



# FET

## through the keyhole

Future and Emerging Technologies in Europe  
July 2011



European Commission  
Information Society and Media

*“You see things; and you say, 'Why?'  
But I dream things that never were; and I say, 'Why not?'” ~George Bernard Shaw*

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### Welcome

Welcome to the July 2011 edition of *FET through the keyhole*. In this edition, we would like to highlight our fet<sup>11</sup> conference, the launch of the FET Flagship pilots, the launch of the FET-House, a brand new web site targeted at future young scientists, as well as upcoming funding opportunities for the proactive and open schemes.

We wish you pleasant reading and a nice summer break!

*The FET Team*

### **fet<sup>11</sup> – the European Future Technologies Conference & Exhibition in Budapest 4-6 May 2011**

What do a neuroscientist, an expert on robot societies, a quantum physicist and researcher on graphene have in common? In early May they met in Budapest

at the fet<sup>11</sup> conference and went away with a bunch of new contacts, new ideas and a lot of inspiring experiences. Like FET09 - the first FET conference held in Prague in 2009 - fet<sup>11</sup> showed the reach and breadth of research funded by FET. There is currently no other forum in Europe that goes as far in facilitating cross-disciplinary dialogue on frontier research related to information technologies.



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Commissioner Kroes opened the conference and officially launched the six FET flagship pilots that will prepare the scientific research programme, the organisational and financial implementation plan and scientific rationale for each initiative, from which two flagships will be selected for funding in 2013. Mrs Kroes also launched a brand new FET web site for future young scientists, the FET House, and had particularly warm words to say about FET's Young Explorers and High-tech Research Intensive SME schemes. Following the opening, a panel discussed how best to fund research and multidisciplinary science. It concluded that both an open way leaving space for new ideas as well as a targeted mission-oriented approach to create critical mass in selected areas are pertinent.

With more than 1000 registered participants, fet<sup>11</sup> managed to bridge across a variety of disciplines and to further the dialogue between science, policy, and society: it included seven keynote speeches, 30 scientific sessions and a lively science café that featured fascinating discussions of established scientists with young researchers. Furthermore, 30 booths demonstrated in a top-notch, hands-on exhibition some of the most interesting achievements in the realm of FET research.

Grasp the fet<sup>11</sup> spirit and watch the plenary sessions at:

[http://videotorium.hu/en/events/details/390.The\\_European\\_Future\\_Technologies\\_Conference\\_and\\_Exhibition?order=recordedtime&direction=&start=0](http://videotorium.hu/en/events/details/390.The_European_Future_Technologies_Conference_and_Exhibition?order=recordedtime&direction=&start=0).

A lot of press attention was given to FET over the three days of the conference, both from TV and the written press. Press coverage focussed on the launch of the flagship pilots and the technologies on show in the exhibition hall.

And now? We all look forward to fet<sup>13</sup>.

## Awards

### First Prize, Best Exhibit

Anna Mura et al for  
"The future of biomimetic machines":  
<http://www.fet11.eu/programme-and-exhibition/exhibition?task=exhibit&id=50>.

### First Prize, Best Poster

Bastian Degener et al. for  
"Building simple formations in large societies in tiny mobile artifacts."  
[http://www.fet11.eu/images/final\\_posters/121\\_final\\_poster.pdf](http://www.fet11.eu/images/final_posters/121_final_poster.pdf)

### Find out more about other winners

<http://www.fet11.eu/awards>

fet<sup>11</sup> home page:  
<http://www.fet11.eu>

fet<sup>11</sup> in the media:  
<http://www.fet11.eu/media/media-coverage>

BBC "Click" featuring fet<sup>11</sup>  
[http://news.bbc.co.uk/2/hi/programmes/click\\_online/9491296.stm](http://news.bbc.co.uk/2/hi/programmes/click_online/9491296.stm)

## FET House: Targeting the next generation

Europe has been at the heart of ICT research and innovation - from Gutenberg's printing press right up to GSM mobile phone standards and the World Wide Web. To maintain this level of achievement Europe needs to ensure that it continues to sell ICT science as a career.

In this spirit, FET has just launched a new web site called FET-House, which is designed to provide a friendly and open place for young people to discover what it would mean to work in ICT research: What is ICT research about? What would a career in ICT science look like? What steps should they take to get into this field?

At the FET-House, budding FET scientists can learn first hand from a group of mentors what the fascinating world of ICT science can offer. These mentors share their experience and career stories, and invite the young visitors to ask questions, to post contributions in the forum, and to learn about the breadth of opportunities available. It may even be possible to arrange for real-life visits, to give young people first-hand experience of a lab working on cutting-edge technologies.



