Available online at www.sciencedirect.com
SCIENCE DIRECT®
ELSEVIER
Computer Communications xx (2005) 1–3
computer communications
www.elsevier.com/locate/comcom

Editorial

Special issue on wireless sensor networks and applications

The advent of nano-technology has made it technologically feasible and economically viable to develop low-power devices that integrate general-purpose computing with multi-purpose sensing and wireless communications capabilities. It is expected that these small devices, referred to as *sensors*, will be mass-produced and deployed, making their production cost negligible. Individual sensor nodes have a small, non-renewable power supply and, once deployed, must work unattended.

For most applications we envision a massive deployment of sensors, perhaps in the hundreds or even thousands. Aggregating sensors into sophisticated computational and communication infrastructures, called *sensor networks*, will have a significant impact on a wide array of applications ranging from military, to scientific, to industrial, to health-care, to domestic—establishing ubiquitous wireless sensor networks that will pervade society redefining the way in which we live and work. Sensor networks are currently being established as a specific subtask of the rapidly unfolding area of ubiquitous and pervasive computing.

This special issue contains papers presented at the *Dagstuhl Seminar No. 04121* titled '*Wireless Sensor Networks and Applications*' organized and run by the three guest editors from *March 14 to March 19, 2004*. The main goal of the seminar was to provide an opportunity for researchers to explore the connection between sensor network techniques and paradigms and the development of solutions to problems that arise in various application domains.

In response to the call for papers for this seminar, we have received a variety of papers related to sensor networks and their applications from Europe and the United States—making the seminar a truly international event. The seminar Co-Chairs have carefully considered the suitability of the topics for the workshop and also ranked the manuscripts on their original contributions. From all presentations at the seminar, 11 manuscripts were selected for inclusion in this special issue.

0140-3664/$ - see front matter © 2005 Published by Elsevier B.V.
doi:10.1016/j.comcom.2004.12.035

The collection of papers presented here is a good sampler of the theoretical and practical aspects of state-of-the-art research in sensor networks. They contain techniques and paradigms that are known to lead to the design of robust algorithm and protocols for solving a large number of fundamental problems ranging from self-organization, self-structuring and self-governance to security, to peer-to-peer aggregation of sensor networks, to various other areas of contemporary interest.

The first four papers approach the topic from a theoretical standpoint.

Römer and Mattern propose to overcome the separated consideration of time and location in algorithmic developments of sensor networks. They argue for a mutual fertilization of both domains due to the significant overlap and similarity of the algorithms used.

Wattenhofer relates the algorithms for ad hoc and sensor networks to graph theory problems, and emphasizes the specific requirements from the limited communication bandwidth and frequent changes in topology.

Olariu and Xu discuss the energy-efficiency of protocols in self-organizing massively deployed sensors, forming a virtual infrastructure, which is robust and adaptive to size, topology and density in different application contexts.

A short paper by *Hof and Zitterbart* proposes a secure service directory for content addressable networks.

The next four contributions provide insight into ongoing practical and experimental approaches and platforms.

Beutel uses Bluetooth communication in an example hardware implementation of small computing nodes, and experiments with self-healing distributed scatternet formation.

Bellis et al. promote the application of field-programmable gate arrays for digital signal processing in a sensor platform, and introduce their 25 mm × 25 mm hardware development in ambient intelligence settings.

Schiller, Liers and Ritter emphasize the educational aspect of their ScatterWeb hardware/software platform, with easy re-programmability as a key feature for changing experimental setups with real-world sensors.

Ferscha et al. experiment with orientation sensing for gesture-recognition and interaction. They define a

development framework and prove their concept with an inertia hardware setup.

Three papers populate the application and architecture-oriented section of this special issue.

Ibrahim, Kronsteiner and Kotsis discuss semantic and algorithmic issues of data representation and aggregation in mixed sensor networks with plenty and heterogeneous data sources.

Pfeifer proposes a redundant positioning architecture to fuse location data from a multitude of different sources, either built purposely for location or bearing inherent location data to improve coverage and precision spanning different administrative domains.

Krco, Cleary and Parker provide a peer-to-peer overlay in the context of 3G mobile networks to access ubiquitous sensors, supported by a JXTA middleware.

We take this opportunity to thank all the authors for their submissions and the referees for taking time to thoroughly review all the submissions.

