable MANET AODV (ORAODV) protocol is proposed. It adapts itself quickly according to the changing MANET topology conditions[51]. To retransmit the data, it uses the Blocking Expanding Ring Search (Blocking-ERS) method[52]. ORAODV has been shown to have better performance in terms of PDR, routing overhead, and delay under different network sizes and node speeds [43]. A novel method for detecting attacks on port scanning using Fuzzy logic is proposed. To improve the functionality of port scanning detection a fuzzy logic controller is designed and integrated with Snort[50]. Experiments are performed in wired as well as wireless networks [44]. An Improved Location assisted Cluster Based Routing Protocol (ILCRP) with the Mobile Ad Hoc Networks Intrusion Detection System. In MANETs with malicious nodes, ILCRP for GPS-enabled MANETs was analyzed, and an Intrusion Detection System was used to increase the packet delivery ratio [45]. A changed ROUTE REQ packet in Fuzzy enhanced ADRP to achieve security in multicast routing. By doing this even though the number of paths is decreased and simulation time increases, protected paths are found out between sources to destination [46].

A novel, stable, MAODV based S-MAODV routing protocol. S-MAODV takes full advantage of trusted computing technologies, combined with the Bit-set framework for Secure Node Authentication and Safety Indicator. Their SMAODV is an anonymous protocol, with no Trusted Third Party (TTP) requirement [47]. A trust model is used which identifies the attackers and isolates them from the network. The attackers are identified using the energy consumption component, based on direct trust values[48]. Nevertheless, watchdog scheme could be included in the supervisor module to make the network more secure [60]. A suggested Security Improvements for Mobile Ad Hoc Networks use Unclear Logic for Trust Management[49]. In the proposed methodology, a combination of the uncertain logic, Bayesian inference, and Dempster-Shafer theory estimates the trust value of the monitored node [61]. A trust-enhanced, lightweight on-demand multi-path routing is used in MANET. Developing a reliable routing protocol is given top priority in the proposed technique [62].

III. CONCLUSION

A cross-layer based lightweight reliable and secure multicast routing (CLR-SMR) protocol has been developed in which a multicast tree is established. It is hierarchically divided into clusters based on the depth of the tree. Then Cluster Heads (CHs) are selected based on the link stability, residual energy power, and remaining bandwidth and gateway nodes are chosen depending on their residual energy, and packet delivery rate. The proposed (TSGKM) has been simulated in NS2 and compared with the Fast Transmission based Novel Key Management (FTNKM) scheme. Simulation results show that TSGKM outperforms FTNKM in terms of delivery in terms of communication overhead, computational overhead, and detection accuracy.

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