

16th IST Mobile and Wireless Communications Summit - Tutorial T3  
**Wireless Sensor Networks Capturing Context**

**Tutorial Title:** Wireless Sensor Networks Capturing Context  
**Duration:** Half Day (3 hours, 10:00 start, 13:20 finish)  
**Organiser:** Derek Babb, University of Surrey, UK & Luis M. Campoy, Telefónica I+D, Spain  
**Project Association:** e-SENSE ([www.ist-e-sense.org](http://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.

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### Brief Structure of the Tutorial

Topic 1: The Socio-Economic Challenge of Wireless Sensor Networks in Beyond 3G Service Platforms (10:00 to 10:30)  
Speaker: Valerie Chanal, UPMF (FR)

Topic 2: ZigBee and Beyond (10:30 to 11:00)  
Speaker: Wolfgang Schott, IBM (CH)

Topic 3: Energy Efficient Wireless Sensor Network Protocols (11:00 to 11:30)  
Speaker: Jussi Haapola, University of Oulu (FI)

*Coffee Break (11:30 to 11:50)*

Topic 4: Implementing Low Power standards compliant PHY designs for Wireless Sensor Networks (11:50 to 12:20)  
Speaker: Eric Mercier or Laurent Ouvrey, CEA-LETI (FR)

Topic 5: Raw data acquisition techniques for wireless sensor networks (12:20 to 12:50)  
Speaker: Supriyo Chatterjea for Paul Havinga, University of Twente (NL)

Topic 6: Cross System issues in densely deployed Wireless Sensor Networks (12:50 to 13:20)  
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

#### 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.

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**Wolfgang Schott**

*Research Staff Member in the Sensor Network group of the Systems Department at the IBM Zürich Research Laboratory (Switzerland)*

He received the Dipl.-Ing. and Dr.-Ing. degrees in electrical engineering from the Technical University of Darmstadt, Germany, in 1977 and 1982, respectively. In 1982, he joined the IBM Research Division, where he worked primarily in the area of digital signal processing techniques for storage and wireless communication systems. From 1989 to 1990, he was assigned to the IBM Storage Technology Division, San Jose, CA, where he contributed to the design of a VLSI implementation of the PRML magnetic-recording channel. Since 1992, his work has concentrated on the baseband and protocol design for cellular systems such as GSM and 3G-CDMA, and for short-range radio communication systems such as Bluetooth and 802.11 wireless LANs. Currently, his main scientific interest focuses on wireless sensor networks. Dr. Schott is a Senior Member of IEEE, and he has served as a technical program committee member, session chair, and paper reviewer at various IEEE conferences.

**Jussi Haapola,**

*Project Manager, Centre for Wireless Communications, University of Oulu (FI)*

holds an M.Sc in Physics from the University of Oulu since 2002 and he is currently a final year PhD student of Telecommunications. He functions a project manager at the Centre for Wireless Communications and also is working in the field of low power wireless networking with an emphasis on medium access control. He has experience in several European Commission, state, and industry funded projects and has acted as a project manager since 2005..

**Eric Mercier**

*Project Leader CEA-LETI*

is graduated from Ecole Nationale 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.

**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.

**Dr. Paul J.M. Havinga**

*University of Twente*

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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.

**Supriyo Chatterjea**  
*University of Twente*

Supriyo Chatterjea is currently a researcher at the Department of Mathematics, Electrical Engineering and Computer Science at the University of Twente in the Netherlands. After graduating from Nanyang Technological University, Singapore, with a Bachelor's degree in Electrical Engineering in 2001, he obtained a Master's degree with distinction in Computing and Internet Systems from King's College London, U.K., in 2002. He was also awarded the 'Best MSc Project' award for his work on service discovery in mobile ad hoc networks at IBM Research Laboratory, Zurich, Switzerland. His research interests lie in the field of distributed data management for wireless sensor networks.

**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 automatization 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.

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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 e-SENSE and PULSERS PF6 projects. 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.