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EXPOSURE OF MISCHIEF TRICKS IN DEPENDENCE PROVIDENCE IN DELAY TOLERANT NETWORKS

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Abstract— The network consists of numerous nodes, some nodes represents malicious and self-seeking behavior. This gives the heavy hazard for the routing in Delay Tolerant Networks (DTNs). The DTNs have unique feature so designing a mischief exposure proposal is very complex. The probabilistic mischief discovery scheme that is iTrust, is conventional for secure routing in DTN. The iTrust introduce a Trusted Authority (TA) for detecting the node's behavior. By collecting the routing evidence from the nodes the TA checks the node about its behavior then performs the apt actions for the behavior of nodes. TA gives the precautions of DTN routing at lower cost. The detection probability is interrelated with a node's reputation gives the dynamic recognition probability based on the trust of users. The simulation results show that the proposed format is efficient for establishing trust with the DTNs.

Keywords— ***Compensation, Delay Tolerant Networks (DTN), mischief discovery scheme, punishment, Trusted Authority (TA)***

I. INTRODUCTION

Delay tolerant networks (DTNs) acts like a cover on peak of regional networks. It supports interoperability of regional networks by accepting lengthy delays between and within regional networks including the internet. DTNs have unique characteristic such as the end-to-end connectivity is irregular, long delays, asymmetric data rates and high error rates [1]. The DTNs make use of the "accumulate carry-and-promote" policy. The in-transit messages are named as bundles, and can be sent above the existing link until the next link in the path appears the bundles are stored in next hop node. The routing is passed in an opportunistic fashion [2] [3].

Routing misbehavior can be caused by selfish nodes or malicious nodes. The main intention of self-interested nodes is to save its own power, capacity, memory cycles by enjoying the services provided by DTN and refuses to promote the bundles supplementary. The malicious nodes intention is to attack or damage the network by falling the packets purposely or creating the false route to the destination. This will reduce the packet delivery rate and produces a heavy hazard against the network performance of DTNs [4] [5]. Therefore, a mischief detection and controlling scheme is very much required to provide a secure and trustable DTN routing [6].

For controlling the mischief of nodes the traditional mobile adhoc network uses the techniques such as neighborhood monitoring or objective acknowledgement. These techniques exploits the credit-based and reputation-based incentive schemes for self-seeking nodes and revocation schemes for malicious nodes [7] but these techniques are not suitable for DTNs because of the exclusive attribute such as intermittent connectivity, large or long delays, asymmetric data rates, high blunder rates etc.[8-11].

In the example shown below in Fig.1, A acts as sender and wants to send packets to receiver C. B acts as intermediary neighboring node. A sends packets to B, B will not promote the packets to the receiver C and launch the black hole attack. In the black hole attack, the malicious nodes moreover drops packets or creates the forged route to smash up the network. At the flash B meets C there will be no adjacent nodes that are no witness, so the misconduct cannot be easily detected.

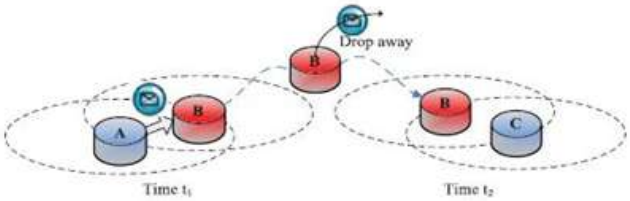

Fig. 1. Example of black hole attack in DTN

For this intention, the traditional locality monitoring techniques are less practical in a sparse DTN. Recently the mischief discovery technique such as forwarding history verification is proposed but it is costly in terms of transmission overhead, security overhead and confirmation cost.

