



Mobile Communications & Technology Platform

# **Workshop on Low Power Wireless Communications**

**IMEC, Leuven, Belgium**

**2006-12-13**

Version 5

## THE MOTTO

### The power efficiency problem

Wireless communication has witnessed in the last decade a continuous trend towards application diversification, leading to a significant growth in usage and services. With the proliferation of nomadic devices (Smart Phones, PDAs, laptops) and real-time multimedia applications, user demand is progressively shifting from simple data rate increase to complex and heterogeneous Quality of Service (QoS) requirements.

The complexity of these Heterogeneous Broadband networks and the battery powered nomadic devices connecting to them is driving new requirements in terms of Power Efficiency to ensure Environmental, OPEX, Battery Life and thermal criteria can be met.

Increasing performance requirements and Environmental requirements are coupled with drastic constraints on energy-efficiency. This is in fact becoming a key concern: there exists a continuously growing gap between the Energy of emerging radio systems and what can be achieved by:

- Battery Technology Evolution.
- Existing Technology: Scaling and circuit design progress.
- Existing Technology: System Level Architecture progress.
- Thermal & Cooling Techniques.

There is a clear need for disruptive strategies to address all aspects of power efficiency from the User Devices through to the Core Infrastructure of the network and how these devices and equipment interact with each other.

## DATE AND VENUE

The workshop will be held on December 13<sup>th</sup> 2006, at IMEC premises in Leuven, Belgium.

## COORDINATION

The Workshop is coordinated by a group of members from eMobility:

- Luis M. Correia, IST – Technical University of Lisbon, Portugal
- Liesbet Van der Perre, IMEC, Belgium
- Juha Saarnio, Nokia, Finland
- Stuart Revell, Freescale, UK

## FORMAT

The workshop is intended to be as interactive as possible. There will be presentations to trigger discussions on power efficiency problems and potential solutions, from different viewpoints and on different levels of wireless systems.

The list of speakers is:

- Peter Zillmann, *Research Associate*, T.U. Dresden, Germany
- Amre El-Hoiydi, *Senior R&D Engineer*, CSEM, Switzerland
- Liesbet Van der Perre, *Scientific Director for Wireless Research*, IMEC, Belgium
- Eric Mercier, *Ultra-Low Power RF Project Leader*, CEA-LETI, France
- Stuart Revell, *Director of Strategy and Business Development - Networking and Computing Systems Group EMEA*, Freescale Semiconductors, UK
- Sien-An Ong, *Senior Research Engineer*, Nokia Research Centre, Finland
- Bernard Després, *Head of Spectrum, Antennas, EMC and Environment Laboratory*, France Telecom R&D, France

## PROGRAMME

The schedule is as follows:

- 10h00 - 10h30: Opening, including overall problem statement
- 10h30 - 12h00: Morning Session
  - *Elements of Low Power Wireless Networks*, Peter Zillmann
  - *The Ultra-Low Power WiseNET System*, Amre El-Hoiydi
  - *Towards seamless connectivity: flexibility in radios can enable low power*, Liesbet Van der Perre
- 12h00 - 13h30: Lunch
- 13h30 - 15h30: Afternoon Session
  - *Low power solutions for future wireless modems*, Eric Mercier
  - *Optimising power in next generation systems*, Stuart Revell
  - *System-level Energy Management*, Sien-An Ong
  - *Energy issues of wireless telecommunications - an operator's perspective*, Bernard Després
- 15h30 - 16h00: Break
- 16h00 - 16h30: Panel/Discussion
- 16h30 – 17h00: Wrap up

## ABSTRACTS

### *Elements of Low Power Wireless Networks*, Peter Zillmann

Our view on three elements of low power wireless communications will be presented briefly: low power signal processing chip design and the data locality principle; low power networks using cooperative relaying and multi-hop communications; the “Dirty RF” principle and the trade-off between baseband and RF power consumption.

### *The Ultra-Low Power WiseNET System*, Amre El-Hoiydi

The WiseNET system includes an ultra low-power system-on-chip (SoC) hardware platform and WiseMAC, a low power medium access control protocol (MAC) dedicated to duty-cycled radios. Both elements have been designed to meet the specific requirements of wireless sensor networks and are particularly well suited to ad-hoc and hybrid networks. This talk will present the WiseNET system, with an emphasis on the low power medium access control problematic.

