

# CCSR Newsletter

Centre for Communication Systems Research Newsletter

## Welcome

The Centre for Communication System Research would like to welcome you to the first edition of the research newsletter. Inside you will find articles about the activities and research we have been undertaking in the last few months.

We hope you enjoy our first edition.

Professor Barry Evans



## Mobile VCE Elective Project "Fundamental Capacity Limits for Wireless Networks"

The signal theoretic analysis of Wireless systems is key to determining key bounds and advising Wireless operators as to the benefits of making changes to their networks.

This project has produced really interesting outputs and has received very positive response and feedback from the industrial sponsors. The first phase of the project is near its end and the work plan for the next phase has been finalised. Several publications are under review and at least one paper will appear in IEEE Transactions on Communications. Three conference papers have also been accepted and will be presented at international conferences in Greece and Russia and the four PhD students working on this project

successfully passed their MPhil to PhD transfer examination last October. An International Workshop sponsored by Mobile VCE and the industrial sponsors of the elective on April 10, 2008 took place at CCSR. Renowned academics from USA, Germany, Turkey and UK were presented perspective on the scope of the project and its current direction. Panel discussions among the academic guests, the industrial sponsors and the project team provided a positive input for improving the quality of the work on the project.

Imran Majid

## Sound Source Separation to Improve Communication

The researchers in I-Lab Multimedia and DSP Group in CCSR has developed a new system that separates simultaneously active sound sources in real-time. This technology provides interference-free versions of all the sounds present in an environment enabling the users to listen to only a desired sound source, or eliminate undesired noise and interferences.

The system provides high signal-to-noise ratio improvement in real-time even in highly reverberant environments (enclosed spaces). Thanks to its unique algorithm, only a compact microphone array is required, providing additional flexibility for a variety of applications, including surveillance, mobile phones and hearing-aid devices.

This system is expected to be utilised on CCTV cameras for automatically aiming the camera at a sound source, such as a person shouting for help or posing a threat, in a noisy environment. Conversations on mobile phones can also be improved as the noise or other speakers in the background can be eliminated before transmission. Hearing-aid users can also receive great benefit from this system.

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# Final Audits of FP6 Projects and New FP7 Projects



In early March a number of our FP6 projects went through their concluding technical evaluations and passed. This included eSense, E2R 2, WINNER 2, Ambient Networks 2 and e-Mobility. Other FP6 projects that were evaluated included UNITE (CCSR is project leader) and SPICE.

## IKick-Off New FP7 Projects

In December 2007, the first projects of the 7th European Research Framework were kicked off. The mobile group is involved in projects, ranging from the Strategic Support Action e-Mobility, via a range of targeted research projects, including **M:Ciudad**, **Fireworks**, **WHERE**, to the large scale integrated projects **E3**, **SENSEI**, **4WARD**.

**M:Ciudad** was started on December 1st in Bilbao, Spain. The project is lead by Robotiker, with 8 partners complementing the consortium. The project aims at investigating the means and developing the mechanisms for user-friendly creation tools in the mobile, optimised execution environment. This includes definition of a model for a "knowledge warehouse", a specific search engine for micro-service offerings and investigations into possible business models for users, for service providers and for third parties. The mobile group is mainly involved in the research on mobile service support and service execution.

### E<sup>3</sup> – End-to-End Efficiency

This project can be seen as an evolution of E2R, while E2R was mainly dealing with reconfigurability architectures and dynamic spectrum allocation, E3 exploits the results of E2R by applying cognitive radio and autonomous communication principles on user devices as well as access and core network.

