

Ultra High-Speed Mobile Information and Communication

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## Message from the Coordinator

June will be a busy month for the UMIC organization team. UMIC will be present as exhibitor at two major events, the NGMN partner forum in Shanghai and the Design Automation Conference (DAC 2010) in Anaheim, California. While the NGMN partner forum addresses in particular the mobile communication industry, DAC is the key event of the electronic design automation research and industry communities. We will be pleased to welcome you at our booth; please drop by when you are attending the events.

We welcome the fifth assistant professor (Juniorprofessor) funded by the UMIC research cluster, Prof. Anupam Chattopadhyay. He com-

plements the terminal implementation activities, focussing on Multi-Processor System-on-Chip architectures and design. Prof. Chattopadhyay has started in February.

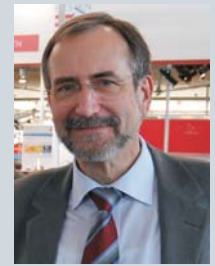
The German Federal and State governments agreed to continue the excellence initiative allowing both continuation proposals and new applications. Since final proposals will have to be submitted by August 31<sup>st</sup>, 2011, the UMIC researcher team has started the planning for a UMIC-II proposal. Two workshops have already brought forward a strong list of research challenges to be addressed in a second phase.

This newsletter presents three articles on key UMIC research

projects and an article on an associated project (Mobile Access), which is executed in collaboration with UMIC. The other three articles relate to a lead topic in UMIC, cognitive radio and energy efficient, flexible transceiver implementation. Enjoy reading the newsletter, more information about our research and a list of the publications is available on the UMIC web site:

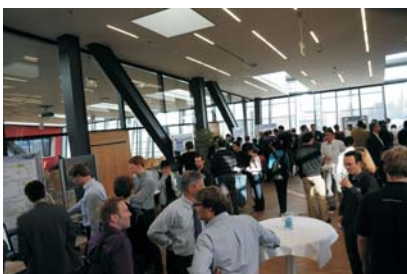
[www.umic.rwth-aachen.de](http://www.umic.rwth-aachen.de).

Gerd Ascheid, ISS



## The UMIC DAY 2009

20th October 2009, 1:30 pm, on the sixth floor of the Super C building of RWTH Aachen University with a beautiful view of Aachen city and its historic cathedral: the third UMIC day commences with a welcome snack. Prominent guests are welcomed by the members of the steering committee, in particular members of the advisory board, Prof. Ed Brinksma, Rector Magnus from University of Twente, Prof. Robert Calderbank from Princeton University, Prof. Christian Jensen from Aalborg University, James Massey, Professor emeritus from ETH Zurich, and Dr. Peter Meissner, head of the NGMN forum.



An attractive scientific program was composed with a keynote speech by Prof. Henning Schulzrinne, a leading scientist in the area of networking and Internet traffic. He is also the designer of the EDAS conference manager, well known to scientists all over the world and

an inevitable tool for organizing large conferences.



His talk entitled "Internet 2.0: Hype or Hope" gave a broad overview of ongoing research and developments to improve and adapt the present, somehow ossified internet to its exponential growth over the last years, to upcoming new services and future challenges. The internet has become a core civilizing infrastructure, along with energy, water and transportation, such that problems like address exhaustion, routing scaling, fairness, security and manageability urgently need to be addressed and solved. Prof. Schulzrinne also reported on early standardization efforts in this area.

Subsequently, four technical talks on selected UMIC topics were given. Gerd Ascheid, UMIC coordinator and principal researcher, addressed the question "Software defined radio – just a problem of programming?" An amazing appli-

cation of model checking techniques to battery lifetime was presented by Joost-Pieter Katoen. After a short break two more talks were given: "Beyond LTE - evolving the physical layer" by Helge Lüders and "Privacy-preserving distributed applications on mobile equipment" by Ulrike Meyer. New applications and prototypal transceiver implementations were exhibited in the forum of the lecture hall.



The inspiring UMIC day 2009 was concluded by a performance of the juggler Joram Seewi, an exceptional artist, wittily embedding his show on "Infinite Mobility" into the framework of wireless communication standards. As a concluding event, participants still enjoyed discussions and exchange of ideas while a delicious buffet and beverages were available in the foyer.

Rudolf Mathar, TI

## UMIC Sponsor

In the decade of the 00'ies, we saw the number of mobile phone subscriptions grow from 700 Million to over 4 Billion this year. Particularly in developing countries, the introduction of mobile technology has changed people's lives for the better. We can all feel lucky to work in a sector that has brought so much good to the world and in these recessionary times, that has such a high growth potential for the coming decade. Looking forward, within a couple of years, everyone in the world who wants to have a mobile phone will be able to have one. This expectation that we will soon achieve full penetration is already starting to change the focus of research programmes in communications. Now our attention is moving to addressing the challenges of how to bring broadband communications to everyone and to how communications can help solve the challenges facing global society.

