IERC
European Research Cluster on the Internet of Things

# IERC Newsletter

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July, 2013

## European Research Cluster on the Internet of Things

**Points of interest:**

- Project news
- Cluster Book
- FuNeMS 2013
- IoT Week 2013
- IoT@Work
- iCore
- News and events

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Dear IoT Enthusiasts and Innovators,

Even if temperature-wise it has been rather cold in Europe in the past months the subject of Internet of Things has not stopped in gaining speed, attention and why not temperature.

During the IoT Week in June in Helsinki numerous exchanges among IoT specialists from all over the world took place. Interestingly enough new people were directing their attention towards this event and also a representative from the European Parliament was present. At the very same occasion the new IoT Forum was founded, willing to push business, social, legal and technical development and adoption of the IoT. Furthermore, the Connect Advisory Forum (CAF) organised its dedicated IoT workgroup meeting at the beginning of the IoT Week as part of its mission to ensure common understanding and coherent effective action across sectors and policy areas in the IoT.

On another European event in Lisbon at the beginning of July 2013, FUNEMS – Future Network and Mobile Summit, the Internet of Things was a prominent subject in relation to many network and communication related topics, driving requirements for future networks. As a pleasant topping an IoT exhibition stand won the first price.

If we look forward, eight new IoT projects on a reliable/safe and smart IoT and related to Smart Cities will start from September 2013 onwards. Part of these will be a Coordination and Support Action working on an international technology road-mapping for the IoT of tomorrow and beyond. On neighbouring activities a joint EU-Japan IoT/Cloud project has set sail and a few new projects in the context of the sensing enterprise will equally start soon. While these projects will join or collaborate with the Cluster, some existing ones will come to an official end, but of course be welcome to stay connected and participate in the Cluster work.

As we look forward to Horizon 2020, specific IoT challenges will be addressed by a larger cross-cutting activity, focusing on the creation of IoT platforms and ecosystems. Furthermore, a study on the "Definition of a research and innovation policy leveraging Cloud Computing and IoT combination" is expected to deliver results in the course of 2014. It is also intended to collaborate stronger with Member States' initiatives like Industry 4.0 in Germany and European Technology Platforms.

Finally, the results of a study on Europe's policy options for a dynamic and trustworthy development of the Internet of Things are currently been reviewed by DG CONNECT for revitalising its IoT Research & Policy Strategy.

I wish you excellent connected and disconnected moments during the summer break.

Yours sincerely - Peter Friess

*European Commission - IoT Cluster coordinator*

## "Brother in ARM" session at IoT Week *by Francois Carrez & Srdjan Krco*

*This session was organised by the "Architecture" Work Package of IoT-A with the aim of going one step beyond the usual dissemination about the Architectural Reference Model (ARM) of IoT-A as already achieved in respectively Barcelona and Venice IoT weeks 2011 and 2012. It was also a unique opportunity to disclose the latest information about the final version of our ARM deliverable. One special feature for this IoT week was the introduction of a "Red Thread" example that was used by all presenters in order to emphasised the impact of our work on a concrete use-case inspired by a Logistic scenario. After the classical Q&A slot following the ARM presentation we had a discussion with the session attendees about the sustenance of the ARM after the end of the IoT-A project in November 2013. It was further explained that the ARM will be taken care of by the Technology Working Group of the IoT Forum. The plan is to identify "ARM profiles" like for instance Semantic interop. or security and to work them out in great details, hence providing architects with detailed design and technology choices. Within the Forum we also plan to issue a "label" to profile-compliant systems or building blocks.*

*Contact: Francois Carrez (UNIS)*
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## Cluster Book 2013: Internet of Things
## Converging Technologies for Smart Environments and Integrated Ecosystems

