
Preface

Fundamentals of WiMAX was consciously written to appeal to a broad audience, and to be of value to anyone who is interested in the IEEE 802.16e standards or wireless broadband networks more generally. The book contains cutting-edge tutorials on the technical and theoretical underpinnings to WiMAX that are not available anywhere else, while also providing high-level overviews that will be informative to the casual reader. The entire book is written with a tutorial approach that should make most of the book accessible and useful to readers who do not wish to bother with equations and technical details, but the details are there for those who want a rigorous understanding. In short, we expect this book to be of great use to practicing engineers, managers and executives, graduate students who want to learn about WiMAX, undergraduates who want to learn about wireless communications, attorneys involved with regulations and patents pertaining to WiMAX, and members of the financial community who want to understand exactly what WiMAX promises.

Organization of the Book

The book is organized into three parts with a total of twelve chapters. Part I provides an introduction to broadband wireless and WiMAX. Part II presents a collection of rigorous tutorials covering the technical and theoretical foundations upon which WiMAX is built. In Part III we present a more detailed exposition of the WiMAX standard, along with a quantitative analysis of its performance.

In Part I, Chapter 1 provides the background information necessary for understanding WiMAX. We provide a brief history of broadband wireless, enumerate its applications, discuss the market drivers and competitive landscape, and present a discussion of the business and technical challenges to building broadband wireless networks. Chapter 2 provides an overview of WiMAX and serves as a summary of the rest of the book. This chapter is written as a standalone tutorial on WiMAX and should be accessible to anyone interested in the technology.

We begin Part II of the book with Chapter 3, where the immense challenge presented by a time-varying broadband wireless channel is explained. We quantify the principal effects in broadband wireless channels, present practical statistical models, and provide an overview of diversity countermeasures to overcome the challenges. Chapter 4 is a tutorial on OFDM, where the elegance of multicarrier modulation and the theory of how it works are explained. The chapter emphasizes a practical understanding of OFDM system design and discusses implementation issues for WiMAX systems such as the peak-to-average ratio. Chapter 5 presents a rigorous tutorial on multiple antenna techniques covering a broad gamut of techniques from simple receiver diversity to advanced beamforming and spatial multiplexing. The practical considerations in the

application of these techniques to WiMAX are also discussed. Chapter 6 focuses on OFDMA, another key-ingredient technology responsible for the superior performance of WiMAX. The chapter explains how OFDMA can be used to enhance capacity through the exploitation of multiuser diversity and adaptive modulation, and also provides a survey of different scheduling algorithms. Chapter 7 covers end-to-end aspects of broadband wireless networking such as QoS, session management, security, and mobility management. WiMAX being an IP-based network, this chapter highlights some of the relevant IP protocols used to build an end-to-end broadband wireless service. Chapters 3 through 7 are more likely to be of interest to practicing engineers, graduate students, and others wishing to understand the science behind the WiMAX standard.

In Part III of the book, Chapters 8 and 9 describe the details of the physical and media access control layers of the WiMAX standard and can be viewed as a distilled summary of the far more lengthy IEEE 802.16e-2005 and IEEE 802.16-2004 specifications. Sufficient details of these layers of WiMAX are provided in these chapters to enable the reader to gain a solid understanding of the salient features and capabilities of WiMAX and build computer simulation models for performance analysis. Chapter 10 describes the networking aspects of WiMAX, and can be thought of as a condensed summary of the end-to-end network systems architecture developed by the WiMAX Forum. Chapters 11 and 12 provide an extensive characterization of the expected performance of WiMAX based on the research and simulation-based modeling work of the authors. Chapter 11 focuses on the link-level performance aspects, while Chapter 12 presents system-level performance results for multicellular deployment of WiMAX.