

Ultra High-Speed Mobile Information and Communication

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Message from the UMIC Coordinator

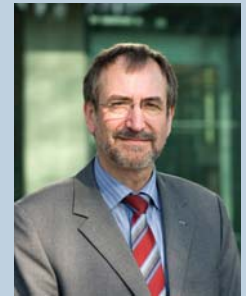
The second newsletter of this year is distributed later than in previous years since the renewal proposal for the UMIC research cluster kept the whole team extremely busy. After submission of the written proposal (end of August) and a short vacation period, presentation and defense of the proposal on November 24 in Bonn had to be prepared. Funding decisions will be made on June 15, 2012, in a meeting of a "Joint Commission" formed by the DFG, the German Council of Science and Humanities, and the Federal and State Ministers of Science and Research.

A great UMIC Distinguished Lecture 2011 was given by Anthony Ephremides discussing stable

throughput, rate control, and delay in multi-access channels in more theoretical depth. Besides the almost "traditional" UMIC day in October, UMIC members organized this year two top conferences in Aachen: IEEE DySPAN and ISWCS. For both conferences the participant feedback was extremely positive. DySPAN was ranked as one of the best IEEE conferences of 2011. Even the local weather supported us with sunshine and pleasant temperatures. Last but not least, UMIC achievements demonstrated in a booth at the Design Automation Conference 2011 in San Diego received significant attention.

The newsletter again provides a lot of information about UMIC activities

and several project reports. This includes a report on live test of a smart sensor shirt, providing health status



data of its bearer continuously via a cellular phone during the 5.5 km Lousberg cross-country run.

Enjoy reading the newsletter! Please also note that a short version of the recently released UMIC movie can be viewed at the UMIC web site (www.unic.rwth-aachen.de).

Gerd Ascheid, ISS

The UMIC Distinguished Lecture 2011

The annual distinguished lecture is an important event of UMIC. Renowned scientists of highest international reputation are invited as speakers. In 2011, the lecture took place on Monday, May 23. We were glad that Prof. Anthony Ephremides accepted our invitation. Prof. Ephremides holds the Cynthia Kim Eminent Professorship Chair of Information Technology at the University of Maryland. He furthermore holds a joint appointment with the Institute for Systems Research, of which he has been a founding member, and he is also a member and former Co-Director of the Maryland Hybrid Networks Center. Prof. Ephremides served in many capacities in the IEEE and other organizations. In 1987 he was President of the IEEE Information Theory Society. His research interests include all aspects of communications systems with focus on energy efficiency and cross-layer approaches to design. He is also interested in systems theory, stochastic systems, optimization, signal processing, and wireless communications.

Prof. Ephremides presented a lecture entitled "Stable Throughput, Rate Control, and Delay in Multi-Access Channels". He considered a framework for the study of multi-access channels that combines traditional networking approaches with physical layer aspects. In this framework he demonstrated the connection between stability and reliable communication. The related problem of emptying a set of queues in minimum time was

also discussed. The audience was delighted by the vivid presentation style of the speaker about a subject of great interest to the research within UMIC.

The day concluded with a joint dinner where Anthony told about amusing episodes from his rich scientific life. We deeply thank Professor Anthony Ephremides for an awesome lecture and a very enjoyable evening.

Rudolf Mathar, TI



The UMIC DAY 2011

An important event of our Cluster of Excellence is the annual UMIC Day, in 2011 commencing at 2:00 pm on October 18. Two keynote speeches framed two technical talks by UMIC principle investigators. Breaks of half an hour between the presentations provided time for intensive discussions and networking. We were able to invite Prof. Adam Wolisz from TU Berlin and Dr. Stephan ten Brink from Alcatel-Lucent as keynote speakers.

by Dr. ten Brink dealt with "Trends in Wireless Communications" from an industry point of view. Manufacturers of wireless network equipment must be aware of future technological developments and user demands to survive in a market which is highly competitive. Dr. ten Brink drew a clear picture of technologies, which will find their way into wireless equipment and devices. The talk was of high interest to UMIC, particularly for gauging our research objectives to industry needs.

ways of fair spectrum sharing, and dispensing with a central control unit. His experience in complexity theory and algorithmic design leads to novel efficient strategies for decentralized network control.

It is a tradition that the concluding event of the UMIC day somehow visualizes "ultra-high speed" and "mobility". After having watched hip-hop dancing, juggling, music and Latin dancing on previous UMIC days, trick cycling was selected as the entertaining highlight this year. Angie Koepsel and Nicole Fürth gave an impressive performance on the small stage of the lecture hall. It is amazing in which ways bikes



Prof. Wolisz gave an extremely vivid and inspiring talk entitled "Do we have a Vision of the Future Wireless Network?". He developed a variety of visionary ideas on how the prospective wireless internet would look like and what services might emerge in the future. The keynote

The first in-house presentation was given by Prof. Mathar, entitled "Coding on a Façade". Six chairs in the field of information and communication technology will move to a new building in 2013, the so called *ICT cubes*. The name stands for the cubic shape of the building. Its façade will be made of slats, into which key messages from famous researchers will be encoded by position and shape, like "It is better to do the right problem the wrong way than the wrong problem the right way" by Richard Hamming. Subsequently, Prof. Vöcking reported on "Algorithmic Aspects of Spectrum Allocation in the Physical Model". He introduced a class of algorithms, motivated by game theoretical approaches, to find

can be ridden, even on a single whirling wheel. Everybody was invited to try by himself after the performance. While some people still practiced others gathered at the buffet to conclude the UMIC Day 2011 with food and drinks.

Rudolf Mathar, TI



Demonstration of the UMIC HealthNet Project at Lousberglauf 2011

At this year's Aachener Lousberg Run also a team of the UMIC HealthNet project of RWTH Aachen University participated. The interdisciplinary team was constituted of five runners (Dr. Christoph Quix, Xiang Li, and Sandra Geisler of the Information Systems chair, Saim

Kim of the Philips chair for Medical Information Technology (MedIT), and Marwan Hassani of the Data Management and Data Exploration chair) who started in a field of about 2000 runners.

Each of the runners in the UMIC team was equipped with the sensor



shirt developed in the project and a smartphone. On the smartphone the athletes could observe in real-time their vital signs, speed, distance (measured by the sensors and the smartphone) and estimated arrival time. Additionally, the data of the runners was transmitted via UMTS to Till Quadflieg (Institute for Textile Technology), who represented the trainer. Till observed the data on his smartphone and followed the position of the runners on a map during the run. The security and privacy of the data transmission has been facilitated by the UMIC IT Security chair. (i5)



IuK Day NRW 2011

At the third "Tag der Informations- und Kommunikationswirtschaft Nordrhein-Westfalen" (IuK Day NRW), held in Wuppertal, on November 18, 2011, UMIC demonstrated recent research results. Organized by the Ministry of Economic Affairs, Energy, Building, Housing and Transport, the "IuK-Tag NRW" is the high ranking annual meeting which gives impulses for future strategies for the IT business sector of NRW.