Dear readers,

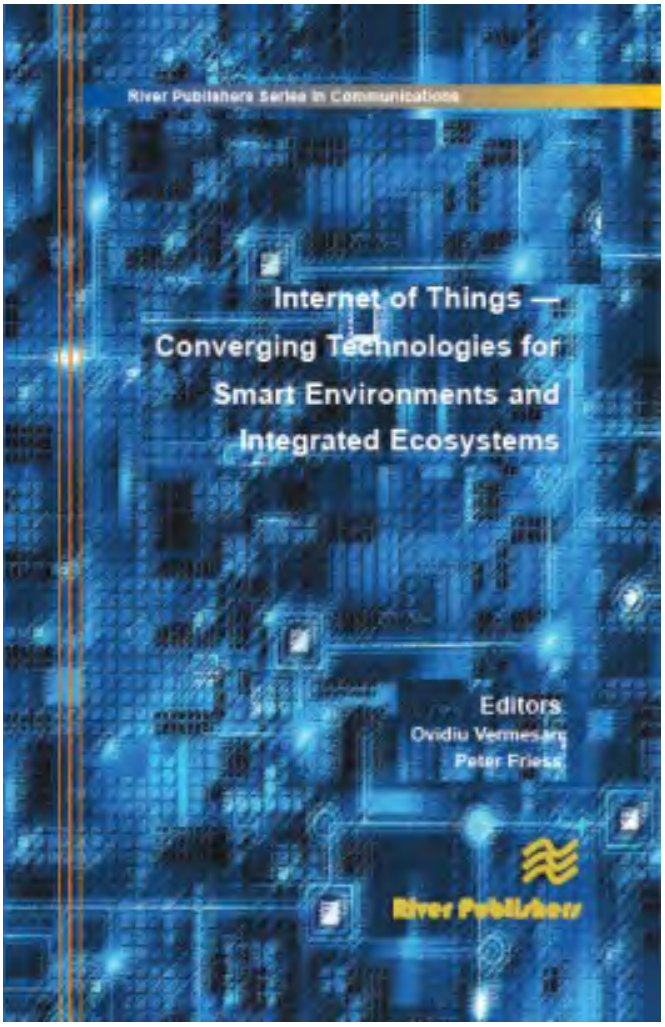
We are proud to announce the publication of **IERC Cluster Book 2013** and the release of the **Internet of Things Strategic Research and Innovation Agenda 2013**.

The book aims to provide a broad overview of various topics of the Internet of Things (IoT) from the research and development priorities to enabling technologies, architecture, security, privacy, interoperability and industrial applications.

It is intended to be a stand-alone book in a series that covers the Internet of Things activities of the IERC - Internet of Things European Research Cluster - from technology to international cooperation and the global "state of play".

The book builds on the ideas put forward by the European Research Cluster on the Internet of Things Strategic Research and Innovation Agenda and presents views and state of the art results on the challenges facing the research, development and deployment of IoT at the global level.

The rationale for the IERC is to address the large potential for IoT-based capabilities in Europe - coordinate and encourage the convergence of ongoing work addressing the most important challenges - to build a broadly based consensus on the ways to implementation and adoption of IoT in Europe.




Chapter 2 of the book is the IERC Strategic Research and Innovation Agenda (SRIA) that covers the important issues and challenges for the Internet of Things technology.

It provides the vision and the roadmap for coordinating and rationalizing current and future research and development efforts in this field, by addressing the different enabling technologies covered by the Internet of Things concept and paradigm.

The Strategic Research and Innovation Agenda is developed with the support of a European-led community of interrelated projects and their stakeholders, dedicated to the innovation, creation, development and use of the Internet of Things technology.

The IERC Cluster Book 2013 provides a road map for readers to navigate their way into uncovering the research and development challenges in the area of Internet of Things Technology and applications.

The 4th edition of the Cluster book "Internet of Things - Converging Technologies for Smart Environments and Integrated Ecosystems" was launched officially in Helsinki at the opening of IoT Week 2013.

The Cluster book was printed by River Publishers, DK, June 2013 (ISBN: 978-87-92982-73-5).

The SRIA will be downloadable from the Cluster Web Site in autumn.

Yours sincerely,

*Ovidiu Vermesan*
*IERC Coordinator*

## Future Network & Mobile Summit 2013, 3 - 5 July 2013, Lisbon, Portugal


**Future Network and Mobile Summit 2013** took place in Lisbon, Portugal, 03 - 05 July 2013.

This was the twenty-second in a series of Annual Conferences supported by the European Commission, which regularly attracts 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 FP7-ICT and Horizon 2020.

It contributed to showcasing European research in the field, and position it within the multiplicity of related initiatives supported in other regions of the world.

In the context of convergence and innovation, the 22nd Future Network and MobileSummit addressed the challenges of building the Future Internet Infrastructures, based on mobile, wireless and fixed broadband communications technologies.

The Final Programme incorporated Plenary, Panel, paper and poster sessions and workshops.

FutureNetworkSummit 2013 was opened by the General Co -chairs: Mário Campolargo, Director for "Net Futures", DG CONNECT, European Commission and Zeinal Bava, CEO, Portugal Telecom.