When TeliaSonera opened the first commercial LTE network (supplied by Ericsson) for business in Stockholm in December 2009, a significant milestone on the path to bringing high data rate broadband wireless to the world was achieved. Still, much R & D remains to be done to reduce the energy consumption of both fixed and wireless networks and this is certainly one of the big challenges in communications research in the coming years. Given that spec-

trum scarcity is a driver for energy consumption, ensuring the availability of sufficient, suitable radio spectrum and the technical capability to use the spectrum available in a flexible manner, the UMIC work on these issues can only grow in importance. The need to reduce the energy consumption of networks is a small part of the global efforts to reduce CO<sub>2</sub> emissions and moves to develop sustainable societies. In this context, Ericsson has just published a methodology to access how CO<sub>2</sub> emissions can be reduced through using ICT as part one of our sustainability initiatives.

In the coming decade, communications will be integrated into our energy, transport and medical systems, improving their efficiency and enabling innovative new functionality. These new networked systems will change our lifestyles, reducing our energy usage, reducing our travel related CO<sub>2</sub> emissions and creating a platform for start-up companies to develop new growth businesses. UMIC is already taking the initiative in starting inter-disciplinary research, having excellent research partners in the energy, transport and industrial engineering sectors in RWTH itself and it is well placed to continue to develop its leadership position as these new fields of research develop.

As I look back on Ericsson's first year as an industrial sponsor of UMIC - in fact we were UMIC's first

industrial sponsor - I feel that both my colleagues in UMIC and Ericsson should be proud of their achievements. We established a dialogue with a range of research groups, we helped each other to broaden our knowledge and competence and our discussions on research topics resulted in technological advances in four areas of activity related to reconfigurable systems. In all research cooperations, developing the personal relationships between the research partners is the key to producing good results. Our frequent meetings have helped us to get to know each other, challenged our ideas in exciting discussions, and provided us with a solid basis for our cooperation in the coming years. I look forward to our continued cooperation as do all my colleagues in Ericsson!

Fiona Williams, Research Director,



## Ericsson-UMIC Diploma Thesis Award

**René Hummen** (Ph.D. student and member of the Distributed Systems Group) was awarded the Ericsson-UMIC Diploma Thesis Award for his thesis. The award-winning thesis was advised by the Distributed Systems Group in cooperation with the Helsinki Institute for Information Technology in Finland.

The thesis, titled "HIP: Secure Identity-based Middlebox Functions using the Host Identity Protocol (HIP)", evaluates the feasibility of providing identity-based secu-

rity functions on in-network elements like firewalls. Firewalls play an important role in network access control but typically cannot verify the origin of a packet in data stream efficiently. Mr. Hummen's thesis addresses the problem of the high computational complexity of traditional per-packet authentication mechanisms. Using lightweight authentication techniques, his work enables to considerably improve security in wired and wireless networks while retaining high throughput. The prize was handed



over to René Hummen by Dr. Norbert Niebert (Ericsson Research Aachen) at the annual graduation ceremony (Tag der Informatik).

## Enabling Dynamic Spectrum Access

Dynamic spectrum access (DSA) and cognitive radios are among the hottest research topics in the wireless communications community. DSA has a great potential in improving spectral efficiency of wireless networks by enabling the use of licensed frequencies, if those are left unused by the license holder. The research community, including many of the UMIC researchers, has worked hard on enabling technologies for DSA networks, for example on accurate detection of the licensed transmitters. Cognitive radio technologies is one of the key research topics within UMIC.

Regardless of the importance of the topic there has been very little scientific work on systematic measurements on the potential of DSA, and the construction of the empirical models of spectrum use needed for accurate performance evaluation of such systems. The UMIC funded research groups have worked hard to change this. The Institute for Networked Systems has been leading DSA research within UMIC in both experimental and theoretical domain.

We have been carrying out over the past few years extensive measurement campaigns, studying how spectrum is actually used. These measurements have covered long-term observations on the use of different frequencies at fixed locations, both in Germany

and in Netherlands, and also distributed measurements studying how the use of spectrum differs at nearby locations. A large number of different locations have been covered from extreme spectrum usage at the CEBIT to measuring so called spectrum holes in the countryside of the Euregio. The resulting extensive and unique data set has enabled UMIC researchers not only characterize use of different frequency bands and technologies in detail, but also to develop detailed models of different aspects of spectrum use. These models enable studying dynamic spectrum access in greater detail and realism than previously possible, and have generated significant interest in the worldwide research community. The work has lead to several journal articles and a large number of conference presentations.



Two of the UMIC designed spectrum monitoring stations at the CEBIT

We are also currently in the process of extending the work using new measurement platforms, allowing us to simultaneously carry out measurements at four different loca-

tions at a time. These measurements allow us to obtain even more detailed information on the benefits of collaborative sensing, the key enabling technology for mitigating transmitter detection problems induced by shadow fading.

In order to allow other groups to verify and replicate our work, we have also placed significant portions of the data available for free download. This unique approach of sharing scientific data has received many commendations from larger international scientific community. One of our aims is to use this work as a starting point for a global repository of measurement data related to spectrum use. We have been in contact with a number of related research projects around the world, including several European Union funded initiatives, promoting both the measurement and modeling work carried out in UMIC, and the benefits of sharing of such data sets on global level. The reception has been overwhelmingly positive, and we are confident that the present work will act as a starting point for significant number of collaboration activities in the near future.

