

# EURESCOM mess@ge

The magazine for telecom insiders

**NEWS**



# Environmental observation and the Future Internet

Events

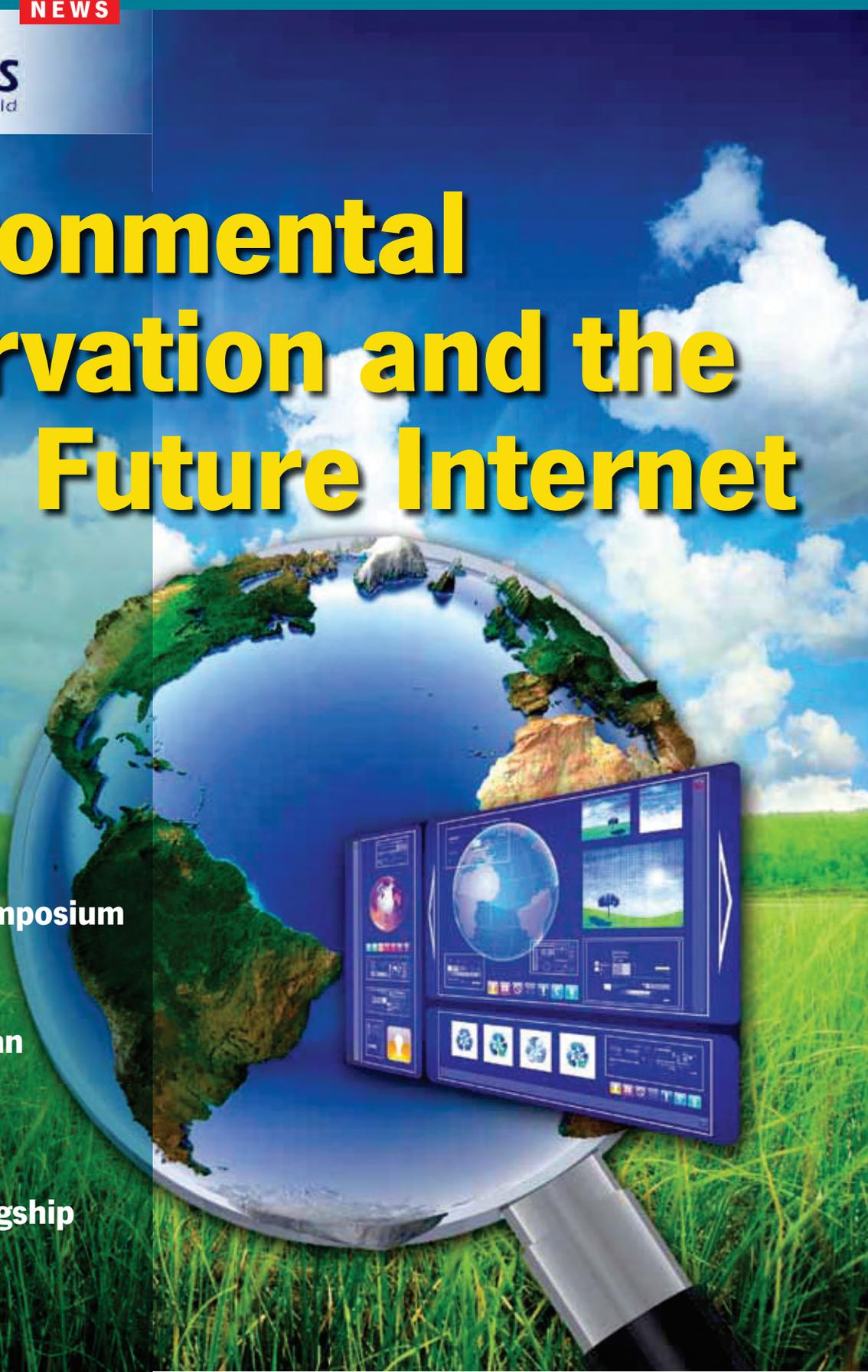
**4th EU-Japan Symposium**

Project results

**Augmented human cognition**

European issues

**The FuturICT Flagship Project**



## Funding Opportunity for European R&D Projects

### Celtic-Plus Spring Call for Proposals – Deadline: 21 May 2012

Celtic-Plus is a EUREKA Cluster dedicated to realising the vision of a smart connected world through an industry-driven R&D programme. There are two calls per year, in spring and in autumn, with an expected total project volume of up to 100 million euro. The funding is orchestrated via the Celtic-Plus programme and provided by Public Authorities from EUREKA.

#### Eligible topical areas

##### Get Connected

- Infrastructure and connectivity aspects
- Fixed/ Wireless, optics, energy-efficiency
- Network architecture, autonomic networks

##### While Connected

- End-to-end services and applications, like
  - Digital home, digital enterprises
  - Digital City (incl. digital school, digital transport)
  - E-Health
  - Security, privacy, identity

##### Future Internet relations

- Complement Future Internet (FI-PPP) program by
  - Making the Internet a high-quality service platform
  - Introduce the 'Celtic-Plus Use-Case Factory'
    - Extend the program by additional use-cases not covered in the FI-PPP program
    - Contribute to future internet capacity building and test cases/ platforms

##### Green-Internet relations

- Consider environmental issues in ICT
- Encourage better energy efficiency
- Consider Smart Grid, Water management & ICT
- Develop multi-disciplinary approach

##### User friendly call process

The Celtic-Plus programme gives proposers the opportunity to submit proposals twice in the year – **Spring Call: 21 May 2012, or Autumn Call: 15 October 2012**. Celtic-Plus now has an accelerated one-stage call process to ensure the shortest possible time between proposal submission and start of selected projects. Celtic-Plus proposals should be complete and clearly present the technical objectives, timescales, participants, manpower, and expected results. These proposals are evaluated by independent evaluators and the proposals meeting the required standards will be retained and given the Celtic-Plus label.

##### Further information

Please visit the Celtic-Plus website at [www.celticplus.eu](http://www.celticplus.eu) for call details and the Celtic-Plus Purple Book for details on the R&D priorities of Celtic-Plus.

For further information, please contact Heinz Brüggemann, director of the Celtic Office, at [brueggemann@celticplus.eu](mailto:brueggemann@celticplus.eu)



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

## Celtic-Plus Proposers' Day

Berlin, 3 July 2012, 14:00 to 19:00

### Held in conjunction with the Future Network and Mobile Summit

The next Celtic-Plus proposers' day will take place on 3rd July at Hotel Estrel in Berlin on the day before the Future Network and Mobile Summit (FuNeMS).

The proposers day is a very effective opportunity for you to present, and listen to, new project proposal ideas targeted for the Celtic-Plus autumn call (15 October 2012).

#### Free registration – deadline: 22 June

Participants may register for the Celtic-Plus proposers' day by 22 June 2012 via the event website at [www.celtic-initiative.org/Events/Proposers-day-Berlin/PD-Berlin-program.asp](http://www.celtic-initiative.org/Events/Proposers-day-Berlin/PD-Berlin-program.asp)

We also recommend that you take the opportunity to register for participation in the Future Network and Mobile Summit 2012.

#### About the Future Network and Mobile Summit

The Future Network and Mobile Summit 2012 takes place in the Hotel Estrel, Berlin, Germany, from 4 to 6 July 2012. The event supported by the European Commission regularly attracts over

500 delegates from industry and research to share experiences and research results, identify future trends, discuss business opportunities and identify opportunities for international research collaboration under the ICT Theme of Framework Programme 7 (FP7).

In the context of convergence and innovation, the 21st Future Network and Mobile Summit will address the challenges of building the Future Internet infrastructures, based on mobile, wireless and fixed broadband communications technologies.

Further information is available on the Summit website at [www.futurenetworksummit.eu/2012](http://www.futurenetworksummit.eu/2012)



## Dear readers,

Understanding our natural environment in all its' complexity is of crucial importance for the survival and long-term well-being of humankind. Just think of global environmental issues like climate change or species extinction, and the importance of having data and models on understanding environmental processes becomes obvious.

Information and communication technologies have helped us to collect and access more information about the Earth than any generation before us. And this is only the beginning. Current European research projects are working on utilising the emerging capabilities of the future Internet to create a global Earth observation system that will allow us to know what is going on in the seas, on land, and in the atmosphere.

In view of the progress made in the area of Earth observation and the growing importance of the Internet for collecting, analysing, and sharing environmental observation data, the editorial team of Eurescom mess@ge decided it is about time to dedicate a cover theme to this important

interdisciplinary topic at the junction between ICT, geography, and environmental science. In this issue, we will highlight the progress already made in creating a global Internet-based system for environmental observation as well as the R&D challenges and opportunities on the way ahead.

The first article in the cover theme provides an overview on the current global initiatives in the area of Earth observation. The ensuing article by Jose Lorenzo Mon presents the European Future Internet research project ENVIROFI, which is laying the foundation for an environmental observation web.

In an exclusive interview, geo-information scientist Prof. Yola Georgiadou shares her views on the Digital Earth concept. Sven Schade from the JRC provides a first-hand report on the Euro-GEOSS contributions to the Global Earth Observation System of Systems. Finally, Conor Delaney and Paul Gaughan from the Marine Institute in Ireland explain the latest research activities on next-generation decision support tools for the global marine sector.

This selection of articles does not cover all aspects of environmental observation and the Future Internet, but it provides insights on some major challenges, opportunities and solutions.

This issue also includes a variety of further articles on different, ICT-related topics, including a report on the EU-Japan Symposium that took place in January 2012 as well as a summary of the findings of a recent Eurescom study on augmented cognition and its impact on the networks. See also the articles in our sections "The Kennedy Perspective", "Viewpoint", "News in brief", and "A bit beyond". I hope you enjoy reading them.

My editorial colleagues and myself would appreciate your comments on the current issue as well as suggestions for future issues.

**Milon Gupta**  
Editor-in-chief





## Events calendar

**7 – 9 May 2012**

**eHealth Week 2012**

Copenhagen, Denmark  
<http://worldofhealthit.org/2012>

**10 – 11 May 2012**

**Future Internet Assembly**

Aalborg, Denmark  
<http://www.future-internet.eu/news/view/article/future-internet-assembly-aalborg.html>

**28 May – 1 June 2012**

**The IFA 11th Global Conference on Ageing**

Prague, Czech Republic  
<http://www.ifa2012.com>

**11 – 13 June 2012**

**TridentCom 2012**

Thessaloniki, Greece  
<http://www.tridentcom.org/2012>

**3 July 2012**

**Celtic-Plus Proposers' Day**

Held in conjunction with the Future Network and Mobile Summit  
 Berlin, Germany  
<http://www.celticplus.eu>

**4 – 6 July 2012**

**Future Network and Mobile Summit**

Berlin, Germany  
<http://www.futurenetworksummit.eu/2012>

**31 August – 5 September 2012**

**IFA**

Berlin, Germany  
<http://b2b.ifa-berlin.com/en>

**6 – 11 September 2012**

**IBC 2012**

Amsterdam, The Netherlands  
<http://www.ibt.org>

**15 – 19 October 2012**

**NEM Summit 2012**

Istanbul, Turkey  
<http://www.nem-initiative.org>

**17 – 19 October 2012**

**eChallenges e-2012 Conference and Exhibition**

Lisbon, Portugal  
<http://www.echallenges.org/e2012>

**15 – 16 November 2012**

**FOKUS FUSECO Forum 2012**

Berlin, Germany  
[http://www.fokus.fraunhofer.de/en/fokus\\_events/ngni/fuseco\\_forum\\_2012/index.html](http://www.fokus.fraunhofer.de/en/fokus_events/ngni/fuseco_forum_2012/index.html)

## Sn@pshot



### “Stop ACTA”

The photo shows an anti-ACTA rally in Warsaw on 27 January 2012. Poland was the first European country, where thousands of people protested against the multinational Anti-Counterfeiting Trade Agreement (ACTA) for intellectual property rights enforcement.

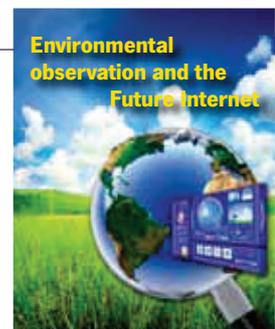
The opponents of ACTA claim that the agreement would violate fundamental civil rights, including freedom of expression and communication privacy.

On 11 February 2012, anti-ACTA protests were held in more than 200 European cities – with noticeable results: a number of European countries that had signed the treaty postponed ratification in response to the public outcry.



# Contents

<b>EDITORIAL</b>	3	Dear readers, ...
	4	Events calendar
	4	Sn@pshot
<hr/>		
<b>COVER THEME</b>	<b>6</b>	<b>Environmental observation and the Future Internet</b>
	6	Global Earth observation and the Internet – An overview
	7	Towards an environmental observation Web – ENVIROFI
	8	Next-generation decision support tools for the global marine sector
	10	EuroGEOSS contributions to the Global Earth Observation System of Systems
	12	Digital Earth and the generativity of the Internet – Interview with geo-information scientist Yola Georgiadou
<hr/>		
		<b>Celtic-Plus News</b>
	C1	Editorial
	C2	Celtic-Plus Event in Stockholm
	C3	Celtic Awards 2012
	C4	Project Highlights:
	C4	MOTSWAN
	C6	AWARE
	C7	COMESI
	C8	Imprint
	C8	About Celtic-Plus
<hr/>		
<b>THE KENNEDY PERSPECTIVE</b>	13	When the norm becomes a crime
<hr/>		
<b>VIEWPOINT</b>	14	The European exploitation gap
<hr/>		
<b>EVENTS</b>	16	4th EU-Japan Symposium – Closer collaboration between European and Japanese organisations agreed
<hr/>		
<b>PROJECT RESULTS</b>	17	Augmented human cognition and the impact on the network – Insights from Eurescom study P2155
<hr/>		
<b>EUROPEAN ISSUES</b>	18	Future and Emerging Technologies: The FuturICT Flagship Project
<hr/>		
<b>NEWS IN BRIEF</b>	20	Cisco forecast: more mobiles than humans by end of 2012 ++ Pew report: Americans turning on to online privacy ++ Commission presents proposal for reform of EU data protection rules
<hr/>		
<b>A BIT BEYOND</b>	22	Undead on the Web
		Imprint
		EURESCOM mess@ge, issue 1/2012 (March 2012)
		ISSN 1618-5196 (print edition)
		ISSN 1618-520X (Internet edition)
		Editors: Milon Gupta (editor-in-chief), Peter Stollenmayer, Anastasius Gavras, Uwe Herzog
		Submissions are welcome, including proposals for articles and complete articles, but we reserve the right to edit. If you would like to contribute, or send any comments, please contact:
		Eurescom mess@ge · Wieblinger Weg 19/4 · 69123 Heidelberg, Germany
		Phone: + 49 6221 989-0 · Fax: + 49 6221 989-209 · E-mail: message@eurescom.de
		Advertising: Luitgard Hauer, phone: +49 6221 989-405, e-mail: hauer@eurescom.eu
		Eurescom mess@ge is published three times a year. Eurescom mess@ge on the Web: www.eurescom.eu/message
		© 2012 Eurescom GmbH. No reproduction is permitted in whole or part without the express consent of Eurescom.



