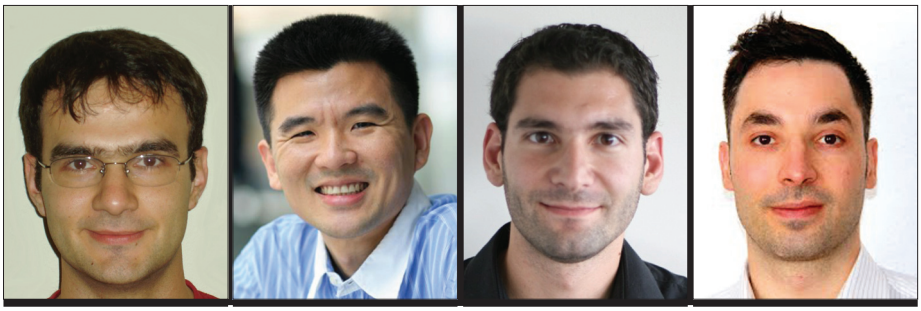
HETEROGENEOUS AND SMALL CELL NETWORKS: PART 2



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We are back this month with a sequel to our May 2013 Feature Topic on heterogeneous and small cell networks (HetSNets). In this follow-up, we have six more articles that address cognitive radio, moving cells, WiFi offloading, and energy efficiency aspects of HetSNets. The first article, by Song *et al.*, provides a holistic view of hyper-dense HetSNet deployments by comparing massive antenna and dense deployment, and providing some enabling technologies that can handle the technical challenges in HetSNets. To further manage interference and enhance spectral efficiency, the concept of cognitive radio can be exploited by reusing underutilized portions of the licensed spectrum, provided that the transmissions of secondary radios do not cause harmful interference to primary users. The next two articles are on the use of cognitive radio techniques by HetSNets. The article by Hossain *et al.* discusses how cognition in small cells can be exploited for overcoming multi-tier coexistence issues. Using stochastic geometry, user offloading and distributed channel access techniques are analyzed. The next article, by Wang *et al.*, is on cognitive radio inspired approaches for interference mitigation in femtocell networks. Techniques including spectrum sensing for cross-tier interference estimation, spectrum sharing, and cognitive relay are presented.

Due to the proliferation of mobile devices, an exponential increase in data traffic is compelling mobile operators to find ways to offload data traffic. The next article, by Bennis *et al.*, addresses the intelligent integration of both WiFi and small cells to perform traffic offload in a cost-effective manner.

The continuous demand for higher data rates and the ever increasing number of wireless users have led to rapid increase in power consumption and the operating cost of cellular networks. Deploying small cells is seen to be a promising way of implementing energy-efficient, or so called *green*, multi-tier cellular networks. The fifth article, by *Shakir et al.*, focuses on energy-efficient HetSNets and proposes deployment of small cells around the macrocell edge with adaptive uplink power control as a means to reduce CO_2 emissions.

The last article, by Sui *et al.*, is on the use of mobile relays for improving the wireless broadband experience on moving vehicles, such as buses, trams, and trains. Mobile relays help reduce vehicular penetration loss, and allow exploitation of powerful smart antenna techniques, which are not limited by the size of typical wireless devices. Both of these benefits are verified through simulation results in the article.

Before closing, we would like to thank again all submitting authors for considering our Feature Topic, our reviewers for their high-quality evaluations, and the editorial/publishing team of *IEEE Communications Magazine* for their patience in working with us. From the many high-quality submissions, it has been a real challenge to select the best and most relevant papers. Considering the active interest in small cell PHY enhancements in Third Generation Partnership Project (3GPP) Release 12 standardization and beyond, we believe that both Feature Topic parts have been very timely. We hope that they will trigger new research activities in both academia and industry as we head into the small cell revolution.

BIOGRAPHIES

ISMAIL GUVENC [SM'10] (iguvenc@fiu.edu) received his Ph.D. degree in electrical engineering from the University of South Florida in 2006, with an outstanding dissertation award. He was with Mitsubishi Electric Research Labs during 2005, and with DOCOMO Innovations Inc. between 2006 and 2012, working as a research engineer. Since August 2012, he has been an assistant professor with Florida International University. His recent research interests include heterogeneous wireless networks and future radio access beyond 4G wireless systems. He has published more than 70 conference and journal papers, and several standardization contributions. He has co-authored/co-edited three books for Cambridge University Press, and is an Editor for *IEEE Communications Letters* and *IEEE Wireless Communications Letters*.

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