From the Movie "Diamond Computers" created by K. Pruvost and J. Nunn, University of Oxford  
Movie: [http://youtu.be/HNklspWqP\\_4](http://youtu.be/HNklspWqP_4)

FET-House shows that ICT research involves more than eating take-away pizza in the corner of the computing lab and walking around with sandals on! ;-) The site displays a broad range of ICT research topics, from zero-power computation and communication, to robotics, quantum technology, understanding the brain and data privacy. Demos, videos and catchy write-ups help to convey the excitement of these technologies and the people working to create them.

With this new web site, FET aims to encourage young people to consider taking the essential first step on to the ICT research career ladder. The FET-House will also be useful for classroom discussions, individual exploration by aspiring students, and for those who like reading real stories about real people who made similar decisions to those they are facing now.

Please give us a hand in promoting the new site by passing the message to school leavers and any other budding young scientists in your networks.

Try it out at <http://cordis.europa.eu/fet-house>

Background information and feedback form for school teachers:  
[http://cordis.europa.eu/fp7/ict/programme/fet-house\\_en.html](http://cordis.europa.eu/fp7/ict/programme/fet-house_en.html)

## **"Zoobotics", a new discipline emerging?**

Well, at least it is the title of a great article published by "The Economist" about latest research results on animal like robots in order to better understand solutions nature found. Some of the work has its home in the FET initiatives on "Bio-ICT convergence" and "Embodied Intelligence".

<http://www.economist.com/node/18925855>  
[http://cordis.europa.eu/fp7/ict/fet-proactive/bioict\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/bioict_en.html)  
[http://cordis.europa.eu/fp7/ict/fet-proactive/embodi\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/embodi_en.html)

## **FET Conferences & Workshops**

### **FET @ Horizon 2020**

As you may know, the current Framework Programme, FP7, runs until 2013. So what is next after that? The name at least has now been decided. Welcome to Horizon 2020, which will run from 2014 until 2020.

Horizon 2020 will of course feature FET again, in fact even more of it. Following the public consultation on the Green Paper the Commission has held a large consultation on this programme and many of you have expressed an opinion supporting FET. In fact 133 out of 788 position papers received referred to the FET scheme, it's added value and a significant number of actors proposed to extending FET to other domains beyond ICT – a big thank to all of you who so actively have participated in this consultation process.

In the mean time we are discussing in various meetings and workshops the specifics of the FET contribution to Horizon 2020 – its role and scope, but also how it should be positioned and what types of projects it should support. For instance a workshop coorganized by FET and RTD with more than 30 participants took place the 29th of June 2011 discussing perspectives of FET within Horizon 2020.

The report will be published soon at:  
[http://cordis.europa.eu/fp7/ict/programme/fet\\_en.html](http://cordis.europa.eu/fp7/ict/programme/fet_en.html)

And of course, we are always interested in your views - so feel free to write to us and let us know how you see the future.

CSFRI/Horizon 2020 home page  
[http://ec.europa.eu/research/horizon2020/index\\_en.cfm](http://ec.europa.eu/research/horizon2020/index_en.cfm)

Consultation results:  
[http://ec.europa.eu/research/horizon2020/pdf/consultation-conference/summary\\_analysis.pdf#view=fit&pagemode=none](http://ec.europa.eu/research/horizon2020/pdf/consultation-conference/summary_analysis.pdf#view=fit&pagemode=none)

## **CapoCaccia Cognitive Neuromorphic Engineering Workshop, Sardinia, Italy**

The exciting and unconventional CapoCaccia Cognitive Neuromorphic Engineering Workshop, took place from 27 April to 14 May 2011 in Sardinia.

The aim of this workshop series is to provide a forum for international EU and non-EU researchers to discuss and explore concepts and methods necessary for advancing neuromorphic systems towards a more cognitive quality of behavior. It is supported by both EC and NSF. More than 200 participants registered to the workshop. Morning sessions held discussions on a specific problem of the day, while afternoons and evenings were focused on projects and tutorials.

Workshop:  
<http://capocaccia.ethz.ch/capo/wiki/2011>  
List of sessions:  
<http://capocaccia.ethz.ch/capo/wiki/2011/Refs>

## **Workshop on Topology in Fluid Flow Visualization, Pisa, Italy**

Visualization approaches are becoming common for studying and understanding flow phenomena. Among the variety of existing visualization techniques, topological methods play an important role because they promise to describe even complex phenomena with a low number of graphical primitives. Researching such methods is the focus of the Sem-Seg project (4D Space-Time Topology for Semantic Flow Segmentation" (FET-Open) which started in 2009.

The goal of this workshop on "Topology in Fluid Flow Visualization" (June 24th, Pisa, Italy) was to bring together experts from Scientific Visualization, Astrophysics, Geophysics, applied Mathematics, Computer Vision, and Computational Fluid Dynamics to share their knowledge and opinions about current problems in topology-based flow analysis and visualization.

At the workshop, a lot of inspiring discussions took place, culminating in a panel discussion on the topic "Topological methods for unsteady flows – how far is the solution?" The workshop concluded that despite significant improvements in recent years, there is still a lot to do.