### *Towards seamless connectivity: flexibility in radios can enable low power*, Liesbet Van der Perre

In the quest for seamless connectivity, one of the major bottlenecks is the need for Software Defined Radios (SDRs) for wireless terminals, which should provide flexibility, yet feature low power consumption. In this objective, we present a cross-layer optimization methodology and run-time control to translate flexibility and energy-scalability into low-energy operation. Traditional designs are still mostly tuned for the worst-case. By carefully scanning and following the exact (run-time) requirements without over-dimensioning the active part of the components, much energy can be saved.

### *Low power solutions for future wireless modems*, Eric Mercier

The Wireless Sensor Nodes market has brought numerous works during the recent years. Publications on this topic have exhibited a real interest from the both the educational and the industrial world. The wide spreading of these technologies is now led by the ability of the modules to reach the autonomy or at least a life-time compatible with their business added value. There, the three technical fields of radio transmission, energy management and sensor processing are melting into a concept of modem. On one hand, the radio transmission is expected to transmit more information in a more reliable way, while being compatible with a standard to allow interoperability and exchange of information. On the other hand, the energy management has to ensure a battery life of years and is expected to take the benefits of the environment natural source of power. At the end, the modem concept will surely require to search new ways of co-designing the RF in relation with the availability of

the energy, but the target for reducing current consumption of RF PHY layer still leads our current researches.

*Optimising Power in Next Generation Systems, Stuart Revell*

The explosive growth of services, applications and content running over existing and new broadband technologies is creating conflicting design requirements in terms of Power consumption versus features. Ubiquitous, real-time, multi-media communications will dramatically increase the requirements and complexity for high-speed Terminals, Access, Transport and Core Technology Building Blocks. This talk will cover some of the conflicts and examine options to address the technology power efficiency paradigm required to create the fundamental building blocks and how they interact together. Silicon, Software, End Equipment and End to End Network Level solutions will be addressed.

*System-Level Energy Management, Sien-An Ong*

Discussed is a system-level energy management framework for mobile phones. In this framework power policies play a central role. Instead of offering best effort system performance, power policies configure the system configuration in such a way that the mobile phone's battery lifetime is prolonged while good user experience is still being offered.

*Energy issues of wireless telecommunications - an operator's perspective, Bernard Després*

The presentation explains the stakes for a telecommunication operator's regarding energy issues in wireless systems both regarding the network part and the customer devices. New services (data, video...) are more and more energy demanding in a context where operators both try to control the expenses due to the energy aspect and take increasingly into account the environmental impact of our activity. The paper will focus on R&D activities that are done in France Telecom to face these new challenges.

## **REGISTRATION**

The registration fee, to cover costs of coffee breaks and lunch, is 150 €

The number of participants is limited.

All participants are requested to fax the completed registration form, in attachment, by Dec. 11<sup>th</sup>.

## **DIRECTIONS**

Please find the information attached, and at:

<http://www.imec.be/wwwinter/about/en/IMECmap.shtml>

## **HOTEL INFO**

See attachment, and contact [mso@imec.be](mailto:mso@imec.be) in case you would need help.





## How to reach IMEC ? Here's the map !

### By car

IMEC is located in Heverlee, Leuven at approximately 25 km from Brussels and its International Airport "Zaventem". It takes half an hour drive by car to reach IMEC from Brussels, capital of Belgium.

Leuven lies at the intersection of two highways, the E40 highway London (UK) - Brussels - Liège - Köln (Germany) and the E314 highway Leuven-Hasselt-Aachen (Germany).

Take exit number 15 on the E314 highway. At the second traffic lights, turn right. The second street on your right (after  $\pm 100\text{m}$ ) is the Kapeldreef. The main entrance and visitor parking are on your right.

For a visual representation, see our map below.

### By train

Leuven is situated along the international railroad London (UK) - Brussels - Liège - Köln (Germany).

If you are travelling from another direction then the ones mentioned above, a changeover at Brussels' North, Central or South Station is needed to reach Leuven.