# Global Earth observation and the Internet

## An overview



Milon Gupta  
Eurescom  
gupta@eurescom.eu

**For the first time in history, humankind is now capable of collecting comprehensive data about planet Earth's physical, chemical and biological systems and making them globally accessible via the Internet. Progress in this area has been driven by a high demand for consistent Earth observation data. In order to make informed decisions on global environmental issues, like measures against climate change, or to forecast potentially disastrous natural events, like tsunamis, public and private actors need reliable data as promptly as possible. International institutions, governments and non-governmental organisations have been collaborating in a unique effort to establish a global Earth observation system.**

Such a global system aims to integrate a wide range of observation data from all over the world. This includes, for example, photos and radar images taken from remote-sensing satellites, numerical measurements taken by thermometer, wind gauge, ocean buoy, altimeter or seismometer, as well as a birdwatcher's notes on bird sightings. The central international initiative for achieving this is GEOSS, the Global Earth Observation System of Systems.

### Global Earth Observation System of Systems

Within the Group on Earth Observations (GEO), 87 member countries and the European Commission as an institutional member as well as 64 Participating Organizations have joined forces to build GEOSS, the Global Earth Observation System of Systems. GEOSS will provide decision-support tools to a wide variety of users. Through the Internet, GEOSS will establish a global network of Earth data providers, allowing decision makers to access an extraordinary range of information at their desk.

GEOSS is connecting existing and planned observation systems worldwide and promotes common technical standards so that data from the

thousands of different instruments can be combined into coherent data sets. Through the 'GEO-Portal' users have a single Internet access point for seeking data, imagery and analytical software. The portal connects users to existing data bases and portals and provides reliable, up-to-date and user friendly information, which is vital for the work of decision makers, planners and emergency managers.

### European contributions to GEOSS

Europe is one of the main contributors to GEOSS. Besides the European Commission and the EU Member States, a number of European organisations in relevant fields contribute to GEOSS as Participating Organizations. This includes the European Space Agency (ESA), European Environmental Agency (EEA), European Centre for Medium-Range Weather Forecasts (ECMWF), the European Sea Level Service (ESEAS), the Network of European Meteorological Services/Composite Observing System (EUMETNET), European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), and EuroGeoSurveys.

### Digital Earth

An initiative that is closely related to GEOSS is Digital Earth. The idea behind the Digital Earth concept, which was initiated by former US vice president Al Gore in 1998, is to provide a virtual representation of the Earth that is spatially referenced and interconnected with the world's digital knowledge archives. One of the main drivers of the Digital Earth concept is the International Society of Digital Earth (ISDE).

Key areas relevant for the implementation of the Digital Earth concept include Spatial Data Infrastructures (SDI), virtual globe geo-browsers such as Google Earth or NASA's World Wind, linked networks of geo-sensors, and Volunteered Geographic Information.

### Volunteered Geographic Information

The term Volunteered Geographic Information (VGI) was coined by geographer Michael Goodchild in 2007. The term refers to the rapidly growing volume of user-generated geo-data which are shared via the Web by both experts and non-experts. VGI, like, for example, photos and observations from hobby birdwatchers, com-

plements the information from traditional sensors, like meteorological satellites, sensor nodes for monitoring air pollution and detecting forest fires, or weather buoys in the sea.

### Enabling role of the Internet

The Internet plays a key role in assembling and providing Earth observation data. The current Internet already provides access to observation data via portals like the GeoPortal or geo-browsers. The Future Internet will provide even more.

One of the main European research projects in this area is ENVIROFI. The project envisages a system with dynamic understanding of the Earth's atmospheric, marine and terrestrial spheres. Accordingly, ENVIROFI aims to establish an Environmental Observation Web in which all environmental data, whether from sensors, citizens, or models, are available anytime anywhere through the Internet in a standardised, usable format.

### Main research challenges

One of the main challenges for European research project like ENVIROFI, TaToo, EuroGEOSS, and GEOWOW is to achieve combinable models for Earth observation data, which would enable full interoperability between data sources and, thus, a new dimension of data analysis and representation.

Giving everyone access to interoperable, standardised Earth observation data would facilitate a deeper understanding of the Earth's complex and sensitive ecosystem. This would help governments, public authorities, and businesses make better decisions, which will help improve the well-being of the Earth's more than seven billion human inhabitants as well as the state of the planet's flora, fauna, seas and atmosphere.

Further information:

- GEOSS (Global Earth Observation System of Systems) – [www.earthobservations.org](http://www.earthobservations.org)
- ISDE (International Society of Digital Earth) – [www.digitalearth-isde.org](http://www.digitalearth-isde.org)

# Towards an environmental observation Web

## Future Internet research project **ENVIROFI**



Jose Lorenzo  
Atos Research & Innovation  
jose.lorenzo@atos.net

**ENVIROFI is a European research project which will lay the foundation for an environmental observation Web. Thus, ENVIROFI will help Europe tackle the grand societal challenges of climate change, environmental degradation, and sustainable growth. The project is part of the Future Internet Public Private Partnership (FI-PPP) programme of the EU's Seventh Framework Programme (FP7), representing the environmental usage area.**

### ENVIROFI's role in the Future Internet PPP

The Future Internet Public Private Partnership (FI-PPP) aims to advance Europe's competitiveness in Future Internet technologies and systems and to support the emergence of Future Internet-enhanced applications of public and social relevance. ENVIROFI is one of eight use case projects within the first phase of the FI-PPP, which runs in three phases from 2011 to 2015 (see figure). ENVIROFI defines scenarios from the environmental usage area to be tested in experimental trials in later phases. In addition, the project defines use-case specific requirements in order for the core platform to support these requirements.

ENVIROFI aims to assure that the data and services of the environmental usage area are readily available for Future Internet applications.

It provides environmental sector requirements to FI-WARE, the FI-PPP core platform project, and designs applications for collecting and processing environmental data within the Future Internet framework. FI-WARE supports ENVIROFI and the other seven use case projects by defining a suitable architecture and by implementing the software for common ICT enablers needed for a range of use case trials.

### Challenges and objectives

ENVIROFI envisages a system with dynamic understanding of the Earth's atmospheric, marine and terrestrial spheres for the benefit of all European citizens. Accordingly, we want to establish an Environmental Observation Web in which all environmental data, whether from sensors, citizens, or models, are available anytime anywhere through the Internet in a standardised, usable format.

Until today, we miss a standardised Europe-wide, cross-domain and web-enabled solution for capturing, storing, processing and visualizing the avalanche of observation sources. Reasons for this unsatisfactory situation can be traced back both to shortcomings of the available technology and to the parallel evolution of information systems and data models across geographic areas and application domains.

The diversity of stakeholders and the strong involvement of key ICT industry players in the FI-PPP programme put ENVIROFI in a position to overcome the unsatisfactory situation and address its causes. The project will help in developing advanced technical solutions beyond the scope of the environmental area alone; and it will make important contributions for establishing the observation-related and geospatial standards

in usage areas currently relying on non-standard and proprietary solutions.

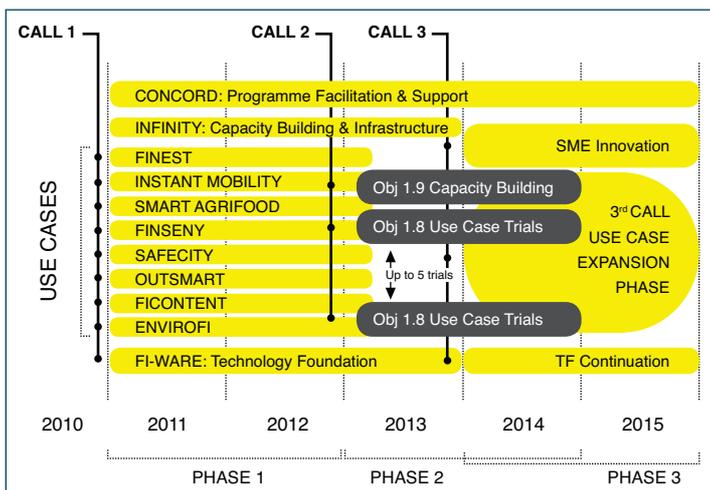
In order to succeed, ENVIROFI has to assure the existing environmental resources can be used in multi-disciplinary applications, while at the same time assuring the environmental applications can profit from Future Internet developments.

The key challenge for ENVIROFI is therefore to assure the Future Internet architecture is compatible with standards, best practices as well as existing and upcoming infrastructures of the environmental usage area. In order to overcome this challenge, the ENVIROFI team has to (1) understand the needs and architectural constraints of FI-WARE and of the other usage area projects; (2) share knowledge with all FI-PPP participants on generic standards and best practices which were developed within the environmental usage area; and (3) inform the environmental usage area community of the advanced functionality developed within the FI-PPP.

Further challenges arise from our decision to embrace volunteered geographic information (VGI) and information from low-quality sensors as additional sources of observations. These community-generated environmental observations by far outweigh the observations from traditional sensor networks. However, this wealth of information cannot be easily used by administration, research, educational institutions and industries, mainly due to lack of information on data quality and uncertainty.

In addition to making information management standards, services and resources of the environmental usage area more accessible to the wider European communities, ENVIROFI will also lay the foundation for a Pan-European environmental observation Web through the following activities and results:

- identifying and implementing environmental enablers operating in a multi-style Service Oriented Architecture (SOA);
- implementing reusable knowledge management services for the marine, land and atmospheric usage domains and beyond;
- enabling the wide communities to have access to environmental observations from various sources with context and situation aware spatial information;
- providing on-demand integrated information to large communities and industries operating in diverse market sectors, such as the environmental energy and the leisure sector.



The three phases of the Future Internet PPP

**The ENVIROFI approach**

ENVIROFI's approach is based on three main scenarios:

**Scenario 1: Terrestrial biodiversity**

In terms of phenomena on the land, the project focuses on terrestrial biodiversity. The UN Convention on Biodiversity (CBD) and the EU have set a new target of halting the loss to biodiversity by the year 2020. In order to meet this goal the project must first provide a solid basis upon which to judge this progress. Observational data on biodiversity must be merged from all available sources while assuring high quality. Using outreach groups for data survey, ENVIROFI can greatly widen the base from which observational data may be gleaned. Scenarios on biodiversity occurrence illustrate the use of humans supported by mobile devices such as smart phones as the main 'sensor' for data provision.



eEnvironment services shall therefore aid the users in tailoring information relevant to their individual requirements.

**Scenario 3: Marine ecosystem**

For the marine domain, the challenge for research and innovation is to create synergies with the market and with policy needs that are necessary to deliver significant value added to Europe from its vast marine resources. Enabling technology platforms are currently deployed across a range of existing marine-related sectors including shipping, security and logistics, environmental monitoring and offshore energy. Next-generation decision-based management tools have to transcend national borders. They shall address these developments in respect to distributed sensing, and wireless and cable communications.

during the upcoming period.

ENVIROFI has set up a methodological procedure for identifying and collecting the requirements from the use cases and to provide a first version of the infrastructure for documenting the collected requirements. The establishment of initial, generalised use cases based on input by the three scenarios served as a way to simplify the relationship between requirements and use cases, but also as a way to clearly indicate the "offer" in terms of the enablers that will be developed by the ENVIROFI team.

At the time of writing, the project had already defined concrete specific enablers that can be instantiated via prototype software services for proof of concept purposes, following different thematic categories. These thematic categories include federating catalogues and discovery services, geo-referenced data collection applications, semantic tagging tools that provide support for semantic enrichment of environmental data, geospatial data provisioning and storage of environmental observations and measurements, and more. In this way, we will achieve a high level of coherence across our project results. This will enable ENVIROFI to significantly contribute to developing a first prototype of the complete Future Internet ecosystem, consisting of generic FIWARE enablers, specific enablers and domain applications, within the next 12 months.

**Scenario 2: Atmosphere**

In regard to the atmosphere, the project concentrates on personalised exposure assessment. Much of the related information, including e.g. air quality, pollen and meteorological data can be easily accessed via television, radio and the World Wide Web today. All this data contributes to a common sense, but relevance of the data to individual users, and their interpretation in terms of the individualized exposures, immediate and long-term health hazards remains out of reach for the large majority of the citizens. Future

**Conclusions and foresight**

ENVIROFI as a part of the FI-PPP has already made important steps towards implementing the vision of an environmental observation Web. In its first year, the project has already achieved significant results toward the objectives of elaborating the three scenarios and breaking them down into individual use cases, describing both domain-specific and cross-cutting functionality. Due to the agile nature of ENVIROFI's development approach, this is an ongoing process, and it will continue as the actual pilots are defined

Further information:

- ENVIROFI website - <http://www.envirofi.eu>
- ENVIROFI on Twitter - <http://twitter.com/ENVIROFI>
- Future Internet PPP Portal - <http://www.fi-ppp.eu>

# Next-generation decision support tools for the global marine sector



Conor Delaney  
Marine Institute  
cdelaney@marine.ie

**The global marine sector generates and consumes massive volumes of data every day. Intelligent data integration and management systems and the provision of next-generation decision support tools has been identified as a key requirement by stakeholders across the marine sector.**

marine sector also has a stated interest in the development of next generation technology to drive cost-effective and sustainable management of marine resources for enterprise development. This is of particular interest to regional marine communities looking to support regional growth and employment.



Paul Gaughan  
Marine Institute  
PGaughan@marine.ie

The European marine resource is increasingly recognised as a critical source of food, transport, tourism and renewable energy. Member states have a recognised need to improve the spatial and temporal resolution of existing sampling regimes and datasets in order to understand the impacts of human activity and climate change on the marine environment. By extension the

**Legislative, socioeconomic and technological considerations**

From a European perspective there is a need to implement legislation and policy including the EU Water Framework Directive, the Habitats Directive and the European Commission Marine Strategy Framework Directive. These legislative



SmartBay buoy in Ireland's National Research, Test and Demonstration Facility

instruments have specific monitoring requirements, and are already acting as drivers for the development of new technologies and methods to enable efficient monitoring and management of marine resources. From a socioeconomic perspective there is also a need to support economic development and sectoral growth and to fully realize the economic value of the global marine resource in a cost effective and sustainable manner. The Future Internet and associated technology platforms will be a key tool to enable the delivery of next generation decision support services to the global marine sector and drive the sustainable economic development of regional and coastal communities.

From a technology point of view there are still significant challenges for the development of cost-appropriate reliable autonomous sensor and data management networks that can survive extended deployment and present an accurate picture of the challenging and dynamic conditions presented by the marine environment. In some cases the development roadmap for these technologies is 10+ years. However, the architecture of the Future Internet must be designed to support a myriad of streaming data from advanced platforms currently under development. Requirements encompass the integration of data streams from multi-modal sources including in-situ sensor networks, control and interface systems through to advanced visualization and forecast tools.

Internet enabled cell phones and mobile devices are already being used by the marine sector for the delivery of real-time updates on changing weather and sea state conditions. Gaming technologies are also being investigated for the visualization of seabed environments and to act as interactive design tools for marine spatial planning and offshore infrastructure development. Integrated data portals and cloud computing services are deployed across a range of

global marine related markets including: environmental monitoring, security, oil & gas, transport & shipping, aquaculture, coastal tourism with new opportunities identified in the emerging areas of marine renewable energy and water management. The Future Internet must deliver advanced functionality including on demand data services and scalable sensor web solutions harvesting legacy and real time datasets while ensuring quality of service to end users in the marine sector.

#### Marine use case in FP7 project ENVIROFI

Since the launch of the ENVIROFI project in April 2011, the Marine Institute and associated partners have initiated an in-depth consultation with representatives of the European marine sector. This has enabled a user-centric approach to the articulation of a number of forward-looking marine use case scenarios in the domain areas of oil spill, harmful algal bloom, ocean energy and marine leisure and tourism.

