

Editorial for MONET Special Issue on Networking in 5G Mobile Communications Systems: Key Technologies and Challenges

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Editorial:

This special issue includes eight high quality papers in the research area of Networking in 5G Mobile Communications Systems. With an ever-increasing number of mobile devices and the resulting explosive mobile traffic, 5G networking system should be re-designed by combining both communication and computation technologies. This special issue kicks off with an article on the cloudified wireless network architecture, namely “Cloud-based Wireless Network: Virtualized, Reconfigurable, Smart Wireless Network to Enable 5G Technologies”, co-authored by Min Chen, Long Hu, Yin Zhang, Tarik Taleb and Zhengguo Sheng. The article reveals that 5G is a multi-service and multi-technology integrated network, meeting the future needs of a wide range of big data and the rapid development of numerous businesses, and enhancing the user experience by providing smart and customized services. Then, the authors propose a cloud-based wireless network architecture with four components, i.e., mobile cloud, cloud-based radio access network, reconfigurable network and big data centre, which is capable of providing a virtualized, reconfigurable, smart wireless network.

The second article, “Hybrid Architecture Performance Analysis for Device-to-Device Communication in 5G Cellular Network”, co-authored by Zhijian Lin, Zhibin Gao, Lianfen Huang, Chi-Yuan Chen and Han-Chieh Chao, first develops a new hybrid architecture concept for D2D communications, which combines ISM 2.4G spectrum as the Out-Band mode and uses Bluetooth and Wifi-Direct with the cellular spectrum as the In-Band mode. And then a scheme is designed to form the Out-Band cluster and makes the following periodic signaling interaction via the Bluetooth interface. Traffic is transferred via the Wifi-Direct interface inside the cluster but carried on the cellular spectrum among the clusters.

For the topic of spectrum sharing and cognitive radio techniques, the third article in the special issue, “A Cyclostationarity-Based Implicit Channel for Cognitive Radio Applications”, co-authored by Tianheng Xu, Sha Yao and Honglin Hu, provides a Cyclostationarity-based Implicit Channel (CIC), which can assist conflict-avoidance coexistence for radio systems in the cognitive radio networks. The proposed implicit channel works as an add-on channel to a conventional OFDM system, which supplies extra communication opportunities without affecting the performance of the main system. Progressively, the article introduces the system model, interprets the operational principle, and manifests the modulation/demodulation scheme for the CIC technique. Afterwards, performance investigation is presented, showing the potential feasibility of the CIC technique being adopted in the future cognitive radio networks.

The next article “Reliable Machine-to-Machine Multicast Services with Multi-Radio Cooperative Retransmissions”

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investigates Machine-to-Machine Multicast Services and is co-authored by Andres Laya, Luis Alonso, Jesus Alonso-Zarate and Periklis Chatzimisios. In this article, a multi-radio cooperative retransmission scheme is proposed to efficiently carry out multicast transmissions in machine type communication networks, reducing both control signaling and improving energy-efficiency. The proposal can be executed in wireless networks composed by devices equipped with multiple radio interfaces which enable them to connect to both a cellular access network and a short-range machine type communication area network. By carrying out retransmissions over the machine-to-machine area network upon error in the main cellular links, the proposed scheme yields a reduction in both the traffic load over the cellular links and the energy consumption of the devices.

The fifth article, “Adaptive SON and Cognitive Smart LPN for 5G Heterogeneous Networks,” from Songlin Sun, Michel Kadoch and Tiantian Ran, proposes a novel scheme of adaptive self-organization network by integrating cognitive radio with inter-cell interference coordination. The scheme combines the spectrum sensing function from cognitive radio and the radio resource layering function from inter-cell interference coordination. And then a hungary algorithm based self-organization strategy is presented to improve the smart low-power node (SLPN) adaptive optimization.

In the sixth article with the title “Interference Minimization in 5G Heterogeneous Networks”, the authors (Tao Han, Guoqiang Mao, Qiang Li, Lijun Wang and Jing Zhang) propose a transmission power normalization model, which is able to convert a multitier cellular network into a single-tier network, such that all base stations have the same normalized transmission power. Based on this model, a new user association scheme is proposed in heterogeneous cellular networks, where the base station that leads to the smallest interference to other co-channel mobile stations is chosen from a set of candidate base stations that satisfy the quality-of-service constraint for an intended mobile station.

The seventh article in this special issue is titled “Frame-Based Medium Access Control for 5G Wireless Networks” and co-authored by In Keun Son, Shiwen Mao, Yihan Li, Min Chen, Michelle X. Gong and Theodore (Ted) S. Rappaport. As mmWave communications have been recognized as one of the key technologies for 5G, this article presents a frame-based medium access control protocol for mmWave networks, which exploits the grated polling service to achieve high spatial reuse, low control overhead, and high

network-wide throughput. The performance of the proposed protocol is validated with both analysis and extensive simulations.

In the last article “QoS aware Data Dissemination for Dense Urban Regions in Vehicular Ad Hoc networks”, the authors (Amit Dua, Neeraj Kumar and Seema Bawa) propose a new mechanism to maintain the coordination for data dissemination among the different vehicles in VANETs. An intelligent forwarding mechanism is used by newly designed metric which assigned weights to the routing paths from source to destination. Separate algorithms are designed for route construction and maintenance in the proposed scheme. The performance of the proposed scheme is studied by extensive simulations with respect to various metrics such as delay incurred, percentage of active links and load on wireless networks.

The guest editors are thankful to our reviewers for their effort in reviewing the manuscripts. We also thank the Editor-in-Chief, Dr. Imrich Chlamtac for his supportive guidance during the entire process.



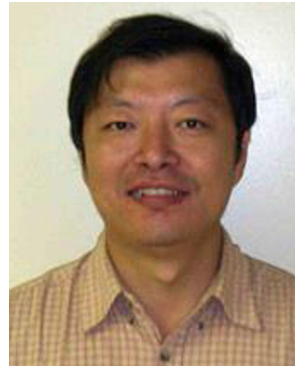
Xiaohu Ge is currently a Professor with the School of Electronic Information and Communications at HUST, China. He has worked at HUST since November 2005. He has published about 90 papers in refereed journals and conference proceedings and has been granted about 15 patents in China. He received the Best Paper Awards from IEEE Globecom 2010. He has been actively involved in organizing more ten international conferences since 2005. He served as the General

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