Design and Deployment of Small Cell Networks

This comprehensive resource covers everything you need to know about small cell networks, from design, to analysis, optimization, and deployment.

Detailing fundamental concepts as well as more advanced topics, and describing emerging trends, challenges, and recent research results, in this book experts explain how you can improve performance, decision making, resource management, and energy efficiency in next-generation wireless networks.

Key topics covered include green small cell networks and associated tradeoffs, optimized design and performance analysis, backhauling and traffic overloading, context-aware self-organizing networks, deployment strategies, and mobility management in large-scale heterogeneous networks (HetNets).

Written by leading experts in academia and industry, and including tools and techniques for small cell network design and deployment, this is an ideal resource for graduate students, researchers, and industry practitioners working in communications and networking.

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Preface

The ever-increasing use of smart phone devices, multimedia applications, and social networking, along with the demand for higher data rates, ubiquitous coverage, and better quality of service, pose new challenges to the traditional mobile wireless network paradigm that depends on macro cells for service delivery. Small cell networks (SCNs) have emerged as an attractive paradigm and hold great promise for future wireless communication systems (5G systems). SCNs encompass a broad variety of cell types, such as micro, pico, and femto cells, as well as advanced wireless relays, and distributed antenna systems. SCNs co-exist with the macro cellular network and bring the network closer to the user equipment. SCNs require low power, incur low cost, and provide increased spatial reuse. Data traffic offloading eases the load on the expensive macro cells with significant savings expected to the network operators using small cells.

As the demand for increased bandwidth rages on, SCNs emerged in dense urban areas mainly to provide coverage and capacity. They have now gained momentum and are expected to dominate in the coming years, with the rollout in large scale – either planned or in ad-hoc manner – and the development of 5G systems with many small cell components. Already, the number of "small cells" in the world exceeds the total number of traditional mobile base stations. SCNs are also envisioned to pave the way for new services. However, there are many challenges in the design and deployment of small cell networks, which have to be addressed in order to be technically and commercially successful. This book provides various concepts in the design, analysis, optimization, and deployment of small cell networks, using a treatment approach suitable for pedagogical and practical purposes.

This book is an excellent source for understanding small cell network concepts, associated problems, and potential solutions in next-generation wireless networks. It covers from fundamentals to advanced topics, deployment issues, environmental concerns, optimized solutions, and standards activities in emerging small cell networks. New trends, challenges, and research results are also provided. Written by leading experts in the field from academia and industry around the world, it is a valuable resource dealing with both the important, core, and specialized issues in these areas. It offers a wide coverage of topics, while balancing the treatment to suit the needs of first-time learners of the concepts and specialists in the field. It serves as a one-stop reference book for students,

instructors, researchers, and industry practitioners who are working in the design and deployment of small cell networks. Some highlights are:

- dense networking and multi-radio networking
- green small cell networks and tradeoffs
- optimized design and performance analysis
- backhauling and traffic overloading
- small cell network management
- deployment strategies
- latest standard activities
- context-aware self-organizing networks
- mobility management in large-scale HetNets
- coverage centric deployment of small cells
- enhanced inter-node carrier aggregation in small cells

The editors would like to thank all the chapter authors for their excellent and timely contribution. Special thanks go to the staff at Cambridge University Press for their professional and dedicated service. Last, but not least, we want to thank our families for their support, encouragement, and sacrifice.

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