Info: Holger Theisel (University of Magdeburg)  
[theisel\(AT\)isg.cs.uni-magdeburg.de](mailto:theisel(AT)isg.cs.uni-magdeburg.de)

Workshop:  
[http://www.isg.cs.uni-magdeburg.de/visual/index.php?article\\_id=172&clang=0](http://www.isg.cs.uni-magdeburg.de/visual/index.php?article_id=172&clang=0)



## FET at the ICT proposers' day in Budapest, Hungary

FET was present at the ICT Proposer's Day in Budapest on 19th-20th May 2011. Many hundreds of delegates stopped by to meet FET colleagues and discuss scientific research and future funding opportunities relating to future and emerging technologies.



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Info:

FET-Open: Matteo Mascagni,  
[matteo.mascagni\(AT\)ec.europa.eu](mailto:matteo.mascagni(AT)ec.europa.eu)

FET-Proactive: Julian Ellis,  
[julian.ellis\(AT\)ec.europa.eu](mailto:julian.ellis(AT)ec.europa.eu)

Download the given presentations:

[http://ec.europa.eu/information\\_society/events/cf/bud11/item-display.cfm?id=5422](http://ec.europa.eu/information_society/events/cf/bud11/item-display.cfm?id=5422)

and have a look on the next pages in " FET Funding Opportunities ".

## Privacy: The Beginning or the End? Istanbul, Turkey

As the developments in ICTs improve almost every aspect of our lives and activities, new concerns related to their proliferation are becoming a focal point of passionate debates. One such concern is privacy. It is now easy to collect and store personal/private information through various technological means with or without an individual's consent. Often, people advertently publish personal information without fully considering its consequences. More importantly, one piece of private information, once leaked/published in the cyber-world, may stay there forever.

The issue of privacy is multi-faceted. Concerned parties, from ICT research, to law, sociology, psychology, data protection and law enforcement agencies, regulators and businesses have different views on privacy issues such as the definition of privacy, classification of private information, and approaches to management of privacy.

The two-day conference "Privacy: The Beginning or the End?" (Sabanci University, Istanbul, June 20-21st 2011) was organized by the MODAP project and brought together stakeholders from many areas to discuss these issues. The conference is striving to create a platform, whereby representatives from the aforementioned disciplines and stake holders, can openly voice their concerns while understanding and appreciating others' perspectives. The conference started with the talk by Faruk Eczacıbaşı, president of the Turkish Informatics Foundation. Leading international experts and sector representatives gave talks while organized panel sessions assisted in the exchange of ideas.

Info:

<http://modap2011.modap.org/>

## SBM2011 The Second International Workshop on Social Behavior in Music

Music making and listening are a clear example of human activities that are above all interactive and social. However, today mediated music making and listening is usually still a passive, non-context sensitive, and non-social experience. Current electronic technologies, with their potential for interactivity and communication, have not yet been able to fully support and promote these essential aspects, and new mediated forms of sharing music experience in a social context with local or remote users or as a part of a community are emerging. Novel research challenges are faced and novel disciplines develop, e.g., Social Signal Processing.

Foundational issues including techniques for identifying the leader in a group of users, measuring the cohesion of the group, recognizing and stimulating empathy between the participants, find in music an ideal test-bed for research and for scientific and technological investigation. In this framework, new paradigms for embodied and active experience of music are needed, where multimodal non-verbal communication channels, and in particular movement and gesture, play a central role.

This workshop was co-organised with the SIEMPRE project and focused on the social signals and their features that are most significant for a qualitative and quantitative analysis of social behavior and experience in music. Computational models, algorithms, and techniques for the analysis of social behavior in music, their application in concrete test-beds, their evaluation in experimental set-ups, and their exploitation in future scenarios were discussed.

Info:

<http://www.infomus.org/siempre/>

## International workshop announcement

### From Young Researchers to Future Discoveries 19-21 September 2011, Hotel "Azure Sea", Kiten, Bulgaria

This workshop is planned as a meeting of young researchers from various fields, giving them the opportunity to exchange challenging interdisciplinary ideas. The event is inspired by the recent advances of Information and Communication Technologies (ICT) in computational scenarios concerning various natural sciences and the dedicated support focused on Future and Emerging Technologies (FET) in ICT. It is organised under the auspices of the Bulgarian Academy of Sciences.

The workshop invites 50-60 young researchers who are willing to share innovative ideas in their respective domains. The participants will be selected based on submitted informal "motivation letters" – abstracts containing short descriptions of novel views in some domain.

Info:

<http://www.iict.bas.bg/young-2011/>

## FET Flagships



Six FET Flagship Pilots were launched by Vice-President Neelie Kroes on May 4th 2011 at fet<sup>11</sup>, marking an important milestone in European research cooperation, and contributing to the outstanding success of the

Hungarian presidency event in Budapest. The scientific goals presented by the Pilot actions are indeed highly ambitious: to provide real-time socioeconomic modelling on global scale; to base future electronics on graphene; to produce a system of networked, zero-power monitoring devices; to simulate the human brain; to integrate globally collected physiological data into individual digital health models; or to deliver sentient robot companions. The horizontal support action FLEET is assisting the FET Flagship Pilots in addressing common, non-competitive issues such as social acceptance and ethical aspects of novel technologies.

