Editorial

Rong Zheng

Department of Computing and Software,
McMaster University,
ITB 121, 1280 Main Street West,
Hamilton, Ontario, L8S 4K1, Canada
Email: rzheng@mcmaster.ca

Xinbing Wang

School of Electronic Information and Electrical Engineering,
Shanghai Jiaotong University,
800 Dongchuan Rd., SEIEE Building, 1-439,
Shanghai, 200240, China
Email: xwang8@sjtu.edu.cn

Xiaohua Tian

Department of Electronic Engineering,
Shanghai Jiaotong University,
800 Dongchuan Rd., SEIEE Building, East 5-301,
Shanghai, 200240, China
Email: xtian@sjtu.edu.cn

Biographical notes: Rong Zheng is now a tenured Associate Professor in Computing and Software and an associate member of Electrical and Computer Engineering in McMaster University, Canada. She received the BE and ME in Electrical Engineering in 1996 and 1998 from Tsinghua University, China, and the PhD from the Department of Computer Science, University of Illinois, Urbana-Champaign, in 2004. Her current research interests include resource management of large-scale distributed systems, performance analysis and prototyping of wireless systems, and wireless sensor networks. She is a member of the IEEE Computer Society.

Xinbing Wang is currently a Professor in School of Electronic Information and Electrical Engineering, Shanghai Jiaotong University, Shanghai, China. He received the BS (with honours) from the Department of Automation, Shanghai Jiaotong University, Shanghai, China, in 1998, and the MS from the Department of Computer Science and Technology, Tsinghua University, Beijing, China, in 2001. He received the PhD major in the Department of electrical and Computer Engineering, minor in the Department of Mathematics, North Carolina State University, Raleigh, in 2006. His research interests include the scaling law of wireless networks and cognitive radio.

Xiaohua Tian is currently an Associate Professor in Department of Electronic Engineering of Shanghai Jiao Tong University, China. He received his BE and ME in Communication Engineering from Northwestern Polytechnical University, Xian, China, in 2003 and 2006, respectively. He received the PhD in the Department of Electrical and Computer Engineering (ECE), Illinois Institute of Technology (IIT), Chicago, in December, 2010. His research interests include application-oriented networking, Internet of Things and wireless networks.

Current advances in wireless and mobile communication systems have revolutionised the traditional concept of Internet. The novel paradigm of Internet of Things (IoT) is rapidly gaining ground in various applications. It is envisioned that several aspects of our everyday life and behaviour will be fundamentally changed. Applications such as assisted living, e-health, and enhanced learning are only a few examples of possible scenarios in which the IoT will play a leading role in the near future. Larger-scale applications like automation and industrial manufacturing, logistics, business/process management, intelligent transportation of people and goods will be the visible consequence of IoTs proliferation. Topics like sensor networks, RFID, short-range wireless communications, real-time localisation, ad-hoc networks, and mobile security are attracting much attention recently. The goal of the special issue is to publish the most recent results in the development of IoT.

M.M. Islam et al. proposed an energy-efficient multilayer routing protocol to tackle the issue of energy conservation for the battery-powered IP-based wireless sensor networks (IP-WSN). With the help of the Sensor Proxy Mobile IPv6 (SPMIPv6) protocol, a tiny sensor node is capable of handling multilayer routing to improve efficiency of energy consumption and end-to-end communication. The IP-WSN architecture compatible with the proposed protocol has been established, with software framework, message formats and addressing scheme discussed. Solid mathematical derivations and extensive simulations show the effectiveness of the proposed scheme. We believe interested readers can benefit from their paper entitled 'Energy-efficient multilayer routing protocol for SPMIPv6-based IP-WSN'.

Jian Qiu et al. represented an adaptive neighbour detection scheme for rapid sensor network configuration, especially in wireless sensor networks (WSNs). As sensor nodes have no knowledge about the locations of other nodes and the connections between them after deployment, neighbour detection process is very necessary in order to accomplish network configuration and future data transmission scheduling. The authors firstly proved that neighbour detection is critically important when the network topology is changed through their real network experiment. Then, an adaptive neighbour detection scheme was introduced, in which signalling packet broadcasting and adaptive back-off mechanism guarantee a high connectivity detection probability. Last but not the least, the work was verified by testbed experiments in a practical large-scale sensor networks. We hope their paper entitled 'An adaptive neighbour detection scheme for rapid configuration of wireless sensor networks' will provide readers with more insightful ideas.