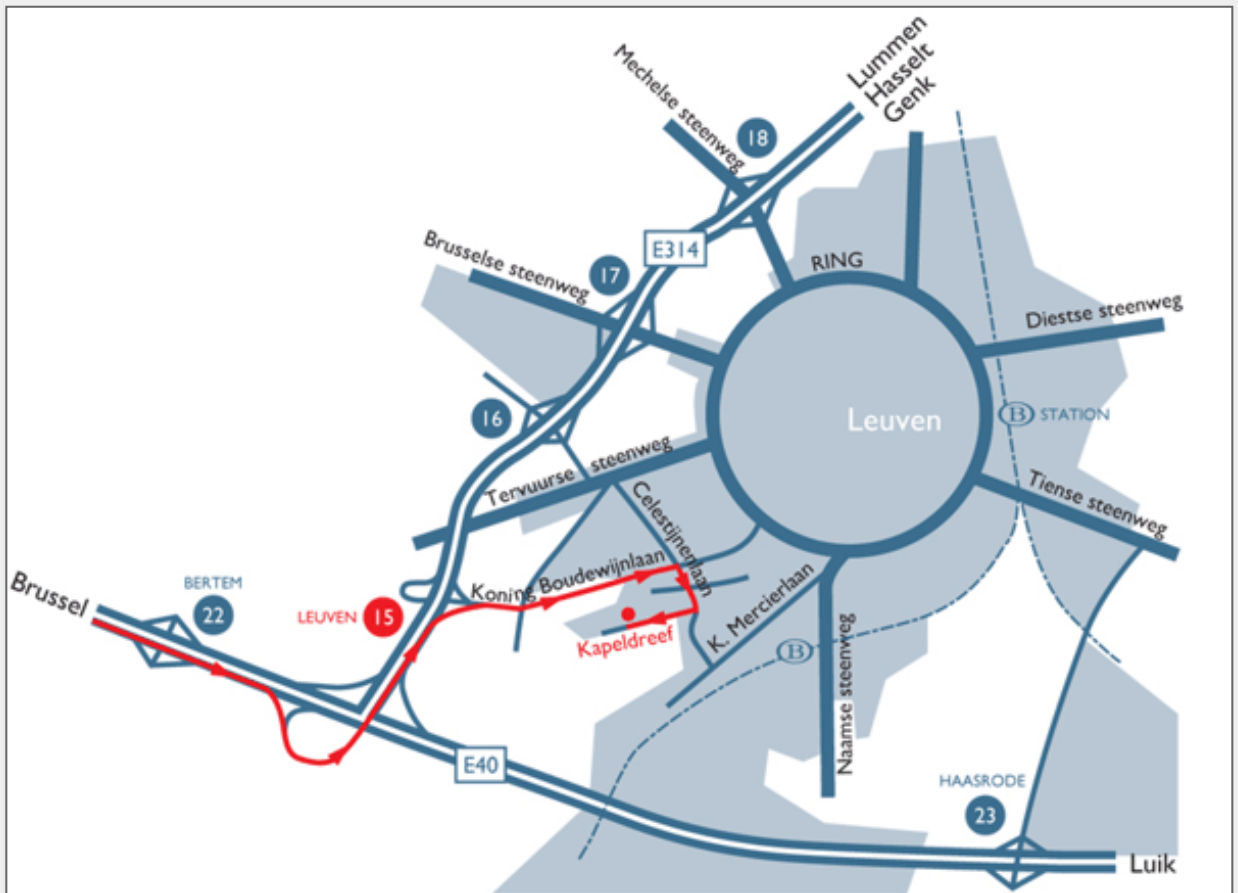
Brussels International airport has its own railway station located in the airport building. You can take a direct train from the airport to Leuven.

For more information about the Belgian Railroad company "NMBS" and its trains go to [www.nmbs.be](http://www.nmbs.be)

### By bus (Leuven area)

From Leuven station or downtown Leuven city, bus 2 - CAMPUS will bring you to the Kapeldreef in Heverlee (terminus). The busstop is situated just opposite of the IMEC building.