The UMIC cluster gave a short overview of some current research projects which address various aspects

of using augmented reality (AR) concepts in the context of mobile applications. Our examples perform vision-based localization by image matching, AR navigation for pedestrians and Segway-drivers, and the online collaborative authoring of pervasive games. We demonstrate the effectiveness of our techniques by prototypical implementations for real world applications.

Our vision-based localization service LocalizeMe is the basis for our applications, as it is a key functionality for other mobile services due

to its great benefits compared to established localization techniques like GPS. Especially in the field of Augmented Reality fast and precise self-localization is the key component to make these new kinds

of applications possible. Our AR based pervasive game was presented as one working prototype of this technique that fully runs on a smartphone. Navigation systems can also benefit from our high precision localization technique, but we also demonstrated new interface concepts like haptic feedback for Segway driver assistance.

Prof. Kobbelt participated in a panel discussion on the topic of augmented reality together with other experts in this field. The discussion was well received by the audience that consisted of the larger parts of the participants of the IuK Tag NRW.

Most participants were coming from the IT business sector, politics and administration of NRW as well as representatives of international companies and research institutions. The goal of this event was professional networking and making new contacts for future cooperation in research and development.

Ming Li, Robert Menzel, Prof. Leif Kobbelt (i8)



rwthCTF 2011 - Cyberwar the Flag!

The rwthCTF 2011, which took place on September 30, 2011, was the first capture-the-flag style tournament organized by the relatively young IT Security Research Group (ITSec) within the UMIC excellence cluster at RWTH Aachen University. While there had been previous cyber tournaments at RWTH Aachen under the name CIPHER CTF, organized by the Chair 4 of Computer Science and now discontinued, the rwthCTF 2011 marks the first time the OldEurope team had the opportunity to create interesting services and challenges for participants from all around the world.

These virtual capture-the-flag tournaments work a lot like regular capture-the-flag, and realistically mirror the demands and tasks faced by IT security professionals everyday. This means that a given service has to be available and has to stay available with little to no interruption, while at the same time it has to ensure confidentiality of data stored by different users. Downtime costs money, much like in the real world, and leaking information is expensive as well. If a vulnerability is found in a service, this vulnerability can be used against every other team employing the same version of the software. And if using the vulnerability is not that interesting, information about it can be sold to other interested parties on a virtual black market.

In the rwthCTF 2011, the roughly 50 participating teams were supplied with a Linux virtual computer image and network connectivity through a virtual private network (VPN), so they could directly reach other teams. The Linux image given to the teams contained five services, implemented in a variety of programming languages and offering completely different sets of services to users. The common ground for these services was the central game server, which would connect to each service, store a piece of unique information (the *flag*) and

retrieve it at a later time. Defending these services and the flags stored within them while at the same time attacking other teams was only part of the challenge though. The money earned for offensive and defensive maneuvers would not matter for the final ranking, but could be used to buy access to a challenge network which would culminate in physical control over a small robot which had to be steered through a maze and crashed into a self-destruct button. The challenge network consisted of multiple stages which required either advanced binary exploitation



skills or a solid understanding of cryptography.

The rwthCTF started on time at 5 pm CEST, scheduled to last until roughly 4 am. An hour after the decryption key for the predistributed Linux images was released, the network connectivity was activated and the rwthCTF officially started. Within minutes the rwthCTF team saw stolen flags arriving on the game server and the first advisory appeared in the black market. After about an hour, the first team managed to pass the first of five stages

of the challenge network. Then it took some time before any of the teams made significant progress with solving the challenges. After ten hours, with the original deadline closing in, the rwthCTF team decided to extend the tournament by another 90 minutes, at the end of which the "FAUST" team from the University of Erlangen managed to score a decisive victory in the challenges and steer the robot into the self-destruct button. The Dutch national team "De Eindbazen" came in a close second place, and the "LeetMore" team from Saint Petersburg managed to finish third.

Thanks to the generous donation by the UMIC cluster, these teams will also receive a monetary prize. After an exiting tournament and stressful weeks leading up to the event, the rwthCTF team was quite happy with the results. The network ran stable, the game server did not crash, most teams managed to connect without any problems and communication was quick. Positive feedback from some teams has already arrived, and considering that 50 teams with an average of ten team members participated, there were surprisingly few complaints. With some lessons learned and a lot of great memories, everyone is looking forward to rwthCTF 2012.

Johannes Gilger, IT-Sec



IEEE PerCom Workshop PerCoSC'11, March 21, Seattle, USA

The First IEEE PerCom Workshop on Pervasive Communities and Service Clouds (PerCoSC'11) organized by Informatik 5, RWTH Aachen University (Yiwei Cao, Ralf Klamma, and Dejan Kovachev) and Aarhus University (Christian S. Jensen) was successfully held in conjunction with IEEE International Conference on Pervasive Computing and Communications, March 21-25, 2011, Seattle, USA. Eight high-quality papers were presented by the authors from six countries with instructive discussions. The topics cover the research areas of software engineering, security and privacy, cloud services with an extension of pervasive/ubiquitous computing and pervasive/ubiqui-

tous cloud, Service-oriented Architecture (SOA), and smartphone multimedia applications on the cloud. Around thirty participants attended the workshop and joined in the interactive discussions.

The idea to have PerCoSC'11 came up with the organization of UMIC Workshop on Future Mobile Applications held at UMIC Research Center on February 26, 2010. Similarly, this PerCoSC participant community has shown great interest for another successive event. We are going to propose PerCoSC'12 to the IEEE PerCom 2012 conference which will be held in Lugarno, Switzerland. The workshop proceedings will be soon available at

IEEE Xplore. Please join us in the PerCoSC LinkedIn group at <http://www.linkedin.com/groups/Per-CoSC2011-3835210?mostPopular=&gid=3835210>

Yiwei Cao, Christian S. Jensen, Ralf Klamma, and Dejan Kovachev, i5



Georg Hackenberg received the first prize of the Hugo Geiger Award for the best master thesis



Georg Hackenberg, former UMIC student researcher at the Informatik 5 group (Prof. Dr. Matthias Jarke) and graduate of RWTH's international Master Program in Software Systems Engineering, received the first prize of the Hugo Geiger Award for the best master thesis completed

among the roughly 5.000 students working within the Fraunhofer Society for Applied Research in 2010. The award was handed out by the Bavarian Minister of Science at the Annual Fraunhofer Research Festival in Nürnberg on May 25, 2011. In his thesis, conducted at Fraunhofer FIT under supervision of Prof. Wolfgang Prinz Ph.D., he developed a 3D multi-touch interface in which a 3D camera system captures gestures

down to the precision of individual finger movements in realtime, thus significantly improving marker-free gesture recognition. More information can be found under <http://www.fit.fraunhofer.de/presse/11-05-26.html>. Georg's YouTube video demonstrating the system has enjoyed about 100.000 downloads: http://www.youtube.com/watch?v=Tw1mXjMshJE&feature=player_embedded.