The consortium consists of 21 partners, including the Chinese BUPT. E3 aims to converge cognitive radios and cognitive networks from technical, business, regulatory and standardisation perspectives. The business models research will permit selection of the most relevant concepts and solutions ensuring development and future deployment of sustainable cognitive radio systems. The regulatory research will further and support the adoption of E3 concepts and solutions in the world radio regions. This research will also help the evolution of the regulatory framework to cope with the future development of more flexible spectrum usage that will only be possible if suitable solutions for managing and controlling complex heterogeneous systems are in place. E3 will build on the IST E2R research results on reconfigurable equipment extending the corresponding concepts towards the design of a wireless cognitive radio system in which network entities will be able to self-adapt to a dynamically changing context. The focus will furthermore be on the evolution of wireless systems in an evolutionary, non-disruptive way, by integrating existing wireless radio standards into a common framework with user devices be able to reconfigure and maintain one or multiple links simultaneously, and contributing to currently active/emerging standardisation bodies

with a focus on key convergence enablers. In particular, ongoing standardisation on IMT-Advanced related radio and cognitive systems are targeted, with contributions enabling the convergence towards a future harmonised and interoperable wireless landscape. E3 will devise structuring rules for the definition and design of next generation of various standards allowing a seamless use of these standards to fulfil the scenarios of the current definitions of 4G systems at lower cost and complexity, and for a better spectrum efficiency (plug and play "lego blocks" for standards).

**4WARD** is the major European initiative to investigate principles of the future Internet. This project has gathered a strong, industry-led consortium of the leading operators, vendors, SMEs, and research organisations, with the determination, skills, and critical mass from Europe, and some internationally know institutions from the United States and Canada.

The first phase of the project started in January 2008 and will run for the duration of 24 months.

4WARD aims to increase the competitiveness of the European networking industry and to improve the quality of life for European citizens by creating a family of dependable and interoperable networks providing direct and ubiquitous access to information. These future wireless and wireline networks will be designed to be readily adaptable to current and future needs, at acceptable cost. 4WARD's goal is to make the development of networks and networked applications faster and easier, leading to both more advanced and more affordable communication services.

## New FP7 Projects - Where and SENSEI



WHERE's objective is to combine wireless communications and navigation for the benefit of future mobile radio systems. The impact will be manifold, such as real time localization knowledge in B3G/4G systems which increase the cellular capacity. GPS as well as the upcoming European Satellite Navigation System Galileo will be supplemented with techniques that improve accuracy and availability of indoor navigation and location based service coverage.

To enable ubiquitous mobile network access and to increase data rates, scientific and technological development is becoming more focused on the integration of radio access networks (RANs). This allows an efficient use, even if the radio access technology behind such networks is dynamically changing. The knowledge of the position of mobile terminals is for an efficient usage of RANs valuable information in order to allocate resources or even to predict the allocation within a heterogeneous RAN infrastructure. The WHERE consortium consists of 14 partners, including two non-EU partners: University of Alberta (Canada) and City University of Hong Kong (China). CCSR is one of the primary players in this project.

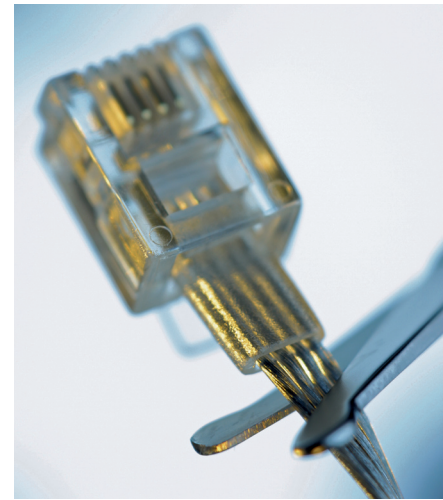
SENSEI is the largest (15MEuros) Integrated Project currently funded in ICT Challenge 1 Network of the Future. The project is focused at researching and developing the real world dimension of the Future

Internet. To realise the vision of Ambient Intelligence in a future network and service environment, heterogeneous wireless sensor and actuator networks (WS&AN) have to be integrated into a common framework of global scale and made available to services and applications via universal service interfaces. The aim is to create an open, business driven architecture that fundamentally addresses the scalability problems for a large number of globally distributed WS&A devices. Anticipated outcomes of SENSEI include: 1) A highly scalable architectural framework with corresponding protocol solutions that enable easy plug and play integration of a large number of globally distributed WS&AN into a global system. 2) An open service interface and corresponding semantic specification to unify the access to context information and actuation services offered by the system for services and applications. 3) Efficient WS&AN island solutions consisting of a set of cross-optimised and energy aware protocol stacks including an ultra low power multi-mode transceiver targeting 5nJ/bit. 4) Pan European test platform, enabling large scale experimental evaluation of the SENSEI results and execution of field trials.

