5G Wireless with Cognitive Radio and Massive IoT

Editorial

Emerging 5G wireless communications envision very high data rates (typically of Gbps order), extremely low latency, significant increase in base station capacity and improvement in users' perceived Quality of Experience (QoE), compared to current 4G/3G wireless networks. Rapid proliferation of smart devices, increasing number of multimedia and gaming applications, together with a non-linear increase in wireless data (multimedia) usage is already creating a significant burden on existing cellular networks. 5G wireless systems, with improved data rates, capacity, latency, and QoS are expected to alleviate these problems. The major distinctive characteristics in which 5G wireless differs from the traditional wireless systems are the following:

1. Supporting 1~10 Gbps data rates in real networks, i.e. almost 10 times increase from traditional LTE network's theoretical peak data rate.

2. A reduced round trip latency of 1ms, i.e. also almost 10 times reduction from 4G's 10ms round trip time.

3. Allocate high bandwidth in unit area, possibly by exploiting Cognitive Radio, for enabling large number of connected devices for longer durations.

4. Enormous number of connected devices to realize the vision of IoT.

5. Ensure complete coverage irrespective of users' locations.

6. Reduction in energy usage by development of green technology, even with high data rates and massive connectivity of 5G wireless.

Wireless industries, academia and research organizations have started collaborating in different aspects of 5G wireless systems.

The scope of this special issue is focused on various research challenges and solutions on different aspects of 5G wireless systems with Cognitive Radio for supporting Massive IoT. There are in total six papers in this special issue dealing with different aspects of 5G wireless. Depending on the different aspects of 5G wireless, the papers in this special issue are classified into four different categories: (a) Cognitive Radio and energy harvesting (two papers) (b) data offloading (one paper), (c) multi-link failure in SDN (one paper), (d) Internet of Things (IoT) (one paper) and (e) network caching (one paper).

The first paper, entitled "Full-Duplex Cooperative Spectrum Sensing with Primary User Activity in Cognitive Radio Networks" explores a Cognitive Radio Network (CRN) using full-duplex communications technology, with several secondary users cooperatively sensing the presence of primary user's activity. Under the assumption of time-slotted CRN transmission and non-time-slotted primary user's transmission, the analysis for false alarm and miss-detection probability are estimated. The second paper, entitled "A Review on Game Theoretic Incentive Mechanisms for Mobile Data Offloading in Heterogeneous Network", provides a survey of game-theoretic incentives for hybrid access in heterogeneous networks. The authors discuss the mobile offloading models from both the technical perspective and the economic perspective, and review the non-cooperative game theoretic models, cooperative game theoretic models, auction models, and point out major open issues. The third paper, entitled "Scalable and Efficient Forwarding

Table Design for Multi-link Failover in Open Flow-enabled Networks" addresses the multi-link failover problem in the Software Defined Network (SDN). Scalability and efficiency are improved using the proposed Flowtable design, which is a quite important issue in an Openflow-based network. The fourth paper, entitled "Hybrid Artificial Bee Colony Algorithm for an Energy Efficient Internet of Things Based on Wireless Sensor Networks" proposes a hybrid artificial bee colony algorithm to solve the scheduling problem for saving power in ad hoc networks of simultaneous transmissions. The proposed solution increases effectiveness by scheduling less number of smart devices. The fifth paper, entitled "Social Network Aware Caching for 5G Radio Access Network", explores a proactive caching scheme by using social ties of mobile users. By exploring users' behavior and cached content properties, it increases cache efficiency and 5G network capabilities. The sixth and the last paper, entitled "Optimal Operational Parameters for 5G Energy Harvesting Cognitive Wireless Sensor Networks", fuses Cognitive Radio Network and Wireless Sensor Network by introducing a CR-WSN model, based on energy harvesting in M/M/1 Markovian battery models, with the proposal of a frame structure of the wireless node's charging and sensing time..

The Guest Editorial team would like to thank the authors of all papers submitted (both those that are accepted and those that, unfortunately, could not be included) for considering our special issue to disseminate their work. We also would like to warmly thank all the reviewers for their difficult and conscientious work and for the time they spent in reviewing. We also extend our thanks to the IETE and Taylor-&-Francis staffs, in particular Sandeep Kaur Mangat, and the IETE Technical Review's Editor-in-Chief Prof. M. Jagadesh Kumar, for offering us the opportunity to present this special issue. We hope that the readers can use the research results presented in these papers to further enhance their knowledge for research and development in 5G wireless communication systems.

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