For more information, visit our measurement-related website at <http://www.mobnets.rwth-aachen.de/index.php?id=tools>

Janne Riihijärvi, Petri Mähönen, iNets/MobNets

## ICWL 2009

The 8th International Conference on Web-based Learning (ICWL 2009) was held August 19-21, 2009 in Aachen. ICWL 2009 was jointly organized by the Hong Kong Web Society, Informatik 5 (Information Systems, Prof. Jarke) at RWTH Aachen University, and the Max-Planck-Institute for Computer Science, Saarbrücken. ICWL is an annual international conference series on web-based learning that has been held in Asia, Australia, and Europe so far. A total of 106 submissions

were received from over 30 countries from which the program committee accepted 38 papers from 21 countries. As a novelty in the ICWL series, we had four workshops co-located with the conference. Renowned web-based learning experts gave keynote talks and invited paper talks: Erik Duval from Katholieke Universiteit Leuven, Wolfgang Nejdil from L3S Lab at University Hannover, Ulrik Schröder from RWTH Aachen University, Won Kim from Kyungwon University, and Helen Ashman from

the University of South Australia. Over 150 participants joined the conference.

Ralf Klamma, i5



## New Design Approaches for Future Wireless Communication Devices – the Nucleus Project

Design of wireless communication devices is one of the most challenging assignments algorithm and hardware designers are facing today. The key challenge is the high computational complexity of communication standards, while fulfilling at the same time the tight real-time constraints and maximizing the energy efficiency to guarantee long standby and active times of the device.

In 2008, the Nucleus project was launched as a flagship project of the UMIC Research Area RF Subsystem and SoC design to address these challenges. The topics covered by the project are algorithms for future wireless communication including their HW implementation as well as novel tools and design methodologies to support hardware designers. Currently, the focus is on the computational-intensive Physical (PHY) and Media Access Control layers (MAC). However, the proposed concepts and tools are applicable to other layers as well. The wide range of research activities makes cross-disciplinary research a must. Therefore, five professors from four different institutes and 21 researchers combine their expertise and efforts to address the challenging task of providing solutions for future wireless communication systems – one of the key problems that motivated UMIC in the first place.

The fundamental nucleus idea, initially proposed by Prof. Meyr, is to decompose various algorithms into primitive computational kernels that come with an efficient HW architecture. The combination of these efficient implementations has the potential to achieve an optimal trade-off between the contradicting goals of computational performance, energy efficiency, and flexibility. Similar ideas had already been envisioned by MorphICs Technology Inc. which was acquired by Infineon Inc. in April 2003. Other related approaches like the ones of UC Berkeley and Intel target the general pur-

pose computing domain, but have similar ideas.

Based on this idea, the Nucleus Project was created to challenge the concept with actual state-of-the-art transceivers. Due to the inherent complexity of communication systems, the project was subdivided into three areas: algorithms, architectures and tools (see figure). Apart from identifying nuclei, the algorithmic research focuses on finding implementable algorithms that can e.g. trade the error rate against the computational complexity at a given SNR. The area of architecture design has the challenge of devising a platform, undoubtedly a heterogeneous MPSoC, in which highly optimized and efficient components are integrated so that the complete system incorporates enough flexibility to serve the application needs.

project different algorithms for MIMO demapping were analyzed and various algorithmic implementations of sphere decoding were proposed. At the same time, a concept for tool development was envisioned. In a second phase and following a bottom-up approach, an efficient architecture for sphere decoding was developed which was demonstrated during the UMIC Day 2009.

To the present, all teams are heavily working to make the common vision become true. More precisely, the algorithmic and architecture experts are investigating the actual cost of flexibility in a bottom-up approach. Started with a configurable ASIC solution of the MIMO demapper, a smooth transition targets a flexible ASIP hardware architecture. The conceptual tool infrastructure is now under deve-

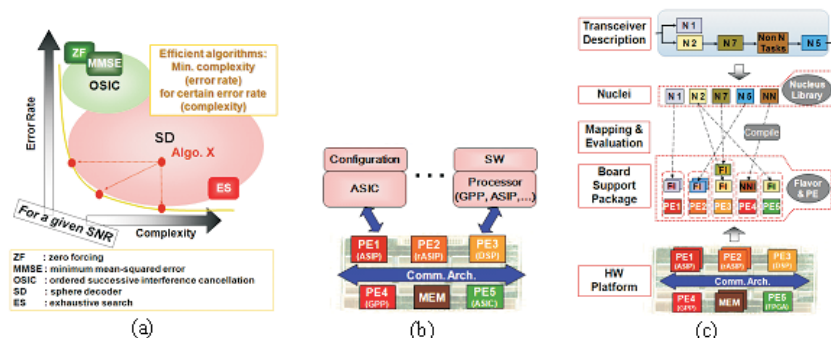


Figure: (a) Algorithm research. (b) Architecture research (c) Tools research

The cross-disciplinary teams concentrate their efforts on the demapper (done at ISS, RWTH Aachen University), the channel decoder (performed by the external partners in the Microelectronic System Design Group, TU Kaiserslautern) and the MAC layer (MobNets in corporation with ISS. Finally, in order to account for productivity / ease-of-use, the complexity of such a platform must be hidden with appropriate design methodologies and tools which is the focus of the third area.

