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Editorial
LTE/LTE-Advanced Cellular Communication Networks

Cyril Leung,[1] Raymond Kwan,[2] Seppo Hämäläinen,[3] and Wenbo Wang[4]

[1] *Department of Electrical and Computer Engineering, The University of British Columbia, Vancouver, BC, Canada V6T 1Z4*
[2] *Centre for Wireless Network Design, University of Bedfordshire, Bedfordshire LU1 3JU, UK*
[3] *NSN Research, Nokia Siemens Networks, 02610 Espoo, Finland*
[4] *Key Laboratory of Universal Wireless Communication, Beijing University of Posts and Telecommunications (BUPT), Beijing 100876, China*

Correspondence should be addressed to Cyril Leung, cleung@ece.ubc.ca

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From humble beginnings in the 1980s with bulky 1G analog handsets, the wireless cellular communications industry now enjoys a major presence in most countries, with nearly 5 billion subscribers worldwide and revenues in the one trillion USD range. Consumer demand for services is expected to grow rapidly in the next few years, fuelled by new applications such as mobile web-browsing, video downloading/streaming, online gaming, and social networking. The commercial deployment of 3G networks began with 3GPP UMTS/WCDMA in 2001 and has evolved into current UMTS/HSPA networks. To maintain a competitive edge, 3GPP UMTS networks need to support higher bit rates, improved spectrum efficiencies, and lower delays, all at a reduced cost. A well-planned and natural evolution to 4G networks is considered essential. Long-term evolution (LTE) and LTE-Advanced are important steps in this transition. LTE technology demonstrations began as early as 2006 and commercial LTE networks are starting to be deployed by wireless carriers worldwide.

This special issue consists of five papers. The first three papers focus on LTE: there is a survey paper on resource scheduling and interference mitigation techniques, a paper on resource scheduling for the provision of different services, and a paper on a method for improving the tradeoff between service quality and radio coverage for enhanced multimedia broadcast and multicast service (E-MBMS). The other two papers are focused on LTE-A: one paper discusses distributed algorithms for solving two self-configuration problems and the other examines the performance of decode-and-forward relaying.

Resource scheduling and interference mitigation will be instrumental in the success of LTE. In the first paper, "*A survey of scheduling and interference mitigation in LTE,*" Kwan and Leung present an overview of downlink and uplink resource scheduling techniques, including tradeoffs involved in selecting a channel quality indicator reporting scheme. A variety of methods which have been proposed for reducing intercell interference (ICI) in order to improve the link quality for cell-edge users are also described. The paper includes a brief discussion of the challenges for LTE-Advanced network designers.

The issue of joint radio resource allocation for multiple services is challenging, as each service is associated with different characteristics and quality of service requirements. In the second paper, "*Scheduling for improving system capacity in multiservice 3GPP LTE,*" Lima et al. address the issue of scheduling algorithms for multiple services in LTE, in which resources are jointly allocated. Their proposed scheme takes into account different traffic characteristics as well as current achieved satisfaction level of each service. Results show that the proposed scheme can provide significant capacity improvement over conventional approaches.

Video broadcast and multicast services are expected to play a very important role in future mobile communications. One of the key techniques for improving performance is the use of hierarchical modulation (HM). In HM, users with poorer channel qualities can access data via a low-rate but more error-protected "base-layer" (BL). On the other hand, users with better channel qualities can access the high-rate "enhanced layer" (EL) associated with less error protection.

The aim is to provide a good design tradeoff between service quality and coverage. In the third paper, "*Hierarchical modulation with vector rotation for E-MBMS transmission in LTE systems,*" Zhao et al. propose the use of vector rotation to improve the performance of the ELs in the context of LTE multicast/broadcast networks. Simulation results show that the proposed method can provide significant benefits for video quality and coverage compared to conventional schemes.

In LTE-Advanced systems, the number of available primary component carriers (PCCs) and physical cell IDs (PCIs) are limited and their assignment can be formulated as graph coloring problems. In the fourth paper, "*Distributed graph coloring for self-organization in LTE networks,*" Ahmed et al. investigate algorithms for solving these problems in a distributed fashion, considering both real-valued and binary pricing of interference. The number of component carriers needed to select conflict-free PCCs and the number of PCIs needed to assign confusion-free PCIs are estimated from simulations.

Decode-and-forward relaying is likely to play an important role in LTE-Advanced networks. In the fifth paper, "*On the coverage extension and capacity enhancement of inband relay deployments in LTE-Advanced networks,*" Saleh et al. investigate the coverage extension capabilities and capacity enhancements achievable with in-band Type 1 and Type 1b relaying within the LTE-Advanced framework in different propagation scenarios. System level simulation results show that the gains from employing these two types of relays vary greatly, depending on the deployment environment.

It is evident that this special issue does not cover many other important areas of relevance to LTE/LTE-Advanced networks. Nonetheless, we hope that readers will find the information presented to be interesting and useful. We thank all the authors who responded to the call for papers. We also wish to acknowledge all the reviewers for their dedicated efforts in ensuring a high standard for the selected papers.

Cyril Leung
Raymond Kwan
Seppo Hämäläinen
Wenbo Wang