CCSR is one of the major players in SENSEI, Mirko Presser is the project's technical manager and is actively involved in increasing CCSR's visibility. SENSEI is, so far, the largest European project for CCSR with 10 students and RAs contributing to SENSEI.



## ROCKET



The project aims at providing a ubiquitous wireless solution to reach bit rates higher than 100Mbps with peak throughputs higher than 1Gbps, based on **Reconfigurable OFDMA Cooperative Networks** enabled by agile spectrum use (ROCKET). While increasing peak rates is a natural must-do for new standards, providing homogeneous high rate coverage is equally important as it guarantees a constant user experience over the whole served area and is the key enabler to a higher average spectral efficiency of the system. Rocket aims to achieve this goal by devising methods for improved spectrum usage, advanced multi-user cooperative transmission and ultra-efficient MAC design. Providing inputs to standardization bodies, generating IPR and conceiving architectures for some of the algorithms on a hardware platform are the ways the project plans to have actual impact. CCSR is one of the important players in ROCKET and is involved mainly in three technical work packages: Enlarged System Bandwidth, Advanced Cooperative Transmission Techniques, and Multi-cell coordination for advanced interference management. The CCSR team in ROCKET are Reza Hoshyar, Shyamalie Thilakawardana, Fabien Heliot, and Yinan Qi.

## Rohde & Schwarz UK enter agreement with CCSR

Rohde & Schwarz UK Ltd. has supplied test equipment to CCSR for many years and is sponsoring a new satellite communications research lab, after welcoming CCSR into its UK University Partnership scheme. The collaboration came about when CCSR chose Rohde & Schwarz test and measurement equipment for a satellite network test bed being created in a new lab. Rohde & Schwarz UK has supplied key elements of the test bed, including a R&S DVM400 digital video measurement system, an R&S SFU broadcast test system, and a portable R&S EFL100 that will be used to assess satellite service delivery,

with a focus on satellite digital video broadcasting (DVB-S/S2).

Through the University Partnership scheme, Rohde & Schwarz UK will provide further educational support via e-learning material, seminars, and input as a Steering Committee member into the University's MSc in Satellite Communications. Rohde & Schwarz UK will also award an annual prize for an appropriate MSc project and provide application support to students via Rohde & Schwarz HQ in Munich. Rohde & Schwarz UK's University Programme Manager, Phil McCluskey's comments "CCSR has an impressive track record in satellite



communications research and Rohde & Schwarz UK looks forward to supporting future efforts."

## Enterprise Activities

### Patent applications:

Suparna De (PhD student working with Klaus Moessner) has recently got MVCE approval for the filing of a patent application on "Ontology merging", this has been filed with the US patent office under the official title: "Method and apparatus for producing an ontology representing devices and services currently available to a device within a pervasive computing environment", reference 12/062,794. Getting MVCE approval for this filing shows the industrial relevance and applicability of our long term research, it is particularly hard to get approval for purely software based patent applications.

Benga Awoseyila (PhD student working with Christos Kasparis and Barry Evans) has recently filed a patent via the University on an improved method of frame/symbol timing and carrier frequency synchronisation for OFDM signals transmitted over frequency-selective wireless channels.

We have been working with CAMATRI Ltd to exploit some of the CCSR patents and currently there is growing interest in several of the patents.

## CCSR Seminar programme

CCSR has recently seen some well received seminars such as presentations from Prof Mike Short of O2, Dr Charith Abhayaratne of the University of Sheffield and Trevor Gill from Vodafone. Seminars will begin again from September 2008. Dates, topics and times will be announced in the Autumn newsletter and on our website; [www.ee.surrey.ac.uk/CCSR](http://www.ee.surrey.ac.uk/CCSR)



University of Surrey  
Guildford  
Surrey, GU2 7HX, UK  
[www.ee.surrey.ac.uk/ccsr](http://www.ee.surrey.ac.uk/ccsr)