The developed use case scenarios have prioritized current and future functionality requirements of marine sector stakeholders. These are also heavily influenced by the future development roadmaps for each sub sector which in the case of ocean energy is still at an early stage of development. The kinds of services envisioned include provision of access to forecast models via the Internet, integrating different data sources into a centralised web interface and ensuring a high quality of service to the end user.

Discussions have included representatives from marine industries generating and consuming data sources, public bodies engaged in service provision to industry and government as well as the broader community. A distinct effort has been made to identify complementary marine research and development initiatives already underway and to leverage expertise and preliminary

findings of relevant European initiatives in the area of marine information and communications technologies.

One aspect of the ENVIROFI project will be adding semantic web enrichment to new and existing data streams published by the Marine Institute. This action opens up marine data to the European software development community, which could potentially lead to a dramatic increase in the transport of marine observations over the Internet and drive the development of new technology enabled services and business opportunities for the European marine and ICT sectors. This work builds on Ireland's developing capacity in the area of marine ICT supported by a national programme in this area and will be implemented in Ireland's SmartBay national research, test and demonstration facility.

#### Conclusion

The marine use case scenarios build on existing and likely future approaches to the use of ICT in the marine sector. Taking into account likely sectoral development roadmaps, we look forward to the future enablement of 'digital oceans', actively managed by a series of fixed and mobile data collection and visualisation solutions enabling real-time and adaptive management of Europe's marine resource.

Further information:

- SmartBay - [www.marine.ie/home/services/operational/SmartBay](http://www.marine.ie/home/services/operational/SmartBay)
- ENVIROFI project - [www.envirofi.eu](http://www.envirofi.eu)

# EuroGEOSS contributions to the Global Earth Observation System of Systems



Sven Schade  
European Commission –  
Joint Research Centre  
sven.schade@jrc.ec.europa.eu

**The dynamic understanding of the Earth system – including its climate, natural resources, and hazards – is crucial to enhancing human welfare and achieving sustainable development. Observations provide a foundational input for advancing this understanding. Local, regional and global information about natural resources in forests, for example, supports management in cases of fire. The over 65,000 forest fires, which Europe witnesses each year, have a direct impact on governments, businesses and conservation. This impact can only be accessed if all related information has been collected, analysed and made available to the involved stakeholders.**

The example above indicates some of the central challenges for the 10-year implementation plan of the Global Earth Observation System of Systems (GEOSS), which should provide decision-support tools to a wide variety of stakeholders, including governmental organizations, but also laymen.

The development of GEOSS is coordinated by the Group of Earth Observations (GEO), which is a voluntary partnership of governments and international organizations. Work has been started in 2003 in response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialized countries. Today, GEO’s members include over 87 governments and the European Commission. More than 64 intergovernmental, international, and regional organizations with a mandate in Earth observation or related issues have been recognized as participating organizations.

GEOSS is simultaneously addressing nine areas of critical importance to people and society. It aims to empower the international community to protect itself against natural and human-induced disasters, understand the environmental sources of health hazards, manage energy resources, respond to climate change and its

impacts, safeguard water resources, improve weather forecasts, manage ecosystems, promote sustainable agriculture and conserve biodiversity.

The cross-disciplinary endeavours of GEO are particularly important to the European Commission (EC), and the Member States of the European Union. Several EC Directorate-Generals (DGs) are active members of GEO, including DG Research and Innovation, which is leading the EC-related activities, and DG Joint Research Centre that is providing supporting services. On-going developments complement the INSPIRE Directive on establishing an infrastructure for spatial information in Europe to support EC environmental policies, and policies or activities which may have an impact on the environment.

At the same time, GEOSS related research became a substantial part of European-funded competitive research projects. The Seventh Framework Programme (FP7) of the European Commission, for example, launches GEOSS related calls each year, with an average annual research funding of approximately 20 million euros. This translates to roughly four new large scale research projects on GEO/GEOSS every year. In the following, we summarize two examples of such projects. We particularly present the main contributions of EuroGEOSS and briefly introduce the recently launched GEOWOW.

## A European approach to GEOSS

The FP7 project EuroGEOSS – “A European Approach to GEOSS” – demonstrates the added value to the scientific community and society of

making existing systems and applications interoperable and using them within the GEOSS and INSPIRE frameworks. The project builds an initial operating capacity for a European Environmental Earth Observation System in the three strategic areas of drought, forestry and biodiversity. It then undertakes the research necessary to develop this further into an advanced operating capacity that provides access not just to data but also to analytical models made understandable and useable by scientists from different disciplinary domains. The project was launched in May 2009 and runs for three years.

This concept of inter-disciplinary interoperability requires research in advanced modelling from multi-scale heterogeneous data sources, expressing models as workflows of geo-processing components reusable by other communities, and the ability to use natural language to interface with the models. The extension of INSPIRE and GEOSS components with concepts emerging in the Web 2.0 communities in respect to user interactions and resource discovery also supports the wider engagement of the scientific community with GEOSS as a powerful means to improve the scientific understanding of the complex mechanisms driving the changes that affect our planet. Ultimately, EuroGEOSS outcomes will be extended to issues on a global scale through our sustainability initiative to support user understanding and applications for improving societal conditions.

At the last GEO plenary meeting in Istanbul on 16-18 November 2011, EuroGEOSS was rightly recognized as a leading example of European-funded research in action. The main scientific

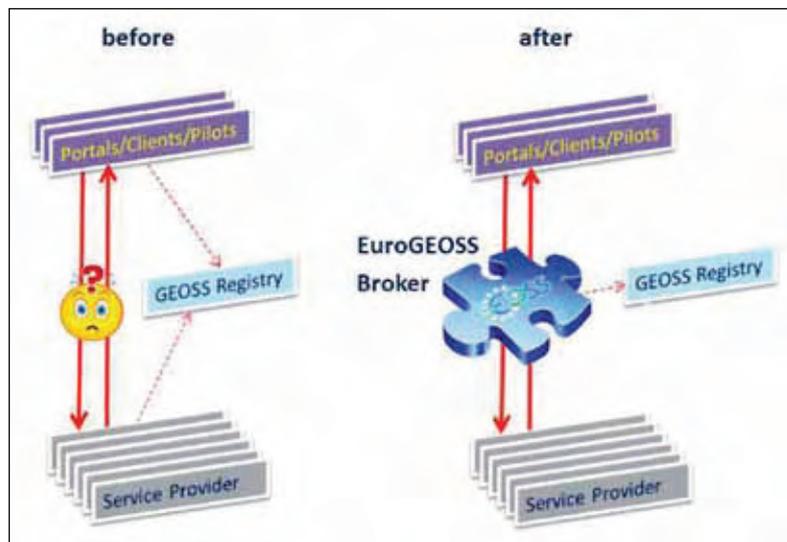


Figure 1: EuroGEOSS brokering approach

achievements of this project include (i) the development of a brokering approach for GEOSS; (ii) the semantic enablement for discovering geospatial information resources; and (iii) a method for transferring geo-processes from the desktop to the Web.

Particularly the 'EuroGEOSS Brokering Approach' and the respective software framework, which has been developed within the project, introduce a powerful positive shift to the central paradigms of the GEOSS Common Infrastructure. While previous versions of the infrastructure required strong commitments of the user community to a limited set of specific standards for data encoding and service provision, the EuroGEOSS approach transfers these loads to a brokering middleware, which finally allows connecting multiple disciplines which all may still follow their own community standards. Functionality, such as discovery, view and data access, is now supported by a set of open and extendable brokers that removes the initial barriers of sharing Earth Observation data and environmental models.

The outstanding positive impact of the brokering approach can be easily quantified. Whereas about one and a half years ago, GEOSS provided access to a total of 141 data sets, hosted about 191 services and connected to 43 Earth Observation Systems, the novel implementation incorporates over 28 million data products (data series, data sets, images, etc.), 1500 service instances and 500 Earth Observation Systems. The time line of this entry boost directly mirrors the introduction of the brokering approach into the system. Re-use is additionally supported by transformation brokering, i.e. by possibilities to download desired data sets from multiple sources in a common coordinate reference system and resolution.

### Beyond EuroGEOSS: GEOSS interoperability for Weather, Ocean and Water

The project GEOWOW – "GEOSS interoperability for Weather, Ocean and Water" – addresses the main challenges to improve Earth Observation data discovery, accessibility and exploitability, and to evolve GEOSS in terms of interoperability, standardization and functionality. This three-year project, which was launched on 1 September 2011, particularly focusses on the further architectural evolution of the GEOSS Common Infrastructure and its extension to three additional

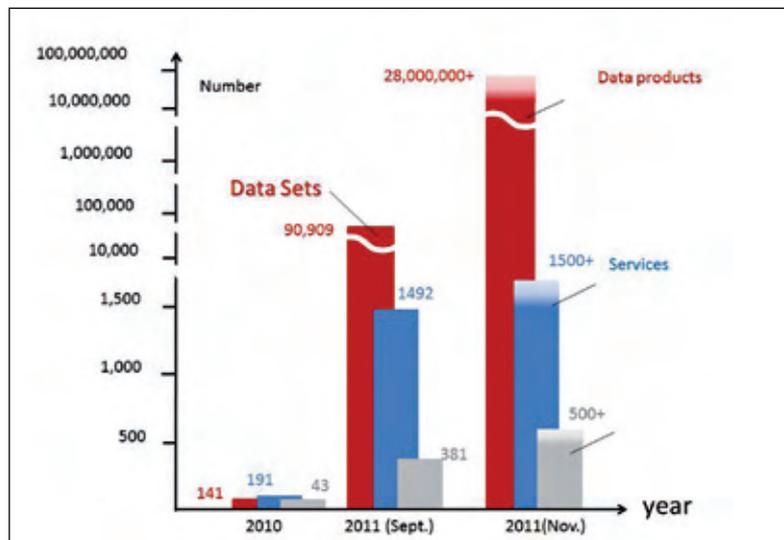


Figure 2: EuroGEOSS Earth observation statistics

social benefit areas: weather, water and ocean eco systems. In doing so, GEOWOW directly builds on the EuroGEOSS contributions to GEOSS and takes the next logical step in the implementation plan.

Expected contributions include:

- The development of innovative methods for harmonized access and use of heterogeneous data, services, models to foster the sharing of knowledge among multiple disciplines, and the more integrated assessment and understanding necessary to advance global sustainability research;
- The harmonized and fast provision of data access for meteorological hazards/extreme events, e.g., floods, including pre-processing services aimed at making the data of immediate use; and
- The enhanced support to access in-situ and satellite ocean observations, information on threats to ocean ecosystems, and key ocean forecasts and projections – for research and assessment. A particular focus will be on supporting inter-disciplinary interoperability and the use of semantics for enhanced discovery of data in the selected social benefit areas.

### Outlook

EuroGEOSS and GEOWOW are two on-going EU-level research projects, which address complementing social benefit areas of GEOSS following

a multi-disciplinary approach. While EuroGEOSS is about to end, GEOWOW was just launched six months ago. It now takes over the main architectural achievements and extends the advanced solution to the social benefit areas weather, water and ocean ecosystems. The brokering approach, which has been initiated in EuroGEOSS, has been integrated into the operational GEOSS several months ago and finally provides the required middleware to truly implement a system of systems that covers the whole globe. The number of available data products and services is expected to continuously increase.

Further information:

- EuroGEOSS project:  
<http://www.eurogeoss.eu>
- GEOWOW project:  
<http://www.geowow.eu>
- GEOSS, the Global Earth Observation System of Systems:  
<http://www.earthobservations.org>
- INSPIRE Directive 2007/2/EC:  
<http://inspire.jrc.ec.europa.eu>

# Digital Earth and the generativity of the Internet

## Interview with geo-information scientist Yola Georgiadou

In 1998, Al Gore, then US vice president, created the vision of the Digital Earth. Fourteen years of technological progress later, it is time to take stock of how far we have come and what still needs to be done to realise this vision. Eurescom mess@ge editor-in-chief Milon Gupta interviewed someone about it who is at the forefront of making the Digital Earth vision happen: Yola Georgiadou, professor at the Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente in the Netherlands. Professor Georgiadou is a member of the Executive Committee of the International Society of Digital Earth (ISDE) and on the editorial board of the International Journal of Digital Earth (IJDE). Her research focus includes the use of geo-information in public governance as well as the governance of Spatial Data Infrastructures (SDI).

### How far have we progressed towards realising the Digital Earth vision since it was created in 1998?

Since Al Gore first envisioned a child's magic carpet ride around Digital Earth, the progress has been enormous. Digital Earth applications in commerce, social networking, collaborative production of geographic knowledge and software, citizen science, and politics are transforming our experience in the market, in the private and the public sphere. Commercial and social networking applications will be more disruptive of old ways than others. Users will adopt them and abandon their old way of doing things. Citizen science and political applications will probably succeed when ambitions are incremental, because of the power distance between citizens and scientists, and between citizens and bureaucrats.

### To what extent have Digital Earth activities, such as geo-browsing, deepened our understanding of complex environmental processes?

Accounts of complex environmental processes encompass the activities and practices of the scientific community as well as the work of political actors and institutions in defining problems and endorsing solutions. As a pragmatist, I would rather ask to what extent geo-browsing helps scientists make claims about complex environ-



Yola Georgiadou

mental relationships that are more actionable to policy makers.

### What is the relationship between global Earth Observation, as done by GEOSS, and Digital Earth, as promoted by ISDE?

If GEOSS is a global and flexible 'system of systems' — an Internet of Earth Observation — then Digital Earth is the geo-world-wide-web. Both GEOSS and Digital Earth display characteristics of 'magic concepts.' Magic concepts have an overwhelmingly positive connotation, can advertise, focus and legitimize certain ways of looking at the world, and help mobilize financial resources and political support. They inspire strategic action, play a central role in the popularization and dissemination of broad ideas of reform, and provide a vision that experts, politicians, and other participants can use. Both are extremely useful in practice when specified and applied in particular ways.

### How successful is science in making sense of the huge data amounts from environmental sensors?

Science is successful in making sense of huge data amounts from remote and in-situ sensors. However, in the future it will not be enough to communicate this 'sense' to the public and increase public awareness, with initiatives as 'public understanding of science'. The acid test for science will be the 'making sense together' of environmental processes with the civic, economic and bureaucratic domains in society. Citizens in particular will increasingly participate in co-producing environmental data and knowledge,

thus increasing the legitimacy and robustness of the environmental policy making process. Environmental views from everywhere will replace the view from a single privileged perspective.

### How important are citizens for environmental data gathering and the Digital Earth vision compared to electronic sensors?

The role of 'citizens as citizens' and empowered participants in environmental policy making is becoming more salient. The convergence of social networks, off-the-shelf geographic toolkits and a variety of location-based digital reports, including texting, voice and images, that are sourced by citizens will amplify citizens' voice in environmental monitoring. Neogeography is putting the power to contribute to a virtual, global, but fragmented "sketch map — perpetually under collective social construction — in the hands of anybody with access to the geographic toolkit. Access to geographic conversation in the virtual public space may become more important than access to geographic information.

