

## Tutorial Track 1: Sensor Networking

### *Wireless Sensor Networks - An Industrial R&D Perspective*

#### **Authors & Affiliation**

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#### **Short Tutorial Description**

Designing WSNs is not a one-layer exercise anymore; a sufficient knowledge of all factors impacting the system performance is hence vital. The objective of this tutorial is to acquaint the academic and industrial audience with important design and analysis tools needed to optimize and deploy WSNs. To this end, the following will be discussed in the three parts:

In the first part, we will discuss the cradle of WSNs and the reasoning of their emergence around a decade ago. We will also dwell on their commercial importance, i.e. business projections, commercial activities worldwide, etc. This part will be finished by detailing current standardization approaches, including WOSA, KNX, IEEE 802.15.4, IETF 6LowPan, IETF R2LN, etc.

The second part is dedicated to node and network design. We will commence by detailing the peculiarities of the WSN channel. This in turn will dictate the PHY design, which is discussed thereafter; in particular, we will discuss the choice of hardware, modulation, whether channel code is needed, some distributed signal processing algorithms, etc. Thereafter, we will dwell on energy-efficient medium access control protocols; in particular, we will discuss latest approaches in preamble-sampled based MACs as well as MACs which do not need to maintain any information on the one-hop neighbourhood. We then move on to fault-tolerant and energy-optimized routing protocols, as well as self-organizing and self-healing sensor network mechanisms, etc. The importance of cross-layer design, localization determination and security with their available techniques will finally be exposed.

The last and final part deals with practical experimentations ranging from in-house experiments ([http://www.youtube.com/watch?v=q6\\_2gtMf03w](http://www.youtube.com/watch?v=q6_2gtMf03w)) to commercial roll-outs (e.g. Coronis/Elster). There will be time for questions and discussion.

1. Introduction & Milestones
2. Scenarios & Business & Applications
3. Standardizations & Alliances
4. WSN Wireless Channel
5. PHY Layer
6. MAC Layer
7. Routing Layer & Auto-\*
8. Cross-Layer Design
9. Experimentations
10. Conclusions & Road Ahead

## Speakers' Biographies

### Mischa Dohler, CTTC, Spain

[\[http://www.cttc.es/en/person/mdohler/miscellaneous.jsp\]](http://www.cttc.es/en/person/mdohler/miscellaneous.jsp)



Mischa Dohler is now Senior Researcher with CTTC in Barcelona. Prior to this, from June 2005 to February 2008, he has been Senior Research Expert in the R&D division of France Telecom working on cooperative communication systems, cognitive radios and wireless sensor networks. From September 2003 to June 2005, he has been lecturer at King's College London, Centre for Telecommunications Research. At that time, he has also been London Technology Network Business Fellow for King's College London, as well as Student Representative of the IEEE UKRI Section and member of the Student Activity Committee of IEEE Region 8 (Europe, Africa, Middle-East and Russia).

He obtained his PhD in Telecommunications from King's College London, UK, in 2003, his Diploma in Electrical Engineering from Dresden University of Technology, Germany, in 2000, and his MSc degree in Telecommunications from King's College London, UK, in 1999. Prior to Telecommunications, he studied Physics in Moscow. He has won various competitions in Mathematics and Physics, and participated in the 3rd round of the International Physics Olympics for Germany.

In the framework of the Mobile VCE, he has pioneered research on distributed cooperative space-time encoded communication systems, dating back to December 1999. He has published more than 100 technical journal and conference papers at a citation h-index of 12 and citation g-index of 25, holds several patents, co-edited and contributed to several books, has given numerous international short-courses, and participated in standardisation activities. He has been TPC member and co-chair of various conferences, is technical chair of IEEE PIMRC 2008 to be held in Cannes, France, and is editor for the IEEE Communications Letters, the IEEE Transactions on Vehicular Technology, the IEEE Communications Magazine, the IEEE Wireless Communications, the IET Communications, the Elsevier Physical Communications journal, the EURASIP JWCN journal, the Bentham Science Recent Patents on Computer Science journal, and the International Journal of Parallel, Emergent and Distributed Systems. He is a Senior Member of the IEEE.

**Thomas Watteyne, France Telecom R&D / INSA Lyon, CITI Lab, INRIA Ares Team**

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Thomas Watteyne holds a MSc degree, specialized in Telecommunications ("diplome d'ingenieur" in French) and a MSc degree in Informatics, specialized in Networking, Telecommunications and Services, from INSA Lyon, France (both 2005). He is finishing his PhD studies at France Telecom R&D, Meylan and the CITI Laboratory, INSA Lyon, France. He is member of the Student Activities Committee of IEEE Region 8, and Electronic Communications Coordinator of IEEE Region 8. His research has facilitated him a one-month stay at CTTC, Barcelona, Spain (May 2007), and a four months stay at the Berkeley Sensor & Actuator Center, University of California at Berkeley, CA, USA, working with Kris Pister (April-August 2008). His research interests include wireless sensor networks, self-organization principles and energy-efficiency. He has published several conference

papers, holds several patents, has been TPC member and member of the organizing committee of various conferences.

**Zach Shelby, Sensinode, Finland**



Zach has an M.Sc. (Eng.) from the University of Oulu and a B.Sc. (Eng.) from Michigan Technological University. Zach worked for 10 years as a research scientist and research manager first for VTT and later for the Centre for Wireless Communications (CWC) and has been responsible for developing innovative research in the area of wireless embedded networking and short range communications. He is especially well known as a pioneer in the use of IP technology in low-power networks with NanoIP 5 years before 6lowpan, was involved with early BT ULP developments and low-rate UWB technology. His results include a large portfolio of publications, public talks, broad research cooperation, key patents and a startup. Zach is one of the founders of Sensinode Ltd. currently in the position of Head of Research. During his career, the mission has been

clear, making the Internet of Things a reality.