

Preface

Wireless spectrum is a scarce resource, and historically it has been divided into chunks and allocated to different government and commercial entities with long-term and exclusive licenses. This approach protects license users from harmful interferences from unauthorized users, but leaves little spectrum for emerging new services and leads to low spectrum utilizations in many spectrum bands. The way to turn spectrum drought into spectrum abundance is to allow dynamic and opportunistic spectrum sharing between primary licensed and secondary unlicensed users with different priorities. Such sharing is becoming technologically feasible due to the recent advances such as cognitive radio and small cell technologies, which allow multiple wireless devices to transmit concurrently in the same spectrum without significant mutual negative impacts.

As the spectrum opportunities are often dynamically changing over frequency, time, and space due to primary users' stochastic traffic, secondary users need to make intelligent spectrum access and sharing decisions. In this book, we propose a novel social cognitive radio networking framework—a transformational and innovative networking paradigm that promotes the nexus between social interactions and distributed spectrum sharing. By leveraging the wisdom of crowds, the secondary users can overcome various challenges due to incomplete network information and limited capability of individual secondary users. Building upon the social cognitive radio networking principle, we develop three socially inspired distributed spectrum sharing mechanisms: adaptive channel recommendation mechanism, imitative spectrum access mechanism, and evolutionarily stable spectrum access mechanism. Numerical results also demonstrate that the proposed socially inspired distributed spectrum sharing mechanisms can achieve superior networking performance.

The outline of this book is as follows. Chapter 1 overviews the related literature and discusses the motivations of social cognitive radio networking. Chapter 2 presents the adaptive channel recommendation mechanism, which is inspired by the recommendation system in the e-commerce industry for collaborative information filtering. Chapter 3 presents the imitative spectrum access mechanism, which leverages the common social phenomenon “imitation” to achieve efficient and fair

distributed spectrum sharing. Chapter 4 presents the evolutionarily stable spectrum access mechanism, which is motivated by the evolution rule observed in many animal and human social interactions. Chapter 5 summarizes the main results in this book.

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