### Which role does the Internet play for achieving the Digital Earth Vision?

As Zittrain famously argued in "The Future of the Internet"\*, it is the generativity of the Internet that makes it a remarkable and transformative technology and that will play a role for achieving the Digital Earth vision. Generativity as described by Zittrain delivers two types of benefits, innovation and participation; the former derived from unanticipated change, and the other from the inclusion of large and varied audiences. It pays to note, however, that generativity is not an immutable feature of the Internet but the result of design decisions inscribed in code, which can be replaced at will, thus making the Internet less generative and the achievement of the Digital Earth vision more remote.

### What requirements should the Future Internet fulfil in order to enable the Digital Earth vision?

The most important requirement in the future will be safeguarding the Internet's generativity, safeguarding an open virtual public space, where

continued on page 13



## Editorial

### Dear reader,

Celtic-Plus is now entering its second year. With Celtic-Plus the scope of the research work has been expanded by new concepts and extended to cross-domain sectors and research collaboration with related initiatives like Future Internet, Smart Cities, and others. In addition, Celtic-Plus introduced a new, accelerated call process with two full calls per years. This new call process already shows that the launch time between project proposal and project start can indeed be reduced. Therefore, the next two calls will be launched in 2012, spring call (deadline 21 May) and autumn call (deadline 15 October).

Another successful Celtic Event was held from 22 to 23 February 2012 in Stockholm, combined with a Proposers' Day, particularly focusing on the coming spring call (21 May). This event was again well attended, and participants considered it to have been very useful. At this event one project (WINNER+) received the newly created Celtic

Innovation Award and three projects received the Celtic Excellence Awards. These awards have become widely recognised as an indication of excellent results from Celtic projects, including those which did not receive a prize but were nonetheless excellent.

In addition, we present four interesting projects, which have finished or which are about to end.

Enjoy reading this issue.

**Heinz Brüggemann**  
Director Celtic Office

## CONTENT

Editorial .....	C1
Celtic-Plus Event in Stockholm .....	C2
Celtic Awards 2012 .....	C3
<b>Celtic Project Highlights</b>	
MOTSWAN .....	C4
AWARE .....	C6
COMESI .....	C7
Imprint .....	C8
About Celtic-Plus .....	C8



# Celtic-Plus Event 2012 in Stockholm

## Realizing the Smart Connected World



Heinz Brüggemann  
Director Celtic Office  
brueggemann@celticplus.eu

**About 200 people attended the second Celtic-Plus Event in Stockholm from 22 to 23 February 2012. Several high-level speeches and an impressive exhibition complemented the demonstration of Celtic's activities and achievements.**



This year's Celtic-Plus Event was organised in Stockholm, supported and co-organised by VINNOVA, the Swedish Governmental Agency for Innovation Systems, and Ericsson.

### Celtic-Plus Proposer's Day for Call 2012 project proposals

The event started with a Celtic-Plus Proposers' Day. The meeting was intended for proposers to present and discuss new project ideas, in this case, ideas which could become a proposal to be submitted for the Celtic-Plus spring call on 21 May 2012. Besides the presentation and introduction of a new project idea, this meeting aimed to establish new connections with other poten-

tially interested project partners. There had been very useful networking discussions with other experts, as well as with exhibitors working on related ideas. The Celtic-Plus web site offers links to the presented proposals, and Celtic will help to establish additional liaisons where needed.

### Project exhibition



Another important highlight of the Celtic-Plus Events was the exhibition of project demos. These demonstrations and the discussions of results with the project experts highlighted how many good and impressive projects are currently on their way and may have good chances to generate real impact and new business.

In total 15 project demonstrations presented the current results and some preliminary new products of Celtic projects. Some of the products may come to the market in a relatively short time. This again proves the high impact of Celtic projects on the positioning of the European ICT industry.

### Celtic-Plus Event session

The main part of the Celtic-Plus Event was the conference, where several high-level representatives presented their views on the future challenges of ICT research in this fast changing world.

In the opening session the Director General of VINNOVA, Dr Charlotte Brogren, presented the views of VINNOVA and their new strategies to maintain the currently strong technological position of Sweden.

Sándor Erdő, the current EUREKA HLG chair presented the 4 key priorities of the Hungarian EUREKA chairmanship, which are:

- Improving the position of EUREKA in the European Research Area (ERA)
- Developing EUREKA services to finance innovation
- Promoting industry-driven RTD project generation

- Exploring the regional dimension of EUREKA

Jan Färjh, the Vice President and Head of Ericsson Research, provided his views on the future challenges of everything being connected to any existing mobile and fixed network leading to millions of new business opportunities that should not be missed by companies.

The next day of the event was marked by a very challenging and interesting panel discussion on the requirements and priorities, the right approach, as well as the challenges and possible threats for introducing the Cloud concepts for ICT. As a summary of the very lively discussion the following was stated:

- The operators need much more activities and new focus not to lose track when Clouds are introduced in the ICT business.
- Clouds require a consistent and complete new eco-system for handling data as well as programmes and services.
- Cloud systems should be open-source. Only then reliable and system/provider independent Cloud solutions can be obtained.
- Europe can still play an important role in defining and implementing Cloud systems and also in making business out of them.

The final speech of the event was given by the incoming EUREKA High Level Group chair, Okan Kara from Tübitak. He said that during the Turkish chairmanship a strong focus will be put on the EUREKA clusters and on Eurostars, as these are the most important EUREKA activities, covering the largest part of the EUREKA research projects.

Further information about the Celtic-Plus Event is available on the Celtic-Plus website at [www.celticplus.eu](http://www.celticplus.eu)

# Celtic Innovation and Excellence Awards 2012



Heinz Brüggemann  
Director Celtic Office  
brueggemann@celticplus.eu

**For some years Celtic has honoured the most successful and most promising finished projects with an excellence award. This year the Celtic Core Group decided to create another award, the Celtic Innovation Award. The first Innovation Award went to the WINNER+ project.**

**In the Celtic Excellence Awards category, the SERVERY project received the Gold Award, OPERA-Net received the Silver Award, and HNPS the Bronze Award.**

**“We are very proud to have such impressively successful projects within our programme portfolio,” said Celtic-Plus chairman Jacques Magen.**

## Celtic Innovation Award Winner 2012: WINNER+

The newly created Celtic Innovation Award was presented by Charlotte Brogren, the Director General of Vinnova, to Werner Mohr, the WINNER+ project leader from NSN Germany. The project acronym stands for Wireless World Initiative New Radio.

Ms Brogren praised WINNER+ as a very good example of how European collaborative research activities can complement each other. WINNER+ started as an FP7 EU project and was continued and finalised as WINNER+ in Celtic, where it carried out verifications and an implementation of the new 4G mobile standards technologies LTE and LTE-advanced.

With LTE and LTE-advanced we have, for the first time, a truly global mobile standard, she explained. This is true not only for Europe but also now in the US and China. This is clearly a huge success for European industry, which has played a significant role in the development of

the standard, thanks to the three WINNER projects both in FP7 and in Celtic.

According to Ms Brogren WINNER+ and the European LTE/ LTE-advanced activities should even be regarded as a GSM-like opportunity to strengthen European industry in the area of new high-speed mobile technology.

The WINNER+ project was a key contributor to the LTE-advanced standardization work and responsible for evaluating the candidate technology proposals for LTE-advanced in ITU-R. WINNER+ demonstrated the feasibility of the key radio interface technologies and supported the leadership of European industry in delivering LTE networks, which will be next big wave in mobile communications.

Finally, Ms Brogren pointed out that after the world's first commercial 4G/LTE network was launched in Stockholm on 14 December 2009, the worldwide number of 4G/LTE subscribers is now at around 10 million.

## Celtic Excellence Awards 2012

Every year Celtic selects the three best finished projects for the gold, silver and bronze excellence award.

The selection criteria are looking in particular at the business impact, including especially new products traceable from the project results, and strong other impact like creation of new business lines, new jobs, strongly influencing standards. The difference compared to the Celtic Innovation

Award is that we are looking here mostly at the expected impact because the projects were just completed; however some projects already have industrial impact even during their lifetime or shortly after they are finished.

The awards are mainly based on successful mid-term and final reviews and impact assessments. The final selection of the gold, silver, and bronze award winners is then made by the Celtic Core Group members.

## Celtic Gold Award winner: SERVERY

SERVERY has realized prototypes and evaluations of an open European service marketplace. The system competes with the Apple store and other online selling points for Apps. In addition to service delivery it also allows to create and to commercialize multimedia services to mobile and fixed broadband users. It gives the possibility for end users to access a great deal of innovative services created by professionals or by the user community.

The business relevance is considered to be very high. Project partners have already created several new products; the most advanced is the BlueVia sales-portal from Telefónica which integrates several Servery functionalities. Alcatel-Lucent, Bull and NSN have also integrated results from SERVERY into some of their new products. The project was led by Jean Pierre Le Rouzic from Orange FT, France.



Celtic Award winners 2012 and their project teams



# MOTSWAN

## MOBILE TV SERVICES WHATEVER ACCESS NETWORK

### Celtic Silver Award winner: OPERA-Net

The OPERA-Net project (Optimising Power Efficiency in mobile Radio Networks) focused on a holistic approach for the reduction of power consumption and for evaluating the network elements and their interdependencies. The business relevance of OPERA-Net is very high: reduction of power consumption is ensured through the network analysis when base stations are in sleep mode and the related efficiency improvement that can be achieved. Another very strong point is the Odyssey simulation tool that was extended to include power consumption and power monitoring as an important tool for reducing power consumption of the network. The project was led by Régis Esnault from Orange FT, France.



**Alexis Pottier**  
Gemalto  
Alexis.Pottier@gemalto.com



**Tuomas Paaso**  
VTT  
Tuomas.Paaso@vtt.fi

### Celtic Bronze Award winner: HNPS

Finally, Harold Linke from HITEC Luxembourg received the Bronze Award for HNPS (Heterogeneous Network for European Public Safety). The project focused on a well-controlled integration of communication systems, including private mobile radio systems and broadband services, using fixed or deployed networks. This controlled integration led to the concept of heterogeneous networks for future European public safety communications.

The project developed a security platform that allows to seamlessly and autonomously use 6 different network technologies. The system can integrate 4 different types of fast deployable mobile networks including Wireless Sensor Networks. Major achievements of the project are also the five demonstrations of the HNPS system to the user communities including policemen and fire-fighters.

HNPS has played an important role already in the development of 8 new products, and another 8 products were improved in incorporating results from the project. More business impact is expected in the future.

**TV services are delivered via a number of different access networks. For Mobile TV alone, optimization of the network infrastructure costs for different reception conditions over 100% of a territory require to take advantage of different access network technologies.**

The aim of the MOTSWAN project was to develop advanced technologies allowing a convenient user experience for the end user whatever the access network technology is.

The main focus was on Mobile TV services, i.e. services available on a handheld device, whatever the access network, i.e. including home reception of ADSL TV via a home Wifi link or public access via Wifi or Wimax.

This includes the following functions: service discovery through ESG (Electronic Service Guide), service subscription, access control to services (service protection and rights management), interactive TV, service access in “roaming” situation, mobile TV services including personal and context aware data services – see in figure 1 the architecture of the project.

### Approach

The preliminary objective of MOTSWAN was to use DVB-H, because Mobile TV services were becoming popular, DVB-H networks were being opened and terminals were published but not yet available. Streaming services were also popular but problematic to operators because of limited bandwidth. At the beginning of the project, DVB-H was the future technology for Mobile TV. Streaming services would only be used to fill in gaps in the DVB-H coverage, and additional services were to be implemented to complement the

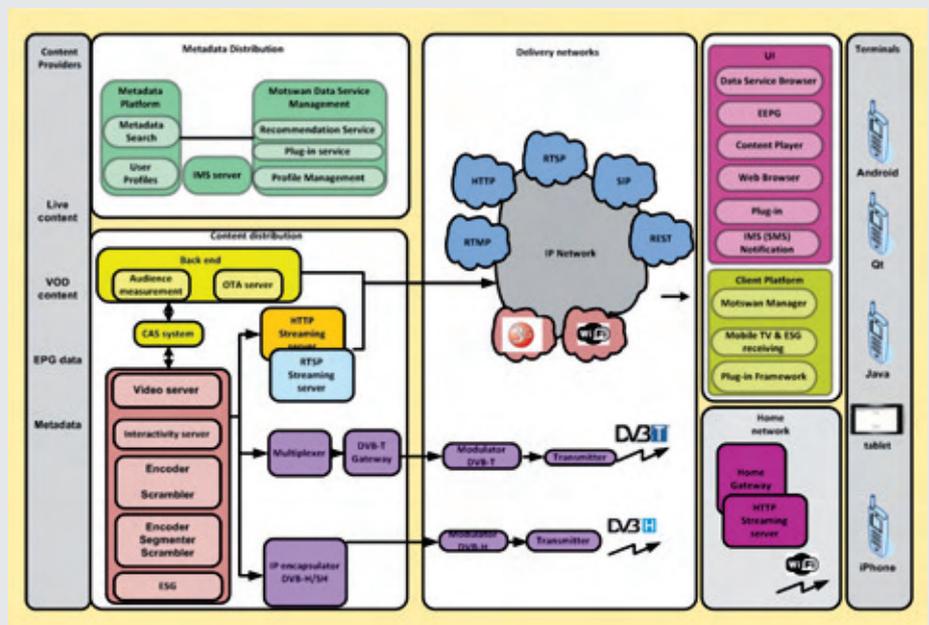


Figure 1: MOTSWAN architecture



broadcast TV service (e.g. betting, VOD/Push-VOD).

However, the operation of the DVB-H network has been terminated in 2010 due to low popularity (no terminals available), and Nokia announced to stop development of Symbian (the only available terminal was Nokia N8).

This resulted in different resolutions in the project. The selected demonstrations with DVB-H were kept, as the same mechanisms apply also for DVB-T and the future DVB-T2: mobile broadcast, hybrid concept of combining broadcast and unicast technologies (TISPAN IPTV standardisation).

New platforms have been taken (Android, Windows Mobile) to test new kinds of Mobile TV Services in a broader sense (without broadcast support).

More effort has been put to the concept of context aware auxiliary services – a concept covering the whole chain from service deployment and management to personalization and consumption has been covered.

**Results**

Two main demonstrators have been built to show both functionalities:

**Enhanced Services**

The demonstration combines auxiliary services to Live TV: provisioning to multiple mobile platforms, metadata management, context (location, preferences) sensitivity and personalization.

The user can watch live TV either using DVB-H reception or HTTP stream, view the programme guide (ESG), and has access to a personalised video-on-demand listing. All of these services can be enhanced by introducing auxiliary services and presenting them to the user regarding the user’s preferences and location and the current media content. For example, if the user is watching the sports channel, the stream also contains sports related advertisements. Alternative delivery means for the same content are also defined as enhanced services.

The content is never statically linked to a specific item, but all content is stored in the MOTSWAN service platform and is linked at runtime using a recommendation service. The user preferences can be defined by the user using an editor in the mobile client. The preferences contain information such as genres that the user



Figure 2: MOTSWAN auxiliary services

likes, or content types, e.g. video or web.

**Service Continuity**

The demonstration can show the TV continuity through different accesses: DVB-H, DVB-T, Web TV, Home Box TV – see in figure 3 the flow-chart of the demonstration.

The demo includes continuity of service protection and audience measurement.

TV services are delivered simultaneously through different DVB broadcast signals and HTTP streaming from an over-the-top server and a home box, provided with an homogeneous set of ESG/EPG (Electronic Programming Guide) and synchronized meta data.

On the client side, the same TV content session can switch between different available accesses through a multi standard receiver and

the ESG.