Over their one-year duration, these Pilot Actions are assembling a Strategic Research Programme leading to the ambitious goals they target to achieve in about

ten years' time. In order to present in 2012 a Flagship Initiative candidate ready for implementation, the Pilots are currently in the process of structuring their research community, and obtaining the necessary support to their research programme from national funding agencies. The milieu of rising attention and recognition by scientific communities and political stakeholders will culminate this year in a brokerage event mid way through the Pilot actions, to be held on 24-25th November 2011 in Warsaw under the auspices of the Polish presidency of the Council of the European Union. Here the Flagship Pilots will have the opportunity to present their progress, including plans for the integration of research programmes, communities and resources towards their ultimate goal.

As Commissioner Kroes said in research\*eu:  
*"FET flagships are designed to be true European science partnerships that will cut across different national and European programmes and unite our brightest researchers in the pursuit of ambitious goals at the frontiers of scientific knowledge"*

research\*eu magazine:

[http://cordis.europa.eu/fp7/ict/fet-proactive/docs/press-22-researcheu\\_en.pdf](http://cordis.europa.eu/fp7/ict/fet-proactive/docs/press-22-researcheu_en.pdf)

In parallel, the Commission, a working group of national representatives, and an independent expert advisory group are engaged in extensive preparations to provide the implementation framework for the FET Flagship Initiatives. Out of the six Pilots, two FET Flagships are foreseen to be selected and launched as Europe-wide initiatives in 2013.

### FET Flagships home page:

[http://cordis.europa.eu/fp7/ict/programme/fet/flagship/home\\_en.html](http://cordis.europa.eu/fp7/ict/programme/fet/flagship/home_en.html)

### FET-Flagships on Facebook:

<http://www.facebook.com/pages/FET-Flagships/141589582520429>

### Six FET Flagship Pilots:

#### FuturICT

<http://www.futurict.ethz.ch/FuturICT>

#### Graphene

<http://www.graphene-flagship.eu/>

#### Guardian Angels

<http://www.ga-project.eu/>

#### HBP

<http://www.humanbrainproject.eu/>

#### ITFom

<http://itfom.salait-hosting.de/ie.php>

#### CA-Robocom

<http://www.robotcompanions.eu/>

## FET e-statistics

<http://twitter.com/#!/fetopen>  
94 tweets, 118 followers

<https://www.facebook.com/fetopen>  
220 likes

<http://www.facebook.com/#!/pages/FET-Flagships/141589582520429>  
177 likes

<http://caFETeria.ning.com>  
642 members

## FET Funding Opportunities

### FET-Proactive - Call 8

Call 8 under the FP7 2011-12 Work Programme (identifier FP7-ICT-2011-8) will be launched on 26<sup>th</sup> July 2011. **The deadline for proposal submission is 17<sup>th</sup> January 2012 (17h00 Brussels time).** The call features 3 thematic R&D initiatives and a call for coordination and support actions. The indicative budget for the objectives in call 8 is 56 M€.

### Information Day on Call 8

FET-Proactive will host an information day on Call 8 on **12<sup>th</sup> October 2011 in Brussels**. The day will provide first-hand information on the FET-Proactive initiatives in this call, as well as contractual, legal and administrative modalities.

In addition, the formation of consortia and synergies will be facilitated through an open exchange 'Proposers Forum'.

#### Info & Registration:

[http://cordis.europa.eu/fp7/ict/fet-proactive/ie-oct11\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/ie-oct11_en.html)

### • Unconventional Computation (UComp)

The objective is to develop alternative approaches for situations or problems that are challenging or impossible to solve with conventional methods and models of computation (i.e. von Neumann, Turing). Typical examples include computing in vivo, and performing massively parallel computation.

The focus of this objective is beyond existing initiatives (e.g. Quantum ICT, Neuro-IT and Brain-Inspired ICT).

More info:

[http://cordis.europa.eu/fp7/ict/fet-proactive/ucomp\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/ucomp_en.html)

### • Dynamics of Multi-Level Complex Systems (DyM-CS)

The objective of this Initiative is to make steps towards a general theory on complex systems through contributions in the area of dynamics of multi-level systems.

### How to develop further the mathematical foundations of multi-scale complex systems?

**Short position papers** on Objective ICT-2011.9.7: "Dynamics of Multi-Level Complex" giving your view on how this could be implemented are welcome. A selection of these contributions will be presented at the European Conference on Complex Systems 2011 - ECCS'11 ([www.eccs2011.eu](http://www.eccs2011.eu), Vienna, afternoon of 16th September 2011)\*.

