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Guest Editorial

Special Section on Wireless networking

In this Special Section on Wireless networking, we are pleased to present a diverse set of papers covering a range of topics within the area of wireless networking. While the huge proliferation of wireless devices and technologies enables a rich set of new applications, it also raises many new research challenges. This section addresses some of these open research challenges.

The proliferation of wireless technologies has led to the coexistence of many different technologies nowadays, including sensor networks, WLAN, WiMAX and cellular networks among others. All these technologies are covered by the papers of this special section. Some of the applications addressed by the articles of this special section (such as vehicular network, industrial control or data aggregation) use one or more of these standard wireless technologies, while other applications addressed (such as underwater networks) require of specific hardware. The challenges faced by the papers of this section in the context of these wireless technologies and applications include security issues, network performance and energy consumption, among others.

This special issue contains a selection of the best contributions presented at the 16th European Wireless (EW) Conference that was held in Lucca in 2010. These include the keynote speeches given by Sajal Das and Michele Zorzi, which provided an insightful review of the fields covered as well as their own contribution in these fields, and five additional papers that have been selected because of their technical depth and novelty. All these papers have been substantially revised and extended for journal publication, and then subjected to the standard ComCom review process. We believe this process has resulted in a very strong set of papers for this special section.

The first article, authored by S.K. Das and J.-W. Ho, is entitled 'A Synopsis on Node Compromise Detection in Wireless Sensor Networks Using Sequential Analysis' and deals with security in sensor networks. By exploiting the unattended nature of sensor networks, an attacker can physically capture and compromise sensor nodes and then launch a variety of attacks. In order to minimize the damage incurred by compromised and replicated nodes, it is very important to detect such malicious nodes as quickly as possible. This paper reviews the previous work of the authors on node compromise detection in sensor networks and provides an extended analysis against related work. To this end, they use the methodology of sequential analysis to detect static and mobile compromised nodes, as well as mobile replicated nodes in sensor networks.

The second article of this special issue is 'Protocol Design Issues in Underwater Acoustic Networks' by P. Casari and M. Zorzi. This paper discusses issues related to the design of underwater acoustic network protocols which are tailored around, and leverage on, the differences between underwater acoustics and terrestrial radio. These differences span physical propagation and energy consumption, and influence the design of medium access control, routing and topology management. The authors introduce a set of solutions which explicitly account for the particular characteristics of underwater acoustics. Then, they review some more realistic underwater sound propagation behaviors and analyze their consequences on MAC protocols. Finally, they briefly discuss the currently available underwater communications hardware and comment on which paradigms are currently realizable.

The third article is 'Power-aware Opportunistic Downlink Scheduling in IEEE 802.16 Wireless Networks' by C. Cicconetti, L. Lenzini, D. Migliorini and E. Mingozzi. This paper deals with two key challenges of 802.16-based networks. First, it proposes a framework based on a static partitioning of bandwidth into chunks with different transmission power levels and allocates higher amount of transmission power to terminals with impaired channel conditions. Second, it proposes a scheduling algorithm that aims at meeting both the QoS and fairness requirements, while taking into account the different power levels of the bandwidth chunks. The performance of the proposed approach is assessed through detailed packet level simulation in realistic scenarios and compared with well-known scheduling algorithms.

The fourth article is entitled 'Modelling and Optimization of Power Consumption in Wireless Access Networks' and is authored by M. Deruyck, E. Tanghe, W. Joseph and L. Martens. This paper addresses power consumption of wireless access networks. It models power consumption of base stations for mobile WiMAX, fixed WiMAX, UMTS, HSPA, and LTE and introduces a new metric to compare the energy efficiency of the considered technologies for a range of bit rates. The study concludes that, for a 5 MHz channel, UMTS is the most energy-efficient technology until a bit rate of 2.8 Mbps, LTE between 2.8 Mbps and 8.2 Mbps, fixed WiMAX between 8.2 Mbps and 13.8 Mbps and mobile WiMAX for bit rates higher than 13.8 Mbps. The paper also investigates the influence of MIMO and deploys, based on the model, a tool for green wireless access networks.

The fifth article is 'The WICKPro protocol with the Packet Delivery Ratio metric', authored by J. Aísa and J.L. Villarroel. It proposes a protocol for Wireless Mesh Networks with chain topologies that provide Hard Real-Time guarantees, which can be used for applications such as remote controlled machines in industrial control networks in road and railroad transportation or in tunnel and mine applications. The proposed approach is a MAC protocol based on the ideas of the Timed-token protocol and the cyclic executive. To validate it, the authors made a testbed using commercial

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802.11 wireless cards and compared their approach against the 802.11 protocol and three specific protocols for WMNs with chain topologies.

The title of the sixth article of this special issue is 'A Directional Data Dissemination Protocol for Vehicular Environments' and their authors are R.S. Schwartz, R. Barbosa, N. Meratnia, G. Heijenk and H. Scholten. This paper presents a simple and robust dissemination protocol that efficiently deals with data dissemination in both dense and sparse vehicular networks. In order to deal with broadcast communication under diverse network densities, the authors design a dissemination protocol that prevents the broadcast storm problem in dense networks by employing an optimized broadcast suppression technique and it efficiently deals with disconnected networks by relying on the store-carryforward communication model. The novelty of the protocol lies in its simplicity and robustness.

Last but not least, the seventh article is 'TDMA Scheduling for Event-Triggered Data Aggregation in Irregular Wireless Sensor Networks' by M. O. Diaz Anadon and K.K. Leung. It proposes a distributed TDMA scheduling protocol for data aggregation. With this protocol, sensor nodes transmit dummy packets to determine whether they can tolerate the interference from the other nodes that are assigned the same time slot and in this way it verifies that the slot allocation is collision-free, in contrast to existing protocols which suffer collisions because they use unrealistic interference models such as neglecting interference generated more than two hops away. Furthermore, the proposed protocol achieves similar concurrency and lower execution time than comparable protocols.

We would like to take this opportunity to thank the authors for the efforts they put in the preparation of the manuscripts as well as the reviewers who refereed the manuscripts in a timely manner and provided valuable feedback to the authors. We would also like to thank Marco Conti for his support during the preparation of this special issue.

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