

Tutorial Title: Wireless Sensor Networks Capturing Context
Duration: Half Day (3 hours)
Organiser: Derek Babb, University of Surrey, UK & Luis M. Campoy, Telefónica I+D, Spain
Project Association: e-SENSE (www.ist-e-sense.org)

Abstract and Objective of Tutorial

This tutorial targets researchers, academics from both practical and theoretical backgrounds and brings them together with real business driven approaches.

- The objective of the tutorial is to first highlight the socio-economic challenge that is inherently present in Wireless Sensor Networks and their applications, in particular focussing on the tools and how to attempt a comprehensive analysis of identified challenges and the economic challenge that integration in to Beyond 3G Service Platforms poses.
- Further ZigBee is still the standard for Wireless Sensor Networks in the industrial world although it has not yet shown its impact. The second topic of the tutorial will review the ZigBee standard and highlight the improvements suggested by research projects such as e-SENSE to the audience.
- The next two topics address the theory and state of the art research in to the structure of efficient protocol stacks and algorithms in terms of energy efficiency, and the ability to cope with different applications and heterogeneous sensors.
- We also take a look at the implementation aspects associated with low power Wireless Sensor Networks, how do you target a few nJ/bit at the radio interface? The Wireless Sensor Nodes market has brought numerous works during the recent years. Amongst them, IEEE 802.15.4 and 4a standard have exhibited potential solutions. The expected wide spreading of these technologies is now led by the ability of the deployed nodes to reach the autonomy or at least a life-time compatible with their business added value. There, the two technical fields of PHY radio and link networking are to be optimized. This tutorial focuses on the PHY layer design and is demonstrating that low-power targets and design under $V_{cc}=1$ V are reachable, with compliance to standards.
- The final topic addresses cross system coexistence issues that may arise from large scale deployment of Wireless Sensor Network Systems.

Brief Structure of the Tutorial

Topic 1: The Socio-Economic Challenge of Wireless Sensor Networks in Beyond 3G Service Platforms (30 minutes)

Speaker: Valerie Chanal, UPMF (FR)

Topic 2: ZigBee and Beyond (30 Minutes)

Speaker: Pierre Chevillat, IBM (CH)

Topic 3: Efficient Wireless Sensor Network Protocols (30 minutes)

Speaker: Michele Zorzi, CFR (IT)

Topic 4: Implementing Low Power standards compliant PHY designs for Wireless Sensor Networks (30 minutes)

Speaker: Laurent Ouvrey or Eric Mercier, CEA-LETI (FR)

Topic 5: Data Processing and Data Fusion (30 minutes)

Speaker: Paul Havinga, University of Twente (NL)

Topic 6: Cross System issues in densely deployed Wireless Sensor Networks (30 minutes)

Speaker: Luis Campoy, Telefonica I+D (ES)

Intended Audience

This tutorial targets researchers, academics and industrials from both practical and theoretical backgrounds and brings them together with state of the art research, real business driven approaches and the complexities of implementation.

Biography of the speakers

Dr. Pierre R. Chevillat

Manager Sensor Networking, IBM Zurich Research Laboratory

Pierre R. Chevillat received the Dipl. El-Ing. ETH degree from the Swiss Federal Institute of Technology, Zürich, Switzerland, and MSEE and Ph.D. degrees from Illinois Institute of Technology, Chicago, USA. He joined the IBM Zurich Research Laboratory in 1976 where he has done research in signal processing, coding algorithms, and protocols for wireless and wireline communication systems. As a research manager (since 1985) he has led projects on voiceband data modems, detectors for magnetic recording, radio and infrared wireless LANs, wideband CDMA for 3G cellular systems, and sensor networking.

Dr. Chevillat received IBM Outstanding Technical Innovation and Achievement Awards, he is an IEEE Fellow ('95) and a recipient of the IEEE Millennium Medal. He has been an Associate Editor for the IEEE Transactions on Information Theory and is currently an editor of the International Journal of Wireless Information Networks. He served on the senate committee of the "Deutsches Zentrum für Luft- und Raumfahrt" (DLR), he was a Steering Board member of the "Wireless World Research Forum", and served on scientific boards for the "Deutsche Forschungsgemeinschaft" and the "Swiss National Competence Center on Mobile Communication".

Valérie Chanal

Professor of Strategic Management at Université Pierre Mendès France in Grenoble (France).

She teaches courses in strategic management, organizational behaviour and innovation management.

Her research is about innovation management, knowledge management, strategic discourse and narratives. It has been published in European Journal of Economics and Social Systems, European Journal of Innovation Management, M@n@gement, Management International, Revue Française de Gestion.

She is a graduate of the European School of Management Studies (EAP-ESCP), received her PhD from Grenoble University (France, 1995) and obtained Tenure in 2001. For her PhD research she was awarded the CNRS Prize (French National Research Foundation) for research-business cooperation in the field of social sciences.

Previously, she was marketing manager in a large software house in France.

