Dynamic Spectrum Management for 5G

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In the last decade global mobile data traffic has approximately doubled each year, growth that is projected to continue unabated, due mainly to the introduction of new services and features specified by standards bodies. Thus, the wireless industry is asked to fulfill an increase in mobile data demand by a factor of 1000×, which is one of the most challenging requirements that the 5G system design has to address. There are various opportunities to enhance the network capacity, for example, by exploiting advanced receiver techniques, novel cooperative multipoint transmissions schemes, innovative multi-antenna solutions, and finally, an effective and broad deployment of heterogeneous networks. Unfortunately, these foreseen technical innovations on small cells and macrocells seem insufficient to reach the 1000× target. One of the key enablers that can allow supporting the required data traffic is to exploit additional bands, and to guarantee access to as much licensed and unlicensed spectrum as possible. Therefore, the wireless research community has to focus much more on enhanced, more effective, and also completely new spectrum management techniques. That is the reason this Special Issue focuses on highlighting some recent and promising results in the area of dynamic spectrum management for 5G and beyond systems. Among the 35 submitted papers, only 16 were selected for this Special Issue, and in the following a very short introduction of each of them is provided.

In "Multi-RAT Dynamic Spectrum Access for 5G Heterogeneous Networks: The SPEED-5G Approach" by Ioannis-Prodromos et al., a new spectrum management solution is presented to address traffic allocation over heterogeneous wireless technologies. In "Spectrum and Network Density Management in 5G Ultra-Dense Networks" by George Koudouridis et al., a framework for spectrum and network access density management in ultra-dense networks is introduced. In "Toward Context-Aware Dynamic Spectrum Management for 5G" by Giuseppe Caso et al., the authors suggest that context-aware interoperability and interference control may be crucial to comply with spectrum efficiency in 5G systems. In "Hybrid Resource Allocation for Millimeter-Wave NOMA" by António Morgado et al., a hybrid orthogonal and non-orthogonal resource allocation technique is presented. In "A Survey of Advanced Techniques for Spectrum Sharing in 5G Networks" by Lin Zhang et al., a survey is given of advanced techniques for spectrum sharing. In "Dynamic Reuse of Unlicensed Spectrum: An Inter-Working of LTE and WiFi" by Youjia Chen et al., a comprehensive survey on spectrum sharing technologies and a novel analytical framework are presented. In "Grid Modernization Enabled by SDN Controllers: Leveraging Interoperability for Accessing Unlicensed Band" by Saba Al-Rubaye et al., the authors provide new algorithms for a centralized SDN controller that governs transmissions of utility information over licensed/unlicensed bands through an LTE-LAA model infrastructure. In "How and How Much Sparsity Can Be Exploited to Overcome IoT Challenges in 5G" by Bassem Khalfi et al., challenges facing the support of IoT through 5G systems are discussed. In "Advanced Dynamic Channel Access Strategy in Spectrum Sharing 5G System" by Siyu Lin et al., a spectrum sharing framework for the 5G system is designed. In "Cooperation in 5G HetNets: Advanced Spectrum Access and D2D Assisted Communications" by Georgios I. Tsiropoulos et al., a heterogeneous networking architecture, where cells of different sizes and radio access technologies coexist, is presented. In "Dynamic Shared Spectrum Allocation for Underlaying Device-to-Device Communications" by Berna Ozbek et al., an overview on spectrum sharing in D2D underlaying communications for 5G and beyond applications is given. In "Unlicensed Spectrum Sharing: From Coexistence to Convergence" by Zhenyu Zhou et al., the authors develop a converged framework for multiple access that helps explore the integration of wireless communication and computer networking. In "Channel Hopping Protocols for Dynamic Spectrum Management in 5G Technology" by Aohan Li et al., the authors analyze the latest channel hopping protocols for dynamic spectrum management. In "Radio Resource Management in Future Terrestrial-Satellite Communication Networks" by Linling Kuang, et al., the authors introduce three technical challenges in radio resource management of terrestrial-satellite communication networks. In "Multi-Tenant Slicing for Spectrum Management on the Road to 5G" by Matteo Vincenzi et al., the authors take into account some radical changes foreseen for next generation networks. In "Data Delivery in Wireless Multimedia Sensor Networks: Challenging and Defying in the IoT Era" by Fadi Al-Turjman et al., best effort and real-time multipath routing protocols for wireless multimedia sensor networks are surveyed.

The articles of this Special Issue cover different topics and propose interesting innovations to enable 5G and beyond networks. We hope that you enjoy reading the issue and will find it interesting and useful. Finally, we would like to thank those who submitted the papers, the reviewers for the time spent selecting them, the SPEED-5G project (H2020-ICT-2014-2, Project ID: 671705) for nurturing the idea of this Special Issue, Professor Hamid Gharavi for effectively guiding us, and Jennifer Porcello for her editorial support.

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