

# Preface

The past decade has witnessed an increasing demand for wireless communication services, which have extended beyond telephony services to include video streaming and data applications. This results in a rapid evolution and deployment of wireless networks, including the cellular networks, the IEEE 802.11 wireless local area networks (WLANs), and the IEEE 802.16 wireless metropolitan area networks (WMANs). With overlapped coverage from these networks, the wireless communication medium has become a heterogeneous environment with a variety of wireless access options. Currently, mobile terminals (MTs) are equipped with multiple radio interfaces in order to make use of the available wireless access networks. In such a networking environment, cooperative radio resource management among different networks will lead to better service quality to mobile users and enhanced performance for the networks.

In this brief, we discuss decentralized implementation of cooperative radio resource allocation in a heterogeneous wireless access medium for two service types, namely single-network and multi-homing services. In [Chap. 1](#), we first give an overview of the concept of cooperation in wireless communication networks and then we focus our discussion on cooperative networking in a heterogeneous wireless access medium through single-network and multi-homing services. In [Chap. 2](#), we present a decentralized optimal resource allocation (DORA) algorithm to support MTs with multi-homing service. The DORA algorithm is limited to a static system model, without new arrival and departure of calls in different service areas, with the objective of identifying the role of each entity in the heterogeneous wireless access medium in such a decentralized architecture. In [Chap. 3](#), we discuss the challenges that face the DORA algorithm in a dynamic system and present a sub-optimal decentralized resource allocation (PBRA) algorithm that can address these challenges. The PBRA algorithm relies on short-term call traffic load prediction and network cooperation to perform the decentralized resource allocation in an efficient manner. We present two design parameters for the PBRA algorithm that can be properly chosen to strike a balance between the desired performance in terms of the allocated resources per call and the call blocking probability, and between the performance and the implementation complexity. In [Chap. 4](#), we further extend the radio resource allocation problem to consider the simultaneous presence of both single-network and multi-homing services in the networking environment. We first

develop a centralized optimal resource allocation (CORA) algorithm to find the optimal network selection for MTs with single-network service and the corresponding optimal bandwidth allocation for MTs with single-network and multi-homing services. Then we present a decentralized implementation for the radio resource allocation using a decentralized sub-optimal resource allocation (DSRA) algorithm. The DSRA algorithm gives the MTs an active role in the resource allocation operation, such that an MT with single-network service can select the best available network at its location and asks for its required bandwidth, while an MT with multi-homing service can determine the required bandwidth share from each network in order to satisfy its total required bandwidth. Finally, we draw conclusions and outline future research directions in [Chap. 5](#).

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