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GUEST EDITORIAL

MONET special issue editorial

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Ultra Wide Band (UWB) radio is a physical transmission technique suitable for different kinds of applications. Given the relevant power emission constraints imposed by the regulatory bodies in the United States, but likely to be adopted by other countries as well, UWB is emerging as a particularly appealing transmission technique for applications requiring either high bit rates over short ranges or low bit rates over medium to long ranges.

With the recent release of the IEEE 802.15.4 standard for low-bit-rate WPANs, the low-bit-rate case has gained worldwide attention, for application to long-range sensor networks such as: indoor-outdoor distributed surveillance systems, non real-time data applications like e-mail and instant messaging, and in general all data transfers compatible with a transmission rate in the order of 1 Mbps over several tens of meters. The application scenarios refer to networks that commonly adopt the self-organizing principle, i.e., distributed networks, like ad-hoc and sensor networks, such as groups of wireless terminals located in a limited-size geographical area, communicating in an infrastructure-free fashion, and without any central coordinating unit or base station. Multi-hop communication is often employed to extend coverage and reduce power consumption.

Furthermore, Ultra Wide Band typical features, such as the need for operating at low power vs. a rather accurate ranging capability, may have a significant impact on the design of the MAC and of routing algorithms and strategies. The optimization of MAC and network modules in ad-hoc networks is a topic that recently gained research attention worldwide. The impulse-radio (IR) principle, in particular, may boost innovation in designing efficient algorithms for resource sharing and management because of the impulsive nature of the transmission. IR intrinsically partitions time in a peculiar way, because of the short and limited duration of the pulses. The very recent adoption of an Aloha-based strategy in IEEE 802.15.4a represents the perfect example of the impact of the IR paradigm.

Given their ultra wide bandwidth, UWB signals must in principle coexist with other radio signals and networks. This principle fully fits the emerging concept of "cognitive radio" aimed at defining and developing technologies that can enable a radio device to adapt its spectrum according to the operating environment, that is, to be aware of the scenario in which it operates. The final goal remains to form wireless networks that cooperatively coexist with other wireless networks and devices.

The idea of editing this special issue originated during the "2*nd International Workshop on Networking with Ultra Wide Band* (NeUWB^2), UWB in Sensor Networks," where extremely interesting discussions were triggered around the work presented by the attendants. This special issue is thus devoted to the specific topic "UWB in Sensor Networks" and gathers eight contributions, focused on the more relevant research activities in such framework.

The first paper of the issue "*Design and Performance Evaluation of a Full-Duplex Operating Receiver for Time-Hopping UWB*" by Tomaso Erseghe and Nicola Laurenti proposes a methodology to design channel estimation/synchronization and demodulation/decoding algorithms for a receiver operating in full-duplex mode, for the specific case of Time-Hopping UWB.

We would like to thank the many people who made this Special Issue possible. We are especially grateful to all authors for their valuable contributions. A particular thank to the MONET Editorial Board and in particular to our Editor-in-Chief, Prof. Imrich Chlamtac, as well as all the Editorial Staff.

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Noise suppression issues are analyzed in the second paper "*Impulsive Noise in UWB Systems and its Suppression*" by Youssef Dhibi and Thomas Kaiser, where the authors propose to model noise in UWB-OFDM communications as a Middleton Class A noise (MCA).

Channel modelling is addressed in the third paper "*The Ultra-Wide Bandwidth Outdoor Channel: From Measurement Campaign to Statistical Modelling*" by Marco Di Renzo, Fabio Graziosi, Riccardo Minutolo, Mauro Montanari, and Fortunato Santucci that presents an investigation of propagation behaviour of IR-UWB signals in outdoor environments, and in particular in different scenarios ranging from "forest" to "suburban".

The methodology for the design of interoperable wireless sensor networks, based on the platform based design principle, is presented in the following paper "*Platform Based Design for Wireless Sensor Networks*" by Alvise Bonivento, Luca P. Carloni, and Alberto Sangiovanni Vincentelli.

The following three papers are related to coexistence, cognitive radio, and system optimization. The paper entitled "*Research Advances in Cognitive Ultra Wide Band Radio and Their Application to Sensor networks*" by Fabrizio Granelli, Stefano Maranò , Honggang Zhang, and Xiaofei Zhou, introduces the general cognitive concept and focuses on on-going research on this topic, which aims at exploring the extended dimensions of Cognitive Radio and UWB and their synergy.

