

Preface

Smartphone fever along with roaring mobile traffic poses great challenges for today's cellular networks. In general, cellular operators and vendors promise to provide seamless mobile access to end users. However, given the temporal and spatial variations of the ever increasing smartphone user demand, they feel obligated to deploy cellular access nodes in a more flexible and intelligent way, e.g., plug-to-play, self-organized, and cost-effective. Therefore, various types of small cells are being adopted indoors and outdoors to complement macrocells in cellular hotspots and blind zones. Designed by different purposes of operations, macrocells and small cells show heterogeneous characteristics, which requires new techniques to solve the challenging coexistence issues including interference management, cell coordination, and interworking.

In this Brief, we exploit cognitive radio techniques to improve spectrum utilization and perform flexible network management in the heterogeneous cellular network (HetNet) formed by macrocells and small cells. Background and literature survey of HetNet and cognitive radio techniques are first presented in Chap. 1. We then introduce an open cell management framework in Chap. 2, namely as *cognitive cellular network management* (CCN), which is mainly aimed to improve spectrum utilization and mitigate co-channel interference in HetNet. In Chap. 3, we investigate in wireless backhaul for flexible deployment of small cells, which requires smooth and reliable communications with the network controller even if wired portal is not available. Instead of static spectrum allocation, overlay spectrum reuse fits such need better, which accommodates the backhaul traffic by fully utilizing the intermittent spare spectrum resources with small spatial prints. An opportunistic routing protocol for wireless backhaul is presented along with the introduction of joint channel and relay selection. In Chap. 4, we further address on the coexistence issue between macrocells and small cells. When small cells are loosely controlled due to limited bandwidth in dense deployment, the effective allocation of radio resources becomes challenging. We propose a distributed QoS-aware cognitive MAC scheme which facilitates users in small cells to find available resources in an opportunistic way so that they can transmit at higher power for better link quality while maintaining tolerable interference to macrocell transmissions.

In addition, a penalty approach is used in backhaul to secure the effectiveness of power allocation in the transmission channels. Finally, we summarize the Brief and provide future research directions in Chap. 5.

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Waterloo, ON, Canada
Waterloo, ON, Canada

Yongkang Liu
Xuemin (Sherman) Shen

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Liu, Y.; Shen, X.S.

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