Chapter 2
Security in Cellular Networks and Communications

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Abstract

Cellular Communication has become more and more important in our daily life. The objective of cellular communications has changed from mainly for voice communications as in many years ago, to that mainly for data transmission. The terminal devices for cellular communications also have many more functions other than the functionality for voice communication. Today most cellphones are also personal data assistances (PDAs) as well. Some advanced cellphones are like computers having many applications that used to be for computers. For example, they are able to access the Internet, through which users can conduct a variety of Internet transactions, download and upload data, enjoy on-line entertainment. This is particularly the case in 3G and later generation of networks which are targeted at high speed and wide bandwidth wireless communications. In order to enable sophisticated functionalities in a cellular phone terminal, an operating system is often needed. While a modern and future model of cellphone can give a lot of convenient services to our daily life, it also introduces many security threats, not only threatening the cellphone terminals, but also the cellular communications. This chapter tends to give a primary introduction of common security techniques in cellular communication networks. It is hard to predict what kind of security threats can be encountered in the future.
2.1 Introduction

Today people are living in two worlds, a real world and a virtual world. The real world is getting virtually smaller due to the development of transport systems (cars, railways, and aircrafts), and the virtual world is also getting smaller due to the development of wireless communications, which enable people to be connected anywhere, anytime. One of the devices that make most of the contribution to the situation is the kind of cellphones, and the number of cellphones being used today has become very large, which is still growing\[1\]. Behind the cellphones which are terminal devices of wireless communications, it is the cellular communication systems and perhaps the Internet that connect people together.

A cellular network is a radio network with many fixed-location transceivers known as base stations distributed over land areas. Since the signal of each of the base stations covers only a limited area, there must be sufficient number of base stations in order to have a good signal coverage. In open land areas (without buildings), experiments show that hexagonal distribution of the base stations can achieve a good signal coverage with relatively fewer number of such base stations than other distributions. These hexagons look like cells geometrically (see Fig. 2.1), and hence such a network is called a

Fig. 2.1 Geometrical view of a cellular network.