Chapter XX
Security in UMTS 3G Mobile Networks

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ABSTRACT

This chapter analyzes the security architecture designed for the protection of the universal mobile telecommunication system (UMTS). This architecture is built on the security principles of second generation (2G) systems with improvements and enhancements in certain points in order to provide advanced security services. The main objective of the third generation (3G) security architecture is to ensure that all information generated by or relating to a user, as well as the resources and services provided by the serving network and the home environment are adequately protected against misuse or misappropriation. Based on the carried analysis the critical points of the 3G security architecture, which might cause network and service vulnerability are identified. In addition, the current research on the UMTS security and the proposed enhancements that aim at improving the UMTS security architecture are briefly presented and analyzed.

INTRODUCTION

The universal mobile telecommunication system (UMTS) (3rd Generation Partnership Project [3GPP] TS 23.002, 2002) is a realization of third generation (3G) networks, which intend to establish a single integrated system that supports a wide spectrum of operating environments. Users have seamless access to a wide range of new telecommunication services, such as high data rate transmission for high-speed Internet/intranet applications, independently of their location. Thus, mobile networks comprise a natural extension of the wired Internet computing world, enabling access for mobile users to multimedia services that already exist for non-mobile users and fixed networking.

Along with the variety of new perspectives, UMTS also raises new concerns on security issues. Wireless access is inherently less secure and

mobility implies higher security risks compared to those encountered in fixed networks. The advanced wireless and wired network infrastructure, which supports higher access rates, and the complex network topologies, which enable "anywhere-anytime" connectivity, may increase the number and the ferocity of potential attacks. Furthermore, the potential intruders are able to launch malicious attacks from mobile devices with enhanced processing capabilities, which are difficult to trace. To defeat the possible vulnerable points, UMTS has incorporated a specific security architecture named as 3G security architecture.

This chapter analyzes the security architecture designed for the protection of UMTS. This architecture is built on the security principles of second generation (2G) systems with improvements and enhancements in certain points in order to provide advanced security services. The main objective of the 3G security architecture is to ensure that all information generated by or relating to a user, as well as the resources and services provided by the serving network (SN) and the home environment (HE) are adequately protected against misuse or misappropriation. Based on the carried analysis the critical points of the 3G security architecture, which might cause network and service vulnerability are identified. In addition, the current research on the UMTS security and the proposed enhancements that aim at improving the UMTS security architecture are briefly presented and analyzed.

The rest of this chapter is organized as follows. The next section outlines the UMTS network architecture and the 3G security architecture. The third section elaborates on the network access security features, and the fourth section examines the network domain security. The fifth section presents the user domain security, the application domain security, the visibility of security operation and configurability, and the network-wide confidentiality option. The sixth section analyzes potential weaknesses concerning the 3G security architecture and the seventh section presents the current research on the UMTS security. Finally, the last section contains the conclusions.

Figure 1. UMTS network architecture