News

Anke Schmeink serves as the lead guest editor for a **special issue** on "Recent Advances in Optimization Techniques in Wireless Communication Networks" of the **EURASIP Journal on Wireless Communications and Networking**, Springer.

For more information see: <http://www.ti.rwth-aachen.de/data/EURASIP.pdf>



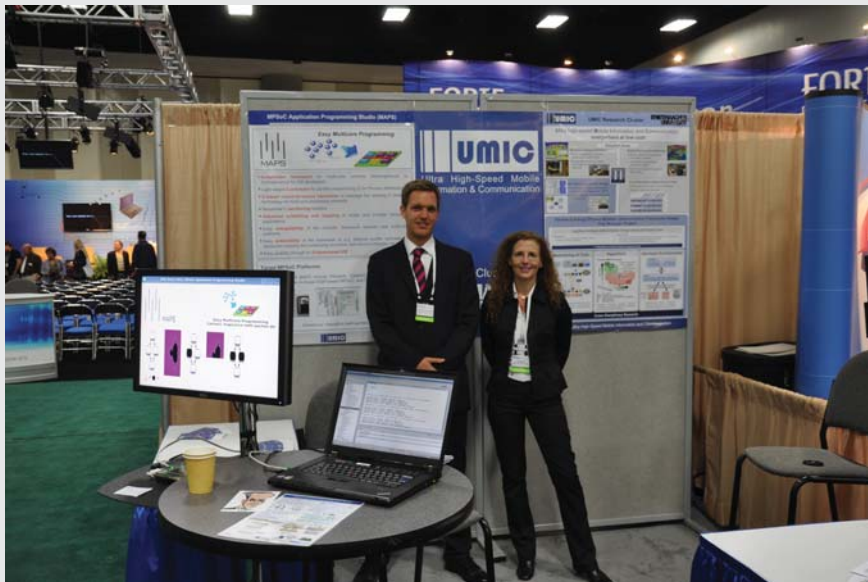
Ralf Klamma was co-organizer of the IEEE Ubi-Media 2010 in China and **editor of a special issue of the World Wide Web Journal**.

For more information about the special issue on "Ubiquitous Media Technologies and Applications" see: <http://www.springerlink.com/content/1386-145x/14/3/>

UMIC exhibits at DAC 2011

The UMIC Research Center, represented in person by Prof. Dr. Ascheid, Prof. Dr. Leupers, Dr. Ute Müller and Dipl.-Ing. Maximilian Odendahl, exhibited at this year's Design Automation Conference (DAC) in San Diego, USA (June 6-8) to present the UMIC cluster and show some key research results.

well as promising newcomers, attracting more than 8000 visitors of industry and academia representatives from all over the world. DAC's well known reputation, size and target audience makes it a very fitting place to show advances of internal projects in this research area.



DAC is a world leading, yearly exhibition in the area of software and hardware design for embedded systems. It includes both a large research conference and exhibition floor featuring industry leaders as

Thus, MAPS (MPSoC Application Programming Studio), a retargetable compilation framework for heterogeneous and homogeneous multicore systems, was presented for the first time to a larger, exter-

nal audience. MAPS, supported by UMIC, results from many years of research and is trying to solve the multicore programming challenge. Taking CPN (C for Process Networks), a light-weight C extension for parallel programming, as input, a newly developed compiler allows automatic code generation for several targets using source-to-source transformations. This approach allows to leverage the existing compiler technologies of the target systems. Additionally, the framework includes powerful sequential code partitioning, mapping and scheduling facilities, which are easily exchangeable as well as extendable.

Although the overall attendance of the conference was slightly lower than expected, the booth was a full success. Not only did it give the UMIC cluster a huge visibility boost, but also allowing to present the MAPS framework to a wide range of people coming from the Electronic Design Automation (EDA) and other computer engineering industry, research and a large number of university representatives from all over the world. On top, our UMIC "mobile phone couch" and Jo-Jo giveaways were very well received and attracted many people.

Maximilian Odendahl, SSS

International UMIC Workshop MultiClust 2011

The 2nd International Workshop on Discovering, Summarizing and Using Multiple Clusterings (MultiClust 2011), organized by the UMIC Data Management and Data Exploration Group of RWTH Aachen University, the Karlsruhe Institute of Technology, and the Aarhus University Denmark, took place in Athens on September 5th, 2011 in conjunction with the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD 2011).

Traditional clustering algorithms identify just a single clustering solution of the data. However, today's complex and high dimensional data allows multiple interpretations for

each data object, and thus, several valid groupings (multiple clustering solutions) can be detected. Recently, an emerging research direction, focusing on detecting, summarizing and using such multiple clustering solutions, has evolved out of this problem. This new clustering paradigm has attracted attention from many researchers and resulted in a number of important publications at leading data mining and machine learning conferences. Focusing on this novel paradigm, the MultiClust workshop attracts a variety of researchers working on different problem instances of multiple clustering solutions and overall more than 40 participants made the workshop

very successful.

The technical program of this workshop has included two invited talks presented by Michael Houle (National Institute of Informatics, Japan) and Bart Goethals (University of Antwerp, Belgium) as well as seven peer-reviewed papers. We would like to highlight the work on "Generating a Diverse Set of High-Quality Clusterings" by Jeff M. Phillips, Parasaran Raman and Suresh Venkatasubramanian. It has been selected as the best contribution and receives the Best Paper Award from the MultiClust 2011 workshop.

Stephan Günemann, Thomas Seidl, i9

UMIC at the Mobile World Congress 2011



The GSMA Mobile World Congress (MWC), the largest annual event in the mobile communications industry, was held from February 14-17 in Barcelona. This year, the organizers proclaimed the MWC as “the biggest and best ever” with more than 60,300 attendees with 51% top-level representation from over 200 countries. Nearly 1,400 companies across 142,000 square meters showcased their organizations through exhibition stand and hospitality space across eight halls at Fira Barcelona. Visiting the exhibition halls provided sneak peeks at exciting cutting-edge products, technologies, applications, accessories, back-end solutions and service innovations that will define the future of mobile communications.

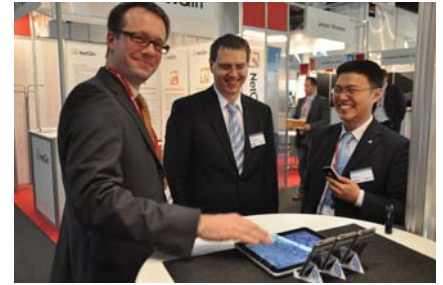
An additional flavor to the importance and high-level nature of MWC was given by the presence of more than 3000 CEO attendees and an exciting lineup of inspiring speakers presented at more than 40 conference sessions and action-provoking panel discussions. The MWC also included an awards program that highlighted the most innovative mobile solutions and initiatives from around the world and offered a great possibility for mobile industry networking, finding business opportunities and establishing connections between development trends and the global market perspective.