The selected driver application is a MIMO OFDM triple-iterative system. During the first phase of the

development and is scheduled to be ready by mid 2010. Additionally, a full system integration is taking place that brings together the PHY system and the MAC layer algorithms (developed at MobNets, RWTH Aachen University) into a common virtual platform. By the end of the project we aim at having a virtual platform of a complete transceiver implementation in which the Nucleus concept is reflected in the algorithms, in the HW architecture, and in the design methodology. In addition, prototyping of critical hardware components is intended.

On behalf of the Nucleus Team Jeronimo Castrillon (SSS) and Torsten Kempf (ISS).

## Mobile ACcess Project Officially Started

The Mobile ACcess project is a UMIC spin-off financed by the European Union and the State of North-Rhine Westphalia via the Ziel2 program. The scientific goal of this 3.5 M Euro project is to develop basic techniques for the installation of a free wireless network in urban environments that exploits the infrastructure of existing WiFi access points. Beyond fundamental research it is planned to actually deploy a prototypic system within the next three years in the cities of Aachen and Monschau. As a consequence, the Mobile ACcess consortium includes not only research groups from RWTH but also local companies of the ICT industry, as well as tourist organizations and the city administrations.

The official inauguration of the project was celebrated on July 7<sup>th</sup>, 2009, at the Printing Museum in Monschau. On this occasion the State Minister for Media and

European Affairs, Mr. Krautscheid, gave a speech in which he highlighted the strong innovative potential of the project and the high economic relevance of the research results for the ICT industry.

The overall project is structured in two major areas: the communication layer and the application layer. On the communication layer, a new protocol is being developed which enables internet access for mobile users which is secure and save for both, the mobile user and the access point owner, who do not need to have a trustful relation. Moreover the protocol enables the transparent handover from one access point to the next one without interruption of the data connection when the mobile user is moving within the city.

On the application layer, we are developing the basic functionalities for future mobile multimedia applications. Such applications will use the built-in camera of mobile

devices as an effective and flexible input device by analyzing the visual content and matching it with digital content stored in online databases.



Together with the GPS location this will allow the system to find out what the mobile user is looking at and to provide the corresponding relevant information as an augmented reality overlay on the mobile device's display. For realistic visualization (like in pedestrian navigation applications) we are generating virtual 3D models of entire cities.

For more information please refer to the project web-page:

<http://www.mobile-access.org>

Leif Kobbelt, i8

## UMIC in Athens : An Expedition to Battleship "G. Averof"

A team from Informatik 5 at RWTH Aachen University visited the Harokopio University Athens from November 16 to 20, 2009, funded by the German Academic Exchange Service (DAAD) and the Greek State Scholarship Foundation (I.K.Y). This research expedition aimed at the promotion and enrichment of the museum archives of the Greek historic battleship "G. Averof" – the worldwide last surviving battleship from the World War I era – for cultural heritage management with advanced mobile information technologies. It provides mobile communities more opportunities to create, access, share, and reuse the valuable multimedia collection about the Battleship "G.

Averof" with the Web 2.0 mobile storytelling technologies on iPhones and other platforms.

During the visit, UMIC Virtual Campfire was presented by Yiwei Cao, Anna Hannemann, and Dejan Kovachev with the focus on mobile and Web 2.0 based multimedia storytelling and 3D scanner technologies. As an example of cultural heritage recovery for research and tourism, 3D scanning of Battleship "G. Averof" was accomplished. UMIC's terrestrial laser scanner system RIEGL LMS-Z390i consists of a highly accurate and fast 3D scanner, the accompanying operating and processing software RiSCAN PRO, and a calibrated and accurately orientated and mounted high-resolution digital camera. The

large data set of 3D data will contribute to location based context-aware storytelling for Battleship "G. Averof", supported by mobile multimedia and metadata management. This additional example helps to extend mobile application scenarios to large-scale multimedia management for mobile social software.

Yiwei Cao, i5



## News

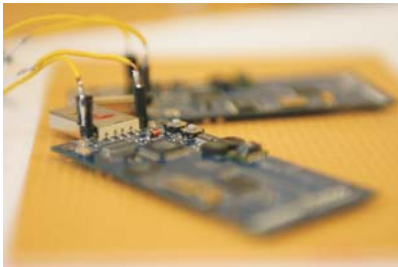
The class **iPhone Application Development**, offered by Prof. Jan Borchers' Media Computing Group, has entered the international Top 100 Downloads on

iTunes U. This is particularly interesting given the competition from places like Stanford and MIT on this online platform for educational materials.

Class: <http://hci.rwth-aachen.de/iphone>

Watch it on iTunes U:  
<http://itunes.rwth-aachen.de>

## Cognitive Radios Progress Towards Standards and Regulations



UMIC funded cognitive radio research, especially work in the modeling of spectrum usage and building a so called Cognitive Resource Manager, has also raised interest of different governmental and industry standardization organizations. Thus our fundamental research is starting to get out of the door towards a fruitful technology transfer. A leading industry group, SDRForum, organized a Reconfigurable Radio Technologies Workshop and a Product Exposition in April 2009. The meeting was held in Madrid, Spain. Marina Petrova from MobNets chaired a special session and also presented a talk on "Flexible Interfaces for Configuration and Reconfiguration of the Future Cognitive Radio Systems".

