

Preface

Communication networks must continuously evolve to ensure a sustainable growth of our “Internet Society.” It has been repeatedly observed that the push for more and more advanced network services leads inevitably to an exponential growth of traffic volumes and to higher quality-of-service requirements by the users; only by resorting to novel technologies and architectural solutions network, operators can keep pace with users’ requirements. The next big innovations in the telecom industry seem to be the forecasted massive deployment of IoT devices (hence the related machine-to-machine communication paradigm), the explosion of video-content network distribution, and the development of ultra-low latency network services. To address the technical challenges associated with these services, many companies, research institutes, and standardization bodies have now started the race towards the 5th generation of mobile communications. Fifth-generation networks are expected to support unprecedented bit rates, guaranteeing strict latency and reliable performance, and offering support for connecting together a tremendous number of devices. Fifth-generation networks will use very dense, low-power, small-cell networks with a high spatial reuse and a high degree of coordination due to strong inter-cell interference. Both fiber-based and wireless-based backhaul solutions will be used to connect small cells and the core network, but so far, access and backhaul are individually designed and therefore not jointly optimized. Hence, the design of 5G networks has long dictated the necessity to merge the currently distinct fiber and wireless infrastructures into an amalgamated network capable of combining the strength of both technologies: the stability and high bandwidth of optical fibers with the flexibility and mobility of wireless networks. This process of integration of the two technologies is usually referred as fiber-wireless convergence (or fixed-wireless convergence) and comprises a large set of technical challenges and solutions.

In this book, we provide the recent developments in the field of fiber-wireless convergence, concentrating on solutions that will be used to support the backhaul, midhaul, and fronthaul of 5G networks. The text presents the trends of industry, as well as current research, in state-of-the-art architectures of converged systems and networks, and takes a vertically layered approach starting from systems,

to architectures, to management/control issues of fixed-mobile convergence. This book is different from a number of other works on 5G networks that tend to focus heavily on the wireless aspects of 5G. Instead, we decided to look at both networking and systems issues, and focus on the latest research developments in a number of areas including radio over fiber, centralized cloud radio access network, and coordinated multi-point transmission for multiple base stations. This book is meant to be an introduction for any reader interested in having a holistic approach to the technical issues in fiber-wireless convergence and to readers interested in understanding some key aspects in more depth. The aim of the editors is to present a body of work that can provide the research scientist, company engineer, and the university professor/researcher with a better understanding on fiber-wireless convergence and ensure that experienced as well as novice researchers can have a single handy source of reference on this topic.

The book is divided into four parts that can appeal to different needs of readers, who are interested in various networking domains and issues. Part I is comprised of the introduction, the market, and the technical motivations for fiber-wireless convergence. Part II presents and discusses transmission systems for wireless-signal transport over fiber (A-RoF and D-RoF), and competing technology to these systems (namely multi-band RF and millimeter-wave transmission), and a set of opportunities that software-defined networks (SDNs) enable for such transmission systems. Part III concentrates on architectural issues related to network integration of fiber and wireless technologies (including use of PONs for mobile backhauling, baseband-unit hoteling, and centralized/coordinated architectures for radio access network, as the No-More-Cell architecture). Finally, Part IV covers management/control topics related to how and which network functions should converge in specific metro offices (Next Generation Point of Presence), as well as provides a closer look to some of these functions such as radio coordination and other SDN-controlled cloud services.

Acknowledgments We are extremely grateful to our past advisors and mentors, colleagues, students, and friends, who have motivated, inspired, and guided us to work in the new field of fiber-wireless convergence. All of them offered us their invaluable advise, exceptional insight, and foresight. They provided us with valuable guidance throughout the years and helped us better understand and appreciate various aspects of this new technological area. We would also be remiss if we did not extend a thank you to Professor Biswanath Mukherjee for taking the time to write the Foreword for this book and for his patience and encouragement while this book was being prepared and delivered. We also wish to express our thanks to Zoe Kennedy, Mary James, and the entire publishing team at Springer Verlag, for their effort and patience in order to bring this project to fruition. Also, a special thanks goes to all the authors who contributed chapters for this book. Finally, Georgios Ellinas is greatly indebted to his family for their understanding and patience during this undertaking. Gee-Kung Chang wishes to thank his wife for her unwavering support and express profound gratitude to Ken Byers who endows an eminent scholar chair professor in advanced telecommunications research at Georgia Tech for several decades. Massimo Tornatore gratefully acknowledges his family and his

fiancée Angela, for their constant love and support. Massimo Tornatore wants to acknowledge the European Community's COMBO project, during which he gained an invaluable amount of knowledge on the topics of this book.

Milan, Italy

Massimo Tornatore
Associate Professor

Atlanta, USA

Gee-Kung Chang
Professor
Byers Eminent Scholar
Chair Professor in Optical Networking
Georgia Research Alliance Eminent Scholar

Cyprus, Cyprus

Georgios Ellinas
Associate Professor

Fiber-Wireless Convergence in Next-Generation
Communication Networks

Systems, Architectures, and Management

Tornatore, M.; Chang, G.-K.; Ellinas, G. (Eds.)

2017, XXVII, 406 p. 205 illus., 167 illus. in color.,

Hardcover

ISBN: 978-3-319-42820-8