One of the main conclusion of this year’s MWC was that the mobile ecosystem is in the midst of an un-

predicted wave of transformation. The leading vendors of networking equipment, including Ericsson, Alcatel-Lucent and Huawei, stated that the expected data traffic on the world’s mobile network will increase about 30 times through 2015 and 500 times by 2020 serving five billion subscribers in total. The corporate visionaries of the business agreed that a challenge they all would face was managing the increasing demand for mobile data services fueled by the growth in smartphones. Therefore, one of the major trends is to reinsert mobile operators at the heart of the internet ecosystem by establishing them as core enablers and providing customers with the proper infrastructure to exchange their information.

As a leading German research cluster in mobile communications with strong links to wireless industries and mobile network operators, UMIC was represented with 4 high-end demos that showed the wide range of activities covering research on basic concepts, key solutions and tools, development of prototypes and demonstrators, and last but not least, technology transfer to industry. The UMIC exhibition stand was located in the Embedded Devices Pavilion of the App Planet Hall which also hosted the App Developer Conference and major application focused exhibitors.

The Computer Graphics Group (18) was present with two demos. The eye-catching “Mobile Multi Display”



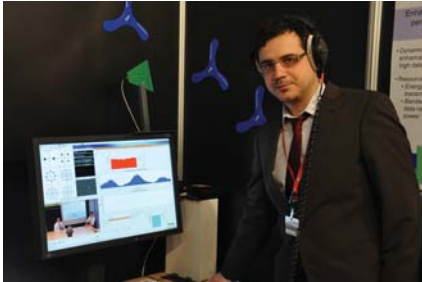
demonstrated a framework which enables the combination of different mobile devices into one multi-display such that visual content can be shown on a larger area consisting, e.g., of several mobile phones placed arbitrarily on the table. The system allows the user to perform multi-touch interaction metaphors, even across different devices, and it guarantees the proper synchronization of the individual displays with low latency. Moreover, dragging large pictures and playing very simple racing games on multiple iPhones and iPods attracted a lot of visitors and pulled useful discussions concerning the further improvements and commercial applications.

The “LocalizeMe” demo showcased a novel technology that allows indoor and outdoor localization with an incredible accuracy even when a GPS signal is not available. The basic concept is that a locally taken picture of user’s surroundings is sent to a server that matches the photo to a database of pictures with attached geolocations. The closest match is found and an interactive 3D video of the user’s surroundings is sent back to the mobile client.

The Institute for Communication Technologies and Embedded Systems (ICE) presented a Virtual Plat-



form for simulating embedded computer systems, like mobile phones, on a regular consumer PC. Having the “Chumby” as hardware counterpart, many visitors had the opportunity to experience the hardware configuration process from the inside.



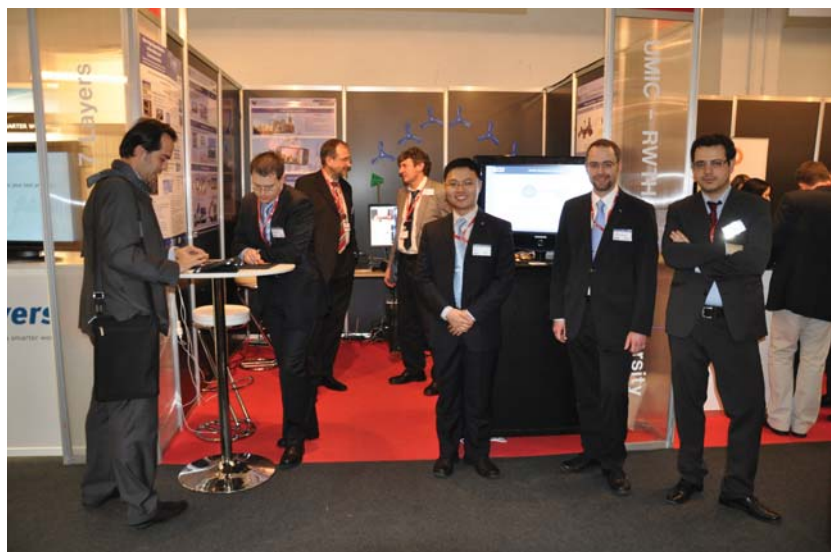
The “HD Audio-Visual Conferencing over an Optimized Radio Link” was jointly presented by the Institute for Theoretical Information Technology (TI) and the Institute of Communication Systems and Data Processing (IND). The demo showcased a binaural conference communication which allows for spatial perception, carried over an optimized OFDM radio link, thus emphasizing the potential of optimized capacity achieving OFDM-based data transmission for quality and robustness improvement of the next generation mobile

standard LTE+. Many visitors with high technical competence level showed their interest in the demonstrated concept and gave constructive suggestions how it can be transferred to industry applications.

The general impression was that all demos were well attended and the exhibition stand was crowded most of the time, even sometimes leaving no space for demonstrators themselves. The visitors, ranging from software developers, small business managers, up to representatives of government technical agencies and leading mobile tech-

nology vendors, were attracted and pleased by the content and variety of presented demos as well as by sufficient amount of tasty Aachener “Printen” available at the UMIC exhibition stand. Finally, MWC was shown to be a perfect opportunity for UMIC to demonstrate the latest research achievements, to get insight into global trends in mobile technology, and to establish important contacts with industry representatives while strengthening the old connections.

Milan Zivkovic, TI



i5 organizes the International Workshop on Managing Health Information in Mobile Applications (HIMoA) at the MDM conference in Lulea, Sweden

The workshop on Managing Health Information in Mobile Applications was held in connection with the Mobile Data Management (MDM) conference 2011 which took place near the polar circle in Lulea, Sweden. Eight researchers from five countries presented their research results in the workshop. A highlight was the outstanding talk by Prof. Upkar Varshney from the Georgia State University, Atlanta, which gave a detailed insight into mobile

and pervasive healthcare with its challenges and upcoming directions. The workshop closed with a fruitful final discussion showing that there are still many issues which have to be tackled in the future of (mobile) healthcare applications and systems. A second edition of the workshop is planned for next year.

Christoph Quix, i5



Marián Kühnel / IT-Sec

Marián Kühnel received his Diploma degree in Electrical Engineering from the Slovak Technical University of Bratislava in 2010, and his Master's degree in IT Security/Information Engineering from the Ruhr-University Bochum one year later. Marián joined the Research Group IT-Security as a research assistant

in April 2011. His current research and main project ASMONIA (Attack analysis and Security concepts for Mobile Network infrastructures, supported by collaborative Information exchAnge) aims to improve the resilience and reliability of current mobile networks and to develop a holistic security concept for future

mobile network infrastructures that satisfies the diverse requirements of modern networks.



Ayesha Khalid / MPSoC Architectures

Ayesha Khalid holds Bachelors Degree in Computer Systems Engineering from the National University of Sciences and Technology, Pakistan. Afterwards she joined the Center of Advanced Research in Engineering, Pakistan and worked on the development of various FPGA-based embedded system solutions until 2008. Meanwhile she received her Master degree in Elec-

trical Engineering with specialization in DSP and Computer Architecture from the University of Taxila, Pakistan in 2007.

