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Special Issue on Green Communications, Computing, and Systems

The convergence of computing and communications, a recognized phenomenon since 1996 (“The Convergence of Communications and Computing: What are the Implications Today?,” PROCEEDINGS OF THE IEEE, 1996), has accelerated in recent years. Computing technologies are used extensively in network systems, such as cloud computing and grid computing, and the Internet is the most well-known and widely used network infrastructure for computing. Networked software and hardware applications, especially wireless and mobile ones, have been made remarkable and fast increasing impacts on society development and human lives. They touch a great number of the human population in the world through ubiquitous mobile phones and devices. Computing and communications are indispensable components in many diverse systems. All these systems have energy issues. Their increasing spread, particularly with the emergence of the Internet of Things, is a great challenge to a world seeking to reduce its reliance on fossil fuels and address global climate changes. At the same time, although energy concerns are one of the dominant “green” topics, the green issues could be more generally defined as those making the world and the components of man-made systems both sustainable and friendly in an environmental, economic, social, and/or technical sense (“Big Data Meet Green Challenges: Greening Big Data,” IEEE SYSTEMS JOURNAL, 2016). In this sense, the word “green,” includes not only the sustainability objectives but also the “most positive and friendly” characteristics concerning human environments and societies. This Special Issue aims to be one among solid efforts in promoting green communications, computing, and systems. Green communications (J. Wu et al., Green Communications: Theoretical Fundamentals, Algorithms, and Applications, CRC Press, 2012) and green computing (Harnessing Green IT: Principles and Practices, Wiley, 2012) are highly overlapping research areas due to their strong convergence. Green wireless communications are one of the dominant areas within green communications (“Green wireless communications: From concept to reality,” IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, 2012). Additionally, with focuses on energy and computing issues, one relevant research domain is energy informatics (Energy Informatics, Green ePress, 2011). We stress that green communications, computing, and systems cover many relevant topics on energy efficiency and management, resource efficiency and management, sustainability, and environmental protection.

This Special Issue started the dissemination of the Call for Papers in the middle of 2014, received 63 high-quality submissions, and accepted 22 papers after rigorous peer-review processes based on expert peer reviewers. The review process for the third and fourth accepted papers in the list below was handled independently by the Editor-in-Chief. The paper “Cross-Layer Energy Minimization for Underwater ALOHA Networks” by Koseoglu et al. investigates the crosslayer energy minimization problem in underwater ALOHA networks considering the unique transmission properties of the underwater medium. The paper “Improving the Energy Efficiency of Broadband

Copper Access Networks: Review and Performance Analysis” by Guenach et al. reviews the main techniques that can be applied to improve the energy efficiency of broadband copper access networks. The paper “Energy-Efficient Precoded Coordinated MultiPoint Transmission With Pricing Power Game Mechanism” by Fu et al. generalizes the noncooperative pricing game mechanism with pricing across both frequency and space in the scenario of multiuser multiple-input–multiple-output-based coordinated multiple-point transmissions. The paper “Network Connectivity Proxy: Architecture, Implementation and Performance Analysis” by Bolla et al. extends the knowledge about the concept of network connectivity proxy (NCP) by defining an extended set of tasks that the NCP can carry out, via introducing a suitable communication interface to control NCP operation, and designing, implementing, and evaluating a functional prototype. The paper “PoweRock: Power Modeling and Flexible Dynamic Power Management for Many-Core Architectures” by Lai et al. proposes a novel flexible dynamic power management approach based on a profile-guided dynamic-voltage/frequencyscaling scheme to meet the different goals. The paper “Demand Response in Data Centers Through Energy Efficient Scheduling and Simple Incentivization” by Paul et al. presents the formulation and solution to the optimal server provisioning problem for server provisioning at different tiers, based on a discrete-time model, then proposes a simple and effective mechanism to facilitate more renewable integration into the grid through providing monetary incentives on deadline deferral. The paper “Distributed Energy Consumption Management in Green Content-Centric Networks via Dual Decomposition” by Fang et al.studies the tradeoff between energy consumption and quality of service in content-centric networking by switching off the redundant network content routers and links via a mixedinteger linear programming model and proposes a centralized solution via spanning tree heuristic, and then proposes a fully distributed energy optimization algorithm that is proposed based on the dual decomposition. The paper “Energy-Aware Mapping and Live Migration of Virtual Networks” by Rodriguez et al. introduces a set of new algorithms for the mapping of virtual networks on network substrates designed to reduce network energy consumption, and further proposes two new algorithms for the migration of virtual routers and links. The paper “A Game-Theoretic Analysis of Energy Efficiency and Performance for Cloud Computing in Communication Networks” by Lin et al. adopts a game-theoretic approach to data traffic management to obtain a distributed and energy-efficient solution. The paper “Green Link Weights for Disruption-Free EnergyAware Traffic Engineering” by Okonor et al. provides a framework for disruption-free energy-aware traffic engineering to leverage on selective link sleeping and wake-up operations in a disruption-free manner. The paper “Reducing Greenhouse Gas Emissions With Power Source Aware Multi-Domain Multi-Layer Networks” by Schoendienst and Vokkarane introduces a hierarchical groom- ¨ ing approach to collect, multiplex, and groom traffic at those energy efficient nodes to reduce carbon emissions. The paper “Priority Scheduling for Heterogeneous Workloads: Tradeoff Between Evictions and Response Time” by C¸ avdar et al. presents a system model with a slot-based priority scheduler that captures the execution progress, evictions, and response times when executing complex workloads