The iTrust, a probabilistic misbehavior detection scheme for establishing trust in DTNs. Dissimilar from older mechanism which only consider the misconduct detection or incentive scheme, it jointly consider both misbehavior detection and motivation scheme in the same framework. [12][13]

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The iTrust scheme is inspired from the inspection game in which an examiner verifies inspectee, adheres to certain legal rules. The inspectee wants to smash the rules while the inspector performs the partial verification and corresponding punishment is given to put off the misconducts of inspectees. Furthermore, the inspector checks the inspectee with a higher probability than Nash Equilibrium points to get rid of the offences, as the inspectee has to select legal rules for its rational behavior.

iTrust introduces a occasionally available TA(Trusted Authority) to perform the probabilistic detection of selfish node by collecting the proof history from all the nodes which are involved in packet transmission. Then, TA decides to penalize or compensate the node based on its behavior. This achieves the tradeoff between the security and detection cost. [14] [15]

To further develop the performance of the proposed probabilistic inspection scheme, the reputation scheme is also introduced. In which the inspection probability can be varied with the target node's reputation.

Under the reputation system, a node with a good status will be checked with a lower possibility while a bad reputation node will be checked with a higher possibility. Thus the proposed misbehavior detection scheme is very efficient for protected routing as well as providing confidence with the user [16].

The rest of the paper is organized as follows. Section 2 includes the connected work. Section 3 gives the problem formulation. Section 4 explains system design. Section 5 gives the working process of the future scheme. Section 6 gives the interpretation of results. Finally, Section 7 provides the conclusion.

II. RELATED WORK

H.Zhu, S.Du, Z.Gao, M.Dong, Z.Cao mentions that DTNs are networks of self-organizing wireless nodes, where end-to-end connectivity is discontinuous. To sense the misconduct in DTN probabilistic misbehaviour detection scheme iTrust provides Trusted Authority (TA) for detecting the node's performance. By collecting the routing evidences from the nodes the TA checks the node about its performance then performs the suitable actions for the behavior of nodes. iTrust is designed as inspection competition and performs game speculative analysis using an appropriate investigation probability. TA gives the defense of DTN routing at lower cost [1].

Q. Li, S. Zhu, and G. Cao says that routing misbehavior can be caused by selfish (or rational) nodes, objective is to maximize their own remuneration and enjoys the services of DTN while refuses to promote the bundles to others, or malicious nodes purpose is to fall the packets even when it has the capability to forward the data. This will diminish the packet delivery rate and gives the severe threat against the network presentation of DTN. The Social Selfishness Aware Routing (SSAR) algorithm is used to permit the user selfishness and gives the good routing act. For selecting the next leap node, SSAR algorithm checks both users wish and the contact probability in the neighboring nodes. This results to enhanced forwarding strategy than other approaches [2].

H. Zhu, X. Lin, R. Lu, Y. Fan, and X. Shen state that DTNs exists end-to-end network connectivity is not fully available. The intermediate nodes nearby in the communication path are require to do store-carry-forward mechanism. The messages are called as bundles and it is act upon in opportunistic way so it is called as opportunistic data forwarding. The selfish or malevolent nodes, main intention is to misuse the resources by not forwarding packets or by dropping packets. To solve this problem the protected multilayer credit-based incentive scheme is generated. This credit based scheme is used to determine the problem of detection overhead and provides the efficient optimization techniques [3].

H. Zhu, X. Lin, R. Lu, P.-H. Ho, and X. Shen declare that the wireless mesh networks (WMNs) are usually contain a high frequency inter-domain roaming proceedings with the mesh access points (MAPs). The secure localized authentication and billing (SLAB) scheme is one of the good resolution for roaming and billing events in WMNs. The SLAB is proposed to provide completely protected network transmission. The SLAB provides the secure roaming facility and billing facility in metropolitan area WMNs [4].

R. Lu, X. Lin, H. Zhu, and X. Shen pronounce that (DTNs) are a class of networks which has characteristics as lack of definite connectivity, small frequency between nodes, long propagation delays, asymmetric data rates within the network. The message transmissions in DTN obtain place in store-carry-forward manner. The selfish nodes in DTN gives terrible damage to opportunistic routing scheme. For solving the selfishness problem the incentive protocol, Pi is projected. The source node sends a message, and affix some incentive on the bundle, which is very attractive and good to the entire nodes. With the fair incentive scheme, the selfish DTN nodes can be resolved and gives good packet delivery performance. [5]

III. PROBLEM FORMULATION

The network consists of numerous nodes, some nodes represents malicious and selfish behavior. This gives rise to heavy warning against routing in Delay/Disruption Tolerant Networks (DTNs). Since DTNs have unique characteristic such as as intermittent connectivity, huge or long delays, asymmetric data rates, high error rates etc, so designing a misbehavior detection scheme in DTNs is very complicated.