**Keynote Speakers included:**

- Dr. Aref Chowdhury, Chief Technology Officer Optics, Alcatel-Lucent
- Ulf Wahlberg, Vice President, Industry and Research Relations, Ericsson
- Dr. Stefan Ferber, Director Business Development, Bosch Software Innovations

**Panel Sessions included:**

Towards Virtualised Networks
Optical Networking: Enabler for the Future Converged Networks
Public Safety Future Networks: Industry and Stakeholder Views on Emerging Technologies, Standardisation Status and Regulatory Issues

Supported by the European Commission and the Net! Works European Technology Platform (through the NetSoc CSA project), Future Network and MobileSummit integrated high-level industry/policy plenary sessions that discuss strategic issues for Future Networks with high quality technical/scientific tracks and workshop sessions.

Technical/scientific tracks presented papers that showcase original results and hot topics in all areas of mobile, wireless and fixed broadband communications systems and networks.

Visit the Net!Works ETP website to view the video clips and interviews with plenary speakers, panelists and participants.

**Awards:**

The Best Paper was awarded to "A Control Architecture for Wireless MAC Processor Networking" authored by Pierluigi Gallo, Domenico Garlisi, Fabrizio Giuliano, Francesco Gringoli, Ilenia Tinnirello, Giuseppe Bianchi, CNIT, Italy (ICT Flavia & CREW Projects).

The Runner up Paper was awarded to "A Cognitive Management Framework for Service Provisioning in the Internet of Things" authored by Vassilis Foteinos, Dimitris Kelaidonis, George Poulios, Panagiotis Vlacheas, Vera Stavroulaki, Panagiotis Demestichas, University of Piraeus, Greece (iCore Project).

The Best Demonstration Stand was awarded to iCore project and the runner-up demonstration stand to Future Cities Project (page 7 of this Newsletter).

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## New international Internet of Things Forum will push business, social, legal and technical development and adoption

**Mid June, during the IoT Week in Helsinki the new IoT Forum was founded.**

*"This is a significant achievement and a great match to the global challenges with international partners"*

states Mirko Presser from the Alexandra Institute, Denmark.

Wednesday the 19th of June the IoT Forum was founded in Helsinki during the international IoT Week. 14 organisations, from eight different countries and three continents are the founders. Mirko Presser is the chair of the forum which is backed by the European Commission and the founding organisations. The main goals for the forum are to sustain the IoT-week (the next event is planned for June 2014 in London), sustain the activities on the IoT ARM (Architectural Reference Model) and subsequent certification (ARM label), sustain the IoT comic book as a publication (currently there exist Danish, English and Portuguese editions with commitment from Germany, Spain and China for additional translations), develop knowledge in the domains of Privacy and Ethics for IoT as well as the investigation of new Business Models for the IoT – in particular moving form profitable vertical domains into horizontal constructs.

The IoT-i FP7 project, led by the University of Surrey, provided the incubation of the IoT Forum, and the forum is backed by the EU Commission:

*"In order to make the Internet of Things happen in Europe and all regions of the world, the role of the International IoT Forum is crucial for federating all key actors to support the creation of open and integrated IoT environments"*

states Peter Friess (EC).

University of Surrey has invested, together with the Alexandra Institute, a large effort in the finalization of the IoT Forum, because they both realize the big potential in the forum:

*"The IoT Forum brings a unique opportunity to the IoT take-off worldwide and will build up a strong community of IoT actors from various horizons - the technical, the societal and the ethical perspectives will all be worked with in the IoT Forum"*

explains Francois Carrez .

**Open invitation**

The IoT Forum is a collaborative and member based forum. All companies from all kinds of sectors, be it energy or culture who have an interest in IT, innovation and Internet of Things are invited to sign up. They will get influence on the IoT development and gain access to an open and international network with a broad reach and influence in big organisations such as EU and the global sphere.

As mentioned earlier, the forum will focus on four main subjects: Societal, economics, technology and governance based on the members requests and initiative. It is an engaged and open forum.

*"We've had the wish to found this forum for a long time, and it's based on several years of experiences and international and collaborative work on IoT; There is a really good, constructive and open spirit here"*

Mirko Presser tells.
Currently there is a website and LinkedIN-group, and the registration for the forum will open ultimo July.

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## IoT@Work Project: TXT e-solutions SpA Software Developments Freely Available

All the software components developed by TXT in the project are made available as open source (Apache License 2.0) to foster their reuse and further developments. These components are shortly described in the following (further information can be found on the related Google Code site, as well as on the papers reported there).

