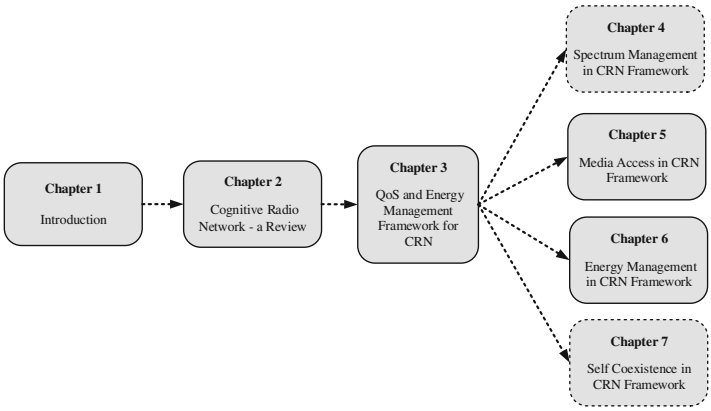
Preface

The approval of free usage of frequency spectrum via dynamic spectrum access methods on a non-interfering policy basis in various countries has made the cognitive radio technology a prominent candidate for wireless communication systems. Most of the wireless devices and their supporting infrastructure available today are capable of handling multimedia content delivery over wireless channels. Therefore, quality of service (QoS) is an important parameter for users experience while utilizing the services rendered on their wireless devices. For realization of cognitive radio-based dynamic spectrum access over conventional devices with conventional services (VoIP, Video, text messaging, Web page, etc.), QoS is an important factor that need to be provided to the wireless devices and applications. The QoS is broadly defined via two network parameters: throughput and latency. Similarly, energy management is also an important criteria for increasing the lifetime of portable wireless devices. Different aspects of a wireless network contribute toward varying network parameters and energy consumption, with each aspect having its own weight in contribution.

In this book, we discuss a QoS provisioning framework for cognitive radio network, which identifies and divides attributes of system into different modules responsible for quality of service and energy management. These modules are independently studied and a relation between them is shown to depict the interaction between these modules. These modules are responsible for channel selection, media access control, self-co-existence, and energy saving. A relationship is drawn among these modules for a coherent decision followed by the system. The framework supports four access categories for service differentiation. The framework is also designed in such a way that it separates main communication protocol stack from quality of service engine and thus allows its support for legacy protocol stack with minimal variation. Along with the provisioning of QoS, energy management in cognitive radio is also discussed. Since, the goal of the cognitive radio is to enter into a commercial market in a transparent way, energy management of the devices in the secondary network plays a crucial role to achieve this. Energy management from the viewpoint of channel selection, spectrum sensing order, and media access scheme is also discussed in this book. Each of these viewpoints

provides different ways through which energy can be efficiently managed in cognitive radio network.



The structure of this book is given as shown in figure above. It is recommended for a beginner to start from Chap. 1, while an experienced reader in the field of cognitive radio can directly proceed from Chap. 3.

Chapter 1 introduces basic motivation for reading this book and provides a basic background on cognitive radio and spectrum regulation issues. This chapter reminds the need of opportunistic spectrum usage and presents a comparison of software-defined radio with cognitive radio. This chapter also introduces basics on QoS, channel selection techniques, MAC protocols, and self-co-existence in cognitive radio network. Chapter 2 provides a review on different modules of the cognitive radio framework, including spectrum management, spectrum selection, media access schemes, and cognitive radio platforms. These modules are discussed from the perspective of quality of service and energy management.

Chapter 3 briefly describes QoS provisioning and energy management framework for cognitive radio network. QoS provisioning framework for cognitive radio network at Layer 2 of the protocol stack and different functional modules for QoS provisioning from the perspective of latency and throughput are discussed in this chapter. It is shown that latency and throughput can be directly identified by the media access scheme and channel selection technique, respectively, and also the effect of self-co-existence and energy management is separately studied.

A case study is conducted on spectrum usage behavior in Chap. 4. The concept of deterministic and stochastic-based classification of channel selection technique is discussed. Deterministic channel selection schemes utilize deterministic behavior of spectrum and make decision on spectrum selection ahead of time. A packet-to-channel tabular mapping-based fast spectrum selection scheme is discussed for stochastic channel environment.

In Chap. 5, a case study is done on a hybrid media access control protocol for QoS provisioning which encompasses two different channel access etiquettes. The

discussed media access scheme realizes service differentiation for four different types of packets. The support for important network operations such as broadcast and multicast, as well as realization of power saving mode is also discussed.

A case study is presented on the energy management functionality of cognitive radio network via utilizing a spectrum selection strategy in Chap. 6. A scheme is discussed to allow selection of low bandwidth channels so as to conserve transmission energy. The scheme also realizes a packet admission control technique for graceful degradation of QoS of the system.

Resource relocation and resource sharing-based self-co-existence techniques are discussed in Chap. 7. The approach of graph coloring is utilized to allocate disjoint set of resources, so as to mitigate interference. A frame sharing based approach is also discussed for self-coexistence.

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http://www.springer.com/978-3-319-45858-8

QoS and Energy Management in Cognitive Radio Network
Case Study Approach

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2017, XII, 202 p. 60 illus., 39 illus. in color., Hardcover
ISBN: 978-3-319-45858-8