A unified content protection scheme is provided for broadcast and streaming, together with an audience measurement solution.

**Expected impact of the results**

Services and solutions developed in the project will be used commercially in the future. The results are a good basis for new competitive products and services, like EPG generator, homebox and key generator in Conditional Access.

Further information is available at <http://www.celtic-initiative.org/Projects/Celtic-projects/Call6/MOTSWAN/motswan-default.asp>

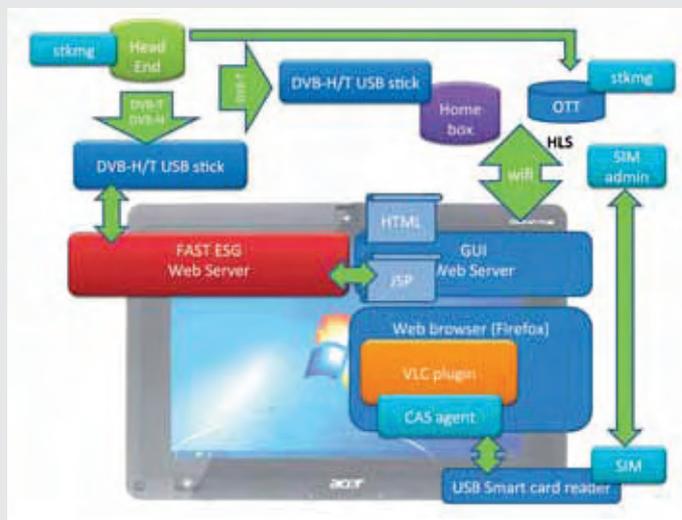


Figure 3: Flow-chart of the MOTSWAN demonstration



# AWARE

## Aggregation of Wireless Access Resources



Olivier Marcé  
Alcatel-Lucent Bell Labs France  
Olivier.Marcé@alcatel-lucent.com



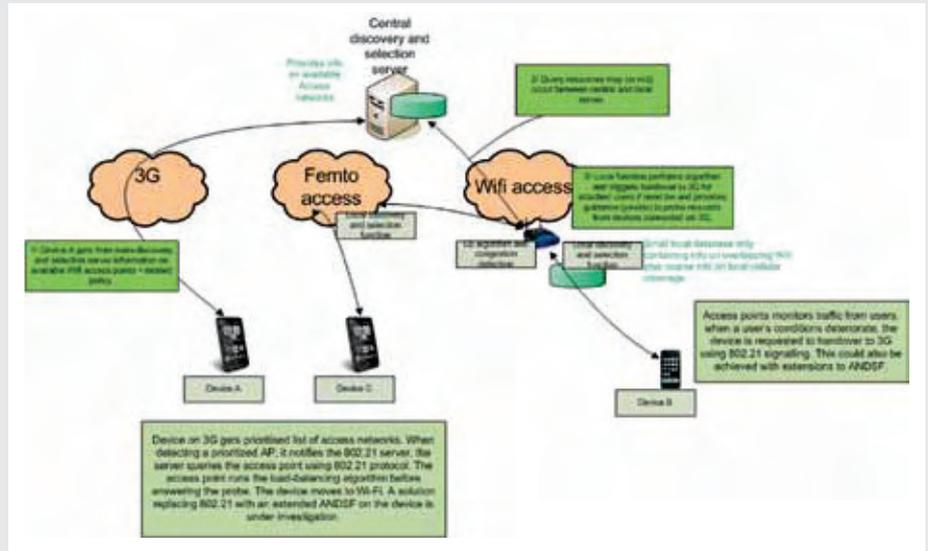
Peter Reichl  
FTW Telecommunications Research Center Vienna  
Peter.Reichl@ftw.at

**The growing demand for wireless access created by the amazing success of smartphones is the source of major concern for mobile network operators. Besides acquiring additional spectrum or increasing spatial efficiency, we have to think of alternative solutions, considering the network as a whole. The time for a substantial increase of the spatial density of sites based on small cell technologies has arrived.**

In this article, we focus therefore on key ideas of the AWARE project on creating small cell networks by placing base stations directly into the home or the office of an end user while using the already existing cheap public Internet access (DSL, cable, etc.) for backhauling, i.e. for connecting the base station to the core network. The base stations can be either a Femtocell that uses the licensed spectrum under the control of the operator, or a Wi-Fi access point owned and controlled by the user.

### Making Wi-Fi cellular friendly

Originally, Wi-Fi has not been designed as a



The AWARE concept for aggregating wireless access resources

mobile technology. As a result, in spite of the high bandwidth and low latencies that it can provide, today's user experience is unsatisfactory. Difficulties of establishing a working connection to a Wi-Fi access point – due to authentication, interference, congestion, edge of coverage, or other contingencies – often discourage users from using Wi-Fi entirely. This leaves the challenge of how best to exploit both cellular and Wi-Fi coverage while delivering a simple customer experience to the end users.

The solution designed and prototyped by the AWARE project is composed of an innovative measurement system located at the Wi-Fi access point that is able to determine how intensively the terminals are using the radio resources. A connection manager on a smartphone that supports network selection protocols (IEEE 802.21, 3GPP ANDSF) connects to a network server able to take decisions based on congestion information. This approach enables cellular and Wi-Fi networks to handle congestion detection on Wi-Fi and to decide which users should be migrated back to cellular, thus ensuring optimal experience for all users sharing that network access (see figure).

### Strategy for sharing wireless access

A model for wireless resource sharing has been designed to study optimal strategies. The objective is to allow both customers and mobile operator to benefit from this cooperation. The customers are divided into two classes: the Service Providing Customers (SPC) who are owners of wireless access which they have contracted with a mobile operator, and the Service Requesting Customers (SRC) who are using a mobile device and request using the access points of one or more SPCs being in reach. Note that

users can act as SPC and/or SRC at the same time, which justifies employing the notion of "prosumers" for this specific user role. We use game theoretic methods to provide initial insight into the competition between users providing bandwidth and those requesting it. The existence of a corresponding Nash equilibrium can be shown, and the efficiency of a distributed learning algorithm has been investigated. Essentially, during each iteration this algorithm updates a probability vector for the available pure strategies, based only on local information, most notably the utility achieved from the most recent allocation decision, together with a learning parameter governing the speed of the learning process. In this way, all users are able to learn to issue the best request and answer depending on their individual needs and resources as well as the competition.

### Conclusion

The AWARE project explored the field of aggregating users' wireless resources with mobile operator networks in a safe and efficient manner. It showed how Wi-Fi can be integrated with the cellular networks, in order to provide users with high quality of experience, despite the lack of management capabilities of Wi-Fi. The project also studied algorithms for supporting prosumers while selecting their best strategies of wireless resource requests and offers so that an equilibrium can be found. The project results pave the way to a rapid deployment of user provided networks, while part of the work has also been exploited in the new Alcatel-Lucent LightRadio Wi-Fi offer.

Further information is available at <http://www.celtic-initiative.org/Projects/Celtic-projects/Call6/AWARE/aware-default.asp>

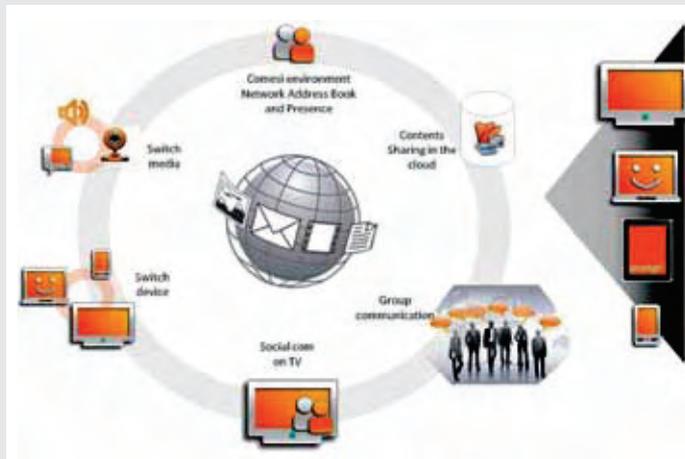


# COMESI

## The future of the Rich Communication Suite



Cécile Batel  
Orange FT, France  
cecile.batel@orange.com

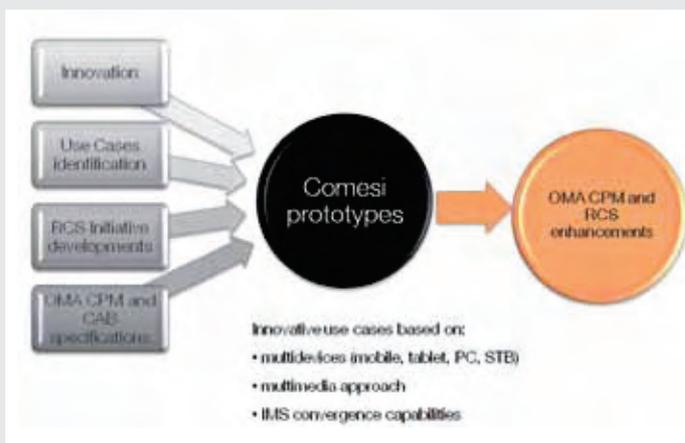


The recent Internet revolution has changed the way we communicate. We do so with more contacts, more devices and with more types of media. The COMESI project is proposing a set of service prototypes based on clients for the Rich Communication Suite (RCS). The prototypes provide the end user with a new and enriched communication environment: multiple devices, real continuity of service, ease of use, and better control of data.

Web actors are offering more and more communication services introducing significant competition for the traditional telecom operator market. Their business model may be very attractive for customers. However, their solutions are very scattered and require many users comprising a critical mass. As a possible answer to this problem, The COMESI project prototyped a set of services made available to the user's address book and utilized all of his devices (PC, Mobile, Tablet, TV) while remaining operator agnostic.

### The COMESI prototypes

The prototyped services of the COMESI project include content sharing in the Cloud, communication with a favourite social network, and switching from one media or one device to the other with no session interruption. This functionality is available on every device, including the television. One of the key components is the address book and having it available and up to date on the network. This allows presence information to be available as well.



### OMA, RCS standards and project collaboration

COMESI's technical objectives were, on one hand, to make the most of the existing OMA CPM & CAB specification, which was, along with the enablers, developed within the RCS initiative. On the other hand, the point of the project was to go beyond the current OMA CPM & CAB specifications by proposing innovative integrated service prototypes. To reach these objectives, it was important to gather the expertise of our partners, (Telefónica, Orange), messaging platforms (Acision), presence platform (Italtel), PC software editor (Broadsoft, ex-Movial), and STB manufacturer (Pace France). Most of the partners were part of the OMA CPM or CAB work groups and RCS initiatives. Integration and service quality were ensured by SQS while the user acceptance analysis was managed by the University of Delft.

### Service innovation: RCS enrichment, interoperability, security

COMESI services correlate additional features on the RCS client which was ported on PC, tablet and TV (through STB) in addition to the mobile. All COMESI services will be at the users' disposal through a single application, the usual address book. Therefore, the user experience is simplified, as he can use all of his communication features through a single authentication. In addition to the services being interoperable, they will work with any user's contacts, because the services are subscriber operator agnostic. Users will also benefit from service security and reliability granted by the operators.



### User acceptance analysis

User acceptance analysis was a very important topic for the COMESI project members. A focus group was organized early on to verify that users understood the concepts and accept them. This allowed us to solicit and accept user feedback during the specification stage. In the last project year, a survey was held throughout Europe to evaluate the service features as well as an in-lab experiment. Results were very positive – the most interesting one is that the users would be interested in the COMESI services even more so after trying them.

### Conclusion

The Celtic COMESI project's prototypes are based on an innovative architecture combining the standardized OMA Converged Address Book, OMA Converged IP messaging and OMA presence enablers. They are based on RCS (Rich Communication Suite) clients and therefore are illustrating the opportunities allowed by those standardized works when gathered in a single pan-European platform.

The COMESI services improve the user experience not only through the use of multiple devices, but also through the interoperability between operators thanks to the RCS clients. In a period when people communicate more often with different services and devices, COMESI is proposing a unified and interoperable service to perform various communication activities in a safe, secure and better controlled environment.

The COMESI prototypes have received very positive feedback when demonstrated at the Orange exhibition in Moldova, at the LTE platform opening in Brest, France, and at the Orange Labs Research Exhibition during the second half of 2011.

Further information is available at <http://www.celtic-initiative.org/Projects/Celtic-projects/Call6/COMESI/comesi-default.asp>



### IMPRINT

Editor-in-Chief:  
Heinz Brüggemann  
brueggemann@celticplus.eu

Contact:  
Celtic Office  
c/o Eurescom GmbH  
Wieblinger Weg 19  
69123 Heidelberg, Germany  
Tel: +49 6221 989 405  
Fax: +49 6221 989 451

### About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new "Smart Connected World" paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the inter-governmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.



# When the norm becomes a crime

Interview with Yola Georgiadou  
continued from page 12

citizens and NGOs can have access to geographic conversation with each other in the collaborative production of geographic knowledge, with scientists in citizen science and with government in political applications of Digital Earth. The dilemma will be between satisfying the requirements by regulators and consumers for a safer and secure cyber environment and maintaining the generativity of the Internet.

## What needs to be done yet to fully reach the Digital Earth vision, and by when do you expect this to happen?

A significant research effort is needed at the interface of geospatial science and policy science to fully reach the Digital Earth vision. Often geospatial scientists and policymakers are 'lost in translation' between geospatial expertise and policy making. Science policy interactions will often be problematic. Neither the political view – 'politics on top, science on tap' – nor the scientific view – 'speaking truth to power' – is valid. Research questions that need to be addressed include: How do geospatial scientists come to know facts, theories and relationships regarding human action and the environment, and persuade others their knowledge is credible enough as basis for political decisions and actions? How do policy actors draw on geospatial knowledge to justify collective action?

Predicting the future is fraught with problems, but one thing is clear now: if the events since 1998 are any guide for the future, much of the Digital Earth vision will be achieved in 10–15 years from now. At that time, we will probably need a different magic concept to inspire global collective action.

\* Jonathan Zittrain: The Future of the Internet – And How to Stop It. New Haven & London 2008. URL: <http://futureoftheinternet.org>



David Kennedy  
Director of Eurescom  
kennedy@eurescom.eu

**We all seem to get more biased and a little right-wing as we get older. With more experience we appreciate more the values inherent from hard work and achievements, and we resent disruptive actions. However, we always have to be careful that our middle-aged dislike of disruptive activities is not manifested by repressive actions or even putting oppressive mechanisms in our laws. That is the doorway to the society George Orwell feared we would see in 1984.**

This is where we are at with the new digital era. We all have now the power to make a digital copy of music, videos, or whatever, and the copy quality is every bit as good as the original. So logically, the copy has the same value as the original. If I then put this copy on the market, I am selling your property to my benefit without respecting your rights. This is why there are now several initiatives around international trade agreements to protect digital property.

One such example is the Anti-Counterfeiting Trade Agreement, or ACTA as it is called, which aims to establish common international laws and mechanisms for protecting intellectual property rights. However well-intentioned ACTA is, it is still a very crude instrument and it could do a lot of collateral damage. As always in these situations, the devil is in the details.