As she was awarded DAAD scholarship for Ph.D. studies in Germany, in winter 2010 she joined the Multiprocessor System-on-Chip Architectures group at UMIC, under the guidance of Prof. Dr. Anupam Chattopadhyay. Her research interest

lies in development of scalable architectural templates for specific applications in embedded and scientific computing.



Johannes Gilger / IT-Sec

Johannes Gilger graduated from RWTH Aachen University in May 2011, completing his studies in Computer Science (Diploma). During his time at the university, he received a grant for his work on an adaptive and lightweight protocol for hop-by-hop authentication (ALPHA) as part of the Undergraduate Research Opportunities Program (UROP) of RWTH Aachen University.

After graduating, he joined Prof.

Dr. Meyer's IT-Security Research Group as a doctoral candidate. He currently works on a research project which is concerned with secure communication, privacy, multi-user support, and establishing security credentials in the emerging Internet of Things (IoT). These technologies will be used in very small, battery-driven devices which will permeate both public and personal spaces to enable a new level of connectedness, which is why security is of

paramount importance. His work is funded by Siemens AG to enable a new level of connectedness, which is of paramount importance.

His work is funded by Siemens AG.



Dominik Auras / ISS

Dominik Auras received his Diploma degree in Computer Engineering from RWTH Aachen University, Germany in 2011 with distinction. In January 2011, he joined the Architecture Group of the Chair for Integrated Signal Processing Systems

(ISS) at the RWTH as a research assistant. His present research and study interests lie in the area of flexible and energy-efficient architectures for mobile wireless communications with a focus on the design of heterogeneous multi-processor

systems on chip (MPSoCs) for software defined radio (SDR). He is a member of the Nucleus project of UMIC.



Mark Schlösser / IT-Sec

Mark Schlösser received his Diploma degree in Computer Science from RWTH Aachen University in 2011. His thesis project dealt with a secure framework for distributed function calls. In September he joined the Research Group IT-Security as a research assistant. His current research focuses on malware

collection through honeypots, botnet analysis and threats to mobile devices like smartphones and tablets. Apart from these main topics he also works on improving his diploma thesis project to make machine-to-machine communication easier. Last but not least he is responsible for running a practical course on

both offensive and defensive techniques in IT Security for Master students.



Juan Eusse / SSS

Juan Eusse received the degree of electronic engineer from the University of Antioquia, Colombia in 2007. In December 2009 he obtained his Master degree from the University of Brasilia, Brazil. Throughout 2010 he worked as a research assistant for the Microelectronics and Control

research group of the University of Antioquia. In 2011, he enrolled as a research assistant of the Chair for Software for Systems on Silicon (SSS) of the Institute for Communication Technologies and Embedded Systems (ICE). His current research topic lies in the field of Application

Specific Instruction Set Processors (ASIPs).



Florian Weingarten / IT-Sec

Florian Weingarten studied from 2006 to 2011 at RWTH Aachen University where he received his diploma in computer science as well as his bachelor of science in mathematics. During his studies, Florian worked at the Network Operations Center (NOC) in the Center for Computing and Communication (RZ) as well as at Chair D of Math-

ematics. In his theses, he worked on the homomorphic Paillier cryptosystem with Prof. Dr. Aloys Krieg and on secure multi-party computation with Prof. Dr. Ulrike Meyer. In July 2011, he joined the Research Group IT-Security as a Ph.D. student where he has been working on detecting and filtering network address translated (NAT) traffic. His

future research work will cover different aspects of theoretical as well as applied cryptography.



PhD News

Mobile Server Platform: Architectures and Protocols for Future M2M Ecosystems

Fahad Aijaz, i5

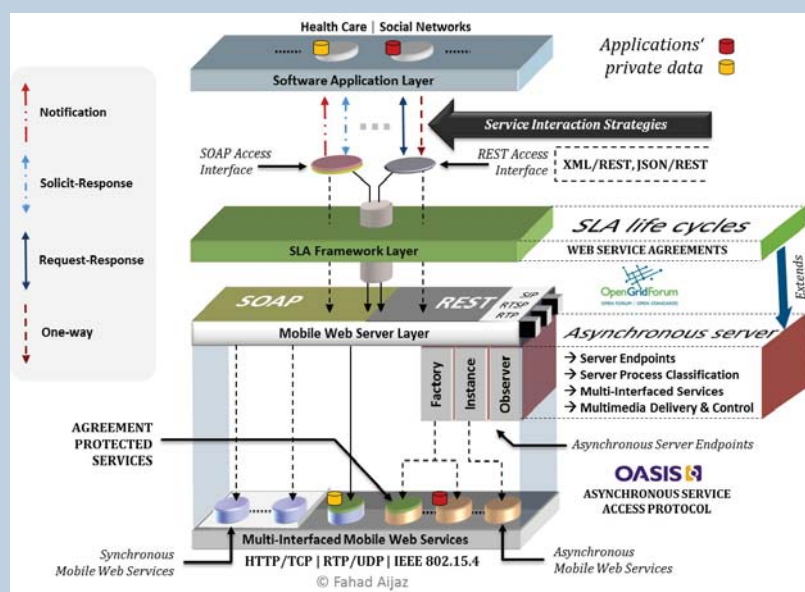
The two remarkable phenomena of engineering, the internet and the mobility, have merged today into an independent ecosystem that is known as the mobile internet. Now, this ecosystem is driving rapidly its integration with the service-oriented paradigm that aims to deliver a plethora of content-rich and interactive mobile internet services to terminals, which typically are end user mobile devices, such as smart phones, tablets or laptops. As a result, the contribution of these devices to the internet traffic has seen a tremendous rise, which has forced the IT and Telecommunication experts to envisage an era beyond the existent. An era of ubiquitously connected daily life objects that are able to consume and provide mobile Internet services to one another. Today, this is known as the era of Machine-to-Machine (M2M) communication, the so-called Internet of Things (IoT).

This research presents a novel concept and prototypical implementa-

tion of a Mobile Server Platform (MSP) to address various emerging gaps in the M2M domain. The MSP provides a set of strategically connected layers of architectures to enable the offerings of mobile internet services through M2M terminals. These layers are mainly categorized into Mobile Web Server layer, SLA Framework layer and Software Application layer.

Fahad Aijaz completed his dissertation in the context of a UMIC

cooperation on mobile web services between the Communication Networks group (Prof. Dr. Bernhard Walke) and the Information Systems group (Prof. Dr. Matthias Jarke). Its demonstrator application on privacy-preserving mobile community services, in which there is no need for a central storage of personal data, achieved 4th place in a worldwide competition for innovative mobile applications conducted by Ericsson in 2009.



