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Editorial
Wireless Network Algorithms, Systems, and Applications

Benyuan Liu,[1] Azer Bestavros,[2] Jie Wang,[1] and Ding-Zhu Du[3]

[1] *Department of Computer Science, University of Massachusetts Lowell, Lowell, MA 01854, USA*
[2] *Department of Computer Science, Boston University, MA 02215, USA*
[3] *Department of Computer Science, University of Texas at Dallas, TX 75083, USA*

Correspondence should be addressed to Benyuan Liu, bliu@cs.uml.edu

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Advances in wireless communication and networking technologies proliferate ubiquitous infrastructure and ad hoc wireless networks, enabling a wide variety of applications ranging from environment monitoring to health care, from critical infrastructure protection to wireless security, to name just a few. The complexity and ramifications of the fast-growing number of mobile users and the variety of services intensify the interest in developing principles, algorithms, design methodologies, and systematic evaluation frameworks for the next-generation wireless networks.

This special issue contains twelve papers selected from submissions through open calls and the technical program of the Fourth Annual International Conference on Wireless Algorithms, Systems, and Applications (WASA 2009), held in Boston, Massachusetts, USA, during August 16–18, 2009. These papers highlight some of the current research interests and achievements in the area of wireless communication and networking. The topics include routing, localization, scheduling, target detection and coverage, and privacy in mobile ad hoc networks and sensor networks.

F. Li, S. Chen, and Y. Wang's paper presents Circular Sailing Routing (CSR), a routing protocol that provides a load-balanced routing for wireless networks. Their method maps the network onto a sphere via stereographic projection and makes routing decision by "circular distance" on the sphere. They show that the distance traveled by packets in CSR is bounded above by a small constant factor of the length of the shortest path.

J. Choi, B.-Y. Choi, S. Song, and K.-H. Lee's paper presents a network quality-aware routing (NQAR) mechanism to avoid noisy paths with high possibility of collision, and thus save time from transmission backoffs and retransmissions. Their experiment results show that NQAR effectively reduces the end-to-end delay and outperforms the direct diffusion mechanisms under error-prone environments.

T. Le and Y. Liu's paper studies the capacity of hybrid wireless networks with opportunistic routing. They present a linear programming method to calculate the end-to-end throughput in a hybrid network. They show that opportunistic routing can efficiently utilize base stations and achieve significantly higher capacity than traditional unicast routing.

C. Laurendeau and M. Barbeau's paper presents positioning algorithms to estimate the position of an uncooperative transmitter, based on the received signal strength of a single target message at a set of receivers with known coordinates. Their simulation results demonstrate that their algorithms can effectively localize a target within the regulations stipulated for emergence services location accuracy.

P. D. Tinh and M. Kawai's paper presents a distributed range-free algorithm based on self-organizing maps. Their algorithm uses only connectivity information to determine node locations. Utilizing the intersection areas between radio coverages of neighboring nodes, the algorithm intends to maximize the correlation between the neighboring nodes, which reduces the learning time significantly.

A. Cakiroglu and C. Erten's paper provides fully decentralized but collaborative primitives for uniquely localizing wireless nodes with low computation and messaging requirements. The primitives are based on construction of a special order for multilaterating the nodes within a cluster. With relatively small clusters and iteration counts, the proposed approach can localize almost all the nodes that are uniquely localizable.

H. Chen, W. Lou, X. Sun, and Z. Wang's paper investigates the impact of wormhole attacks on localization and presents a consistency-based secure localization scheme. The localization scheme includes wormhole attack detection, valid locator identification, and self-localization. The paper also presents theoretical models to analyze the proposed localization scheme and evaluate its performance via simulation.

L. Bao and S. Liao's paper addresses the spectrum scarcity problem caused by the unbalanced utilization of radio frequency bands in the current state of wireless spectrum allocations. The paper presents a spectrum-access scheduling to improve the spectrum utilization efficiency in heterogeneous wireless systems. Their simulation results show that spectrum-access scheduling is a feasible and promising approach to handling the spectrum scarcity problem.

J. Zhou, J. Li, and L. B. Burge III's paper introduces the notion of "pigeon networks," motivated by an ancient practice of employing pigeons for long-distance communications, as a special type of delay-tolerant networks (DTNs) that use special-purpose message carriers for applications such as disaster recovery. The paper presents efficient scheduling strategies for message carriers and analyzes the traffic that can be supported under deadline constraints.

Q. Liang's paper studies target recognition in radar sensor networks. Inspired by human's innate ability to process and integrate information from disparate and network-based sources, the paper proposes two human-inspired target detection algorithms for target-detection in radar-based sensor networks. Simulation results show that the proposed approaches perform well, whereas the existing two-dimensional construction algorithm does not work.

G. Fusco and H. Gupta's paper studies the k-coverage problem of wireless sensor networks. The goal is to activate minimum number of sensors to ensure that each target in the area is covered by at least k sensors. This problem is NP complete. The authors present an algorithm with an approximation ratio of $O(\log M)$ based on the extension of the classical ε-net technique, where M is the number of sensors in an optimal solution.

J. Ren, Y. Li, and T. Li's paper deals with the source privacy problem in mobile ad hoc networks (MANETs). Source privacy is a critical security requirement for mission-critical applications, especially for MANETs due to node mobility and the lack of physical protection. The paper presents communication protocols that provide source privacy, end-to-end routing privacy, and message authenticity. The theoretical analysis and simulation show that the proposed schemes are efficient and can provide a high message delivery ratio.

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Benyuan Liu
Azer Bestavros
Jie Wang
Ding-Zhu Du