### Dangerous details

The ACTA agreement states in article 27, paragraph 6 a) that "...each Party shall provide protection at least against:

- to the extent provided by its law;
- the unauthorized circumvention of an effective technological measure carried out knowingly or with reasonable grounds to know; and
- the offering to the public by marketing of a device or product, including computer programs, or a service, as a means of circumventing an effective technological measure; "

The danger here is that normal actions will become criminal. My immediate concern is that I have hacked DVDs to get them to play on my iPad. Clearly, under the above-mentioned Article, I am guilty of an offence as I circumvented some technological measure to have the content of my DVD available on my other devices. I did not offer it to the public but I am exposed anyway in that the signatory parties to the ACTA are expected to have legal measures to deal with people like me who circumvent encrypting. It does not grant exemptions for personal use. In fact I suspect that anyone born after 1995 will be guilty here by default.

ACTA goes even further to determine in article 27, paragraph 6 b) that there should also be laws to "provide protection at least against: (...)

- the manufacture, importation, or distribution of a device or product, including computer programs, or provision of a service that:
- is primarily designed or produced for the purpose of circumventing an effective technological measure; or
- has only a limited commercially significant purpose other than circumventing an effective technological measure"

So now the guys who produce the programmes that allow me to put the copy of my DVD on my devices are expected to be locked up. Their programme is allowing me to circumvent a technological measure so national laws should stop them. Again the applicability of this part depends on the legal interpretation of what "limited commercially significant purpose" means,

I have no doubt that the authorities concerned will be very quick to assure me that it is not me they are concerned about – I can do what I want for my private use. But that is an insufficient answer: when does my private use stop being private? If I put a copy on my daughters' iPads, iPhones, PCs, and whatever other devices the well-equipped teenager has these days am I now a distributor? If I have the digital content on a USB stick, am I guilty of possessing with intent to supply?

### The assumptions problem

Very quickly we learn that content generators don't trust users to only share it as they are entitled to. Therefore they implement electronic coding and locking measures to protect their content. Maybe their experience is such that this is a fair assumption, but it runs the risk of all assumptions, in that it generalises and affects

the innocent as much as the guilty. Their measures restrict the freedom of legitimate purchasers of the content.

But they are not the only ones guilty of assumptions. We, the users and the citizens are afraid of the ACTA approach as we don't trust the governments – and even worse: the corporations – to stay within the spirit of the agreement in its application.

### The responsibility problem

ACTA offers no guidance to determine if the owner of a content sharing site is responsible for the files shared in his domain. The recent shut-down of one notorious sharing site shows that there can be a lot of innocent casualties when dramatic actions against suspected copyright breach facilitators are taken.

It raises a serious question of responsibility for the thousands of legitimate files that are trapped in frozen servers in such a case. Honest people are denied their service because some of the service users were distributing content they should not have. What are the rules for this? Who should be liable?

### The policing problem

Who should be the police in this Internet scenario? Is every service provider obliged to freeze any customers' activities as soon as they are accused by someone of breaching copyright? How serious does the accusation have to be and who has the right to make it? Even if this is done legally, what are the procedures to restore services? What about partial service constraints? What about unsubstantiated accusations?

For example: it is probable that the authorities involved felt that Megaupload did not do enough to stop the real bad guys, but it is also likely that the same authorities have no idea of the number of innocent parties damaged by their freezing action on Megaupload services.

If a service provider is denied the ability to continue to provide services then, most likely, the business will be dead long before any legal case is resolved. This is effectively a "guilty until proven innocent" type of justice based on accusations. We should not go there.

### The way forward

The first thing we must do is fight blanket rules that do not provide detailed definitions of the parameters that make acts illegal. If the intention is that I am allowed to make copies for my own use then state this clearly in the agreement. If I am so allowed to copy content I have purchased, then legislators cannot make it illegal for others to supply me with a programme I need to exercise this right.

Legislators should come up with fair rules for stopping inappropriate behaviour that recognises the roles and responsibilities without making honest companies criminals, because their facilities have been misused or because they are falsely accused. An improved version of ACTA should specify requirements to punish authorities and other parties for misuse or abuse of these powers, just as they specify punishments for those who misappropriate digital content.

The target crime here is the unauthorised mass copying and distribution of digital content. We must be very careful that the cost of addressing this is not a restriction of the rights of individuals and the freedom of the Internet.

## VIEWPOINT

# The European exploitation gap

## In need of a better entrepreneurial culture



Peter Stollenmayer  
Eurescom  
stollenmayer@eurescom.eu

**MP3 was invented and patented in the early 1990s by a Fraunhofer institute in Erlangen. A European innovation success story? Not fully: the first commercial MP3 players were produced by US and Korean companies. Although Fraunhofer still gets a license fee of 0.75 US dollar per manufactured MP3 unit, Europe has lost the business of producing MP3 players probably for ever.**

Europe is really great in researching, inventing and developing things, and even in securing the related patents. It is however not so great in turning these inventions into marketable products and services securing employment for European workers. In the following I would like to share some personal thoughts why Europe is not so

successful in turning knowledge into commercial products and how this situation could be improved.

### Entrepreneurial attitude

Entrepreneurs are a special breed; they like challenges and risks. They are willing to work hard to make their dreams come true. Traditionally Europeans rather appreciate secure jobs and good social security. Leaving a secure job with guaranteed pension rights for becoming an entrepreneur with the risk of failure is not what most Europeans would want to do. According to Grasshopper.com the rate of entrepreneurs in the US is 11.3% compared to 3.5% – 6.3% in the different European countries. In the US 37% feel optimistic when they start a new business, in European countries only 14% – 30% feel optimistic (the Netherlands are an exception with 39%).

Also the attitude towards failures differs significantly. In the US it is quite normal to start a new business after one or more failures. In Europe failures are taken much more seriously and can cause irreparable damage to an entrepreneur's reputation.

Such cultural attitudes are hard to change. Changing them requires a lot of combined effort including society, governments and education. Unfortunately my firm opinion is that exactly these slow-changing cultural attitudes are the main obstacle for better European entrepreneurship.

### Entrepreneurial experience and education

Often indirect problems not related to the business itself lead to entrepreneurial failures. Even if the business idea is promising, there are a lot of legal, administrative, regulatory and economic barriers to overcome. A successful entrepreneur is not just good in his/her subject, but also in solving non-subject related problems. Business administration related knowledge is crucial for this. Primary and secondary education in Europe do not take this well enough into account. In Germany, for example, you can easily pass your A-levels, or even obtain an academic degree, without having heard anything about business plans, balance sheets or profit and loss statements.

It is probably one of the most important mid-term requirements to include and improve business administration and economic subjects in basic and higher education. There is some light at the end of the tunnel: the European Commission has recognised the need for more entrepreneurial education and created a programme “Promoting entrepreneurship in schools and universities” containing recommendations to push education for a more active role in creating a more entrepreneurial culture in Europe.

### Political and economic environment

If a region is to create successful new businesses, the political, economic and legal environment has to be entrepreneurship friendly. This includes simple administrative procedures and friendly tax regulations for new businesses. The EU and the Monetary Union has somewhat helped to improve the European situation, but there are still many national differences in administrative, legal and tax regulations.

### Venture capital and EU support

New businesses normally need more or less money, depending on the business. There are many ways to finance new businesses. Often the owners raise enough capital for starting the business. If more capital is required it could come from banks (not easy during the current bank crisis), venture capital investors, business angels or other sources. An interesting funding mechanism fitting perfectly with the idea of a networked information society is “crowd funding”. It depends very much on the type of business whether the capital is a crucial barrier. In many cases it might not even be an issue.

### Outlook

Bridging the gap between research and products is crucial for European wealth and employment. Currently the European culture is not very entrepreneur friendly, and the education system does not provide enough for it.

We do have to improve the entrepreneurial culture in Europe compared to other parts of the world. This can only be achieved by a multi-faceted effort improving business and economic education, and entrepreneur related regulations. Most importantly we have to change the cultural attitude towards a more entrepreneurship-friendly society. This is difficult and cumbersome; let us nevertheless have a try – it is worth it. Several activities are currently going on, which make me a bit optimistic. Just to name two promising examples:



MP3 – invented in Germany, commercially exploited in America and Asia.

- The European Commission has recognised that the transition from ideas arising from research to competitive production and to markets is the weakest link in European value chains, although absolutely crucial for European growth and job creation. “Horizon 2020”, the upcoming 80 billion euro European Research and Innovation Framework Programme contains strong messages and instruments to improve Europe’s capabilities to market innovative products and services.
- The “German Silicon Valley Accelerator” provides entrepreneurs with a support and mentoring program in the Silicon Valley. The idea is to support German startups in their first steps into becoming internationally recognized and successful companies, including gaining an overall understanding of Silicon Valley business culture.

### References

- For more information on mp3: <http://www.mp3licensing.com/>  
<http://www.mp3licensing.com/mp3/history.html>  
<http://www.mp3licensing.com/royalty/>  
[http://en.wikipedia.org/wiki/Portable\\_media\\_player](http://en.wikipedia.org/wiki/Portable_media_player)
- For more information on Horizon 2020: [http://ec.europa.eu/research/horizon2020/index\\_en.cfm](http://ec.europa.eu/research/horizon2020/index_en.cfm)  
[http://ec.europa.eu/research/innovation-union/index\\_en.cfm](http://ec.europa.eu/research/innovation-union/index_en.cfm)  
[http://ec.europa.eu/research/horizon2020/index\\_en.cfm?pg=h2020](http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=h2020)
- For more information on entrepreneurship: [http://europa.eu/legislation\\_summaries/education\\_training\\_youth/general\\_framework/n26111\\_en.htm](http://europa.eu/legislation_summaries/education_training_youth/general_framework/n26111_en.htm)  
<http://germanaccelerator.com/>

# 4th EU-Japan Symposium

## Closer collaboration between European and Japanese organisations agreed



Anastasius Gavras  
Eurescom  
gavras@eurescom.eu

The 4th EU-Japan Symposium on New Generation Networks and Future Internet took place in Tokyo, Japan, on 19 January 2012. The symposium focused on several topics of mutual interest to Japanese and European researchers which require joint research efforts in order to be addressed more efficiently.

### Background

In 2008, the European Commission and the National Institute of Information and Communications Technology (NICT) jointly held the 1st EU-Japan Symposium on Future Internet (FI) and New Generation Networks (NWGN) in an effort to step up the collaborations in the NWGN and FI research activities between the EU and Japan. The 2nd and 3rd symposia were held in 2009 and 2010.

### Opening

The symposium was opened with a welcome speech by the president of NICT, Hideo Miyahara. The participation of Mr Miyahara highlighted the importance of the event. The European delegation was led by Zoran Stančić, Deputy Director General at the EC's Information Society and Media DG. Mr Stančić explained the EU digital policy and the role of international collaboration in the context of Future Internet. In response, Shigeyuki Kubota, Director-General of International and Technology Policy at the Japanese Ministry of Internal Affairs and Communications as well as Tomonori Aoyama from NICT and Keio University presented the Japanese policy and activities in the context of the New Generation Networks. Finally, Megan Richards, Director for Converged Networks & Services at the EC, presented the European Future Internet research perspective.

The future activities in Japan are clearly influenced by the devastating earthquake and tsunami as well as the ensuing nuclear accident which happened in 2011. The emphasis of research is, thus, being reinforced on areas such as disaster



Participants of the 4th EU-Japan Symposium in Tokyo

recovery, security, handling of large amounts of data, and the eco society.

### Technical sessions

Following the opening, the experts had extensive discussions on practical research approaches on six topics of mutual interest. The symposium was organised in six focused break-out sessions that included the following topics of interest:

**Low energy content distribution with content centric networking.** In this session the researchers discussed several approaches to optimisation of content delivery in the broader sense with the main focus to reduce the necessary energy consumption for this purpose.

**Future Internet of things over Clouds.** In this session the researchers discussed how the strengths of the Internet of Things can be combined with Cloud Computing concepts in order to provide a significant value add for the public but also for the businesses.

**Experimental R&D over federated Japan and EU testbeds.** In this session the researchers presented the currently available deployments of testbed infrastructures and discussed the potential federation of these. Resource Virtualisation at all layers and levels was the dominating topic of the session.

**Wireless networking.** The presentations and discussions in this session were dominated by the issues the mobile and wireless world is facing with respect to 4G systems and beyond. The experts discussed potential solutions and spectrum options that need to be available in 2020 and beyond.

**Optical communication.** Similarly in this session the researchers discussed the research challenges in optical ultra-high-speed networking, in particular in conjunction with the required flexibility and programmability of future networks.

**Security.** Finally this session was dedicated to an exchange between the experts on several aspects of security. The aspects discussed included defence against attacks on networks and services, survivability of the network in emergency situations, future security needs in ubiquitous, smart and mobile environments, privacy issues and last but not least the usability of secure systems.

The first three areas were discussed from a very practical point of view to identify immediate collaboration opportunities, whereas the last three areas were discussed more from a fundamental research point of view.

### Outlook

An important outcome of the fourth EU-Japan Symposium has been the intention to issue a coordinated call between the EU and Japan for joint projects in the above-mentioned areas.

You can find more information on the Symposium at [http://www.primo-pco.com/4thJEU Symposium/program\\_e.html](http://www.primo-pco.com/4thJEU Symposium/program_e.html)

# Augmented human cognition and the impact on the network

## Insights from Eurescom study P2155



Dr. Rahul Swaminathan  
Deutsche Telekom Innovation  
Laboratories  
rahul.swaminathan@  
telekom.de



Fausto de Carvalho  
Portugal Telecom Inovação  
cfausto@ptinovacao.pt

**An average person carries with him technology capable of much more than making phone calls. Today's devices are capable of localizing the user, recognizing objects, searching and delivering information, and more. In some sense, current technology already augments our cognition or understanding of our environment.**

With the current pace of technological advancements, it behoves us to ask: what will be the nature of augmented cognition in the future, and how will this impact the communication network?

### Augmented cognition

By Augmented Cognition, we refer to all technological means used to alter the power and scope of the cognitive processes and sensory perceptions of humans. This article presents some key finding from our Eurescom study P2155 "Towards networks and services supporting the human cognition" on the future of augmented cognition and its impact on the network. We study the future scenarios within augmented cognition as being driven by the enabling technologies in three time horizons: short term (5–10 years), mid-term (10–20 years), and long term (beyond 20 years).

### Key enablers

In order to augment our understanding of the world, the technology must be capable of (i) sensing both the environment and the human user, understanding and interpreting the environment from the sensorial data and (ii) interfacing with the human to "display" the filtered data in a form understandable to a human.



Augmented Reality: virtual fish tank in the living room

Researchers and developers are investigating a plethora of technologies starting with the mature fields including image understanding techniques, sensor fusion, advanced 3D scanning and display technologies to more ground-breaking work within neuroscientific and bio-medical engineering. While retinal displays might make a large display redundant, brain computer interfaces (BCI) will not only enable us to control computers, but will also enable the processing of brain wave signals to reconstruct our thoughts digitally. Similarly, advances in biomedical engineering enable "lab on a chip" technologies that detect, diagnose, and administer drugs for local infections and diseases.

### Use cases – Augmented Reality and beyond

Today's mobile devices already possess the required capabilities to enable a slew of Augmented Reality (AR) services. The next 5 to 10 years should see the advent of real-time consumer grade AR services including tourist guides, personalized advertising, as well as multi-media rich content streaming applications such as Free Viewpoint TV, and others. Furthermore, with the growth of sensors networks, we also see the potential of security critical services that aggregate information from ad-hoc networked sensors towards emergency assistance and evacuation guidance systems.