PhD News

Generic Modeling and Mapping Languages for Model Management

David Kensche, i5

Activities in management of schemas and schema mappings are usually solved by special purpose solutions such as coding wrapper components or manually updating view definitions. The goal of model management is to raise the level of abstraction for metadata intensive activities by providing a set of high-level operators that automate or semi automate such tasks. The problems of model management are aggravated by the fact that usually heterogeneous modeling languages, such as the relational data model, XML Schema, or ontologies, are employed within the same organization. Therefore, model management aims at genericness by devising operations that are agnostic about the underlying native metamodels. Current solutions fail to be generic as they are restricted

to certain combinations of modeling languages. Therefore, a generic solution for model management problems requires generic languages for modeling and mapping specification as well as algorithms operating on such generic representations. This work solves some of the problems in generic model management. In particular, the work makes the following contributions: 1. A generic metamodel that allows the detailed representation of schemas imported from various native languages. This is required, for instance, by schema matching algorithms which use the knowledge about schemas to produce a mapping between them. 2. The semantics of our generic metamodel serves as the foundation for a formal and generic schema mapping language which allows data exchange and query rewriting between schemas in different modeling languages. Unlike other languages, our mapping language at the same time supports powerful

restructuring of data and is closed under composition. 3. Our solutions for schema matching, mapping composition and other model management operations have been integrated into a holistic generic model management prototype system. 4. Our schema mapping language has been used to develop an object-relational mapping tool and a federated data management system that is agnostic about the native metamodels employed by its data sources.

This dissertation was completed in the context of a UMIC cooperation with the Technion in Haifa, Israel, and was supervised by Prof. Matthias Jarke (UMIC Information Systems Group) and Prof. Avigdor Gal, Technion. It received the 2010 Friedrich Wilhelm Award for the best dissertation within the Faculty of Mathematics, Informatics, and Natural Sciences, which comprises 170 professorships.

PhD News

Anytime Algorithms for Stream Data Mining

Philipp Kranen, i9

The UMIC dissertation "Anytime Algorithms for Stream Data Mining" by Philipp Kranen summarizes the results from the UMIC project "Mobile Stream Data Mining". The presented research focuses on anytime algorithms for supervised and unsupervised learning in data stream scenarios. Anytime algorithms constitute a special type of algorithm that is well suited to work on data streams. They inherit their name from their ability to provide a result after any amount of processing time. The amount of time available is not known to the algorithm in advance: anytime algorithms quickly compute an initial result and strive to improve it as long as time remains. When interrupted they deliver the best result obtained until

that point in time.

In his thesis Philipp Kranen develops new algorithmic solutions for anytime classification and proposes the first algorithm for anytime stream clustering. In addition to the algorithmic contributions, new meta-approaches are described that significantly widen the area of applications for anytime algorithms. During the thesis the MOA framework for stream data mining was developed in cooperation between i9 and the University of Waikato in New Zealand. MOA has been presented at top international conferences including IEEE ICDM and ECML PKDD and is used for evaluation in publications of third parties. Recent MOA related publications by i9 include a full research paper at the ACM SIGKDD 2011 conference and a workshop paper at SensorKDD 2011.



ICE Receives Best Paper Award at SoC Symposium 2011

The authors from the ICE Institute of RWTH Aachen University (Weihua Sheng, Stefan Schürmans, Maximilian Odendahl, Rainer Leupers and Gerd Ascheid) received the best paper award of the International Symposium on System-on-Chip (SoC), held in Tampere, Finland, October 31 to November 2 2011. The paper entitled "Automatic Calibration of Streaming Applications for Software Mapping Exploration" was recognized for its contributions in the area of fast and accurate virtual

prototyping for multicore software development. Nowadays, software engineers face a huge challenge to map the parallelized applications to multi-core platforms efficiently. The paper introduces a tool-flow to create fast multicore virtual prototypes supporting fully functional execution of software with good timing accuracy. Supported by the UMIC Research Centre of RWTH Aachen University, the work presented has been developed in the context of MAPS (MPSoC Applica-



tion Programming Studio), which is a long-term R&D investment by ICE to enable programming of real-life complex MPSoC platforms.

ECML PKDD 2011 Best Paper Award in Data Mining

Stephan Günemann, Brigitte Boden, and Thomas Seidl received the ECML PKDD 2011 Best Paper Award in Data Mining for their paper "DB-CSC: A density-based approach for subspace clustering in graphs with feature vectors" presented at the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD 2011), held September 5-9, 2011 in Athens, Greece. UMIC members Stephan Günemann and Brigitte Boden are Ph.D. students of the Data Management and Data Exploration group headed by Prof.

Thomas Seidl. Their work describes a novel integrated clustering technique that simultaneously analyses network data and attribute data. Such combined data sources are widely available in today's applications including sensor networks, gene expression data, or social networks. To realize the full potential for knowledge extraction, their novel clustering model joins the paradigms of subspace clustering and dense subgraph mining, i.e. the identified clusters are similar in subsets of their attributes as well as densely connected within the network. Introducing the novel notion



of local densities, this model is the first approach exploiting the advantages of density-based clustering in the domains of network and attribute clustering.

Best Technical Presentation at the ACM WiNTECH 2011

Milan Zivkovic, Johannes Schmitz and Rudolf Mathar from the Institute for Theoretical Information Technology (TI) have been awarded the Best Technical Presentation at the WINCOOL Best Demo Competition associated with the Sixth ACM International Workshop on Wireless Network Testbeds, Experimental Evaluation and Characterization

(WiNTECH) co-located with Mobicom 2011 in Las Vegas, USA. The demonstration entitled "Acquisition and Identification of OFDM Signals using Cyclostationary Signatures" was recognized as an operational prototype for effective synchronization and signal classification in cognitive radio systems.



Best Student Paper Award at the IEEE Conference PIMRC 2011

The paper "Joint BS Selection and Subcarrier Assignment for Multicell Heterogeneous OFDM Unicasting"

by Chunhui Liu, Peng Wang, Anke Schmeink and Rudolf Mathar won the Best Student Paper Award at

the IEEE conference PIMRC 2011 in Toronto.

Aachen Concurrency and Dependability Week 2011

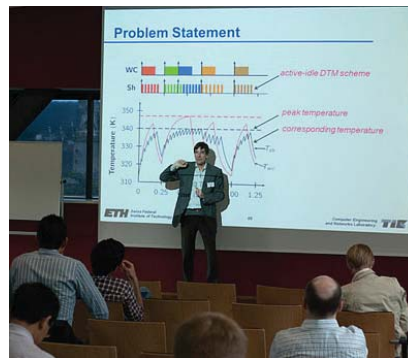


From September 5-10, 2011 the Software Modeling and Verification Chair organized the international "Aachen Concurrency and Dependability Week 2011". It consisted of three conferences: CONCUR, the major conference on concurrency theory, i.e., the theory of multi-threaded programs and systems; QEST, a leading conference on the quantitative modeling and analysis of computer systems, and TGC, an international symposium on trustworthy global computing. In addition, ACDW'11 hosted 9 workshops and 6 tutorials held by experts in the field. Some of the renowned invited speakers at the conference were: Rachid Guerraoui (EPF Lausanne, CH), a.o. former recipient of the Dijkstra prize on distributed computing who held a nice talk about a generalization of one of Lamport's results in the seventies.

