MONET Special Half-Issue “Recent Advances on Communications and Networking in China”

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Published online: 7 November 2012
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Editorial:

This special issue features extended versions of six of the best papers selected from the conference Chinacom 2011, which was held in Harbin, China, on August 17–19, 2011.

The emerging vehicular networks are targeted to provide efficient communications between mobile vehicles and fixed roadside units (RSU), and support mobile multimedia applications and safety services with diverse quality of service (QoS) requirements. In the paper titled “Medium Access Control for QoS Provisioning in Vehicle-to-Infrastructure Communication Networks”, Bi, Cai, Shen and Zhao propose a busy tone based medium access control (MAC) protocol with enhanced

QoS provisioning for life critical safety services. By using busy tone signals for efficient channel preemption in both contention period (CP) and contention free period (CFP), emergency users can access the wireless channel with strict priority when they compete with multimedia users, and thus achieve the minimal access delay. Furthermore, through efficient transmission coordination on the busy tone channel, contention level can be effectively reduced, and the overall network resource utilization can be improved accordingly. The authors develop an analytical model to quantify the medium access delay of emergency messages. Extensive simulations with Network Simulator (NS)-2 validate the analysis and demonstrate that the proposed MAC can guarantee reliable and timely emergency message dissemination in a vehicular network.

Delay tolerant networks (DTNs) rely on the mobility of nodes and sequences of their contacts to compensate for lack of continuous connectivity and thus enable messages to be delivered from end to end in a “store-carry-forward” way, where multiple relay nodes are usually employed in the message delivery process. In the paper “Performance Modeling for Relay Cooperation in Delay Tolerant Networks Layered Fault”, Liu, Jiang, Nishiyama and Kato focus on such relay cooperation and analytically explore its impact on the delivery performance in DTNs. Specifically, the authors first develop a continuous time Markov chain-based theoretical framework to model the complicated message delivery process in delay tolerant networks adopting the two-hop relay algorithm. They then derive closed-form expressions for both the expected

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delivery delay and the corresponding expected delivery cost, where the important relay behaviors of forwarding traffic for itself or for other nodes are carefully incorporated into the analysis.

Internet of things (IoT) points out an inspiring road towards intelligent world of real-time information collection and interaction among people and entities. It may provide various applications by connecting all the existing communication networks. To ensure the reliability of end-to-end transmission in the hierarchical environments, fault management is of great importance. Current relative algorithms are designed for specific network, not suited to these complex conditions. Meanwhile, the utilization of existing facilities should be considered for implementation feasibility. In the paper “Management Scheme for End-to-end Transmission in Internet of Things”, Li, Ji and Li propose a layered fault management scheme for IoT with uniform fault managing procedure control and separate layer functions. Flexible and effective monitoring model would be set in selected observing points around the networks. Advanced fuzzy cognitive maps (FCM) is adopted to realize integrated evaluation and prediction of the possible fault. The observing points could adjust the weighting rule in the model to suit the practical network condition and work independently. After further confirmation among neighbor points, fault recovery therapy could be handed over to the corresponding network with existing countermeasures. The proposed design suits well to the efficiency and feasibility requirements of IoT. Simulation results further prove its desirable behavior.

The paper “An Improved Fuzzy Unequal Clustering Algorithm for Wireless Sensor Network” by Mao, Zhao, Zhou and Ye introduces IFUC, which is an Improved Fuzzy Unequal Clustering scheme for large scale wireless sensor networks (WSNs). It aims to balance the energy consumption and prolong the network lifetime. The authors’ approach focuses on energy efficient clustering scheme and inter-cluster routing protocol. On the one hand, considering each node’s local information such as energy level, distance to base station and local density, they use fuzzy logic system to determine each node’s chance of becoming cluster head and estimate the cluster head competence radius. On the other hand, the authors use Ant Colony Optimization (ACO) method to construct the energy-aware routing between cluster heads and base station. It reduces and balances the energy consumption of cluster heads and solves the hot spots problem that occurs in multi-hop WSN routing

protocol to a large extent. The validation experiment results have indicated that the proposed clustering scheme performs much better than many other methods such as LEACH, CHEF and EEUC.

The fifth paper is titled “Phase Coded Waveform Design for Sonar Sensor Network” and co-authored by Xu, Liang, Wu and Zhang. Since it is known that interference with each sonar sensor could be effectively reduced when waveforms are appropriately designed for a Sonar Sensor Network (SSN), the authors provide a set of new ternary codes called optimized punctured Zero Correlation Zone sequence-pair set (ZCZPS) and provide a method to construct such codes. They study the codes’ properties especially using the ambiguity function to analyze the nature of the output of the matched filter. The ternary codes are applied to the SSN as pulse compression codes for narrowband pulse signals to simulate the target detection performance of the system. Comparing with the classical periodic Gold sequences, it is shown that the proposed codes improve the system detection performance.

In the paper “FPGA Implementation and Energy Cost Analysis of Two Light-Weight Involutional Block Ciphers Targeted to Wireless Sensor Networks”, Zhang, Heys and Li investigate the energy cost of the FPGA implementation of two cryptographic algorithms targeted to wireless sensor networks (WSNs). Recent trends have seen the emergence of WSNs using sensor nodes based on reconfigurable hardware, such as a field-programmable gate arrays (FPGAs), thereby providing flexible functionality with higher performance than classical microcontroller based sensor nodes. In this study, the authors investigate the hardware implementation of involutorial block ciphers since the characteristics of involution enables performing encryption and decryption using the same circuit. This characteristic is particularly appropriate for a wireless sensor node which requires the function of both encryption and decryption. Further, in order to consider the suitability of a cipher for application to a wireless sensor node, which is an energy constrained device, it is most critical to consider the cost of encryption in terms of energy consumption. Hence, the authors choose two involutorial block ciphers, KHAZAD and BSPN, and analyze their energy efficiency for FPGA implementation.

The guest editors are most grateful to the contributions of the authors and reviewers, without which this special half-issue would not have been possible. A special thank to the Edit-in-Chief, Dr. Imrich Chlamtac, for his supportive guidance during the entire process.

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