For more information about the Flemish bus company "De Lijn" go to [www.delijn.be](http://www.delijn.be)



Last modified on: March 14, 2006

### Garden Court - Holiday Inn

Tiensestraat 52  
3000 Leuven  
Tel.: +32/16 31 76 00  
Fax: +32/16 31 76 01 direct reservaties:  
016/31 76 03  
standaard room: 180 euro  
Imec: 125 euro weekprijs  
105 euro week-end  
[Higcleuven@alliance-hospitality.com](mailto:Higcleuven@alliance-hospitality.com)

### Begijnhof Congres Hotel

Tervuursevest 70  
3000 Leuven  
Tel.: +32/16 29 10 10  
Fax: +32/16 29 10 22  
single room: 140,- euro  
double room: 155, euro  
breakfast included (+parking)  
Touristtax: 1 euro pp/nacht

### Binnenhof Hotel

Maria Theresiastraat 65  
3000 Leuven  
tel : +32/16 20 55 92  
fax : +32/16 23 69 26  
Single room 987euro  
Luxe single 98 euro  
Double 110 euro  
Luxe double 105?  
Breakfast included  
[info@hotelbinnenhof.be](mailto:info@hotelbinnenhof.be)  
[www.hotelbinnenhof.be](http://www.hotelbinnenhof.be)

### Jackson Hotel

Brusselsestraat 110-112  
3000 Leuven  
tel : +32/16 20 24 92  
fax : +32/16 23 13 29  
all rooms with bathroom, WC, TV,  
phone, breakfast included

### Ibis Hotel

Brusselsestraat 52  
3000 Leuven  
tel : +32/16 29 31 11  
Fax : +32/16 23 87 92  
single/double room: 86,- euro  
Breakfast 8,50 euro

### Theater Hotel

Bondgenotenlaan 20  
3000 Leuven  
Tel (016)22 28 19  
Fax 016 28 49 39  
GSM (0496)55 35 63  
E-mail voor reservaties:  
[reservations@theaterhotel.be](mailto:reservations@theaterhotel.be)  
**Ma, di, woe, do-nacht:**  
Single douche, 91.80,- euro  
Double douche, 112,- euro  
Single bad, 100.80,- euro  
Double bad, 121.50,- euro  
SingleDuplex 126,- euro  
Double Duplex 146.70 euro  
**Vrij, za, zo-nacht:**  
Single douche-bad, 73,- euro  
Double douche-bad, 95,- euro

### Hotel La Royale

Martelareplein 6  
3000 Leuven  
Tel : +32/16 22 12 52  
Fax : +32/16 29 52 52  
single room with bathroom, TV, phone :  
57euro,-  
double room with bathroom, TV, phone :  
69-82 euro,-  
breakfast included  
[hotel@laroyale.be](mailto:hotel@laroyale.be)  
<http://www.laroyale.be>

### Hotel Professor

Naamsestraat 20  
3000 Leuven  
tel : +32/16 20 14 14  
fax : +32/16 29 14 16  
Single room: 65 euro  
Double room: 80 euro

### Hotel New Damshire

Damiaanplein - Schapenstraat 1  
3000 Leuven  
Tel: +32/16 23 21 15  
Fax: +32/16 23 32 08  
single room:115,- corp. rate 98,-  
double room : 130,- corp.rate 110,-  
breakfast included  
[reservations@newdamshire.com](mailto:reservations@newdamshire.com)

**Hotel bremberg**

Bremberg 1  
3053 Haasrode  
Tel: 016/40.19.96  
Fax: 016/40 34 22  
[www.bremberg.be](http://www.bremberg.be)

**Boardhouse**

J. Vandenbemptlaan 6  
B-3001 Heverlee  
tel.: +32 (0) 16 31 44 44  
fax: +32 (0) 16 31 44 54  
[info@boardhouse.be](mailto:info@boardhouse.be)  
Price: 125 euro standaardkamer

**Novotel Leuven Centrum\*\*\***

Vuurkruisenlaan 4  
B-3000 Leuven  
Phone: +32 16 21 32 00  
Fax: +32 16 21 32 01  
Imec rate: 103 Euro  
Breakfast: 13 Euro  
E-mail: [H3153-re@accor-hotels.com](mailto:H3153-re@accor-hotels.com)

**The Lodge (close to Imec)**

Kantineplein 3  
3001 Heverlee  
Phone: +32 16 509 509  
Fax: +32 16 509 508  
Single: 99 euro  
Double: 119 euro  
Junior suite single: 109 euro  
Junior suite double: 129 euro  
Family room: 199 euro  
(prices include breakfast)

**Klooster Hotel**

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3000 Leuven  
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fax 016/223101  
[kh@martins-hotels.com](mailto:kh@martins-hotels.com)