IV. SYSTEM DESIGN

The system Design is defined as the process of, applying various procedures and principles for the function of defining the elements of a system such as the architecture, modules and mechanism to satisfy specific needs. System architecture includes the system components or building blocks that will work together and creates the overall system.

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***A.* Basic System Architecture –**

The basic system architecture as shown in Fig. 2 involves mainly two phases. One is routing evidence generation phase and second is the auditing phase.

In the routing evidence generation phase, A forwards packets to B, then gets the delegation history back. B holds the packet and then forwards to C and gets the delegation history back. C gets the contact history about B.

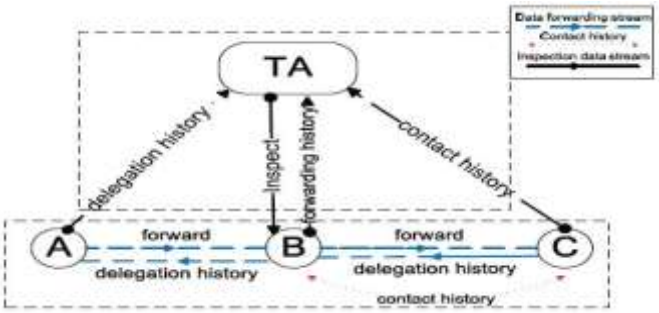

Fig. 2. System Architecture

In the auditing phase, when TA decides to check B, TA will broadcast a message to ask other nodes to submit all the evidences about B, then A submits the delegation history to TA, B submits the forwarding history (delegation history from C) to TA, C submits the contact history about B to TA. By checking these evidences TA will go to decide whether the node is malicious or not.

***B.* Basic System Architecture –**

There are mainly two modules in the block diagram as shown in Fig. 3. One is Node and other is TA(trusted authority). Node module consists of sub modules. Routing history is going to maintain a history of all nodes from source to destination including intermediate nodes that is the entire path. Contact history is going to maintain the history of only contacted nodes that is from one node to its next hop node. Signature generation produces the signature by using the routing and contact history. This is provided to TA module. TA performs the evidence collection from all the nodes. This performs the probabilistic inspection of nodes for checking the nodes behavior. In auditing it verifies if the node is detected as selfish, that node should be punished otherwise that node is compensated or rewarded. In balance info sub module the information about the node (selfish or normal node) is maintained.

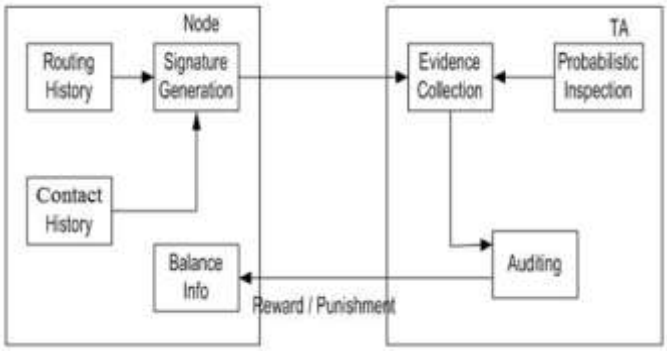

Fig. 3. Block diagram

V. SYSTEM DESIGN

Working process involves the implementation of the project where the theoretical design is converted into the working system.

***A.* Language and Platform used for Implementation–**

For implementation purpose TCL/C++ is chosen as the programming language. Few reasons for which TCL is selected as a programming language can be outlined as follows:-

- TCL is simpler. Those without a C/Unix background generally find TCL syntax far easier to learn and retain.
- TCL is smaller and easier to extend, embed, and customize.
- TCL source code traditionally is a model of lucidity. Perl source code traditionally is dense in magic.

The NS2 Simulator is used as platform for implementation. NS is a discrete event simulator targeted at networking research. NS provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.

***B.* Working process involves the following steps–**

Step1. The numbers of nodes (n) are initialized and random numbers are generated for deploying the nodes.

