

Preface

With the explosive growth of mobile devices and bandwidth-hungry applications, radio spectrum is becoming increasingly congested and scarce. Database-assisted dynamic spectrum sharing emerges as a promising technology for solving the problem of spectrum scarcity and congestion, by allowing unlicensed mobile devices to dynamically access the under-utilized licensed spectrum resources through the assistance of a database. This database-assisted spectrum-sharing network architecture has received wide and enthusiastic support, not only from spectrum regulators (e.g., FCC in the USA and Ofcom in the UK), but also from standards bodies (e.g., IEEE) and industrial organizations (e.g., Google and Microsoft). However, most of the existing related studies focused on solving the technical issues related to such a network, with relatively few considerations on the economic issues of such a network. The latter part turns out to be critically important for the large-scale deployment and commercialization of this technology.

In this book, we focus on the economic issues arising in a database-assisted spectrum-sharing network. We will explain different business models for different network settings and analyze the user behaviors and system equilibrium under each model.

We start in Chap. 1 by discussing the motivation for us to write (and for you to read) this book. We introduce the concept of database-assisted dynamic spectrum sharing and its importance for today's wireless communications. We also discuss the technical and economic challenges related to the database-assisted spectrum sharing network architecture and review the existing studies in this area from both academia and industry.

In Chap. 2, we introduce several economics and game theory models that will be used in later chapters. This chapter can help those readers without a prior economic background to understand the modeling choices and analysis in later chapters more easily.

From Chaps. 3–5, we introduce three different economic models for different network settings. Specifically, in Chap. 3, we introduce a spectrum-trading market model for the sharing of under-utilized registered spectrum resources. We analyze

both the spectrum trading end market and the spectrum reservation market, which differ in terms of who pays for the spectrum resources and bears the risk due to stochastic demand. In Chap. 4, we introduce an information-trading market model for the sharing of unregistered spectrum resources, which are often regarded as public resource and shared by unlicensed devices openly and freely. We discuss how the database can gain revenue through selling the advanced information regarding these spectrum resources to unlicensed users. In Chap. 5, we introduce a hybrid spectrum and information market for the sharing of both registered and unregistered spectrum resources. We analyze how a licensee and a database interact with each other competitively and cooperatively.

Finally, in Chap. 6, we conclude the market models studied in this book and provide an outlook of the open questions and future challenges in each market.

This book can serve as a reference for researchers in white space communications and networking, for regulators in the wireless industry, and for graduate students and senior undergraduate students when taking a course on network economics. Readers can find references, papers, and slides related to this book at the companion Web site: <http://ncel.ie.cuhk.edu.hk/content/books>.

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