Wil van der Aalst (Eindhoven University of Technology, NL), expert on workflow management, process mining and business process management; he is the Dutch computer

scientist with the highest H-index (80). His talk was about recent developments in process mining.

Parosh Abdulla (Uppsala University, S), a world expert on theoretical computer science such as Petri net theory and infinite models who won more than 7 best paper awards at top conferences. He gave a splendid talk on the verification of infinite probabilistic models.



Lothar Thiele (ETH Zurich, CH), expert on embedded systems and software, and a.o. member of the Academia Europaea since 2010. His invited talk on temperature-aware scheduling was very inspiring!

Best paper awards were received by Luca Bortolussi (University of Trieste, Italy) for his paper on "Hybrid Limits of Continuous Time Markov Chains" and Joel Ouaknine, Hristina Palikareva, Bill Roscoe and James Worrell (all Oxford University, UK) for their paper on "Static

Livelock Analysis in CSP".

The ACDW was held in the SuperC building of RWTH Aachen University and attracted 300 participants from all around the world. Sponsors include the German Research Council (DFG), IVU Traffic, EMIC Microsoft, and the UMIC Excellence Cluster. The social program con-



sisted of a reception in the historic Ballsaal in Aachen, and a guided tour, a boat trip and a banquet (on the boat) in Maastricht, The Netherlands. The boat trip on the river Maas passed Belgium after going through a lock that masters a height difference of 15 meters. The ability to visit 3 countries in (less than) a single day excited many of the attendees.

To conclude, ACDW 2011 was a great success both scientifically as well as socially. More information, including slides, programs and so forth can be found at: <http://concur2011.rwth-aachen.de>.

Joost-Pieter Katoen, General Chair, ACDW 2011 (i2)

UMIC Guest Researcher Prof. Michael Houle from NII Japan



In September 2011 Prof. Michael Houle from the National Institute of Informatics in Tokyo visited RWTH Aachen as a UMIC guest researcher. The group of Prof. Dr. Thomas Seidl at i9 has been in close contact with Prof. Houle over the past time, including cooperatively supervised

master thesis between NII and RWTH, an invited talk at NII given by UMIC member Philipp Kranen as well as an invited talk by Prof. Michael Houle at a UMIC organized workshop at the European Conference on Machine Learning. During the stay we strengthened the cooperation with Prof. Houle and the NII and worked on cooperative research projects. A highlight was the UMIC guest lecture given by Prof. Houle on "Intrinsic Dimensionality

and its Applications to Databases and Data Mining", including results from his recent 2010 Best Paper at the IEEE International Conference on Data Mining. The lecture was attended by UMIC researchers from various groups and raised interest as well as novel use cases for his work on intrinsic dimensional analysis.

Philipp Kranen, Thomas Seidl, i9

International ITG Workshop on Smart Antennas 2011 (WSA)

The International Workshop on Smart Antennas was held on February 24 and 25, 2011 on the 6th floor of the SuperC building. It was organized by the Institute of High Frequency Technology IHF at the RWTH Aachen University. Over 40 participants from Asia and Europe presented during eight oral and two poster sessions their recent research. The main topics were antenna arrays and beamforming, MIMO algorithms, Cognitive Radio, multi-user channel capacity and radar signal processing. The increasing demand of mobile high data rate coverage can only be satisfied by the means of smart spectrum usage, multi antenna systems with spatial diversity and base station cooperation to minimise interference. During the coffee breaks between the oral presentations, the professional audience studied the posters displayed in the second conference room. The most important industrial manufacturers of measurement equipment in the high frequency range showed their newest network and spectrum analysers or software tools for the simulation of RF problems. Among the participants, technical discussions could be heard

proving the workshop character of the event. During the social event in the Ratskeller of Aachen's town hall, personal contacts were started and extended. Three industrial application talks delivered insight into ongoing investigations on compact quad band base stations antennas, smart relay nodes for data coverage in urban areas joined by fast

and cheap LTE and 802.11n MIMO Over-the-Air tests using reverberation chambers.

The next Workshop on Smart Antennas will be held in 2012 in Dresden. The papers of the conference are available via the IEEE Xplore platform.

Ralf Wilke, IHF



Informatik 5 (Information Systems) is selected to be provided with 6 Android phones by Google

Based on the teaching experiences of the lab course "mobile cloud computing" as well as development experiences, Informatik 5 (Information Systems, Prof. Jarke) has submitted a device grant proposal to Google's 2011 EMEA AndroidEDU program. Now the steering committee members have made their decisions to grant this proposal based on a fine selection from over 130 proposals from universities across Europe, the Middle East, North Af-

rica and Sub-Saharan Africa. By the end of this year, Informatik 5 will receive 6 Samsung Galaxy S plus phones to distribute to students and faculty researchers for their teaching and research purposes. Dejan Kovachev and Ralf Klamma who have worked on the proposal look forward to sharing ideas and experiences in Android mobile development within UMIC Excellence Cluster.

Google EMEA programs aim to connect Google Engineering with students and academics, ensuring that new and existing opportunities for collaboration are recognized, supported and grown.

Yiwei Cao, i5

DySPAN 2011 in Aachen

This year Aachen hosted the fifth IEEE Symposium on New Frontiers in Dynamic Spectrum Access Networks (DySPAN'11) from May 3 - 6. DySPAN is



the leading international conference dedicated to cutting-edge wireless technologies with a main focus on cognitive radio and dynamic spectrum access. More than two hundred international experts including academics, industry representatives and regulators gathered in Aachen to address the challenges of bringing cognitive radio and DSA technologies and policies forward and ensure faster delivery of these exciting technologies on the market.

On May 3, IEEE DySPAN featured a full day of tutorials including topics such as "Cognitive Wireless Networking with WARP," "Advanced Antennas for Cognitive Radio: New Foundations for Transformational System Design", "Dynamic Spectrum Access Related Standards", "Dynamic Spectrum Markets" and "Non-Contiguous Multicarrier Transmission for Spectrally Opportunistic Wireless Access: Design Decisions And Trade-Offs". The following day, after the official opening speech by the general co-chair Prof. Petri

Mähönen, the conference proceeded with the main program, which included morning keynote talks by a number of renown international DSA policy and research experts followed by technical and policy track sessions in the afternoon. The audience had the pleasure to hear seven excellent keynote speeches in three days. Reiner Liebler, the head of Division for Technical Regulations and EMC in the German Federal Network Agency (BNetzA), spoke about how the "Cornerstones of a Forward- Looking Regulatory Framework" should be designed to "foster investment and innovation", in addition to strengthening competition. David Cleevely, chairman for Cambridge Radio Frequency Services (CRFS) in the United Kingdom, and Douglas Sicker, chief technology officer for the United States Federal Communications



Commission (FCC), then followed with their respective thoughts on "Radio Spectrum and Innovation: Realizing the Potential" and "Dynamic Spectrum Access Policy in

the U.S."