Step2. Compare the calculated probability (pbr) and investigation probability (pb) which is launched by trusted authority. If the former is less than the later then trusted authority asks all the nodes to send some evidences about the required node.

Step3. Basic detection is performed to find the targeted node is selfish or not. In basic detection packet sent (ps) are not equal to the packet received (pr) then that node is considered as selfish one. [1]

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Step4. If the node is found as selfish the punishment (c) is given for the selfish node by reducing its trust value otherwise the compensation (w) is given for that node by increasing its trust value.

VI. INTERPRETATION OF RESULTS

The following graph in Fig. 4 and Fig. 5 shows the interpretation results of the proposed system.

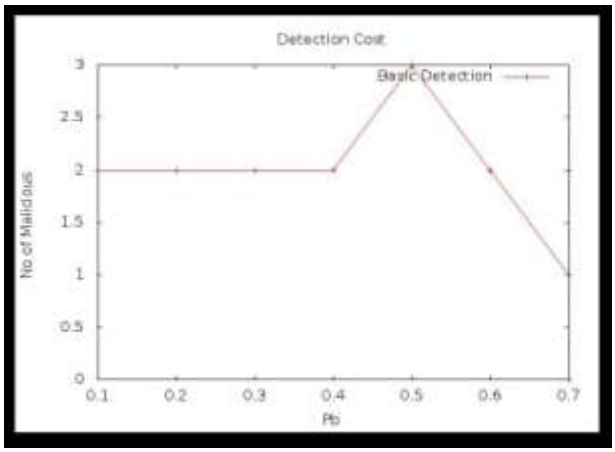

Fig. 4. The graph shows the Detection cost, on X-axis the probability value which is given as threshold by TA (Pb) is taken and on Y-axis the number of malicious nodes with the probability set value are taken.

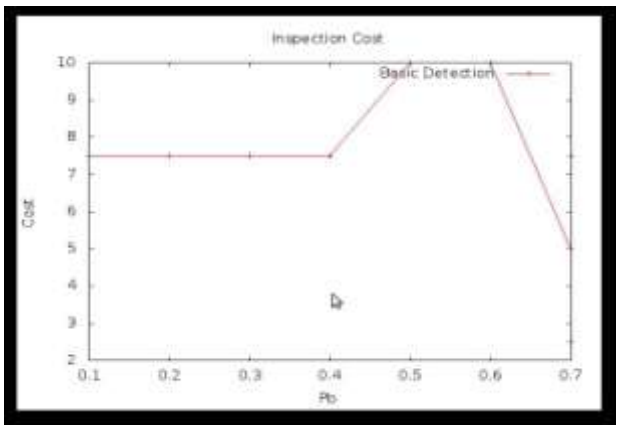

Fig. 5. The graph shows the Inspection cost, on X-axis probability value which is given as threshold by TA(pb) is taken and on Y-axis the total time involved in detecting malicious nodes that is cost is taken.

Detection cost:

For example with x axis pb value = 0.2, no of malicious nodes were 2 and with x axis pb value = 0.5, no of malicious nodes were 3.

The performance of iTrust will be same when the detection probability given as threshold by TA is up to 0.4 that is 40 percent, but the performance of iTrust increases when the detection probability given by TA is in between 0.4 to 0.5 (40 to 50 percent). Thus, the malicious node rate has less effect on the detection cost of malicious nodes so iTrust will be effective scheme for any number of malicious nodes.

Inspection Cost:

For example, with x axis pb value = 0.2 , the cost is 7.5 with x axis pb value = 0.5 , the cost is 10.

The performance of iTrust saves lot of resources on the inspection by choosing appropriate detection probability.

VII. CONCLUSION & FUTURE WORK

The proposed probabilistic misbehavior detection scheme (iTrust), which reduces the misbehavior detection overhead effectively. The scheme is modeled as the inspection game and shows the appropriate probability setting and gives the security of DTNs at lower overhead and provides the trust in the path of DTNs. The simulation results can gives the reduced transmission overhead provided by misbehavior detection and detects the malicious nodes effectively. The future work will focus on the extension of iTrust to other kinds of networks.

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