Venkatesh Ramakrishnan from ISS presented the second talk from UMIC entitled "SDR Waveform Development Concept Using Nucleus Approach". Later in the year, UMIC researchers were invited to present results in SDRForum meeting in Paris, where Ms. Petrova presented our vision on the open interfaces and control mechanisms. During the year also Dr. John Chapin (currently at MIT), who is chairman of Software Defined Radio Forum, visited UMIC and gave an invited talk for a full lecture room of UMIC researchers.

Other notable contributions towards regulation and standardization during the year included an invited participation in a meeting of the newly formed ETSI RRS (Reconfigurable Radio Systems) standardization group, where UMIC and MobNets were represented by Marina Petrova. In the very end of the year, a new COST action on cognitive radios (COST 902) was launched, where some 20 different nations are represented. One of the key topics in this COST activity is to coordinate research

and also monitor regulatory affairs in different countries. UMIC researchers are strongly involved in this COST-action, including the membership in the management committee (P. Mähönen) representing Germany, and leading one of the key workpackages (M. Petrova). Moreover, a number of UMIC researchers got active in IEEE P1900 standardization, especially in the domain of open interfaces for link-layer control.

Last but not the least UMIC researchers were visible in the first joint ERO and CEPT organized Conference on Cognitive Radio and Software Defined Radio Technologies. Although the meeting was mainly aimed to European Regulators, there were also a number of participants representing U.S. interests. Prof. Mähönen, one of the principal investigators of UMIC, acted as a technical rapporteur for the workshop, and Ms. Petrova gave an invited talk on Cognitive Resource Management and Spectrum Measurements.

Petri Mähönen, iNets/MobNets

## Cognitive Radio Tutorial at ISWCS 2009 by UMIC Researchers

The IEEE Symposium on Wireless Communications Systems (ISWCS) was organized in September in the beautiful city of Sienna, Italy. An extensive tutorial on cognitive radios and wireless networks prepared by Petri Mähönen, Marina Petrova, and Christopher Ververidis all working at the Institute for Networked

Systems, was presented for dozens of international researchers. The program committee selected the tutorial to be one of the four workshops at ISWCS. The UMIC authors presented the current state of the art in the cognitive radio domain, and also highlighted some of the recent UMIC results.



## News

### Media Computing Group opened Germany's first Fab Lab

On Monday, December 7<sup>th</sup>, Prof. Borchers' Media Computing Group opened Germany's first Fab Lab. These labs let anybody get from an idea for a new device to a prototype quickly, offering a glimpse of the future of personal fabrication. For example, 3d printers will let you print out your personal plastic cell phone cover at home - greatly impacting how we will think about

mobile devices in the future.

Fab Labs recently started at the MIT Media Lab, and are being set up in many countries - thanks to RWTH Aachen University now also in Germany. From soldering stations and Arduino microcontroller boards, to a PCB mill, a 3D printer and a laser cutter, the Media Computing Group's Fab Lab offers a set of tools to turn ideas into reality.

For more information see the Fab



Lab page at <http://fablab.rwth-aachen.de>.

## Clear Ship for TWEND!

On June 4, the "MS Wissenschaft" went on a four-month tour throughout Germany. The ship serves as a DFG-funded mobile information center, exhibiting trends and projects in current research. Targeted primarily at children and schools, it offers a great possibility to communicate ideas and visions from academic research to the general public in a hands-on fashion.

On board the ship, the UMIC Cluster of RWTH Aachen University provided one of the exhibits. The TWEND system (Twisting and Bending as new Interaction Gesture in Mobile Devices) is a prototype illustrating current research on bendable mobile devices, using an e-book application as example.

On the opening day, Thorsten Karrer and Gero Herkenrath from the Media Computing Group presented their project, followed by Prof. Jan Borchers and Gero Herkenrath who gave a press conference aboard the ship the following week.

The exhibit was highly successful, leading to very positive media coverage and providing important feedback for further development of TWEND. According to the staff guiding visitors through the exhibition, the device was very popular. Watching visitors being fascinated by the idea of a bendable e-book reader was also a thrilling experience for the TWEND team.



Of course, building a system that can withstand thousands of curious school kids for four months is very different from building a research prototype, and the TWEND team had to repair the system a few times due to an unexpected onslaught of visitors.

When the tour ended, over 90.000 visitors had come on board the MS Wissenschaft, and the ship had visited over 30 cities all over Germany. Several news articles covered the exhibit, providing very positive feedback on the project. The TWEND team was approached individually several times to provide further information on this project. Overall, participating in this exhibition was a valuable experience, and provided excellent exposure to RWTH Aachen University and UMIC. There is a special kind of motivation in seeing your own research making a profound impression on the public at large, kids and adults alike.