More ambitious use cases will build up, as more powerful and versatile technology becomes available. For our analysis we have considered a vast set of diverse scenarios including: multi-sensorial tele-presence, technological implant-based rehabilitation, cognitive domotics, nanobot doctor and tele-surgery.

### Ramifications on the network

The various use cases from our study were carefully decomposed into a series of functionalities, requiring specific technical parameters. The study addresses various network aspects which are required for the future communication services associated with augmented cognition. These network aspects include bandwidth, jitter, availability, synchronization, intelligent caching, architecture, topology and policy. In order to timely anticipate the impact of these applications and services, further work is required to understand the challenges and opportunities involved.

### Outlook

Current over-the-top approaches to providing augmented reality type services are not expected to scale with real-time demands and mass usage. This challenge in supporting augmented cognition services can actually be an opportunity for telcos.

In the future, augmented human cognition will blur the boundary between technology and humanity. While the technological impacts can be systematically analysed, the psychological, legal and ethical impacts are much harder to figure out.

Further information on Eurescom study P2155 is available at [www.eurescom.eu/services/eurescom-study-programme/list-of-eurescom-studies/studies-launched-in-2011/p2155.html](http://www.eurescom.eu/services/eurescom-study-programme/list-of-eurescom-studies/studies-launched-in-2011/p2155.html)

# The FuturICT Flagship Project

## Towards socially interactive computing systems



Paul Lukowicz  
DFKI Kaiserslautern  
paul.lukowicz@dfki.de

**This article outlines the concept of the FuturICT Flagship Project. It is one of six preparatory actions, called Pilots, in the area of Future and Emerging Technologies (FET) under the Seventh Framework Programme (FP7). FuturICT and the other Pilots are preparing the large-scale FET Flagship Initiatives, which will be launched in 2013. The ultimate goal of the FuturICT Flagship Project is to understand and manage complex, global, socially interactive systems.**

What do bird flu pandemics, the Arab Spring revolutions, the financial crisis, traffic jams, terrorist networks and mobile phone viruses have in common? They are all manifestations of our ever more highly interconnected world. Quite simply, the current pace of technological change, in particular in the area of information and communication technologies (ICT), is outstripping our capacity to manage them. To understand and perhaps even predict events and effects like these, we need a new kind of science. We also need novel socially interactive ICT technology that fosters stability, transparency, trust, respect for individual rights, and inclusive participation in political and economic processes.

### Holistic view of ICT

The FuturICT project takes a holistic view of ICT as a) a complex, dynamic, globe spanning system, b) composed of

billions of entities interacting over multiple spatial and temporal scales, and c) interweaved with society in a multitude of ways across different functional and structural layers.

A core question addressed by FuturICT is how to turn the relationship between the complex, globe spanning ICT infrastructure and human society into one that benefits humanity and leads to more stable, trustworthy, reliable, and inclusive ICT. To this end we will advance the development of future ICT systems through the innovative concepts described below.

### A Planetary Nervous System (PNS)

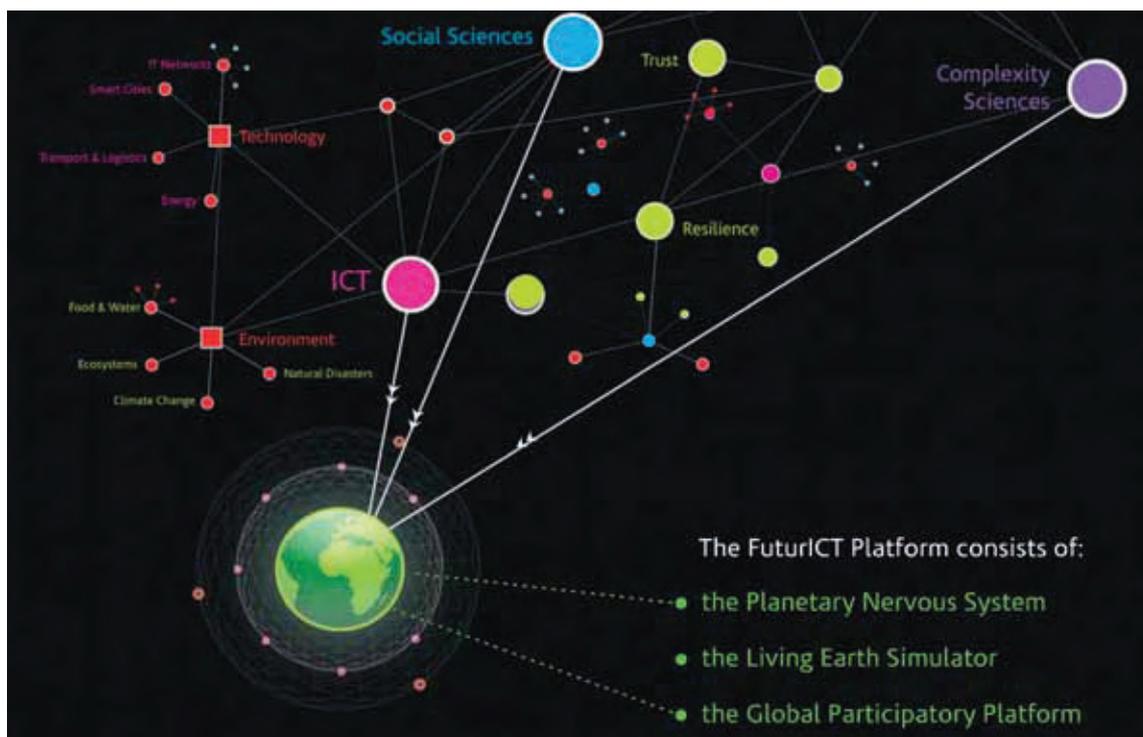
FuturICT aims to transform the current global ICT infrastructure into a socially aware Planetary Nervous System (PNS) that will provide real time information about relevant events, social processes and structures. It will collect and analyse a multitude of heterogeneous, dynamic data sources ranging from crowd sourced sensor information through digital media, social networks and blogs, to public infrastructure. Examples of the derived information are shifts in opinion and social attitudes, changes in consumer behaviour, emergence of tensions in communities, demographics, migration, mobility patterns, or health trends.

### Living Earth Simulator (LES)

The Flagship Project will develop novel, data driven computational social science that will build on the real time information provided by the above “nervous system” to enable comprehensive, real time capable models anticipating social dynamics in different areas, at various temporal and spatial scales up to the global scale of entire humanity. It will lead to the construction of the Living Earth Simulator (LES). The LES is a sophisticated, planetary scale social simulation and visualisation system together with a decentralized, interactive computational social science platform facilitating a broad range of novel participatory applications for individuals, communities, organisations and policymakers.

### Global social ICT system

Another important goal of the Flagship project is to enable the global ICT system to adapt to social needs, react to unforeseen events and in general have a desirable, stabilizing effect on social processes and phenomena. The actions that the system will be able to take will range from reshuffling of resources (e.g. information sources, bandwidth, distributed computing resources) to



The FuturICT Platform concept

enable better monitoring and management of an emerging crisis situation, through mediation of interaction in and between communities, “persuasive computing” based approaches to facilitating behavioural change, to emergency “slow down and ask human” mechanisms preventing the system from accelerating crises and systemic failures. They will be directed by high-level, human formulated goals and implemented by bottom-up, self-organised processes leveraging the system's social awareness and ability to model complex social phenomena.

### Co-evolutionary dynamics of ICT and society

As theoretical underpinning of the above paradigm shifts we will develop a novel science of ICT-society co-evolutionary dynamics. It will provide models, theories and tools for the analysis of complex, dynamic interactions between society and socially adaptive ICT. It will also lead to novel methods enhancing trust, stability and reliability in self-organised ICT infrastructures by leveraging socially inspired mechanisms for cooperation, coordination and reputation propagation.

### Global Participatory Platform (GPP)

Around the fundamental advances and basic components described above, the Flagship Project will build a Global Participatory Platform (GPP). The platform will extend the outlined capabilities to empower citizen, communities, small businesses, and NGOs, thus creating a whole ecosystem of new applications and forms of social participation.

### References

- FuturICT website: [www.futurict.eu](http://www.futurict.eu)
- P. Lukowicz, S. Pentland, and A. Ferscha. From context awareness to socially aware computing. *Pervasive Computing, IEEE*, 11(1):32–41, 2012.
- D. Helbing, S. Balietti, S. Bishop, and P. Lukowicz. Understanding, creating, and managing complex techno-socio-economic systems: Challenges and perspectives. *The European Physical Journal-Special Topics*, 195(1):165–186, 2011.

## FET – Future and Emerging Technologies

Future and Emerging Technologies, short: FET, are part of the European Commission's Seventh Framework Programme. FET is meant to be the incubator and pathfinder for new ideas and themes for long-term research in the area of information and communication technologies. Its mission is to promote high-risk research, offset by potential breakthroughs with high technological or societal impact.

The FET programme consists of two areas, FET-Open and FET-Proactive. FET-Open is a 'roots-up' approach for exploring promising visionary ideas that can contribute to challenges of long term importance for Europe. FET-Proactive is a 'top-down' approach fostering novel non-conventional approaches and foundational research in selected themes in response to emerging societal and industrial needs.

### FET Flagship Initiatives

Within FET-Proactive, the EC is in the process of creating FET Flagship Initiatives, which are ambitious large-scale, science-driven research initiatives that aim to achieve a visionary goal. The scientific advance should provide a strong and broad basis for future technological innovation and economic exploitation in a variety of areas, as well as novel benefits for society. Neelie Kroes, Vice President for the Digital Agenda at the European Commission, summarised the ambition by saying: “FET flagships have the potential to provide solutions to some of society's largest challenges and benefit our economy.”

The EC plans to launch at least two FET Flagships in 2013. They are scheduled to run for 10 years, each with a total budget of up to 100 million euros per year. The funding will come from a mixture of sources, including private and member state investments.

### FET Flagship Pilots

To prepare the launch of the FET Flagships, 6 preparatory actions, called Pilots, are funded by the EC. They started in May 2011 and run for 12 months. The Pilots will create a design and description of consolidated candidate FET Flagship Initiatives, including a feasibility assessment. By mid-2012 the FET Flagship Pilots will have to present a structured community in good position to implement their integrated research agenda, including the involvement and commitment from key stakeholders. By the end of 2012, beginning of 2013 at least two of the Pilots are expected to be chosen to be launched as full FET Flagship Initiatives in 2013.

### Further information

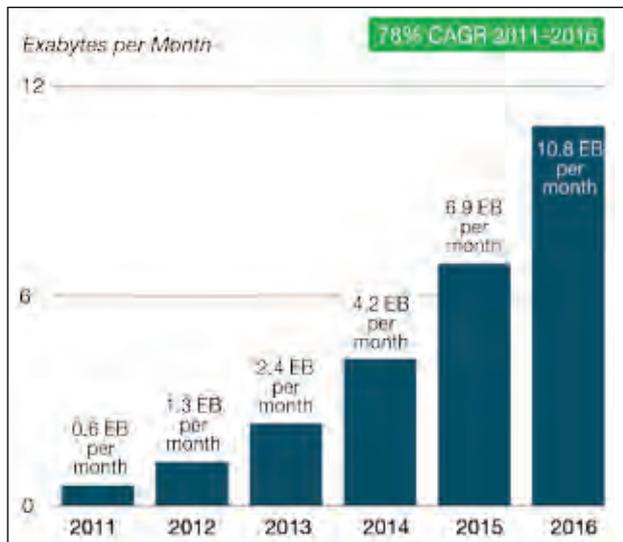
This article is based on public information provided by the European Commission.

Further information is available on the EC's Cordis website at:

- [http://cordis.europa.eu/fp7/ict/programme/fet/flagship/home\\_en.html](http://cordis.europa.eu/fp7/ict/programme/fet/flagship/home_en.html)
- [http://cordis.europa.eu/fp7/ict/programme/fet/flagship/6pilots\\_en.html](http://cordis.europa.eu/fp7/ict/programme/fet/flagship/6pilots_en.html)
- [http://cordis.europa.eu/fp7/ict/programme/fet/flagship/doc/flagshippress01\\_en.pdf](http://cordis.europa.eu/fp7/ict/programme/fet/flagship/doc/flagshippress01_en.pdf)

# News in brief

## Cisco forecast: more mobiles than humans by end of 2012



Mobile data traffic: 10.8 exabytes per month by 2016  
(Source: Cisco VNI Mobile, 2012)

By the end of 2012, the number of mobile-connected devices will exceed the number of people on earth, meaning more than 7 billion, according to the latest Global Mobile Data Traffic Forecast Update by network firm Cisco. The report pre-

dicts that there will be over 10 billion mobile-connected devices in 2016, including machine-to-machine modules. Global mobile data traffic will increase 18-fold between 2011 and 2016, reaching 10.8 exabytes per month by 2016, compared to 597 petabytes per month in 2011. The growth will be driven by an increasing number of data-hungry smartphones, mobile-connected tablets and other mobile-connected devices around the world, which will reach 10 billion by 2016. At the same time mobile network connection speeds will increase 9-fold by 2016. The average mobile network connection speed (189 kbps in 2011) will exceed 2.9 megabits per second (Mbps) in 2016. Network speeds will be pushed up by 4th generation mobile networks (4G). In 2016, 4G

will generate 6 percent of connections, but 36 percent of total traffic.

The main content driver of data consumption is video. Two-thirds of the world's mobile data traffic will be video by 2016. Mobile video will increase 25-fold between 2011 and 2016, accounting for over 70 percent of total mobile data traffic by the end of the forecast period. In order to cope with the huge increase in mobile data traffic, over 3.1 exabytes of it are expected by 2016 to be offloaded to the fixed network by means of dual-mode devices and femtocells each month.

The Middle East and Africa will have the strongest mobile data traffic growth of any region at a compound annual growth rate of 104 percent, followed by Asia Pacific at 84 percent, and Central and Eastern Europe at 83 percent. China will account for over 10 percent of global mobile data traffic in 2016, up from less than 5 percent in 2011.

The growth will be driven by an increasing number of data-hungry smartphones, mobile-connected tablets and other mobile-connected devices around the world, which will reach 10 billion by 2016.

will generate 6 percent of connections, but 36 percent of total traffic.

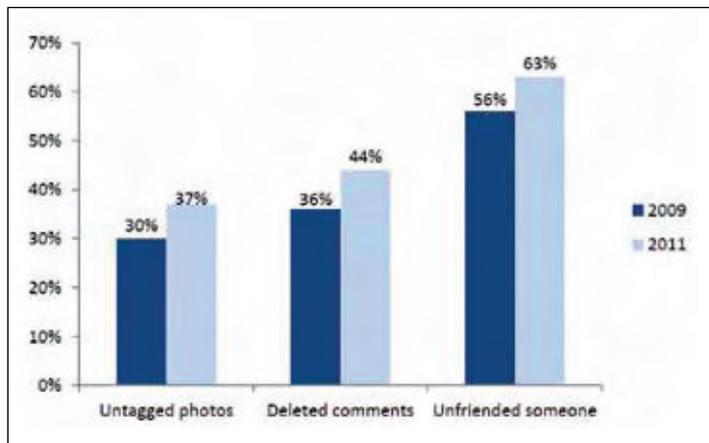
The main content driver of data consumption is video. Two-thirds of the world's mobile data traffic will be video by 2016. Mobile video will increase 25-fold between 2011 and 2016, accounting for over 70 percent of total mobile data traffic by the end of the forecast period.

