CHAPTER 1

Introduction

Connecting to the Internet may some day be as easy as plugging into the same wall outlet that serves your stereo. Powerline telecommunication uses existing electric lines to transmit broadband communications in home networking environments and to deliver telecommunication services to homes and businesses.

Despite the positives that powerline telecommunication can offer, questions remain about whether the regulatory and economic problems that have kept it from truly taking off will hinder new developments. Unless proper standards and regulations are developed globally, powerline runs the risk of living as a niche technology at best.

The beginning of communication over supply mains dates back about eight decades. Although electric networks were basically designed for lossless energy transmission, without considering telecommunication requirements, it was achieved early to bring together lossless energy transmission and reliable data transmission at a satisfactory level. At first, only the power supply utilities (PSUs) had been able to make profitable use, but this situation has changed recently.

Deregulation of the telecommunications and energy markets was initiated in 1998. PSUs have to face future competition in the electric power market, and they want to open up new business fields with growth potential in the deregulated telecommunications market. The "electricity" product can be expanded by special value-added services, such as automatic remote meter reading, various and transparent tariff plans, or other services in the field of "home automation" to eventually strengthen their customer base. The use of electric networks within the local loop to bridge the so-called "last

mile" for telecommunication services is even more interesting. This could provide a real alternative to the existing national telecommunication networks, such as Deutsche Telekom in Germany, for all types of voice, fax, and data services, particularly for fast and low-cost Internet access for all homes. Furthermore, work is under way to exploit indoor powerlines as fast local area networks carrying digital audio and video information besides other data. This topic is of world-wide interest and is currently being pushed forward by the HomePlug Alliance in the United States and within the Information Society Technologies (IST) program of the European Union.

The possibilities and consequences will be so fundamental and comprehensive that they are hard to predict. The value of the new communication paths within the local loop in the form of an electric power distribution system has been recognized by PSUs and the industry. Numerous studies and field tests have shown that the channel capacity of typical distribution networks on the medium-voltage and low-voltage levels allows data rates of up to several hundred Mbits/s, given a frequency range of about 20 MHz. There is an enormous innovation potential that will create considerable economic values—for example, Internet access from the wall plug. The world's largest knowledge and information base will thus be available to everybody anywhere in the world over a ubiquitous infrastructure. High access costs that have been a massive obstacle to Internet use for many users may change dramatically.

In contrast to radio broadcasting, for example, Internet users can select the topics themselves and open up actively a valuable information medium, which will gradually become commonplace, because access over the regular domestic wall outlet is easy and relatively cheap. Worldwide communication, procurement of information, purchasing, and trade will become as ubiquitous as the consumption of electric power from the wall outlet.

The uses of the electric networks are not unlimited, of course, because when occupying a frequency band of about 9 kHz to over 20 MHz, existing services such as longwave, medium-wave, and short-wave radio and amateur radio bands will be overlaid. For frequency allocation and the determination of level limits, tradeoff solutions will have to be worked out. Since communication over power networks is basically wireborne, suitable measures have to be found to prevent inadmissibly high signal radiation. Major efforts are currently being made to work out solutions to ensure electromagnetic compatibility (EMC). This and other challenges of powerline telecommunication will be described in later sections of this book.

Chapter 2 describes the power supply system and its properties. Chapter 3 describes the historical development of powerline data communication. Chapter 4 discusses new possibilities for using the low-voltage level on the basis of European stan-

dards, in particular the European CENELEC standard EN 50065. Chapter 5 deals with the innovation potential from the recent deregulation of the power market, while Chapter 6 presents communication system concepts and hardware implementations. A brief summary and outlook of powerline telecommunication is given in Chapter 7. Finally, Chapter 8 provides an extensive bibliography structured by issue.