Gero Herkenrath, Jan Borchers, i10



## UMIC Project wins EEEfCom Innovation Price

A team of UMIC researchers from the Chair of Integrated Analog Circuits and RF Systems and the Mixed-Signal CMOS Circuits Group has won the prestigious 2009 EEEfCom Innovation Price for their Project "RF-DAC based multistandard, multimode RF-transmitter for mobile communications". The EEEfCom (Electrical and Electronic Engineering for Communication) Innovation Price was initiated in 2001 by Rohde & Schwarz, Agilent Technologies and Gerotron Communications to support especially innovative as well as practically relevant research in the field of communications technology and electronics.

This year's 8th EEEfCom Innovation Price is especially attractive as the winner team is granted the fabrication of a prototype demonstrator of their awarded design idea in an ultra-modern 28nm CMOS technology, sponsored by Infineon Technologies. The submitted UMIC project won against

several competitor projects from academia and industry.

Within the framework of the awarded project the UMIC researchers examine how to "digitize" the RF-transmitter frontend. The RF-DAC (Radio frequency Digital-to-Analog Converter) approach allows the replacement of analog baseband processing blocks by digital counterparts. This enables to build a transmitter which is easily reconfigurable for different mobile communication standards. At the same time the RF-DAC transmitter is compatible to digital-centric nanoscale CMOS technologies.

The award ceremony for the EEEfCom Innovation Price took place on November 18th during the RadioTecC fair in Berlin. The UMIC team consisting of **Niklas Zimmermann**, **Björn Thiel**, **Bastian Mohr**, **Stefan Heinen** and **Renato Negra** received the price from Dr. Nicola Hoogen, program manager C28 at Infineon Technologies.

Mrs. Hoogen approved the awarded project "which utilizes the

possibilities of modern CMOS technologies by using a high-speed signal processing with very sophisticated digital and analog components. The promising architecture allows for high bandwidth, compatibility to all major mobile communications standards and takes into account relevant key parameters of mobile communications, namely high output power, cost advantages by low chip area consumption and low power consumption." She also emphasized the economical relevance of the awarded project. With the future LTE-standard it addresses "a mass-market which is indispensable to economically benefit from advanced CMOS technologies", Hoogen said.

Niklas Zimmermann, IAS



## 8th International ITG Conference on Source and Channel Coding (SCC'10) January 18 – 21, University of Siegen, Germany

The biannual conference is organized by ITG/VDE Technical Committee 5.1 “Information and System Theory”. Prof. Christoph Ruland from Siegen University served as General Chair, Prof. Rudolf Mathar, principal researcher of UMIC and presently chairman of committee 5.1, acted as Program Chair, assisted by Melanie Neunerdt from the Chair of Theoretical Information Technology. With about 110 participants from nine countries the conference was a full success with a dense program of 39 contributed research papers of high quality. The conference was strongly supported by UMIC as may be seen from the following short report.

On Monday, prior to the conference three tutorials were offered, well visited by about 90% of all participants. Prof. Heinrich Meyr, principal researcher of UMIC, assisted by Meik Dörpinghaus from the Chair of Integrated Signal Processing Systems, gave a tutorial on “Iterative Receiver Algorithms”. Two more tutorials by Prof. Gerhard Bauch on “Point to Multipoint MIMO-OFDMA: Principles, Limits and Standardization for LTE” and Prof. Johannes Huber on “Information Combining: Models, Bounds and Applications” were well recognized by the conference participants.



Prof. Robert Calderbank and Prof. Jim Massey, both members of the advisory board of UMIC, gave keynote speeches. Robert's brilliant talk entitled “Something

New, Something Old” bridged known results from coding to recent developments in compressive sensing. Robert is an intoxicating speaker, with a fine sense for clarity and organization. Our cluster of excellence very much appreciates his membership on the advisory board.



The same holds true for Prof. Jim Massey. Jim is one of the most famous researchers in information theory. He asked the question “Combined Source-Channel Coding – a Good Idea”, and carefully investigated it on the basis of some fundamental channel models. He left the audience with some open, far reaching research problems of great importance.



The third keynote speaker was Prof. Gerhard Kramer from University of Southern California, his talk entitled “Capacity Limits of Optical Fibre Networks”. He first introduced optical channels, which typically show nonlinearities. He developed approximate, but accurate models which allow for assessing capacity limits and comparing the perfor-

mance of different optical modulation schemes. Gerhard is an excellent speaker who knows how to fascinate his audience. We should consider inviting him as a distinguished speaker of UMIC in the near future.

Amazingly, not only the keynote presenters but also the session chairs were world famous scientists. Robert was introduced by Prof. Heinrich Meyr, Gerhard by Prof. Joachim Hagenauer, and Jim by Prof. Rudi Ahlswede. Prof. Ahlswede received the “Shannon Lecturer Award” in 2006. He introduced Jim for about 15 minutes, there is simply so much to tell about him. His way of reporting joint incidents, accidents, joint research and successes gave the whole day a fresh and open atmosphere. It was great fun to watch two leading scientists in information theory telling where it all comes from and where it might go into the future.

As an innovation to the conference, a one-minute-madness session was introduced. Poster presenters were given the opportunity to attract people to their poster by telling the essentials in just one minute. Obviously this is a challenge, hard to solve and requiring thorough thinking of what to tell in a few hitting words. Some speakers solved the problem by amazing intuitive graphical representations. Melanie Neunerdt, the session chair, reminded those who exceeded the time limit by a polite “toot-toot” whispered into the microphone. Melanie gave the session a wonderful vivid and interactive flavour.