### The Event Notification Service (ENS)

The ***ENS*** is a middleware component that acts as a flexible and scalable connector among event sources (i.e. *Publishers*) and event consumers (i.e. *Subscribers*). It is based on the AMQP protocol that is one of the few standards for Message Oriented Middleware (MOM) that provides both a high-level model and wire-level standard. The ENS collects events from disparate sources and dispatches them, in a controlled way, to a set of listeners as depicted in the following figure.


*ENS* aggregates events in specific, disjoint, hierarchical **namespaces** for processing and access control convenience. The advantages of this technology are the following:

- complete decoupling of events' sources and consumers (asynchronous, *fire-and-forget* patterns)
- bringing data to the interested consumers instead of bringing consumers to data
- scalability and reconfiguration flexibility
- advanced, flexible and scalable access control features
- dynamic and smooth addition of new events' sources and consumers (**zero downtime**)

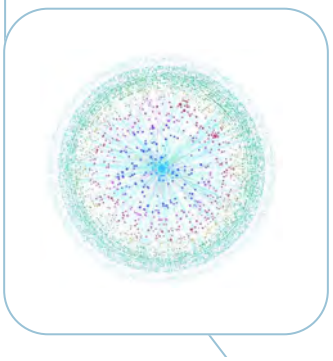
### Capability-based Access Control

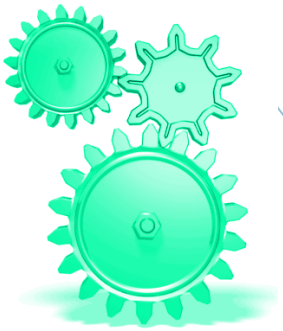
Capabilities are communicable and unforgeable tokens of authority. By virtue of the possession of a capability token, a process/subject can access a resource/service exercising the rights that the capability token grants. A capability based access control and rights delegation approach has the following advantages:

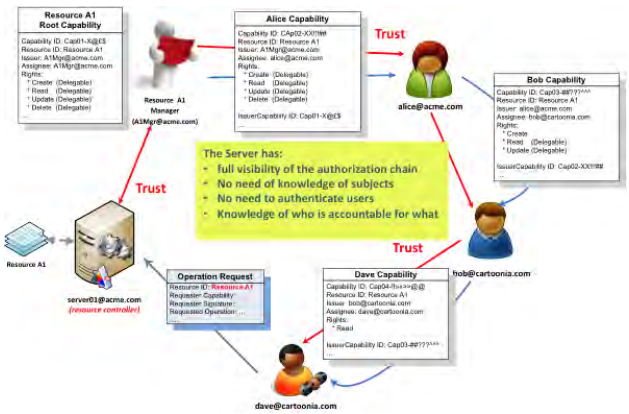
- the Principle of Least Authority (PoLA) is the default
- supports a more fine-grained access control
- less security issues (no Confused Deputy problem)
- externalizes and distributes the management of the authorization process
- no issues related to the complexity and dynamics of identity management

The **ENS** supports a capability based access control mechanism to govern access to **events' namespaces** from single namespace nodes, up to set of disjoint nodes or whole sub-trees. The capability based approach supports: access right delegation, capability tokens revocation, fine-grained access rights. Token elements are based on the SAML/XACML standards (with some extensions). The Figure (top next page) provides an overview of the capability based access control mechanism developed by TXT in the IoT@Work project.

The provided software includes the **wizards** to generate access capabilities (access tokens) and capability revocation tokens, as well as a **Revocation Service**, a **Policy Decision Point**, an **OSGi compliant client library**, an **OSGi compliant Authorization Service** and the web applications for managing these services.








The client library and Authorization Service are actually finalized to manage controlled access to the *ENS* middleware, but can be easily revised to be used for managing access control to other services.