**Submit your view or a position paper** on this objective by email to:

Jose-Luis Fernández-Villacañas  
[jose.fernandez-villacanas\(AT\)ec.europa.eu](mailto:jose.fernandez-villacanas(AT)ec.europa.eu) and  
Roumen Borissov  
[roumen.borissov\(AT\)ec.europa.eu](mailto:roumen.borissov(AT)ec.europa.eu)

(\* Submission or acceptance for presentation of these short position papers does not prejudice the forthcoming evaluation of proposals.

More info:

[http://cordis.europa.eu/fp7/ict/fet-proactive/dymcs\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/dymcs_en.html)

### • Minimising Energy Consumption of Computing to the Limit (MINECC)

The energy consumption of computing technologies becomes more and more an obstacle to realizing new functionalities in, for instance, mobile or distributed applications, and limits performance. It also has an increasing impact on energy supply and environment. Since energy efficiency of today's technologies is orders of magnitude above the theoretical limits, disruptive solutions and radically new approaches are needed to close this gap.

More info:

[http://cordis.europa.eu/fp7/ict/fet-proactive/minecc\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/minecc_en.html)

### • Coordination and Support Actions. Objective ICT-2011.9.12:

a) Actions supporting the coordination and cooperation of the targeted research communities, assessing the impact and proposing measures to increase the visibility of the initiative to the scientific community, to targeted industries and to the public at large. These actions should also foster the consolidation of research agendas.



b) Actions supporting and promoting cooperation with non-EU research teams in foundational research on FET topics, with a balanced participation from partners in the EU and from target countries.

c) Short duration actions (typically 6-12 Months) to organise consultations of multidisciplinary communities to formulate novel FET research topics, focusing on new emerging research areas. The main objective should be to identify and motivate one or more new research avenues from a global perspective, the associated fundamental challenges, and to analyse the expected impact on science, technology and society.

d) Actions to organise conferences and workshops which should foster dialogue between science, policy and society on the role and challenges of interdisciplinary ICT related long-term research, increasing Europe's creativity and innovation base and bridging diverse European research communities and disciplines.

More info:

[http://cordis.europa.eu/fp7/ict/fet-proactive/csa\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/csa_en.html)

### FET-Open in 2011

- **The FET Open Scheme** is as always open for research proposals targetting fundamental breakthroughs and paradigm shifting ideas in any area of ICT. Why not take a look at our open tracks on challenging current thinking, on international cooperation, or our dedicated tracks for young explorers and high tech research intensive SMEs? FET-Open is also currently implementing a special call on the science of global systems (see below).

More info:

[http://cordis.europa.eu/fp7/ict/fet-open/challenging-current-thinking\\_en.html](http://cordis.europa.eu/fp7/ict/fet-open/challenging-current-thinking_en.html)

[http://cordis.europa.eu/fp7/ict/fet-open/ye\\_en.html](http://cordis.europa.eu/fp7/ict/fet-open/ye_en.html)

[http://cordis.europa.eu/fp7/ict/fet-open/high-tech-sme\\_en.html](http://cordis.europa.eu/fp7/ict/fet-open/high-tech-sme_en.html)

[http://cordis.europa.eu/fp7/ict/fet-open/international-cooperation\\_en.html](http://cordis.europa.eu/fp7/ict/fet-open/international-cooperation_en.html)

### FET special initiative in Call 8

- **Science of Global Systems**

Progress in global systems dynamics is required to better understand the interactions between ecological and socio-economic systems and to better respond to global environmental change. Global coordination requires new developments in science based on global system models that span the whole range from local regional to global multi-national decision making. A science of global systems must pay special attention to the interface with policy and society to better ground the scientific tools.

More info:

[http://cordis.europa.eu/fp7/ict/fet-open/global-systems\\_en.html](http://cordis.europa.eu/fp7/ict/fet-open/global-systems_en.html)

## La vie des projets

### BACTOCOM: Bacterial Computing with Engineered Populations

The main objective of BACTOCOM is to build a simple computer, using bacteria rather than silicon. Microbes may be thought of as biological "micro-machines" that process information about their own state and the world around them. Parts of the internal "program" of a bacterial cell (encoded by its genes, and the connections between them) may be "reprogrammed" in order to persuade it to perform human-defined tasks. By introducing artificial "circuits" made up of genetic components, new behaviours will be added or existing functionality within the cell will be modified. The main thrust of this approach is to introduce new functionality via a "bottom up", distributed search process, in which individual bacteria piece together circuit components themselves. By performing massively-parallel bacterial random search, quickly functional devices without "top down" engineering will be obtained. There are many potential benefits to this work, from both a biological and computing perspective. By "evolving" new functional structures, insight into biological systems will be gained. This, in turn, may suggest new methods for silicon-based computing, in the way that both evolution and the brain have already done. In building these new bio-devices, BACTOCOM offers a new type of programmable, microscopic information processor that will find applications in areas as diverse as environmental sensing and clean-up, medical diagnostics and therapeutics, energy and security.



