Chapter 11
A Multi-Parameter Trust Framework for Mobile Ad Hoc Networks

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ABSTRACT

This chapter presents a novel trust model called Multi-Parameter Trust Framework for Mobile ad hoc networks (MTFM). A key feature of this proposed framework is its use of multiple rather than a single parameter to decide the resulting trust value, applying Grey theory. Results presented here demonstrate that the new framework can maintain consistent trust values in the presence of various types of mobility. Simulations conducted in an 802.11-based mobile ad hoc network also show that this framework offers good robustness in misbehaviour detection by employing multiple parameters. The detection capability of the new framework is examined for a range of misbehaviours and its performance is compared to existing single-parameter approaches, such as the Beta distribution method.

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INTRODUCTION

Wireless communication technologies have brought great changes in modern daily life, by letting people be able to access the Internet, whenever and wherever. A mobile ad hoc network (MANET) defined by (Corson & Macker, 1999) is a term of wireless network that does not have fixed network infrastructure, without centralized administration, where wireless nodes are free to move, communicate with each other over limited bandwidth links, fulfil routing discovery, and maintain routing in self-organized and cooperative ways.

Such MANETs were imaged to "have dynamic, sometimes rapidly-changing, random, multihop topologies which are likely composed of relatively bandwidth-constrained wireless links" (Corson & Macker, 1999). MANETs can be employed into situations without fixed infrastructures or some special environments that ignores costs, such as emergency aid, disaster recovery, military field communications, or some crisis services. Today MANETs are also applied in our daily life. For example, some academic conferences where a meeting or collaborative discussion assignment is required to be conducted outside the office building, or in some public buses and ships where people want to play online games with other passengers who take mobile phones within WiFi or Bluetooth modules.

The ad hoc topology of MANET may vary uncertainly and rapidly, as the mobile nodes are independent and have high mobility. Due to the network decentralization, any node in a MANET may act as a router to discover a routing path or to forward the data packets. Unlike wired networks and infrastructured wireless networks, the functional design of MANET should consider many factors such as power limitation, wireless link quality, and multiple user interference.

The main characteristics of MANETs have been summarized by (Corson & Macker, 1999) as follows:

1. **Dynamic Topologies:** That means nodes moving free and arbitrarily. Thus, the network topology, typically with multihop paths, may change randomly and rapidly along with time, which is unpredictable. The topology is dynamic, consisting of both bidirectional and unidirectional links.
2. **Bandwidth-Constrained:** variable capacity links. Usually, wireless connections have much lower capacity than their hardwired counterparts. Additionally, the realized throughput of a wireless connecting link is much less than a channel radio's maximum data transmitting rate, due to the effects of many physical factors, like signal fading, noise, multiple access, interference conditions, and so on.
3. **Energy-Constrained Operation:** The node battery or other power consumption methods can introduce many limits to the nodes in a MANET. In the system design, one essential criteria for optimization should be taken account of, that is energy conservation.
4. **Limited Physical Security**: The successful operation of MANETs depends upon the activities of all of the participants in the networks. However, in distributed mobile environments, nodes lack sufficient information about each other, which increases the risk of being compromised. Additionally, nodes in this kind of network may belong to different self-interested individuals and have limited power and bandwidth; therefore, some of them may tend to be selfish or malicious, during the interactions with their neighbours.

Wireless networks have been threatened by various attacks and intrusions, high-tech crimes and Internet fraud, which are growing in recent years. Thus, security has become as a highlighted research topic, for those designers who intend to utilize wireless technologies and obtain Internet

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