## IoT@Work Directory Service

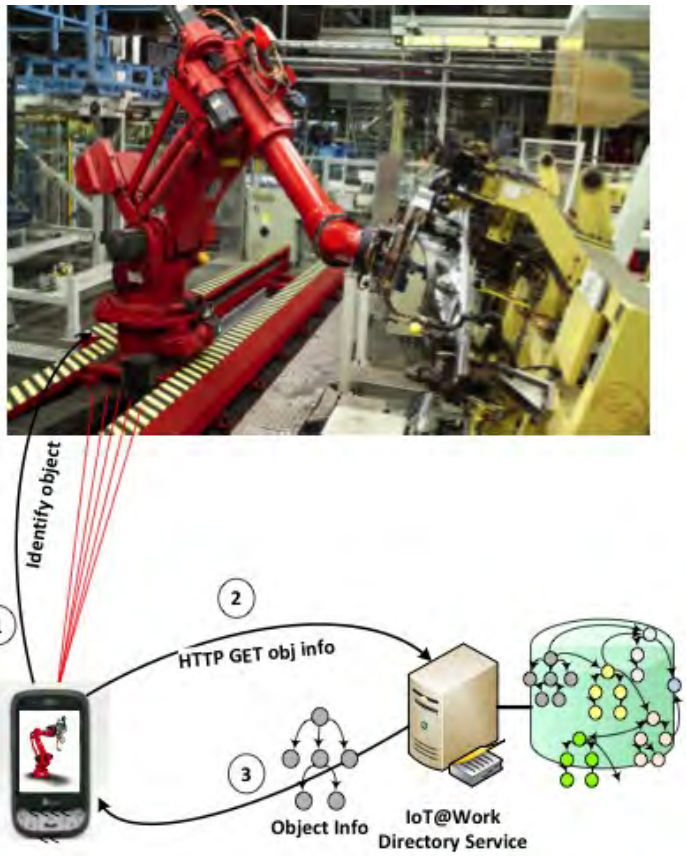
The IoT@Work Directory Service (**DS**) is a RESTful service focused on providing a set of semi-permanent information on devices (and services) deployed in the manufacturing plant (e.g., model, manufacturer, serial number, location, device related IT services).

The **IoT@Work Directory Service** RESTful API provides different representations of the managed entities: JSON, RDFa HTML, RDF enriched XML.

The entities managed by the **IoT@Work Directory Service** can be layered as follows:

- **physical entities**: these are physical objects (*Things*) deployed in the production environment
- **virtual entities**: objects that have an identity but do not have a physical counterpart (e.g.: application services, locations, etc.)
- **primitive elements**: basic data type (e.g.: numbers, strings, URLs, etc.)
- **relationships**: links between objects that express relationships among objects

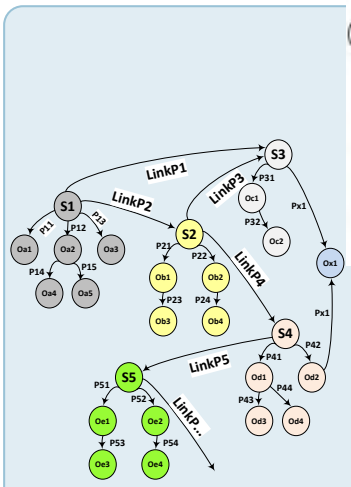
Final users can access the system via **QR Codes**, **NFC tags** or a browser (as depicted in the figure beside**.**




The IoT@Work DS uses a semantically annotated data model inspired to:

- the **uCode Relation Model** where the attributes of a device profile are modeled as ***subject-relation-object*** triples. The *subject* is normally an IoT@Work *Thing*, the *object* can be another IoT@Work Thing or a primitive value, and the *relation* is an object attribute;
- the **RDF** where each attribute of the device profile is modeled as a set of RDF triples.

The IoT@Work DS data model is therefore a connected and directed graph in which nodes (vertices) represent (physical or virtual) entities or primitive elements, and edges store the relationships.

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## IoT and IERC News

IERC participated actively, in the IoT track at the Future Network and Mobile Summit 2013 that took place in the Lisbon, Portugal, 03 - 05 July 2013 (http://www.futurenetworksummit.eu/2013/). The IoT session was scheduled for Day 2: 04 July 2013 and the following papers were presented:

**Session 10d: Internet of Things**

- **A Cognitive Management Framework for Service Provisioning in the Internet of Things**
  Vera Stavroulaki, University of Piraeus, Greece
- **IoT Multiplatform Networking to Monitor and Control Wineries and Vineyards**
  Bruno Cendon , TST, Spain
- **Energy Efficient Relay-aided Shared LTE Network Using CoMP and LB**
  Ayman Radwan, Instituto de Telecomunicações, Portugal
- **Supporting Smart-city Mobility with Cognitive Internet of Things**
  Andrey Somov, CREATE-NET, Italy
- **Test Derivation for Semantically Described IoT Services**
  Daniel Kümper, University of Applied Sciences Osnabrueck, Germany

We are very happy to inform you that **the iCore project was awarded the Best Demonstration Award at the Future Network and Mobile Summit 2013, *out of 26 demonstration stands***. The award was nominated based on a voting process by the participants at the conference (approximately 300 people were registered).

