Chapter XI
Key Distribution and Management for Mobile Applications

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ABSTRACT

This chapter deals with challenges raised by securing transport, service access, user privacy, and accounting in wireless environments. Key generation, delivery, and revocation possibilities are discussed and recent solutions are shown. Special focus is on efficiency and adaptation to the mobile environment. Device domains in personal area networks and home networks are introduced to provide personal digital rights management (DRM) solutions. The value of smart cards and other security tokens are shown and a secure and convenient transmission method is recommended based on the mobile phone and near-field communication technology.

A PROBLEM OF MEDIA ACCESS

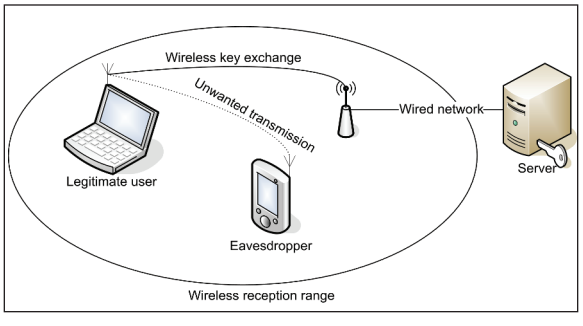
On the dawn of ubiquitous network access, data protection is becoming more and more important. While in the past network connectivity was mainly provided by wired connections, which is still considered the most secure access method, current and future users are moving towards wireless access and only the backbone stays connected by wires. In a wired environment, eavesdropping is existent, but not as spread and also not easy to implement. While methods exist to receive electromagnetic radiation from unshielded twisted pair (UTP) cables, a quite good protection can be achieved already by transport layer encryption or deploying shielded twisted pair (STP) or even fibre.

New technologies emerged in the wireless world, and especially the IEEE 802.11 family has drastically changed the way users connect to networks. The most basic requirements for new devices are the capability of supporting wireless service access. The mobile world introduced general packet radio service (GPRS) and third generation (3G) mobile systems provide permanent IP connectivity and provide together with Wi-Fi access points continuous wireless connectivity. Besides communications devices such as laptops, phones, also cars, machines, and home appliances nowadays come with wireless/mobile connectivity.

Protecting user data is of key importance for all communications, and especially for wireless communications, where eavesdropping, man-in-the-middle, and other attacks are much easier. With a simple wireless LAN (WLAN) card and corresponding software it is possible to catch, analyse, and potentially decrypt wireless traffic. The implementation of the first WLAN encryption standard wired equivalent privacy (WEP) had serious weaknesses. Encryption keys can be obtained through a laptop in promiscuous mode in less than a minute, and this can happen through a hidden attacker somewhere in the surrounding. Data protection is even worse in places with public access and on factory default WLAN access points without activated encryption. Standard Internet protocols as simple mail transport protocol (SMTP) messages are not encoded, thus all user data are transmitted in plaintext. Thus, sending an e-mail over an open access point has the same effect as broadcasting the content. With default firewall settings an intruder has access to local files, since the local subnet is usually placed inside the trusted zone. These examples emphasise that wireless links need some kind of traffic encryption.

When the first widespread digital cellular network was developed around 1985, standardisation of the global system for mobile communication (GSM) introduced the A5 cryptographic algorithms, which can nowadays be cracked in real-time (A5/2) or near real-time (A5/1). A further security threat is the lack of mutual authentication between the terminal and the network. Only the terminal is authenticated, the user has to trust the network unconditionally. In universal mobile telecommunications system (UMTS), strong encryption is applied on the radio part of the transmission and provides adequate security for current demands, but does not secure the transmission over the backbone. UTMS provides mutual authentication through an advanced mechanism for authentication and session key distribution, named authentication and key agreement (AKA).

Figure 1. A basic problem of broadcast environment



A LONG WAY TO SECURE COMMUNICATION

Applying some kind of cryptography does not imply a secured access. Communicating parties must negotiate the key used for encrypting the data. It should be obvious that the encryption key used for the communication session (session key) cannot be sent over the air in plaintext (see Figure 1).

In order to enable encryption even for the first message, several solutions exist. The simplest one, as used in cellular networks is a preshared key supplied to the mobile terminal on forehand. This key can be used later for initialising of the security infrastructure and can act as a master key in future authentications.

In more dynamic systems the use of preshared keys can be cumbersome. Most of WLAN encryption methods support this kind of key distribution. The key is taken to the new unit with some kind of out of band method, for example with an external unit, as indicated in Figure 2. Practically all private and many corporate WLANs use static keys, allowing an eavesdropper to catch huge amounts of traffic and thus enable easy decryption of the content. This implies that a system with just a secured access medium can be easily compromised. Non-aging keys can compromise even the strongest encryption, thus it is recommended to renew the keys from time to time.

Outside the telecom world it is harder to distribute keys on forehand, so key exchange protocols emerged, which offer protection from the first message and do not need any preshared secret. The most widespread protocol is the Diffie-Hell-