Yun Rui et al. investigated the energy efficient power loading problem in multiple-input multipleoutput singular value decomposition (MIMO-SVD) architecture in the imperfect channel state information (CSI) scenario. Taking into account the effects of channel estimation error (CEE), an energy-efficient power loading scheme for MIMO system under imperfect CSI was proposed. The authors gave two algorithms to maximise the system energy efficiency, with a globally optimal one and the other suboptimal one cost different computational complexity presented. Effectiveness and robustness of their proposed power loading scheme were verified through Monte Carlo simulations. We invite readers to check out their paper entitled 'Robust energy-efficient power loading for MIMO system under imperfect CSI' in this special issue for more details.

Jia Liu et al. studied the problem of jointly optimising base stations (BS) placement and power control in buildings to prolong the battery lifetime of sensors in the cyber-physical systems (CPS) network infrastructure. To deal with the challenging BS placement problem caused by impact of building structures and floor/wall separations, the authors proved that the joint BS placement and power control problem can be formulated as a mixed-integer nonconvex programme (MINCP). In addition, the expansion clustering-projection-contraction (ECPC) algorithm was proposed to solve the NP-hard MINCP, with theoretical analysis and numerical results demonstrate the better performance over the branch-and-bound method. We welcome readers to check their paper titled 'On wireless network infrastructure optimisation for cyber-physical systems in future smart buildings' for further discussion.

Jingsong Lv et al. devised an earliest deadline first (EDF)-based dispatcher to support multi-level QoS for information dissemination systems, where Internet of Things (IoT) played a leading role to fuse the physical world and information space connected by wireless and mobile communication networks. The EDF-based dispatcher maps all items from multiple logical channels with speeds commensurate with the respective QoS levels onto a single physical channel. The proposed method introduces no delay and outperforms the input multi-channel allocation in terms of average turnaround time, with a bound on the difference of average turnaround times between single-channel allocation and multi-channel allocation provided. To implement such EDF-based dispatcher, a bipartite graph is constructed to associate all items in multi-channel allocation to different time slots in single-channel allocation. We hope that readers interested in this topic can benefit from their paper titled 'Supporting multi-level quality of services in data broadcast systems'.

Yifan Wu et al. studied the way to implement noncontact recharging of sensor nodes to obtain sustainable functioning for wireless sensor networks, with non-negligible charging time taken into consideration. They considered the coverage problem of providing continuous energy replenishment to wireless sensor nodes in noncontact recharging manner using fixed chargers. Under the condition of non-negligible charging time, the problem of charging sequence scheduling for an energy hub and its covered sensor nodes were examined, with a heuristic method proposed to find the minimum number of fixed energy hubs to guarantee operation of all the nodes. They also shed some light on how to cope with mode changes of sensor nodes by using elastic scheduling. We believe their paper entitled 'Enable sustainable sensor networks with non-contact charging: efficient deployment of energy hubs' can provide the readers with more or less insightful ideas.

Yu Tang et al. proposed a cross-layer method to deliver real-time service in the collection tree topology of wireless sensor networks. Aiming at reduction of packet loss rate under congestion condition, the proposed cross-layer approach combines the timely responsive scheduling in routing layer and congestion mitigation in transport control layer. The sensor packets with transmission deadlines are routed via average transmission time (ATT) based protocol, while the congestion control is imposed through a performance-differentiated packet dropping policy. Simulation experiments on the TinyOS platform show that ATT protocol outperforms collection tree protocol (CTP) by reducing the transmission delay up to 17.7%, while maintains a slightly better transmission reliability measured

by the packet loss rate. We wish the readers care about the technical details about their work can benefit from the paper titled 'A cross-layer approach to timely responsive transmission under collection tree topology in wireless sensor network'.