On Thursday, Pearse O'Donohue, who is responsible for the development and implementation of efficient spectrum use policies as the head of the Radio Spectrum Policy Unit for the European Commission, began the morning with his keynote on "An EU Policy: Framework for Shared Use of Spectrum" and a brief introduction of the EU's coordinated approach to frequency management. Afterwards, Jon Peha, the former assistant director of the White House Office of Science and Technology Policy, offered attendees his insights into "Emerging U.S. Spectrum Policy and the Road to Innovation". Two other highlights of the day were the regulator's panel on "Regulatory Perspectives on Next Generation Radio Systems" and the demonstration & poster session. The panelists discussed the architectural issues necessary for enabling next generation databases, sensing techniques and TV white spaces applications and agreed on the need for interoperable networks through cooperation of standardization organization, industry and regulators.

During the demonstration & poster Session, students and researchers presented 10 working demos and 15 work in progress posters. The demonstration entitled "Constructing Radio Environment Maps with Heterogeneous Spectrum Sensors, by the consortium of the EU funded project FARAMIR got the Best Demonstration Award. Additionally Xi Zhang, Junaid Ansari, Petri Mähönen and Guangwei Yang of RWTH Aachen University received the Best Runner Up for the demonstration named TRUMP: Efficient Realization of PHY/MAC Protocols for Cognitive Radio Networks.

In the evening, attendees enjoyed the conference's annual banquet, which was held in the historic Aachen City Hall.

The last day of IEEE DySPAN 2011





had also a full agenda of keynotes, two panels, and technical and policy sessions. Krishan Sabnani, vice president of Networking Research at Bell Labs, began the day with his keynote titled "Spectrum and Infrastructure Virtualization for Next-Gen Cellular Networks". The last keynote was Victor Bahl, the principal researcher and director at Microsoft Research's Mobile Computing Research Center with his own expert insights into "The Promises and Challenges of the Wireless Frontier – from 600 MHz to 60 GHz" and the development of the Microsoft urban white space network.

The remaining of the morning featured two exciting panels on "Perspectives on Cognitive Radio: The Past and Next 10 Years" and "Business Perspectives on Dynamic Spectrum Access." During each session, industry and academic experts from leading research in-

stitutions and telecommunications companies worldwide provided their professional opinions for reducing wireless network management costs, increasing the useful content of transmissions and sharing spectrum in new cooperative ways. The business perspectives panel was

also particularly exciting due to the lively responses of the representatives from Ericsson, France Telecom, Toshiba, and Kolodzy Consulting and the excellent moderation of the panel chair Pierre de Vries from Silicon Flatirons Center.

After four days of intensive discussions on the current and future trends in cognitive radio and DSA technologies, networking with peers from industry and academia and exciting social events in the beautiful historic city of Aachen, the conference participants left Aachen in good spirits and hope to meet again next year in Bellevue, Washington, where the sixth IEEE DySPAN conference will take place. For more information on the DySPAN 2012 please visit www.ieee-dyspan.org.

Marina Petrova, iNETS



i5 presents research results at CoCarX final event in Düsseldorf

On May 25 the closing event of the Cooperative Cars eXtended (Co-CarX) project took place at the Vodafone Test and Innovation Center in Düsseldorf. The CoCarX project was the successor of the Cooperative Cars project (2007-2009). All project partners, including Ericsson, Vodafone, Ford, BaSt, and BMW, presented their work and the results

achieved in the project in presentations, posters and demonstrators.

Sandra Geisler, Christoph Quix, and Sven Weber from i5 showed results of their research on a data stream management framework for C2X applications by a traffic state estimation live demonstrator and a video about queue-end detection.



The Eighth International Symposium on Wireless Communication Systems - ISWCS 2011

The aim of the International Symposium of Wireless Communication Systems (ISWCS) is to present novel contributions in the form of tutorials, panel discussions, keynote speeches, technical papers, posters and prototypical implementations. ISWCS seeks to address and capture highly innovative and state-of-the-art research from academia, the wireless industry and standardization bodies. In 2011, the eighth symposium took place in Aachen, organized by the Institute for Theoretical Information Technology. Past conferences convened in Mauritius, Italy, Spain, Norway, Iceland and the United Kingdom. Next year's conference will take place in Paris.

With 250 participants from all over the world the conference was a full success. Rudolf Mathar from RWTH Aachen University served as the general chair, Gerhard Kramer (TU Munich) and Kwang-Cheng Chen (National Taiwan University) were the technical program chairs. Leading experts from academia and industry accepted our invitation for keynote speeches: Helmut Bölcskei (ETH Zurich), Hartmut Kretling (CTO Vodafone Europe), Wolfgang Dahmen (RWTH Aachen),



Bruce Hajek (University of Illinois, Urbana-Champaign) and Vincent Poor (Princeton University). Excellent tutorials were offered on "Base Station Cooperation" by Stephen Hanly (National University of Singapore), on "Polar Codes" by Emmanuel Abbe (EPFL, Lausanne), and on "The 3GPP LTE Relaying Solution" by Christian Hoymann (Ericsson Germany). The technical program comprised 130 oral and 53 poster presentations. We have also encouraged young researchers to contribute to the symposium and have received quite a number of high quality international student papers. All papers will be available in IEEE Xplore soon.

The social program included an informal meeting in the Aula Carolina on Monday evening. It was great to talk to numerous participants and get to know their specific view on the

area of wireless communications. On Tuesday evening the conference banquet took place in the coronation hall of the historic Aachen city hall. People were impressed by the awesome environment and the special flavor conveyed by this venue.

A special "thank you" goes to our technical sponsors for their invaluable support: IEEE ComSoc, IEEE ITSoc, IEEE VTS, VDE and ITG, the excellence cluster UMIC and the research project HumTec at RWTH Aachen University, and last but not least Ericsson and DSPECIALISTS.

In summary, we organized a successful convention with much positive feedback from the attendees. Technical assistance by the WZL forum was flawless. They organized registration and assistance to participants in a perfect manner. Warmest thanks go to UMIC for providing generous financial and organizational support and for contributing excellent scientific papers.

www.ti.rwth-aachen.de/iswcs2011

Rudolf Mathar, TI



Prof. Dr. Rudolf Mathar was elected member of the North-Rhine Westphalia Academy for Sciences and Arts



Prof. Dr. Rudolf Mathar, principal investigator and member of the steering committee of UMIC, was elected member of the North-Rhine Westphalia Academy for Sciences and Arts in March 2011.

Rudolf Mathar is chair of the Institute for Theoretical Information Technology and dean of the Faculty of Electrical Engineering and Information Technology. He studied mathemat-

ics at RWTH Aachen University and finished his Ph.D. in 1981. Previous positions include lecturer at the European Business School and the University of Augsburg.

Rudolf Mathar was visiting professor at the University of Melbourne, Australia, Christchurch, New Zealand, furthermore Bangkok and Brussels.



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