
Preface

We can always wait a bit longer to write a better book on technology. We can always wait . . .

In this ever-changing technological scenario, keeping pace with the rapid evolution of wireless technology is a formidable, exciting, and indispensable task more than a challenge. The work is indeed herculean and often discouraging, for technology is vast, the number of topics to be approached is immense, the documentation on standards and recommendations comprises piles of uncountable pages, and we often find we are leaving something important behind when selecting the appropriate subject matter to explore. The consolation, if any, is that as we explore the technologies, we find that much commonality exists among them, although particular features are rather different in each.

The challenge of writing a book in such a “hot” and vivacious field is to provide a clear and concise resource to accommodate the learning process of the basic functions of the main technologies. I did try to keep this in mind throughout the course of selection and description of the topics included in this book. I hope I have succeeded, at least to a certain extent.

The book, divided into five parts, describes protocols, standards, and techniques for 2G and 3G technologies, including those specific to wireless multimedia. The first part—*Introduction*—contains three chapters and covers the basic principles of wireless communications. The second part—*2G Systems*—consists of two chapters and describes two leading technologies of the second generation. The third part—*Wireless Data*—comprises one chapter and introduces three main wireless data technologies. The fourth part—*3G Systems*—encompasses three chapters and details the general concepts of third-generation systems as well as two chief third-generation technologies. The fifth part—*Appendices*—provides a glimpse at some telecommunication issues that are relevant to the understanding of the main text and that are not covered in the introductory part of the book. A more detailed description of the book structure follows.

Part I: *Introduction*

Chapter 1—*Wireless Network*—develops the wireless network concepts within the Intelligent Network framework and describes the basic functions a telecommunication system must provide so that wireless and mobile capabilities can be implemented. General network and protocol architectures and channel structures are described that are common to the main systems. These

descriptions are based on ITU Recommendations, which generalize those concepts that have been used for the various cellular networks. Specific solutions are then detailed in the other chapters.

Chapter 2—*Cellular Principles*—introduces the cellular technology fundamentals, providing a unified approach of these concepts for narrowband and wideband solutions. Topics explored in this chapter include universal frequency reuse, sectorization, power control, handoff, voice activity, interference, and others. Besides the traditional hexagonal tessellation for macrocellular networks, the chapter examines the subject of reuse pattern for microcellular systems. In addition, hierarchical cell structure, overall mean capacity for multirate systems, and the main features of narrowband and wideband networks are also addressed.

Chapter 3—*Multiple Access*—analyzes a considerable number of multiple access control techniques. Several conventional and more advanced duplexing and multiple access protocols are detailed that comply with the various classes of traffic and multirate transmission utilized in broadband services. The access and duplexing methods are explored in the frequency domain, time domain, code domain, and space domain. The performance of the techniques is investigated in terms of channel capacity, throughput, and delay.

Part II: 2G Systems

Chapter 4—*GSM*—describes the Global System for Mobile Communication cellular network in terms of its features and services, architecture, physical channels, logical channels, signaling messages, call management, and particular features.

Chapter 5—*cdmaOne*—details the features and services, architecture, physical channels, logical channels, signaling messages, call management, and particular features for TIA/EIA/IS-95-A as well as for its evolved version TIA/EIA/IS-95-B.

Part III: Wireless Data

Chapter 6—*Wireless Data Technology*—depicts three data technologies applied to wireless networks, namely, General Packet Radio Service (GPRS), TIA/EIA/IS-95B, and High Data Rate (HDR). These technologies are described in terms of their basic architectures and achievable data transmission rates.

Part IV: 3G Systems

Chapter 7—*IMT-2000*—introduces the topic on third-generation wireless networks based on the International Mobile Telecommunications-2000 (IMT-2000) concept. It describes the functional subsystems, the IMT-2000 family concept, and the capability set concept. It also develops the network functional model for IMT-2000.

Chapter 8—*UTRA*—details the IMT-2000 radio interface for direct sequence code division multiple access, the so-called Universal Terrestrial Radio Access (UTRA) or Wideband CDMA (WCDMA) 3G radio transmission technology. Descriptions include its FDD as well as its TDD options.

Chapter 9—*cdma2000*—details the IMT-2000 CDMA multicarrier radio interface, the so-called *cdma2000* 3G radio transmission technology. Descriptions include its various radio configurations, the 1xEV-DO radio configuration option being one of them.

Part V: *Appendices*

These *Appendices* provide tutorial information on topics such as OSI Reference Model, Signaling System Number 7, Spread Spectrum, and Positioning of Interferers in a Microcellular Grid.

The book is suitable as text as well as a reference. As a textbook, it fits into a semester course for both undergraduate and graduate levels in electrical engineering, wireless communications, and more generally in information technology. As a reference, it serves systems engineers and analysts, hardware and software developers, researchers, and engineers responsible for the operation, maintenance, and management of wireless communication systems.