Luis Miguel Campoy Cervera:

Division Head, Telefónica I+D

Telecommunication Engineer by UPM (Madrid Polytechnic University), with two years specialisation in Radio Technology. He obtained a last year student grant, at the Transmission Optical Department of Alcatel (Madrid.) on 1988. He joined Telefónica I+D (Telefónica Research & Development) at the EMC group on 1989, developed the EMC test resources automatisation and participate in the protection of Telecom lines from interferences generated by the first High-Speed Train in Spain.. On 1990-1991 spent a 6 month stay at EMC group of BT labs (Ipswich), researching on equipment and cable radiation models. He has participated in several projects related to the protection of electronic equipment and systems from electric disturbances and transients, which led to modifications in several installed equipment (digital transmission equipment, line subscriber loop boards, RDSI boards, PBX equipment), and to new protections systems and topologies adopted at Telefónica emplacements.

Since 2000 he is professor of a postgraduate master on EMC at the UPM (Madrid Polytechnic University). Since 2001 he joined the radio access technologies department at Telefónica I+D, conducting studies of radio systems coexistence a co-siting of different technologies: GSM, DCS, TETRA, UMTS, etc.

He has been project manager of a Software Defined Radio Platform (PRAGA) for experimentation in advanced communication techniques (UWB, OFDM, MIMO, etc), which has been presented in several symposiums.

At the present time he is the technical manager of Radio Systems Compatibility Division and participates in PULSERS PF6 project. He has done several contributions to national and international conferences, as well as participated in the book "Electromagnetic Protection of Telecom Installations", and has several national and international patents.

Prof. Michele Zorzi
Consorzio Ferrara Ricerche (CFR),

Michele Zorzi received a Laurea degree and a Ph.D. in electrical engineering from the University of Padova in 1990 and 1994, respectively. During academic year 1992-1993, he was on leave at UCSD, attending graduate courses and doing research on multiple access in mobile radio networks. In 1993 he joined the faculty of the Dipartimento di Elettronica e Informazione, Politecnico di Milano, Italy. After spending three years with the Center for Wireless Communications at UCSD, in 1998 he joined the School of Engineering of the University of Ferrara, Italy, where he became a professor in 2000. Since November 2003 he has been on the faculty at the Information Engineering Department of the University of Padova. His present research interests include performance evaluation in mobile communications systems, random access in mobile radio networks, ad hoc and sensor networks, energy constrained communications protocols, and broadband wireless access. He was Editor-In-Chief of IEEE Wireless Communications, 2003-2005, and currently serves on the Editorial Boards of IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, Wiley's Journal of Wireless Communications and Mobile Computing, and ACM/URSI/Kluwer Journal of Wireless Networks, and on the Steering Committee of the IEEE Transactions on Mobile Computing. He has also been a Guest Editor of special issues in IEEE Personal Communications (Energy Management in Personal Communications Systems) and IEEE Journal on Selected Areas in Communications (Multimedia Network Radios).

Dr. Paul J.M. Havinga
University of Twente

has received his Ph.D. on mobile multimedia systems in 2000, and was awarded with the 'DOW Dissertation Energy Award' for this work. His research interests are in the area of energy-efficient architectures and protocols, wireless communication networks, ubiquitous computing, personal communication systems, and (reconfigurable) hardware architectures. This research has resulted in over 140 scientific publications in journals and conferences. He has been a visiting researcher at the University of Pisa in 1998, and the Communications Research Laboratory in Yokosuka Japan in 2000. Currently, he is project leader of the European project EYES, on energy efficient sensor networks, and the nationally funded project CONSENSUS, on collaborative sensor networks. Havinga is project leader of the Dutch project Smart Surroundings, in which 15 large research groups perform research on ubiquitous computing. He also participates in the European project CoBIs (Collaborative Business Items) and in the European Coordination Action Embedded WiSeNts (Cooperating Embedded Systems for Exploration and Control featuring Wireless Sensor Networks), and the nationally founded project Featherlight focused on light-weight distributed mechanisms for networking and collaboration. He is one of the founders of a Dutch foundation promoting research on ambient systems. Paul regularly serves as independent expert for reviewing and evaluation of international research projects for the EU, the US, and international government.

Laurent Ouvry
Group Manager CEA-LETI

is responsible for digital communication lab since 2001 and UWB low data rate activities since 2004. He is involved in several IST and Eureka projects dealing with UWB and sensor networks, among them UCAN, PULSERS, e-Sense and SWANS in which CEA-Leti is studying and prototyping PHY and MAC for UWB low data rate. He was also involved as a proposer and voting member in the IEEE 802.15.4a standardisation body for a new UWB air interface enabling ranging and low data rate transmission.

Eric Mercier
Project Leader CEA-LETI

is graduated from Ecole National Supérieure d'Electrotechnique, d'Electronique, d'Informatique et d'Hydraulique de Toulouse (France), 1991, and holds a DEA in Micro-Waves. After 5 years developing analogue hardware systems for fibre optical test equipments (Schlumberger / Wavetek / Acterna), he has been back to the radio-frequency field being successively a Characterization, Application and Marketing Engineer for semiconductor companies (ST, Atmel). He is now with the CEA-Leti in charge of the Ultra-Low Power RF projects amongst the RF Design and Architecture lab.