Chapter 9
Security Issues in Mobile Ad Hoc Networks: A Survey

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ABSTRACT

A Mobile Ad hoc NETwork (MANET) is a self-organizing, infrastructure-less network of mobile nodes connecting by wireless links. In operation, the nodes of MANETs do not have a central control mechanism. It is known for its properties of routable network, where each node acts as a router to forward packets to other specific nodes in the network. The unique properties of MANET have made it useful for large number of applications and led to a number of security challenges. Security in the mobile ad hoc network is a very critical job and requires the consideration of different security issues on all the layers of communication. The countermeasures are the functions that reduce or eliminate security vulnerabilities and attacks. This chapter provides a comprehensive study of all prominent attacks in Mobile Ad Hoc Networks described in the literature. It also provides various proactive and reactive approaches proposed to secure the MANETs. Moreover, it also points to areas of research that need to be investigated in the future.

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INTRODUCTION

Wireless cellular system has been in operation since the 1980s. Wireless system operates through a centralized support structure such as an access point. Recent advancement of wireless technologies such as Bluetooth (Karygiannis, & Owens, 2002), IEEE 802.11 (Borisov, Goldberg, & Wagner, 2001) introduced a new type of wireless system known as Mobile ad hoc networks (MANETs), which operate in the absence of a central access point (Toh, 2001; Chlamtac, Conti, & Liu, 2003). It provides high mobility and portability of the device, which allows a node to communicate with the network and communication with each other in the network.

In Latin "Ad hoc" means "For a particular purpose only". The ad hoc Network is a spontaneous network and it is especially useful where installation of fixed network is not so easy (Chlamtac et al., 2003). A mobile ad hoc network is infrastructure–less network comprising of autonomous collection of mobile nodes connected by wireless medium and is capable of organizing itself into arbitrary changeable topologies (Perkins, 2001; Stallings, 2009). It is a system of mobile nodes with routing capabilities where each node operates both as host as well as router to forward the packets to each other as shown in Figure 1. The mobile ad hoc network has the following typical characteristics (Murthy, & Manoj, 2004; Ilyas, 2010):

- Autonomous in Behaviour
- Multi-Hop Routing Paths
- Dynamic Topology
- No Infrastructure
- Distributed Operation
- Very Limited Transmission Range
- Device Size Limitation

A MANET environment has to overcome certain issues of limitation and inefficiency:

- Limited Range of Wireless transmissions
- Unreliability of wireless links between nodes
- Packet loss due to errors in the transmission
- Route Changes due to Mobility
- Frequent network Partition
- Limited Battery Life
- Bandwidth and Slower Data Transfer Rate
- Resource Constraints

Figure 1. Mobile ad hoc network