Last but certainly not least we express our gratitude to the Schloss Dagstuhl Foundation for making the seminar possible and for fostering the open, congenial atmosphere conducive of high-caliber interaction.

We trust that you will find this special issue as interesting and informative as we do.

A. Ferscha (University of Linz, Austria)
S. Olariu (Old Dominion University, Norfolk, USA)
T. Pfeifer (Waterford Institute of Technology, Ireland)

Schloss Dagstuhl

The International Conference and Research Center for Computer Science in Schloss Dagstuhl regularly organizes scientific workshops, so-called Dagstuhl-Seminars. They serve to gather a group of scientists who jointly delve into and work on a computer science topic for a week. This topic is generally an established computer science field, and more frequently it is an area which overlaps with various computer science disciplines or other scientific fields.

Tom Pfeifer[a,*]
Stephan Olariu[b]
Alois Ferscha[c]
[a]*TSSG Research Group, Waterford Institute of Technology, Cork Road, Waterford, Ireland*
[b]*Old Dominion University, Norfolk, VA, USA*
[c]*University of Linz, Linz, Austria*
E-mail address: t.pfeifer@computer.org

Tom Pfeifer joined the TSSG research group of Waterford Institute of Technology (WIT) as a Principal Investigator, Director of Research in Ubiquitous and Pervasive Computing, in 2004, funded by the Science Foundation Ireland. As visiting professor, he teaches at WIT as well as at Universities in Limerick and Dublin. From 1992 until 2003 he had worked in Berlin in a variety of senior research, industry consulting, project management and lecturing positions in the Fraunhofer Institute of Open Communication Systems (FOKUS), the GMD Computer Science Research Labs, and the Technical University of Berlin, Faculty of Computer Science and Electrical Engineering. Following lectures in the 1990s in different areas of High-Speed Networking and Multimedia Technology, he had recently developed a module of lectures and seminars on Ubiquitous and Pervasive Computing. Tom Pfeifer received his Dr -Ing. (PhD) in Computer Science at Technical University of Berlin, 2000. He holds a Dipl. -Ing. (Masters) degree in Electrical Engineering /Electronics from the Technical University of Dresden, Germany, 1989. He has published over 30 technical papers, and is a member of the editorial boards of the Journals, Computer Communications and Pervasive Computing and Communications. He has been invited to numerous scientific talks throughout Europe, and served in more than a dozen Programme Committees.

Stephan Olariu is a tenured full professor of Computer Science at Old Dominion University. He is a world-renowned technologist in the areas of parallel and distributed systems, parallel and distributed architectures and wireless networks. He has been invited to more than 150 universities and research institutes around the world lecturing on topics from wireless networks and mobile computing, to biology-inspired algorithms and applications, to telemedicine, to wireless location systems, and demining. Professor Olariu is the Director of the Sensor Networks Research Group at Old Dominion University. Professor Olariu earned his PhD in Computer Science at the McGill University, Montreal. He has co-authored two books: *Solutions to Parallel and Distributed Computing Problems: Lessons from Biological Sciences* (with A. Zomaya and F. Ercal), and *Parallel Computation in Image Processing* (with S. Tanimoto), and is also the author of *Wireless Sensor Networks and Applications*.

Alois Ferscha received the Mag. degree in 1984, and a PhD in business informatics in 1990, both from the University of Vienna, Austria. From 1986 through 2000 he was with the Department of Applied Computer Science at the University of Vienna at the levels of assistant and associate professor. In 2000, he joined the University of Linz as full professor, leading the Institute for Pervasive Computing and being the speaker of the JKU Pervasive Computing Initiative. Prof. Ferscha has published more than 60 technical papers on topics related to parallel and distributed computing. He has been the project leader of several national and international research projects. Currently he is pursuing project work related to context based application frameworks in a 'Wireless Campus' network, public communication displays with wireless remote controls, geo-enhanced mobile navigation systems, RFID based real-time notification systems, wearable computing and embedded internet application frameworks. He has been a visiting researcher at a number of universities in Italy and USA. He has served on the committees of several conferences, and was programme chair of five conferences and workshops, including the Pervasive 2004. Prof. Ferscha holds the Heinz-Zemanek Award for distinguished contributions in computer science.