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Adaptive Risk Aware Response Mechanism for Manet Routing Attacks

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ABSTRACT:

Mobile Ad hoc Networks (MANET) have been highly vulnerable to attacks due to the dynamic nature of its network infrastructure. Among these attacks, routing attacks have received considerable attention since it could cause the most devastating damage to MANET. Even though there exist several intrusion response techniques to mitigate such critical attacks, existing solutions typically attempt to isolate malicious nodes based on binary or naı¨ve fuzzy response decisions. However, binary responses may result in the unexpected network partition, causing additional damages to the network infrastructure, and naı¨ve fuzzy responses could lead to uncertainty in countering routing attacks in MANET. In this paper, we propose a risk-aware response mechanism to systematically cope with the identified routing attacks. Our risk-aware approach is based on an extended Dempster-Shafer mathematical theory of evidence introducing a notion of importance factors. In addition, our experiments demonstrate the effectiveness of our approach with the consideration of several performance metrics.

Index Terms:

Mobile ad hoc networks, intrusion response, risk aware, dempster - shafer theory.

1. INTRODUCTION:

MOBILEAd hoc Networks (MANET) are utilized to set up wireless communication in improvised environments without a predefined infrastructure or centralized administration. Therefore, MANET has been normally deployed in adverse and hostile environments where central authority point is not necessary. Another unique characteristic of MANET is the dynamic nature of its network topology which would be frequently changed due to the unpredictable mobility of nodes.

Furthermore, each mobile node in MANET plays a router role while transmitting data over the network. Hence, any compromised nodes under an adversary's control could cause significant damage to the functionality and security of its network since the impact would propagate in performing routing tasks.Several work addressed the intrusion response actions in MANET by isolating uncooperative nodes based on the node reputation derived from their behaviours.

Such a simple response against malicious nodes often neglects possible negative side effects involved with the response actions. In MANET scenario, improper countermeasures may cause the unexpected network partition, bringing additional damages to the network infrastructure. To address the above-mentioned critical issues, more flexible and adaptive response should be investigated.

2. EXISTING SYSTEM :

The notion of risk can be adopted to support more adaptive responses to routing attacks in MANET. Subjective knowledge could be retrieved from previous experience and objective evidence could be obtained from observation while logical reasoning requires a formal foundation. Wang et al. proposed a naı¨ve fuzzy cost-sensitive intrusion response solution for MANET. Their cost model took subjective knowledge and objective evidence into account but omitted a seamless combination of two properties with logical reasoning.

Disadvantages:

Risk assessment is still a nontrivial, challenging problem due to its involvements of subjective knowledge, objective evidence, and logical reasoning

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3. PROPOSED SYSTEM:

An extended D-S evidence model with importance factors and articulate expected properties for Dempster's rule of combination with importance factors (DRCIF). Our Dempster's rule of combination with importance factors is non associative and weighted, which has not been addressed in the literature.An adaptive risk-aware response mechanism with the extended D-S evidence model, considering damages caused by both attacks and countermeasures. The adaptiveness of our mechanism allows us to systematically cope with MANET routing attacks. We evaluate our response mechanism against representative attack scenarios and experiments. Our results clearly demonstrate the effectiveness and scalability of our risk-aware approach.

4. DEMPSTER-SHAFER THEORY OF EVIDENCE:

The Dempster-Shafer mathematical theory of evidence is both a theory of evidence and a theory of probable reasoning. The degree of belief models the evidence, while Dempster's rule of combination is the procedure to aggregate and summarize a corpus of evidences. However, previous research efforts identify several limitations of the Dempster's rule of combination.The weight for different evidences in their proposed rule is ineffective and insufficient to differentiate and prioritize different evidences in terms of security and criticality. Our extended Dempster-Shafer theory with importance factors can overcome both of the aforementioned limitations.

OUTPUT: One evidence
1 $|Ep| =$ sizeof(Ep);
2 **While** $|Ep| > 1$ **do**
3 Pick two evidences with the least IF in Ep, named E_1 and E_2;
4 Combine these two evidences, $E = \langle m_1 \oplus m_2, (IF_1 + IF_2)/2 \rangle$;
5 Remove E_1 and E_2 from Ep;
6 Add E to Ep;
7 **end**
8 **return** the evidence in Ep

MUL-EDS-CMB Algorithm
5.RISK-AWARE RESPONSE MECHANISM

An adaptive risk-aware response mechanism based on quantitative risk estimation and risk tolerance. Instead of applying simple binary isolation of malicious nodes, our approach adopts an isolation mechanism in a temporal manner based on the risk value. We perform risk assessment with the extended D-S evidence theory for both attacks and corresponding countermeasures to make more accurate response decisions illustrated in Fig. 1.

Because of the infrastructure-less architecture of MANET,our risk-aware response system is distributed, whichmeans each node in this system makes its own responsedecisions based on the evidences and its own individualbenefits. Therefore, some nodes in MANET may isolatethe malicious node, but others may still keep in cooperationwith due to high dependency relationships. Our riskawareresponse mechanism is divided into the following

1) Evidence collection:
In this step, Intrusion Detection System (IDS) gives an attack alert with a confidence value, and then Routing Table Change Detector (RTCD) runs to figure out how many changes on routing table are caused by the attack.