The iCore stand showcased the following demonstrations:

**Demo 1: Cognitive Management of Objects and Applications for the Internet of Things**
This demonstration showcased aspects of the iCore cognitive management framework, in particular in terms of dynamic creation of a Composite Virtual Object (CVO), knowledge-based CVO instantiation, CVO self-healing and CVO coordination across different application domains. In terms of scenarios, one part of the demonstration was related to the Smart Home domain while the other part showed aspects relevant to both the Smart Home as well as the Smart City domain.

**Demo 2: Live Stream Processing Optimization based on Real World Knowledge Modelling in iCore**
This demo, realised by Alcatel-Lucent, showed live stream processing optimization based on real world knowledge modelling, using a toy race track, webcams and a mobile phone as an experimental representation of such real world settings as a CCTV network of a city for traffic or public safety vehicle tracking scenarios, or the live broadcast of a sports event based on video footage from ad hoc infrastructure as well as spectator smart phones.

**Demo 3: Smart City Demo: Controlled Access to streaming Video for Smart Surveillance**
In this demo a Multi-Party, Multi-Use IoT solution based on iCore technologies was shown: images or data from traffic cameras - owned by party A (e.g. high-way traffic management) - can also be used by party B (e.g. the police to control speeding or the general public to check traffic-jams). This demo showed how access rights - essential for the transition from many intranets-of-things to an interworking Internet-of-Things – can be implemented and (extracted information from) camera networks can be modelled as (Composed) Virtual Objects in iCore architecture.

In addition an iCore paper **won the award for the runner up paper of the conference.** The paper is titled "A Cognitive Management Framework for Service Provisioning in the Internet of things", co-authored by Vasilis Foteinos, Dimitris Kelaidonis, George Poulios, Panagiotis Vlacheas, Vera Stavroulaki and Panagiotis Demestichas from the University of Piraeus in Greece.

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## ABOUT IERC

### IoT European Research Cluster

The aim of European Research Cluster on the Internet of Things is to address the large potential for IoT-based capabilities in Europe and to coordinate the convergence of ongoing activities.

### European Dimension

IoT has the potential to enhance Europe's competitiveness and is an important driver for the development of an information based economy and society. A wide range of research and application projects in Europe have been set up in different application fields. Communication between these projects is an essential requirement for a competitive industry and for a secure, safe and privacy preserving deployment of IoT in Europe.

### Global Dimension

IERC will facilitate the knowledge sharing at the global level and will encourage and exchange best practice and new business models that are emerging in different parts of the world. In this way, measures accompanying research and innovation efforts are considered to assess the impact of the Internet of Things at global and industrial level, as well as at the organisational level.

## IoT Events

**July'13**

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| 23rd, | Internet of Things Mashup-up Day. Oxford, UK. More information at http://www.webinos.org/blog/2013/06/26/internet-of-things-mash-up-day-23rd-of-july-university-of-oxford/ |

**August'13**

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| 20th - 23rd, | iThings2013, Beijing, China. More information at http://www.china-iot.net/ithings2013.htm |
| 23rd, | 2nd OpenChina-ICT Thematic Workshop on Internet of Things & Future Internet, Park Plaza Hotel, Beijing, China. Information at http://openchina-ict.eu/project-events/2nd-thematic-workshop/ |
| 20th - 23rd | IoT Workshop & Interoperability China. Programme available at www.probe-it.eu/?p=1588 |
| 28th - 29th | ruSMART 2013. St Petersburg, Russia. Further information at http://rusmart.e-werest.org/cfp.html |

**September'13**

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| 8th - 12th | UbiComp 2013, Zurich, Switzerland. Info at www.ubicomp.org/ubicomp2013 |
| 13th | IERC Meeting |
| 26th | One-day Meet-up on the Internet of Things and Semantic Interoperability. Nairobi, Kenya. Information at www.probe-it.eu/?p=1679 |

**October'13**

| | |
|---|---|
| 1st - 2nd | M2M and Internet of Things Global Summit 2013. Washington DC, USA. Info at: www.eu-ems.com/summary.asp?event_id=173&page_id=1432 |

SEVENTH FRAMEWORK PROGRAMME

The "European Research Cluster on the Internet of Things-IERC" was established by the DG Information Society and Media, as part of Europe's ambition to shape a future Internet of Things for its businesses and citizens.

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