In order to cope with the huge increase in mobile data traffic, over 3.1 exabytes of it are expected by 2016 to be offloaded to the fixed network by means of dual-mode devices and femtocells each month.

The Middle East and Africa will have the strongest mobile data traffic growth of any region at a compound annual growth rate of 104 percent, followed by Asia Pacific at 84 percent, and Central and Eastern Europe at 83 percent. China will account for over 10 percent of global mobile data traffic in 2016, up from less than 5 percent in 2011.

[http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white\\_paper\\_c11-520862.html](http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html)

## Pew report: Americans turning on to online privacy



Percentage of social networking site users who have taken privacy-enhancing steps on their profile (Source: The Pew Research Center's Internet & American Life Project, April 26 – May 22, 2011)

Social network users in the United States are increasingly minding their privacy settings and online reputations, including unfriending people. According to a report from the Pew Internet & American Life project, about two-thirds (63 per-

cent) of Internet users who use social networking sites have deleted people from their "friends" lists, significantly more than in 2009 (56 percent).

Women and younger users tend to unfriend more than others. About 67 percent of women who maintain a profile say they have deleted people from their network, compared with 58 percent of men. Likewise, young adults are more active unfrienders when compared with older users.

In addition, the report documents that 44 percent of social networking users have deleted comments made by others on their profile, and 37 percent have removed their names from photos that were tagged to identify them.

The Pew report is based on a telephone survey conducted in April/May 2011 among a sample of 2,277 adults, age 18 and older.

<http://pewinternet.org/Reports/2012/Privacy-management-on-social-media.aspx>

## Commission presents proposal for reform of EU data protection rules

On 25 January 2012, the European Commission proposed a comprehensive reform of the EU data protection rules. The draft European Data Protection Regulation, presented by EU Justice Commissioner Viviane Reding, is meant to supersede the EU Data Protection Directive from 1995. According to the EC, the new rules will strengthen online privacy rights and boost Europe's digital economy. The Commission's proposals include a policy Communication setting out the Commission's objectives and two legislative proposals: a Regulation setting out a general EU framework for data protection and a Directive on protecting personal data processed for the purposes of prevention, detection, investigation or prosecution of criminal offences and related judicial activities.

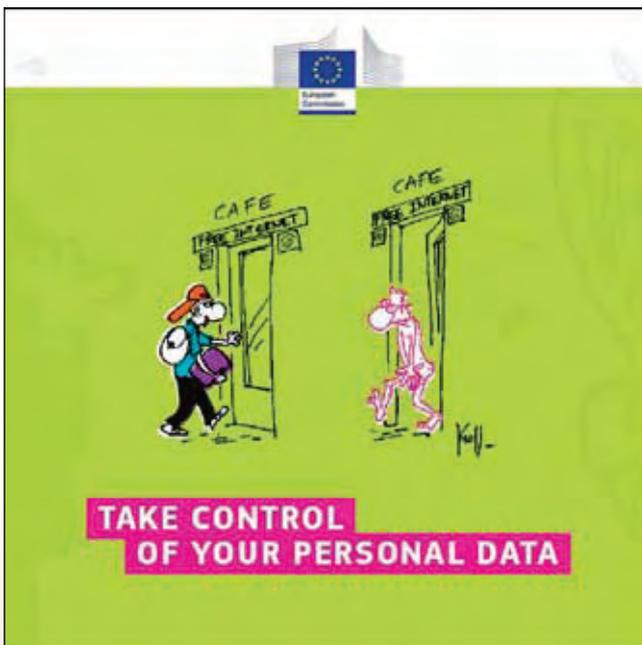
Key changes in the reform include:

- A 'right to be forgotten' aims to help people better manage data-protection risks online. When they no longer want their data to be processed and there are no legitimate grounds for retaining it, the data will be deleted.
- Whenever consent is required for data processing, it will have to be given explicitly, rather than be assumed.
- Easier access to one's own data and the right of data portability, i.e. easier transfer of personal data from one service provider to another.
- Companies and organisations will have to notify serious data breaches without undue delay, where feasible within 24 hours.
- A single set of rules on data protection, valid across the EU.
- Companies will only have to deal with a single national data protection authority – in the EU country where they have their main establishment.
- Individuals will have the right to refer all cases to their home national data protection authority, even when their personal data is processed outside their home country.
- EU rules will apply to companies not established in the EU, if they offer goods or services in the EU or monitor the online behaviour of citizens.
- Increased responsibility and accountability for those processing personal data.
- Unnecessary administrative burdens such as notification requirements for companies processing personal data will be removed.
- National data protection authorities will be strengthened so they can better enforce the EU rules at home.

The Commission's proposals have been passed on to the European Parliament and the EU Member States for discussion. The new privacy rules will take effect two years after they have been adopted.

The reform of the outdated privacy rules reflects that technological progress and globalisation have profoundly changed the way data are collected, accessed and used. In addition, it aims to overcome the current fragmentation of privacy rules across the EU, which has led to costly administrative burdens. This is due to the fact that the 27 EU Member States have implemented the 1995 rules differently, resulting in divergences in enforcement. According to the EC, the new legislation will lead to savings for businesses of around 2.3 billion euro per year.

[http://ec.europa.eu/justice/newsroom/data-protection/news/120125\\_en.htm](http://ec.europa.eu/justice/newsroom/data-protection/news/120125_en.htm)



Cover of EC brochure on data protection

# Undead on the Web

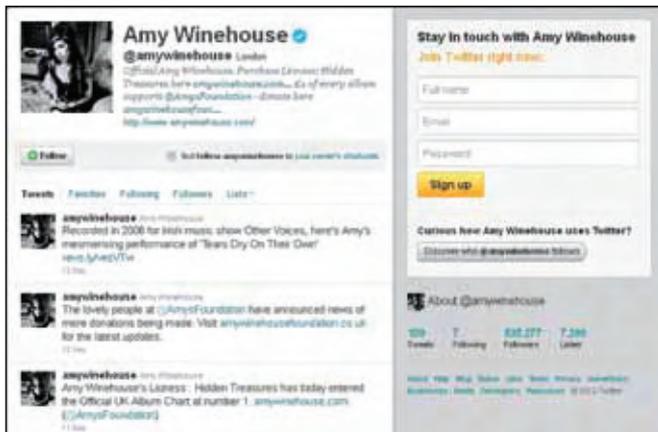
## How the Internet deals with death



Milon Gupta  
Eurescom  
gupta@eurescom.eu

**An undead is someone who is deceased and yet appears to be alive. There are two types of undead, those with a body, like vampires or zombies, and those without, such as ghosts. In the disembodied category, a new species is on the rise – the ‘digital undead’.**

Take singer Amy Winehouse, for example. Her heart stopped beating on 23 July 2011, but her Twitter account ([twitter.com/amywinehouse](http://twitter.com/amywinehouse)) with over half a million followers and her Facebook account ([facebook.com/amywinehouse](http://facebook.com/amywinehouse)) are still up and running. While accounts of dead celebrities are deliberately kept alive for commercial reasons, a large number of lesser known deceased share this fate for less strategic reasons.



Amy Winehouse – deceased: 23 July 2011, last tweet: 12 December 2011.

### Unclear legislation

Obviously, most dying people have other concerns than to organise the cancellation of their social networking accounts for the time after their departure. This leaves it to the relatives to sort out the social networking accounts of the deceased. However, this is not easy, as there seems to be no clear legislation in most countries, whether relatives have the right to do it. Several states in the US have considered legislation that would give personal representatives legal possession of Facebook profiles, Twitter

accounts, and other online information after a death. Such legislation has already been passed in the state of Oklahoma. However, privacy experts argue further legal clarification is needed.

### Memorial pages on Facebook

The case of Facebook shows that there is a grey zone with no easy legal and ethical answers. Since 2009, Facebook has a policy not to delete the account of a deceased user, but to memorialise it. On the Facebook help pages you can find the following explanation: “It is our policy to memorialize all deceased users’ accounts on the site. (...) In order to protect the privacy of the deceased user, we cannot provide login information for the account to anyone.”

In other words, Facebook does not remove the account of a deceased, even if close relatives ask for it. Before 2009, Facebook’s policy was to remove the profile of the deceased one month after he or she had died,

citing privacy concerns. Due to user responses arguing for maintaining the accounts to enable communal mourning, Facebook amended its policy.

Although some of the bereaved may appreciate that their loved one is commemorated on Facebook, not everyone shares this feeling. Some relatives may perceive the memorial page as an up-

setting reminder of their loss and would rather see the Facebook entry removed. Currently, there is no legal basis for this.

This issue will grow in importance with the number and age of users, and the proportionately increasing number of ‘digital undead’. As of January 2012, Facebook has more than 800 million users. The percentage of deaths in the US is about 8 percent of the total population. Allowing for the fact that the mortality of Facebook users, due to a lower average age, is much lower, figures could still be very high. Even 1 percent would already mean 8 million dead Face-



Hong Kong’s virtual graveyard at [www.memorial.gov.hk](http://www.memorial.gov.hk)

book ‘users’ with an equal number of memorial pages.

### Virtual graveyard

Beyond Facebook, it seems that, generally, mourning moves more and more from the physical world towards the Internet. Since 2010, the residents of Hong Kong can choose between either visiting an actual graveyard to pay respects to the dead or remember their ancestors at home from their PC, visiting a virtual graveyard at ‘[memorial.gov.hk](http://memorial.gov.hk)’, which was created by the Chinese government.

Mourners can simply visit the site and set up a page free-of-charge. Users can upload photos and videos in addition to offering condolences. Traditional Chinese offerings can be made through symbols like fruits, flowers and candles. Other popular Chinese graveyard offerings like pigs, chickens and paper money are also present in the form of symbols.

The motivation to create a site where ancestors can be worshipped online was based on the popular Chinese tradition of visiting their dead ancestors at least once a year and remembering them through offerings. A Chinese official stated that the new concept may be a hit with the younger generation, but the older generation may still prefer to visit the graves in person.

### Conclusion

As the Internet never forgets, cyberspace is predestined to be the permanent site for the Internet generation. Every culture has its special ways to deal with death and mourn the dead. Graves and mourning seem to move unstoppably from the physical world to the cyberworld. It would be interesting to know, if anthropologists in the year 3012 – if this academic profession still exists by then – will figure out how people in the early third millennium have mourned their dead, and if they figure it out, how they will interpret it.



# EuresTools

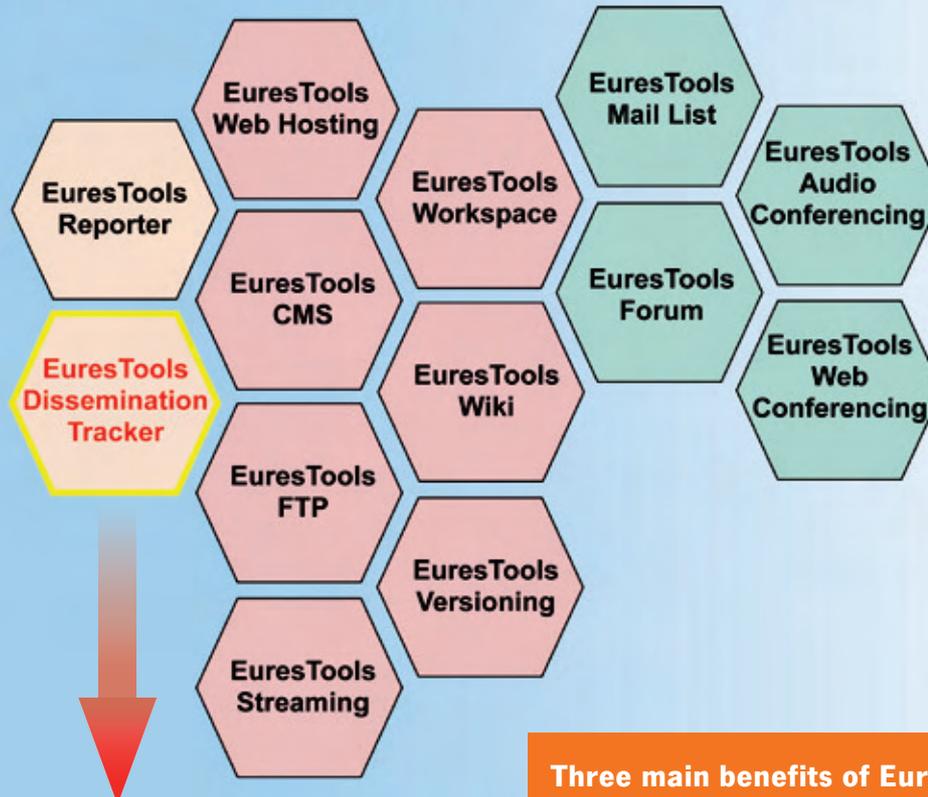
Steer your FP7 project to success



## Controlling & Reporting

## Information & Knowledge

## Communication & Interaction



### Manage dissemination activities effectively – with **EuresTools Dissemination Tracker**

EuresTools Dissemination Tracker makes it easy to manage all of your project's dissemination activities, from approving a draft dissemination activity to summarising all dissemination activities in the Final Project Report.

#### Main benefits of EuresTools Dissemination Tracker:

- **Easy entry** of all dissemination items by authors
- Authors can **keep track** of the status (e.g. accepted, rejected, published)
- **Effective approval** procedure for papers and other dissemination items
- Project managers can **easily retrieve** all required tables for internal reports or reports to the Commission, like periodic or Final Reports
- **Special reports**, like the annual questionnaire by DG INFSO, can be filled in directly via the Tracker

The Tracker is very flexible and can respond to any changes of the European Commission's reporting requirements.

### Three main benefits of EuresTools:

- **Flexible:** EuresTools provide full flexibility through modular, Cloud-based tools – just use the tools you need.
- **Comprehensive:** the EuresTools modules cover all needs of a research project. The tool suite is continuously updated reflecting the needs of customers.
- **Intuitive:** the user interfaces of all modules are very intuitive, making it easy to enter and access data.

What's best: under FP7 you can get EuresTools fully funded by the European Commission, if you include it in the budget of your project proposal.

**Contact us** to get more information and a live demonstration via EuresTools Web Conferencing –  
e-mail: [services@eurescom.eu](mailto:services@eurescom.eu)

[www.eurescom.eu/EuresTools](http://www.eurescom.eu/EuresTools)

**EURESCOM** mess@ge

The magazine for telecom insiders

Get your free subscription of Eurescom mess@ge  
at [www.eurescom.eu/message](http://www.eurescom.eu/message)

**EURESCOM**

European Institute for Research  
and Strategic Studies  
in Telecommunications GmbH  
Wieblinger Weg 19/4  
69123 Heidelberg, Germany  
Tel.: +49 6221 989-0  
Fax: +49 6221 989 209  
E-mail: [info@eurescom.eu](mailto:info@eurescom.eu)  
Website: [www.eurescom.eu](http://www.eurescom.eu)

Innovation through Collaboration

Eurescom is the leading organisation for managing collaborative R&D in telecommunications. Our mission is to provide efficient management and support of R&D projects, programmes, and initiatives for our customers. We offer more than two decades of experience in managing large-scale, international R&D for major industry players, the European Commission, and EUREKA Cluster Celtic-Plus. What distinguishes Eurescom is the combination of a secure, reliable infrastructure for collaborative work, a large European network of experts, and internationally outstanding project management skills.



QR code to the  
online edition of  
Eurescom mess@ge