on heterogeneous systems, and proposes a workload-aware slot con- figuration and task assignment methodology incorporated with slot-based priority scheduling to improve class-based response time and resource efficiency. The paper “Energy Minimization With Network Coding via Latin Hypercubes” by Kocaoglu and Akan studies the best mapping between the input and output symbols at the network coding node that minimizes the average codeword energy using Latin squares, called the minimum energy network code (MENC), and then investigates the MENC for in-N networks using the Latin hypercubes and proposes a low-energy network code to reduce the average energy with network coding. The paper “Energy-Saving Transmission for Green Macrocell-Small Cell Systems: A System-Level Perspective” by Chung proposes an efficient energy-saving transmission algorithm to minimize power consumption for transceivers in both macrocell base stations and small cell base stations in cellular systems with a green deployment policy. The paper “Energy Efficiency Improvement of Coded OFDM Systems Based on PAPR Reduction” by Yoshizawa and Ochiai investigates how much improvement in terms of the power efficiency by such PAPR reduction techniques can be achieved in coded OFDM systems. The paper “Reducing the Energy Footprint of Cellular Networks Thanks to Delay-Tolerant Users” by Gamboa et al.

proposes two delay-tolerant-user-aware sleep-mode strategies in cellular networks. The paper “Metrics on Energy Efficiency for Cognitive Green Equipment Based on FPGA Platform” by Wu et al. introduces some useful metrics for a cognitive management architecture for a field-programmable gate array implementation. The paper “Energy Saving Through Traffic Profiling in SelfOptimizing Optical Networks” by Pederzolli et al. proposes a novel method to reduce the energy consumed by dynamically adjusting the number of active optical carriers to support the short-term load of the optical transport network with a small and controllable margin. The paper “Semantic Systems and Visual Tools to Support Environmental Communication” by Scharl et al. investigates the potential of semantic technologies to address these environmental concerns, presents visualization techniques to explore the lexical, geospatial, and relational context of topics, as well as the entities referenced in these repositories. The paper “Server Consolidation Techniques in Virtualized Data Centers: A Survey” by Varasteh and Goudarzi presents a survey and taxonomy for server consolidation techniques in cloud data centers with the focus on the parameters and algorithmic approaches used to consolidate virtual machines onto physical machines. The paper “A Two-Way Street: Green Big Data Processing for a Greener Smart Grid” by Asad and Chaudhry describes the role of the big data enterprise in envisioning the smart grid via dissecting the big data enterprise into six vital planes impacting the energy footprints of data centers. In the paper “An Energy-efficient Architecture for the Internet of Things (IoT)” by Kaur and Sood, a novel energy-efficient architecture for IoT is proposed with three layers, namely sensing and control, information processing, and presentation, which allows the system to predict the sleep interval of sensors based upon their remaining battery level, their previous usage history, and the quality of information required for a particular application.

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