2) Risk assessment:
Alert confidence from IDS and the routing table changing information would be further considered as independent evidences for risk calculation and combined with the extended D-S theory. Risk of countermeasures is calculated as well during a risk assessment phase. Based on the risk of attacks and the risk of countermeasures, the entire risk of an attack could be figured out.

3) Decision making:
The adaptive decision module provides a flexible response decision-making mechanism, which takes risk estimation and risk tolerance into account. To adjust temporary isolation level, a user can set different thresholds to fulfill her goal.

4) Intrusion response:
With the output from risk assessment and decision-making module, the corresponding response actions, including routing table recovery and node isolation, are carried out to mitigate attack damages in a distributed manner.

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RESPONSE OF ROUTING ATTACKS:

In our approach, we use two different responses to deal with different attack methods: routing table recovery and node isolation.Routing table recovery: Routing table recovery is an indispensable response and should serve as the first response method after successful detection of attacks. In proactive routing protocols like OLSR, routing table recovery does not bring any additional overhead since it periodically goes with routing control messages. Also, as long as the detection of attack is positive, this response causes no negative impacts on existing routing operations.

Node Isolation: may be the most intuitive way to prevent further attacks from being launched by malicious nodes in MANET. To perform a node isolation response, the neighbors of the malicious node ignore the malicious node by neither forwarding packets through it nor accepting any packets from it. On the other hand, a binary node isolation response may result in negative impacts to the routing operations, even bringing more routing damages than the attack itself.

6. SCREENSHOTS:

Fig2: RMI Registry

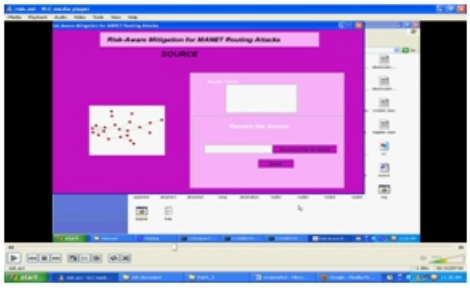

Fig3: Source

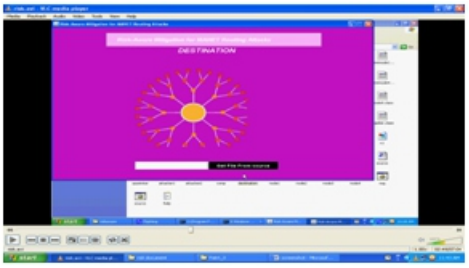

Fig4: Destination

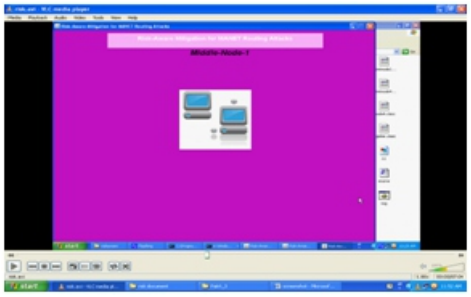

Fig5: Mid Nodes

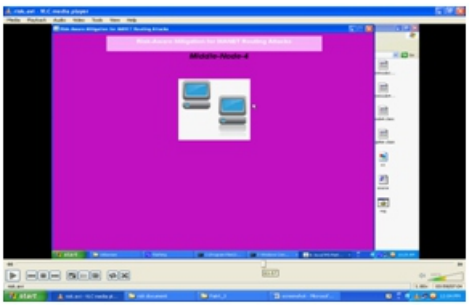

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Fig6: Send File

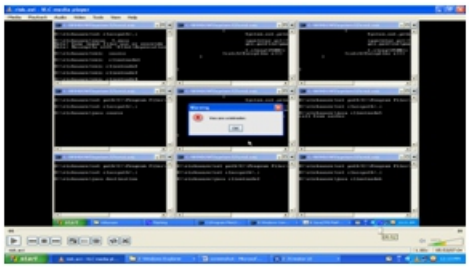

Fig7: Intruder Warning

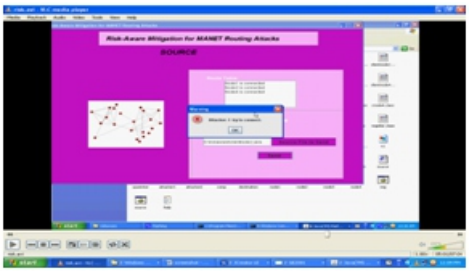

Fig8: Send File

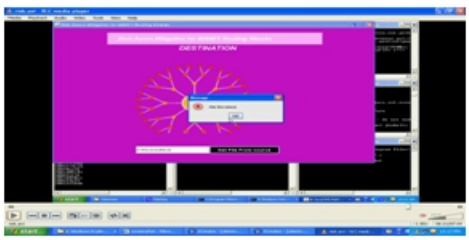

Fig9: Receive File

7.CONCLUSION:

We have proposed a risk-aware response solution for mitigating MANET routing attacks. Especially, our approach considered the potential damages of attacks and countermeasures. In order to measure the risk of both attacks and countermeasures, we extended Dempster-Shafer theory of evidence with a notion of importance factors. Based on several metrics, we also investigated the performance and practicality of our approach and the experiment results clearly demonstrated the effectiveness and scalability of our riskaware approach. Based on the promising results obtained through these experiments, we would further seek more systematic way to accommodate node reputation and attack frequency in our adaptive decision model.

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