



Guest Editorial

Algorithmic Solutions for Wireless, Mobile, Ad Hoc and Sensor Networks

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The field of wireless and mobile computing is an important and research challenging area of computing today. This has been made possible due to the tremendous and continued growth of wireless technology, creating the need of ubiquitous distributed services: anywhere and anytime. In addition to wireless networks based on a pre-existing infrastructure, where wireless communications take place only between the end-nodes and the access points, mobile ad hoc wireless networks and sensor networks are emerging rapidly. Such networks do not need any infrastructure to work, but they comprise mobile clients as well as mobile servers, and they pose challenges in diverse areas such as network topology control, routing and security, resource placement, allocation and discovery, energy consumption, and media access. In this scenario, there is a great need of algorithmic solutions to realize and maintain high-speed, high-performance, cost-effective, energy-efficient and reliable wireless networks.

This special issue brings together contributions in discrete algorithms, optimization techniques, and performance evaluation methods in the context of wireless, ad-hoc, and sensor networks.

More than 60 papers were submitted, out of which only the 16 papers below have been selected for publication. These papers do not cover all aspects that belong to the scope of this special issue. However, they represent interesting research efforts and subjects that definitely belong to the core research on algorithmic solutions for wireless, mobile, ad hoc, and sensor networks.

The first three papers deal with the network topology control problem.

The paper “Dynamic Coverage in Ad-Hoc Sensor Networks”, by H. Huang, A.W. Richa and M. Segal, dynamically maintains measures on the quality of the coverage of a sensor network.

The paper “Algorithmic Aspects of Topology Control Problems for Ad Hoc Networks”, by E.L. Lloyd, R. Liu, M.V. Marathe, R. Ramanathan and S.S. Ravi, shows how to assign power values in ad hoc networks to obtain a graph topology satisfying some specified important properties.

The paper “Wireless ATM Layouts for Chain Networks”, by M. Flammini, G. Gambosi and A. Navarra, integrates the benefits of the ATM technology with the wireless communication, and studies the existence of optimal layouts for special network topologies.

The next two papers consider the problem of routing in ad hoc networks.

The paper “Ad Hoc Multicast Routing Algorithm with Swarm Intelligence”, by C.-C. Shen and C. Jaikaeo, proposes a novel idea for multicast routing based on Swarm Intelligence that refers to complex behaviors that arise from very simple individual behaviors and interactions.

The paper “Regional Gossip Routing for Wireless Ad Hoc Networks”, by X.-Y. Li, K. Moaveninejad and O. Frieder, develops a location based routing protocol and presents a detailed analysis of this routing protocol.

The next three papers study the issues of placement, allocation and discovery of resources in cellular and ad hoc networks.

The paper “Comparison and Evaluation of Multiple Objective Genetic Algorithms for the Antenna Placement Problem”, by L. Raisanen and R.M. Whitaker, evaluates the performance of a greedy algorithm to select and configure base station locations using genetic algorithms methods.

The paper “A Characterisation of Optimal Channel Assignments for Cellular and Square Grids Wireless Networks”, by M.V.S. Shashanka, A. Pati and A.M. Shende, proposes optimal channel assignment algorithms in wireless networks whose topology can be represented by square and cellular grids.

The paper “CARD: A Contact-Based Architecture for Resource Discovery in Ad Hoc Networks”, by A. Helmy, S. Garg, P. Pamu and N. Nahata, proposes a resource discovery mechanism based on distributed directories which is suitable for large ad hoc networks.

The next group of papers involves the energy consumption problem in sensor and ad hoc networks.

The paper “Energy-Balanced Task Allocation for Collaborative Processing in Wireless Sensor Networks” by Y. Yu and V.K. Prasanna, considers the problem of scheduling a real-time application onto a single-hop wireless sensor network taking into account energy requirements for both computation and communication.

The paper “Efficient and Robust Protocols for Local Detection and Propagation in Smart Dust Networks”, by I. Chatzigiannakis, S. Nikolettseas and P. Spirakis, presents various protocols for smart dust based sensor networks for local event detection and propagation of reports.

The paper “Training a Wireless Sensor Network”, by A. Wadaa, S. Olariu, L. Wilson, M. Eltoweissy and K. Jones, proposes a protocol for training nodes in a sensor network. The protocol, partitioning nodes into clusters, obtains a scalable and energy-efficient routing from cluster to the sink.

The paper “Quorum-Based Asynchronous Power-Saving Protocols for IEEE 802.11 Ad Hoc Networks”, by J.-R. Jiang, Y.-C. Tseng, C.-S. Hsu and T.-H. Lai, addresses the asynchronous power management problem for an IEEE 802.11-based Multi-Hop MANET, correlating it to the concept of quorum system.

The last group of four papers deals with the media access and transmission scheduling problems.

The paper “CROMA – An Enhanced Slotted MAC Protocol for MANETs”, by M. Coupechoux, B. Baynat, C. Bonnet and V. Kumar, presents a TDMA based MAC protocol with high utilization in synchronized mobile ad hoc networks. CROMA handles both the hidden terminal and exposed terminal problems to achieve a high throughput.

The paper “Dynamic Bandwidth Management in Single-Hop Ad Hoc Wireless Networks”, by S.H. Shah, K. Chen and K. Nahrstedt, presents dynamic bandwidth management and call admission control in a single hop ad hoc network at the application level. This paper shows an elegant solution to this problem with simulation and experimental results.

The paper “High Speed Networking Security: Design and Implementation of Two New DDP-Based Ciphers”, by N. Sklavos, N.A. Moldovyan and O. Koufopavlou, proposes two new fast ciphers suitable for wireless communications, which set hard specifications in security implementations.

Finally, the paper “Media Synchronization and QoS Packet Scheduling Algorithms for Wireless Systems”, by A. Boukerche and H. Owens II, considers the QoS requirements and the scheduling transmission problems arising when multiple streams of text, images, audio and video are sent to mobile clients through a combined wired and wireless network.

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