In summary, SCC'10 was a distinguished event with presentations of highest quality, a lovely social event at the Krombacher Brewery and an enjoyable conference banquet in the Siegerlandhalle. UMIC's support was well recognized, proceedings distributed on UMIC memory sticks will remind participants of our cluster of excellence also in the future.

Rudolf Mathar, TI

## Sabbatical Report – ACE Associated Compiler Experts bv., Amsterdam

RWTH Aachen University and ACE have enjoyed a long-standing and successful research partnership. Among the highlights of previous collaborations there is, for instance, the Compiler Designer (a product of CoWare Inc. that builds on ACE's CoSy framework and the LISA processor description language) which enables the rapid generation of C compilers for embedded processors. So, it is no surprise that I took the opportunity of the UMIC sabbatical program to reinforce the RWTH-ACE relations via a three months research stay in Amsterdam during April-July 2009. In practice, this meant somehow reducing my duties as a professor to one day in the Aachen office per week and significantly increasing the weekly mileage of my car.

ACE's flagship product is the well-known CoSy system, a versatile retargetable compiler framework. Due to its flexibility and performance, CoSy has a unique position in the market, and ACE is also engaged in various services and side products around CoSy. However, no software tool is made for eternity. ACE has been thinking about how to shape the future of their products to keep pace with important trends in computer

architecture, such as multicore platforms. My role as an expert in Electronic System Level (ESL) design was to consult on different directions for this and provide fresh views from the EDA and hardware design perspectives. The major findings have been summarized in a white paper that was delivered to ACE. Among many other by-products of the sabbatical there was also a joint software demonstration organized at the Design Automation Conference in San Francisco in July.

In return, I was able to participate in the day-to-day operations of the company, including attending the regular team meetings as well as joint customer visits, which provided valuable insights and allowed me to get to know the team much better than before, also on a personal basis. Indeed, the best way to improve the mutual understanding with your industry partners and their respective operation modes, behaviours, concerns, and constraints is to spend time with them! I strongly encourage the UMIC community to also seek opportunities for similar minisabbaticals at interesting places and teams. There are all too few companies operating in the European tools arena and university

researchers can certainly help stimulate activity and innovation here.

Last but not least I should mention that ACE is certainly a very special company to be with. Being successfully active in the IT domain for 30+ years, they combine a relaxed working atmosphere with a constant flow of innovations, implemented via highly skilled technical staff and seasoned management. I experienced a great amount of openness and hospitality, ranging from early support in sabbatical logistics to the waterborne farewell dinner on the Amsterdam Grachten. In fact, every visitor at ACE is received with open arms. So even if you don't plan to spend three months there (which by the way also means to survive on Dutch food), you are encouraged to knock at their door to discuss about any compiler issues.

Rainer Leupers, SSS



## MOBILE HCI09 - Cellphone, PDA & Co.:

**"A single thumb is not enough" was one of the conclusions drawn from the 2009 issue of the worldwide leading conference on the usability of mobile devices and services.**

The 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI 2009) was organized by Fraunhofer FIT and the University of Siegen in cooperation with the University of Bonn in September 2009. Program Chairs included Prof. Volker Wulf (University of Siegen), Dr. Markus Eisenhauer (Fraunhofer FIT), and Prof. Matthias Jarke.

Only 20% of the 176 received submissions could be accepted for presentation, making MobileHCI

one of the most competitive conferences in the field. Hot debates among the almost 350 delegates from 28 countries raged about the usability of future multifunction mobile phones with dual interfaces and gesture recognition. But also wearable mobile devices embedded in clothing, bicycles, and the like found the attention of scientists. Keynote talks were presented by Jun Rekimoto, Prof. at Tokyo University and Director of the Interaction Labs in the Sony Computer Science Laboratories, Kentaro

Toyama, Co-Founder of Microsoft Research India, and Peter Möckel, Manager of Deutsche Telekom Laboratories (T-Labs) in Berlin.



## Chairman of the Fraunhofer ICT Group

Prof. **Matthias Jarke** was elected as new Chairman of the Fraunhofer ICT Group for the period 2010-2012, and is member of the Fraunhofer Präsi-

dium. With a budget of close to 200M€, the Fraunhofer ICT Group is one of the largest research organizations in information and communication tech-

nologies in Europe. Prof. Jarke succeeds Prof. Dieter Rombach, TU Kaiserslautern.

## Best Paper Award

**Stefan Kraemer** and **Rainer Leupers** from the chair of Software for Systems on Silicon together with **Dietmar Petras** and **Thomas Philipp** from CoWare Inc. received the best paper award of the International Symposium on System-on-Chip (SoC 2009), held in Tampere, Finland, 5<sup>th</sup>-8<sup>th</sup> October 2009. The paper entitled "A Checkpoint/Restore Framework for SystemC-Based Virtual Plat-

forms" was recognized for its contribution in the area of fast system simulation and electronic system level (ESL) design. The work presented in this paper has been developed in a joint project together with CoWare, one of the world's the leading ESL companies. Checkpointing is of great interest for complex simulation platform in order to reduce the time spent simulating. The high complexity of the virtual platform

used in the UMIC Nucleus project makes this an ideal test case for the checkpointing technique.