Nuno Pereira et al. established a data collection and distribution architecture that enables gathering physical parameters of a large data centre at a very high temporal and spatial resolution of the sensor measurements. Through this architecture, more accurate heat-flow models of the data centre can be built to optimise energy consumptions. Having a high-resolution picture of the data centre conditions also enables minimising local hot-spots, perform more accurate predictive maintenance (failures in all infrastructure equipments can be more promptly detected) and more accurate billing. Their system architecture is highly hierarchical and modular, with specialised hardware developed to enable its functionalities. The performance of the proposed architecture was validated through a preliminary study of a typical data centre radio environment. We hope their paper titled 'A microscope for the data centre' can provide the readers with some ideas on managing the physical and compute infrastructure of a large data centre.

Gaotao Shi et al. took advantage of temporal and spatial feature of WiFi interference to alleviate WiFi interference for ZigBee networks, which is different from the previous approaches that focused on minimising effect on link level. Based on the experimental examination on the spatio-temporal variation of WiFi interference, a novel interference assessing method jointly considering intensity and density of WiFi interference was developed to better characterise the relation between interference and link quality. Further focusing on the interference locality, they proposed MuZi (Multi-channel ZigBee) as an interference avoiding approach for ZigBee networks. Extensive experiments on a testbed of 802.11 embedded nodes and 802.15.4 TelosB motes showed that, under the existence of WiFi interference, MuZi can achieve 3.3 times throughput than the traditional single-channel method. We recommend the readers interested in WiFi interference avoidance issue refer to their paper entitled 'Exploiting temporal and spatial variation for WiFi interference avoidance in ZigBee networks' for more details.

Qin Liu et al. studied the real-time data aggregation problem for wireless sensor networks, in which a set of sensor nodes and a delay bound are given to maximise the average transmission success probability of all sensor nodes within the delay bound. They considered the situation where CSMA/CA MAC layer protocols was implemented. They divided the system time into timeframes with fixed size and scheduled the transmission of each senor into time-frames. They solve the joint routing and scheduling problem by first constructing an aggregation tree that minimises the node interference. Then, an efficient greedy scheduling algorithm was proposed, with extensive simulations results show the performance improvement in terms of success probability of data collection. We invite readers to check out their paper entitled 'Maximise success probability for real-time sensor networks using contention-based protocols' to get more theoretical and experimental details.

Zuying Wei et al. studied the problem of adaptivewidth channel allocation in multi-hop, non-cooperative wireless networks from a game-theoretic point of view. Firstly, a strategic game model for this problem and demonstration of the existence of Nash Equilibrium (NE) were proposed in an anarchical scenario. As the NE is not an ideal solution, then they established a novel incentive approach, called AMPLE, to guarantee the system performance at high level. To solve the NPcomplete channel allocation problem in multiple collision domains, an approximate algorithm was presented with good system performance. In addition, they designed a charging scheme that guarantees the system to converge to a dominant strategy equilibrium (DSE), in which it is to the best interest of each node to follow the computed channel allocation, regardless how the others behave. Numerical results verify that AMPLE outperforms anarchical NEs in terms of average system throughputs. To get further understanding about their work, we invite readers refer to the paper titled 'Incentive-compatible adaptive-width channel allocation for non-cooperative wireless networks'.

Manal Al-Bzoor et al. introduced a novel energy efficient schema that does not need location information to support geo-routing in underwater sensor networks (UWSN). Unlike other geographical routing protocols, the proposed adaptive power controlled routing (APCR) protocol does layering of nodes based on the power level of interest packets sent by sink nodes. Nodes in APCR are assumed to be able to adjust per packet transmission power to maintain high delivery ratio, reduce energy and lower end to end delay for various network conditions. APCR works well with multiple sink UWSN architecture, maintains fixed delivery ratio while noticeably enhancing end to end delay and slightly reducing total energy expenditure. Extensive simulation results show that APCR has a higher delivery ratio, lower delay and lower energy expenditure when compared to depth based routing (DBR) protocol. More theoretical analyses and implementation details can be obtained from their paper entitled 'An adaptive power controlled routing protocol for underwater sensor network'.

We are very pleased that these research teams allow us to entertain our readership with their work. We believe our readers can certainly benefit from their contributions. We would like to thank all the referees for their careful reviewing. We deeply appreciate the Editor-in-Chief of *IJSNet*, Professor Yang Xiao, who gave us the opportunity to edit this special issue. Last, but not the least, we would also like to thank all the staff in editorial office for their kind help in publishing this issue.