© Bactocom project

The project has recently passed its first annual review, and is making significant progress in terms of the technical foundations for bacterial search and re-engineering. BACTOCOM has constructed a library of genetic parts and devices (including engineered promoters and oscillators), which form the basic "building" blocks of our artificial circuits. One fundamental aspect of the pursued approach is the conditional replication of plasmids (short, circular strands of DNA), which carry these fundamental computing components. Control over the replication of these

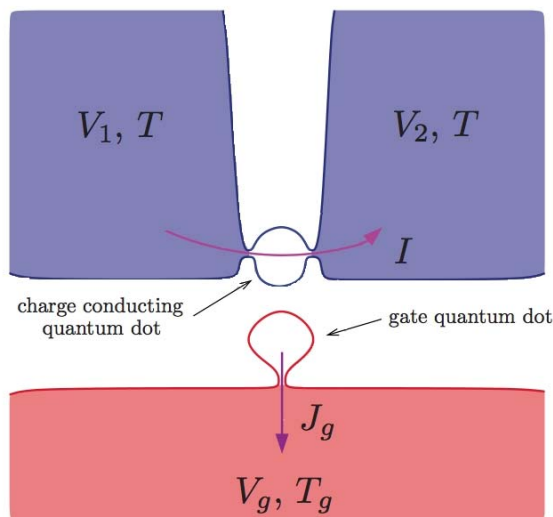
plasmids has been demonstrated, which is a central step in making the approach autonomous and externally tunable.

In addition to the scientific work, BACTOCOM has also been very active in terms of engaging with a wider audience. A team from the Technical University Munich was awarded a prize at last year's iGem (International Genetically Engineered Machine) competition, and BACTOCOM features in a new "Revolution Manchester" gallery in the city's Museum of Science and Industry.

**BACTOCOM:** <http://www.bactocom.eu>

### **NANOPOWER: Hot Spots for current generation**

The search for new efficient ways to power small autonomous electronic devices records an important achievement. In the framework of NANOPOWER, a FET Proactive project devoted to studying nanoscale energy management for powering ICT devices, a novel class of energy harvesters based on purely quantum effects has been developed.



© Nanopower project

These "quantum harvesters", as they have been called, are based on the exploitation of strong interaction between charge fluctuations in small, coupled conductors that are at different temperatures in order to create a finite current in one of them. Specifically, the converter consists of a hot quantum dot that acts as the driver of current through a second quantum dot that is electrically isolated from the driver. The energy level structure in the two dots can be engineered to find configurations for which the efficiency of the heat-into-charge-current conversion reaches the Carnot limit. An important novel aspect of this method is the spatial separation of heat and charge current, while in ordinary thermoelectric converters an electric current flows between electrodes at different

temperatures and these flows are along the same direction.

In the scheme proposed by the NANOPOWER partner group, led by Markus Büttiker, at the University of Geneva, a quantum dot is coupled to two reservoirs via tunnel contacts which permit carrier exchange and is coupled capacitively to a gate such that there is only energy exchange between the conductor and the gate but remarkably no particle exchange (see Figure). The gate is itself structured into a quantum dot that permits carrier exchange with its reservoir. One of the quantum dots is connected to two terminals (at voltages  $V_1 = V_2$ ) in order to support an electric current,  $I$ . The other quantum dot is connected to a single terminal (at voltage  $V_g$ ) which is at a higher temperature than the other two. Thus, the charge fluctuations in this dot are increased with respect to those in the other two terminals. The hot terminal supports a heat current,  $J_g$ , but no charge transport.

The study, published in R. Sánchez and M. Büttiker, *Phys. Rev. B* 83, 085428 (2011), explores the non-equilibrium states of this system and investigate the relation between the charge current flowing through the two terminals of the conductor, and the heat current flowing through the gate terminal at temperature  $T_g > T$ . What the Geneva group has found is that, under proper conditions, an electron that tunnels into the conductor quantum dot from left can only be transmitted to the right after absorbing a quantized amount of energy from the gate. This process allows a heat-to-charge current conversion, whose ratio is determined solely by the ratio of the charge to the energy quanta. These results allow the design of a new class of solid-state environmental energy to current converters of high efficiency. Exporting these ideas to other mesoscopic systems opens new possibilities for highly efficient solid-state thermoelectric devices: a long-sought dream of energy harvesting.

**NANOPOWER:** [www.nanopwr.eu](http://www.nanopwr.eu)

### **NEUROchem's new avenues to chemical sensing**

June 15th saw the final review meeting of the NEUROchem project, where the EC and a panel of experts evaluated the results of its three and a half years of research and development.

NEUROchem, or Biologically inspired computation for chemical sensing, involved nine top research organisations from five different European countries in its aim to develop novel computing paradigms that take inspiration from the biological olfactory pathway. The research developed within the project could open new avenues in odour sources localization in plumes, a process that animals such as dogs or bees carry out with an impressive success rate, but also in



forensics, explosive and landmine detection and border control.