"*Fluid Coding and Coexistence in Ultra Wide Band Networks*" by Daniele Domenicali, Guerino Giancola, and Maria-Gabriella Di Benedetto, analyzes a possible way for controlling the spectrum and multiple access using analog coding.

Routing strategies based on sensors location, link quality and battery capacity information are analyzed in the paper "Performance of Energy-aware and Link-adaptive Routing Metrics for Ultra Wideband Sensor networks" by Jinghao Xu, Bojan Peric and Branimir Vojcic.

The last paper "Introducing Consciousness in UWB networks by Hybrid Modelling of Admission Control" by Maria-Gabriella Di Benedetto, Guerino Giancola, and Maria-Domenica Di Benedetto introduces a model for a self-organizing network of nodes that operate according to the UWB principle based on hybrid modelling formalism. Cognition is introduced in the model by allowing nodes to adjust their rules of operation based on the perception of the environment by an elected node, serving as the observer, that is aware of context, evaluates, and selects one strategy of operation.

We are most pleased to present this issue and we hope that it will trigger renewed research and interest on this exciting topic.

Enjoy the issue!

Guest Editors of the Special Issue

Fabrizio Granelli was born in Genoa in 1972. He received the "Laurea" (M.Sc.) degree in Electronic Engineering from the University of Genoa, Italy, in 1997, with a thesis on video coding, awarded with the TELECOM Italy prize, and the Ph.D. in Telecommunications from the same university, in 2001. Since 2000 he is carrying on his teaching activity as Assistant Professor in Telecommunications at the Dept. of Information and Communication Technology—University of Trento (Italy). In August 2004, he was visiting professor at the State University of Campinas (Brasil). He is author or co-author of more than 40 papers published in international journals, books and conferences, and he is member of the Technical Committee of the International Conference on Communications (ICC2003, ICC2004 and ICC2005) and Global Telecommunications Conference (GLOBECOM2003 and GLOBECOM2004). Dr. Granelli is guest-editor of ACM Journal on Mobile Networks and Applications, special issue on "WLAN Optimization at the MAC and Network Levels" and Co-Chair of 10th IEEE Workshop on Computer-Aided Modeling, Analysis, and Design of Communication Links and Networks (CAMAD'04). Dr. Granelli is General Vice-Chair of the First International Conference on Wireless Internet (WICON'05) and General Chair of the 11th IEEE Workshop on Computer-Aided Modeling, Analysis, and Design of Communication Links and Networks (CAMAD'06).

His main research activities are in the field of networking and signal processing, with particular reference to network performance modeling, medium access control, wireless networks, next-generation IP, and video transmission over packet networks.

He is Senior Member of IEEE.

Maria-Gabriella Di Benedetto obtained her Ph.D. in Telecommunications in 1987 from the University of Rome La Sapienza, Italy. In 1991, she joined the Faculty of Engineering of University of Rome La Sapienza, where currently she is a Full Professor of Telecommunications at the Infocom Department. She has held visiting positions at the Massachusetts Institute of Technology, the University of California, Berkeley, and the University of Paris XI, France. In 1994, she received the Mac Kay Professorship award from the University of California, Berkeley. Her research interests include speech analysis and synthesis, and digital communication systems. From 1995 to 2000, she directed four European projects for the design of UMTS. Since 2000 she has been active in fostering the development of Ultra Wide Band (UWB) radio communications in Europe. Within the 5th framework, she directs for the Infocom Dept. two European projects (whyless.com and UCAN) aimed at the design and implementation of UWB ad-hoc networks. Within the 6th EU Framework her "Networking with UWB" research group participates in the PULSERS Integrated Project which will integrate UWB research and development in Europe for the next years, and in the LIAISON Integrated Project as regards the application of UWB to location-based services. She currently also participates in the HYCON network of excellence. Dr. Di Benedetto is co-editor for the IEEE JSAC Special Issue on UWB Radio in Multi-Access Wireless Communications (December 2002)and for the Journal of Communications and Networks Special Issue on Ultra-Wideband Communications (December 2003). Dr. Di Benedetto recently co-authored with Guerino Giancola a book on Ultra Wide Band from radio to the network, titled "Understanding Ultra Wide Band Radio Fundamentals" and published by Prentice Hall in May 2004.