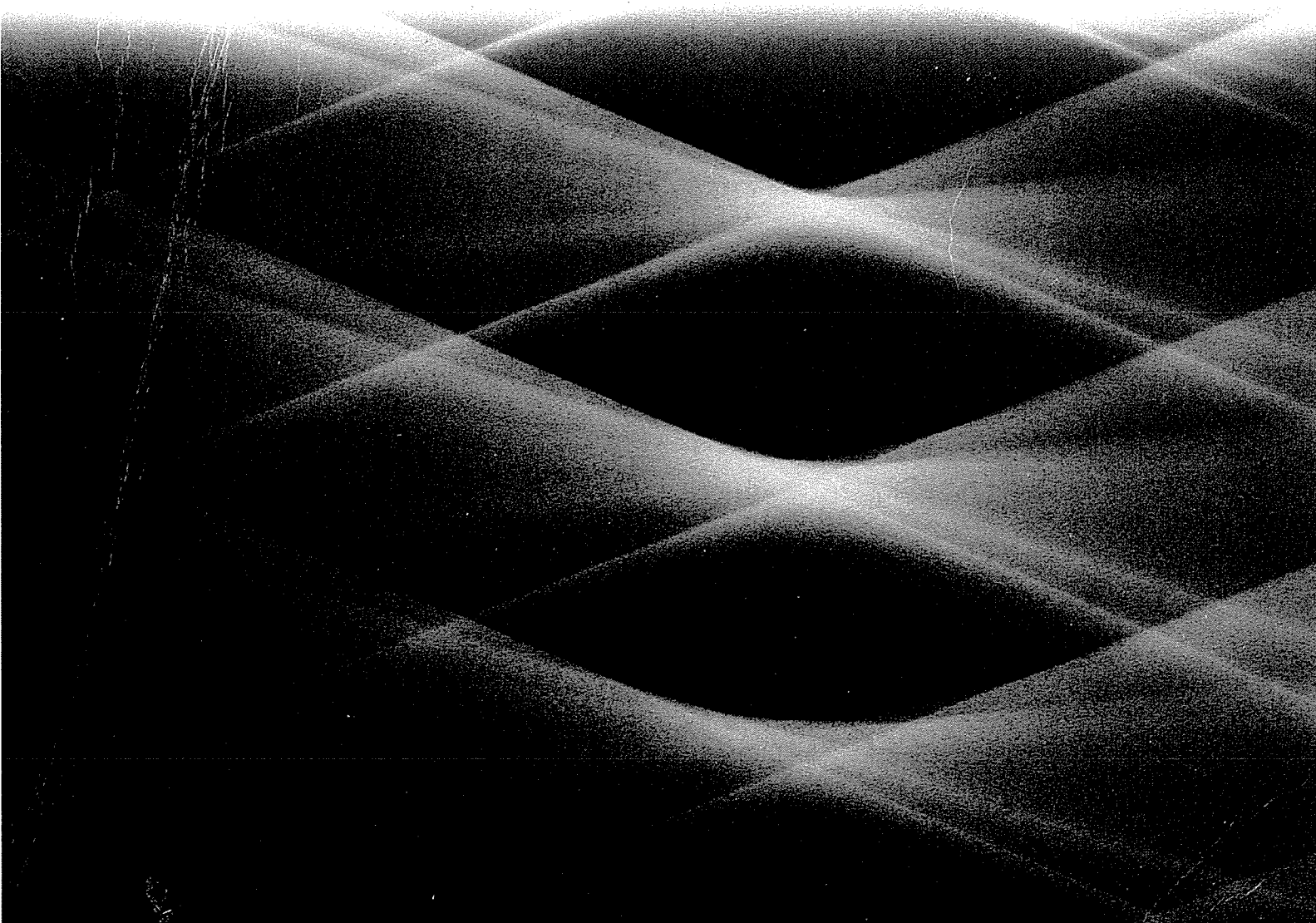


# Mobile Communications

Jochen Schiller



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**W**hat will **computers** look like in ten years, in the next century? No wholly accurate prediction can be made, but as a general feature, most computers will certainly be **portable**. How will users **access** networks with the help of computers or other communication devices? An ever-increasing number without any wires, i.e., **wireless**. How will people spend much of their time at work, during vacation? Many **people** will be **mobile** – already one of the key characteristics of today’s society. Think, for example, of an aircraft with 800 seats. Modern aircraft already offer limited network access to passengers, and aircraft of the next generation will offer easy Internet access. In this scenario, a mobile network moving at high speed above ground with a wireless link will be the only means of transporting data to and from passengers. Furthermore, think of cars with Internet access and billions of embedded processors that have to communicate with for instance cameras, mobile phones, CD-players, headsets, keyboards, intelligent traffic signs and sensors.

Before presenting more applications, definitions of the terms ‘mobile’ and ‘wireless’ as used throughout this book should be given. There are two different kinds of mobility: user mobility and device portability. **User mobility** refers to a user who has access to the same or similar telecommunication services at different places, i.e., the user can be mobile, and the services will follow him or her. Examples for mechanisms supporting user mobility are simple call-forwarding solutions known from the telephone or computer desktops supporting roaming (i.e., the desktop looks the same no matter which computer a user uses to log into the network).

With **device portability**,<sup>1</sup> the communication device moves (with or without a user). Many mechanisms in the network and inside the device have to make sure that communication is still possible while it is moving. A typical example for systems supporting device portability is the mobile phone system, where the system itself hands the device from one radio transmitter (also called a base station) to the next if the signal becomes too weak. Most of the scenarios described in this book contain both user mobility and device portability at the same time.

With regard to devices, the term **wireless** is used. This only describes the way of accessing a network or other communication partners, i.e., without a

## Mobile communications

wire. The wire is replaced by the transmission of electromagnetic waves through 'the air' (although wireless transmission does not need any medium).

A communication device can thus exhibit one of the following characteristics:

- **Fixed and wired:** This configuration describes the typical desktop computer in an office.
- **Mobile and wired:** Many of today's laptops fall into this category; users carry the laptop from one hotel to the next, reconnecting to the company's network via the telephone network and a modem.
- **Fixed and wireless:** This mode is used for installing networks, e.g., in historical buildings to avoid damage by installing wires, or at trade shows to ensure fast network setup.
- **Mobile and wireless:** This is the most interesting case. No cable restricts the user, who can roam between different wireless networks. Most technologies discussed in this book deal with this type of devices and the networks supporting them.

The following section highlights some application scenarios predestined for the use of mobile and wireless devices. An overview of some typical devices is also given. The reader should keep in mind, however, that the scenarios and devices discussed only represent a selected spectrum, which will change in the future. As the market for mobile and wireless devices is growing rapidly, more devices will show up, and new application scenarios will be created. A short history of wireless communication will provide the background, briefly summing up the development over the last 200 years. Section 1.3 shows wireless and mobile communication from a marketing perspective. While there are already millions of users of wireless devices today, the market potential is still enormous.

Section 1.4 shows some open research topics resulting from the fundamental differences between wired and wireless communication. Section 1.5 presents the basic reference model for communication systems used throughout this book. This chapter concludes with an overview of the book, explaining the 'tall and thin' approach chosen. Tall and thin means that this book covers a variety of different aspects of mobile and wireless communication to provide a complete picture. Due to this broad perspective, however, it does not go into the details of each technology and systems presented.

### 1.1 Applications

Although wireless networks and mobile communications can be used for many applications, particular application environments seem to be predestined for their use. Some of them will be enumerated in the following sections – it is left to you to imagine more.



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