The partners, who include experts in electronics, neuroscience, data processing, biology and chemical engineering, created computational neuroscience models of the main building blocks of the olfactory system. Different large-scale sensor arrays to mimic the redundancy and diversity of the olfactory receptor neuron layer were built and used to test the performance of the developed computational models. The models then went through an abstraction stage in which their processing capabilities were captured by algorithmic solutions, before being incorporated into a robotic platform with 'ALL-ON-BOARD' sensing, computing and actuation with real-time operation (pictured).



© Neurochem project

“Biological olfactory systems outperform traditional chemical instrumentation in numerous ways – specificity, response time, detection limit, coding capacity, time stability, robustness, size, power consumption and portability,” says Jordi Fonollosa of the Institute for Bioengineering of Catalonia (IBEC), who coordinated the project.

“NEUROchem achieved all its milestones, including creating the biggest and most diverse conductive polymer array ever produced: 65536 elements, with the corresponding read-out electronics that interpret the sensor signals. In addition, ours is the first robotic platform able to localize one odour source in the presence of two plumes.”

Another achievement by the project was the collection of datasets for computation benchmarking, the first of its kind and a tremendous gain to the artificial olfaction community. In addition, the models themselves offer new insights into information processing. “The comments from the review panel were exceptionally positive and they encouraged the consortium to continue exploring the lines of research and the bioinspired models,” said Jordi. “They also remarked on the interdisciplinary background of all the partners and commended our approach in overcoming the difficulties of coordinating a wide range of different disciplines.”

**NEUROCHEM:** <http://www.neurochem-project.org/>

## REFLECT

N. Serbedzija, Fraunhofer FIRS, Berlin

The REFLECT project (Jan 2008 - March 2011) focussed on pervasive-adaptive systems that control environments relative to the user situation. Different aspects regarding the user are taken into account by such systems: emotional state (e.g. annoyance), cognitive engagement (e.g. high mental workload) and physical conditions and actions (e.g. movement and comfort). For example, the steering wheel of a car measures sweat and pulse, vehicular CAN bus detects driving style and driver's seat measures pressure points. When the system detects that you are fresh and alert it could switch the car into sports mode; if you are having difficulties in driving it suggests you to slow down and blocks incoming calls; if you seat uncomfortably the seat would re-shape automatically.

More than 40 researchers from 8 different partners developed a generic, user-centric software framework featuring responsiveness to users' inner state and users' behaviour. Psychologists, bio-engineers and computer scientists defined a novel approach to mimic the natural adaptation process by a so called bio-cybernetic loop. The loop controls the whole system at different time scales offering immediate, short term and long term adaptation. Numerous experiments and case studies have been conducted and a fully functioning vehicular demonstrator has been implemented illustrating the approach.

A vehicular setting contains sensor devices for physiological and performance monitoring and actuator devices that can influence the driving process. Four bio-cybernetic loops are capturing emotional, cognitive, physical and behavioural aspects of the driver's state. Each loop has been separately evaluated and assessed in a simulating environment and then deployed in the vehicular demonstrator.



© Reflect project - Vehicle as a co-driver prototype

The picture shows the dashboard with three computers running the reflective assistance. The screens display the high-level monitoring, the system diagnoses and the low level measurements. Smart phones are also connected via an ad hoc network allowing

for remote monitoring. The screens are used for external monitoring while the driver experiences support in terms of visual warnings and adaptive vehicular “responses” (e.g. seamless changes in music and mobile equipment functioning in case of emotional, cognitive and driving loop and “automatic” seat re-shaping in case of comfort loop).

The project innovative character is illustrated by adaptive control of multiple user’s experiences and high-level system individualization. With more than 100 scientific publications, numerous workshops and tutorials the project proved its scientific impact. An industrial prototype shows a strong pragmatic orientation and applicability of the project results.

**REFLECT:** <http://reflect.pst.ifi.lmu.de/>

### Links to Project Newsletters

**MODAP – Privacy on the Move**

<http://www.modap.org/content/newsletters>

**ZEROPOWER: Nanoenergy Letters**

<http://www.zero-power.eu/nanoenergyletters>

## Forthcoming events

### IJCAI 2011, Barcelona, Spain

22nd International Joint Conference on Artificial Intelligence

16<sup>th</sup>-22<sup>nd</sup> July, 2011

<http://ijcai-11.iijia.csic.es/>

### NiPS Summer School 2011, Perugia, Italy

Summer School "Energy Harvesting at micro and nanoscale"

Workshop "Energy management at micro and nanoscale"