## Chairman of ITG/VDE Technical Committee 5.1.

**Rudolf Mathar**, principal researcher of UMIC and member of the steering board, was elected chairman of ITG/VDE Technical Committee 5.1 "Information and System Theory" on October 16<sup>th</sup>, 2009. He will be

chairman for two years from 1 January 2010 on. Meeting twice a year the committee consists of leading scientists from academia and information and communication industry. Two current DFG priority programs were

initiated by the committee, namely "Communication in Interference Limited Networks (COIN)" and "Information and Communication Theory in Molecular Biology (InKoMBio)".

## Paper Award

The paper "Power allocation for social benefit through price-taking behaviour on a CDMA reverse link shared by energy-constrained and energy-sufficient data terminals" by **V.**

**Rodriguez, F. Jondral**, and **R. Mathar** was selected as one of the five best papers out of 143 presented at the IEEE ISWCS 2009 (Siena, Italy). Accordingly, it is eligible for inclusion in a special

issue of the prestigious ACM/Springer journal "Mobile Networks and Applications", which is ranked 14 among 67 telecommunication journals by Thomson's Journal Citation Reports.

## Second prize at the ACM WiNTECH 2009 contest won by TI

The Institute for Theoretical Information Theory (TI) was invited to demonstrate recent research on optimal subcarrier allocation in OFDM at The Fourth ACM International Workshop on Wireless Network Testbeds, Experimental Evaluation and Characterization (WiNTECH 2009), co-located with Mobicom 2009 in Beijing,

China. **Milan Zivkovic**, **Dominik Auras** and **Rudolf Mathar** received the second prize in the WinCool demonstration contest for their software radio implementation entitled "A reconfigurable framework for adaptive OFDM transmission". The authors would like to thank UMIC for the continuing support.



## Helene-Lange-Award

30 October 2009:

As the first recipient ever, **Anke Schmeink**, assistant professor at the UMIC Centre, is awarded

the highly endowed Helene-Lange-Award for young female scientists at the University of Oldenburg.



## PhD News

### The Separated User Interface in Ambient Computing Environments - A holistic Framework-based Approach for Design, Infrastructures and Tools

Dr. Andreas Lorenz, Computer Science 5 - Information Systems

In a world of ambient services, the technology disappears into the surroundings and the use of local mouse and keyboard is replaced with interaction from distance, e.g., by employing a mobile phone,

using gestures, or observing body movements. The thesis describes the design of a general solution to cope with the heterogeneity of interaction styles, technology and development processes. It extends the idea of separating the user interface from the application logic by defining virtual input devices which are physically separated from the services to be controlled. The uniformity of the design and development processes supports a common understanding

as a foundation for offering design tools and model-based automatic code generation to achieve interoperability. The results were demonstrated by an Interaction Kiosk shown at the CeBIT 2009.



### Adaptive Multimodal Exploration of Music Collections

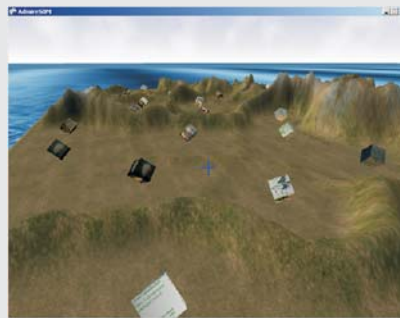
Dr.rer.nat. Dominik Lübbers, Computer Science 5 - Information Systems

Current music collection management systems mainly concentrate on the support for directed search for songs (e.g., on the basis of describing metadata like title, artist, etc.).

However, empirical studies have shown that the typical behaviour of customers in classic music retail stores is much more dominated by undirected browsing in the offered catalogue without being able to articulate a clear information demand.

To improve support for this access paradigm, we conceptualized, implemented and evaluated the exploration environment soni-Xplorer for music collections, which allows its users to freely and autonomously explore a comprehensibly structured music library. Such a structure is based on a quantifiable notion of similarity

between songs. Therefore, we analyzed strategies for calculating meaningful distances between music pieces and implemented a variety of measures covering different aspects of music.



To make the resulting high-dimensional similarity space understandable and accessible to the user, we use multi-dimensional scaling techniques and self-organizing maps which realize a topology-preserving mapping of the data to a two-dimensional grid such that similar songs are placed close to each other.

Furthermore, cluster boundaries

that separate homogeneous groups of similar pieces can be detected. As shown in the figure, this information can be used to build a three-dimensional virtual landscape, which the user can freely navigate in.

A main contribution of the thesis is the supplementation of this visual presentation by permanent spatialized acoustic playback of the placed pieces. To prevent users' acoustic overstimulation we implemented concepts for perception focussing and intelligent selection of songs for playback.

Since the notion of similarity is known to be highly subjective, our system adapts to the user's organization strategy by reweighting the individual similarity measures according to his interaction with the environment.

A concluding evaluation shows the importance of the developed multimodal presentation for the user's orientation in the virtual landscape and proves the performance of the adaptive distance function.

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