1<sup>st</sup>-6<sup>th</sup> August, 2011

<http://www.nipslab.org/summerschool>

### KDD-2011, Grand Manchester Hyatt, San Diego, CA

17<sup>th</sup> ACM SIGKDD Conference on Knowledge Discovery and Data Mining

21<sup>st</sup>-24<sup>th</sup> August, 2011

<http://www.kdd.org/kdd2011/>

### Interspeech 2011, Florence, Italy

12<sup>th</sup> Annual Conference of the International Speech Communication Association

28<sup>th</sup>-31<sup>st</sup> August, 2011

<http://www.interspeech2011.org/>

### CHIST-ERA conference 2011, Cork, Ireland

- From Data to New Knowledge

- Green ICT, towards Zero Power ICT

5<sup>th</sup>-6<sup>th</sup> September, 2011

<http://conference2011.chistera.eu/>

### Quantum Information Processing and Communication (QIPC) 2011, Zürich

5<sup>th</sup>-9<sup>th</sup> September, 2011

<http://www.qipc2011.ethz.ch/>

### The Barcelona Cognition, Brain and Technology summer school, Barcelona, Spain

5<sup>th</sup>-16<sup>th</sup> September, 2011

<http://www.csnetwork.eu/?q=node/430>

### Audio Mostly, Coimbra, Portugal

A Conference on Interaction with Sound

7<sup>th</sup>-9<sup>th</sup> September 2011

<http://www.audiomostly.com/>

### Phonons & Fluctuations Workshop, Paris, France

8<sup>th</sup>-9<sup>th</sup> September 2011

<http://www.em2c.ecp.fr/Members/volz/phonons-and-fluctuations-2011-1>

### ECCS'11, Vienna, Austria

European Conference on Complex Systems 2011

12<sup>th</sup>-16<sup>th</sup> September, 2011

[www.eccs2011.eu](http://www.eccs2011.eu)

### UBICOMP 2011, Beijing, China

13th International Conference on Ubiquitous Computing

17<sup>th</sup>-21<sup>st</sup> September, 2011

<http://www.ubicomp.org/ubicomp2011/>

### 1st International Awareness Summer School (AWASS 2011), Lucca, Italy

18<sup>th</sup>-24<sup>th</sup> September, 2011

<http://www.aware-project.eu/2011/02/08/summer-school-2011-lucca/>

### International Workshop - From Young Researchers to Future Discoveries, Kiten, Bulgaria

19<sup>th</sup>-21<sup>st</sup> September, 2011

<http://www.iict.bas.bg/young-2011/>

### SIMBAD 2011, Ca' Dolfin, Venice, Italy

1<sup>st</sup> Int. Workshop on Similarity-based Pattern Analysis and Recognition

28<sup>th</sup>-30<sup>th</sup> September, 2011

<http://www.dsi.unive.it/~simbad>

**1st Awareness Workshop @ SASO 2011 – Ann Arbor, USA**

7<sup>th</sup> October, 2011

<http://www.aware-project.eu/2011/04/21/1st-awareness-workshop-saso-2011/>

**Information Day on Call 8, Brussels, Belgium**

FET-Proactive information day on Call 8,  
12<sup>th</sup> October 2011

[http://cordis.europa.eu/fp7/ict/fet-proactive/ie-oct11\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/ie-oct11_en.html)

**ISWC 2011, Bonn, Germany**

10th International Semantic Web Conference  
23<sup>rd</sup>-27<sup>th</sup> October 2011

<http://iswc2011.semanticweb.org/>

**CIKM 2011, Glasgow, Scotland, UK**

20th ACM Conference on Information and Knowledge Management  
24<sup>th</sup>-28<sup>th</sup> October 2011

<http://www.cikm2011.org/>

**TNT 2011, Tenerife -Canary Islands, Spain**

Trends in Nanotechnology Conference 2011  
21<sup>st</sup>-25<sup>th</sup> November, 2011

<http://www.tntconf.org/2011/index.php?conf=11>

**FET Flagship Pilot Midterm Event, Warsaw, Poland**

Participants from the Flagship pilots, member state ministries and funding agencies (by invitation only)  
24<sup>th</sup> -25<sup>th</sup> November 2011

**Bionetics 2011, York, United Kingdom 6<sup>th</sup> International ICST Conference on Bio-Inspired Models of Network, Information, and Computing Systems**

5<sup>th</sup> – 7<sup>th</sup> December 2011

<http://www.bionetics.org/>

**IEEE International Conference on Data Mining, Vancouver, Canada**

11<sup>th</sup>-14<sup>th</sup> December 2011

<http://webdocs.cs.ualberta.ca/~icdm2011/>

**CHI 2012, Austin, Texas**

ACM SIGCHI Conference on Human Factors in Computing Systems  
5<sup>th</sup>-10<sup>th</sup> May 2012

<http://chi2012.acm.org/>

## About this newsletter

*FET through the keyhole* is published periodically by the FET-Open and FET-Proactive Units at the European Commission Directorate General for Information Society and Media.

Please contact the editors below if you would like to consider any FET or project related news for publication in this newsletter.

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