



European Research Cluster on the Internet of Things

IoT International Forum *by Prof. Rahim Tafazolli*



Points of interest:

- Reports from IoT week @Venice
- Report from IoT Forum 2
- IERC AC01 & AC14
- Self-IoT workshop
- IPv6 & Handle Care
- Announcing IoT Forum 3

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Welcome to this latest newsletter of the IERC, published in what are pivotal times for the Internet of Things.

Within the IERC a number of flagship projects are nearing their end and will be producing results which we expect to have a significant impact in the wider world of the Internet of Things. Meanwhile, the new generation of projects are taking up the baton and providing new insights.

In the wider IoT community, we see new initiatives such as oneM2M, launched in July, bringing together many of the world's foremost ICT Standards Development Organisations to develop a common global end-to-end M2M service layer. No doubt this will play a contributory role towards the development of the infrastructure which will pro-

Probelt—Benchmarking session *by Sophie Vallet-Chevillard*

During the IoT week, the PROBE-IT project organized a workshop on the topic “benchmarking IoT Deployment”. The session aimed at reviewing the state of the art and needs for a benchmarking of IoT deployments at a global scale, with the objective to identify commonalities and gaps between the various stakeholders’s interests.

The session ran in two steps: Five speakers, representing the view of the different stakeholders (policy makers, technological providers, operators and users) presented their interests and needs regarding

vide the base for the Internet of Things.

At the same time, widely available platforms such as Arduino and Raspberry Pi, together with initiatives like Kickstarter, which opened its doors to UK based projects this month, are encouraging a new breed of experimenters and entrepreneurs to experiment in the IoT space and discover just what these new paradigms could mean for societies, users, and businesses alike. Only a few days ago, London saw its first 3D Printing expo - how long will it be until this culture of personalised and customisable on demand object manufacture takes the next step into easily embedding communications and connectivity into their Things?

It is clear that the Internet of Things does not come from only the research projects, or the large scale industrial standards and networks, or the makers and tinkerers. It is the conjunction of these disciplines into a genuine IoT community which will drive the domain forward and catalyse the many visions we see.

At the national level many initiatives are taking place to

address this multidisciplinary nature of the Internet of Things, such as those under the Digital Economy umbrella within the Research Councils and Technology Strategy Board in the UK, and corresponding activities in other countries. I am sure many valuable lessons will be learnt by comparing the experiences from different regions of the globe as we move forward .

The coming months will also see the transition of the IoT International Forum from its base within the IoT-i project into a genuine community run and supported organisation. This is the place for the global communities and national representatives mentioned above to come together, and the injection of new ideas and directions will enable it to build on the previous successful events and go from strength to strength. University of Surrey / CCSR is proud to be one of the organisations committed to help take it forward, and we look forward to your involvement and the new horizons opening up. Exciting times are ahead for all of us!

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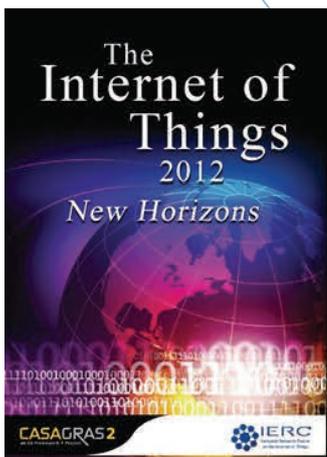
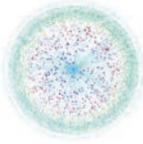
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could match the different approaches? Should an idiosyncratic or a comprehensive approach be chosen? The latter has been preferred and it has been suggested that the project should first draft a wide ontology for the benchmarking framework whose granularity could be increased for subparts of the framework when there is a need to cover the specific need of a stakeholders.

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IoT International Forum 2 by Bernard Hunt

The second meeting of The Internet of Things International Forum took place in Venice from 19-21 June, 2012 in conjunction with IoT Week.

Nearly 200 registrants were interested not only to hear about the latest developments and ideas in the Internet of Things, but also to contribute to the discussions and shaping the future of the IoT.

Keynote presentations from high profile IoT experts such as Adam Greenfield (Urbanscale), Usman Haque (Pachube / Cosm), Ken Sakamura (T-Engine Forum) and Constantijn van Oranje-Nassau (European Commission), set the scene and provided some interesting concepts to return to during the course of the meeting.

In recognition of the global nature of the IoT, delegates from Africa, Australia, Brazil, China, Europe, India, Japan, Korea, Taiwan, and the USA all provided updates on the status of IoT activities in their

regions.

The four Working Groups of the Forum: Economics; Legislation and Governance; Societal; and Technology; had productive working sessions, addressing a diverse range of topics including

- Standardisation landscape and new activities
- Economics of the IoT - large organisations vs. small organisations vs. public funding
- Citizen Science and DIY IoT
- Education programmes for the future leaders of the IoT
- Survey on IoT Governance factors within the European Union

Participants in this Forum event came from a wide variety of backgrounds, including consulting, industry, academia, public institutions, research centres and governments, from thirty countries in six continents.

Further information about the

Forum, and how you can get involved, is available on the website <http://iot-forum.eu/>, along with any of the presentations from the Forum event and reports from the sessions.

The next meeting of The IoT International Forum will be held in Bled, Slovenia, from 28-30 November, 2012, in conjunction with Smart Living Europe and Living Bits and Things. Registration is free, and can be made via the Forum website at <http://iot-forum.eu/>

The IoT International Forum is organised by the Internet of Things Initiative, CATR and the Chinese Institute of Electronics, with the support of the European Commission. We are actively seeking new partners to be involved in shaping this exciting endeavour.

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Cognitive Technologies for IoT (report from IoT week) by Raffaele Giaffreda

iCore project organised the kick-off meeting of the IERC activity chain on "cognitive technologies for IoT" on Monday June 18th 2012, at IoT week in Venice. The meeting was chaired and co-ordinated by the iCore project, with contributions from several other IERC projects (BUTLER, IoT.est, IoT@Work, OUTSMART and EBBITS, besides iCore). After a brief introduction on the envisaged scope and boundaries for of this activity chain, in order to identify key syner-

gies and further collaboration opportunities each of the represented projects illustrated their perspective on opportunities, challenges and approaches associated with the use of cognitive and autonomic technologies. This part of the session highlighted how the use of cognitive technologies is mainly envisaged in making IoT applications context-aware, in the design of supporting autonomic middleware, in the self-management of sensor networks as well as in smart devices. Besides

providing a good dissemination opportunity amongst members of this Activity Chain, the session also gave the opportunity to progress the organisation of a Workshop on Self-aware IoT at ACM ICAC 2012 conference in the US, which is the next stepping stone in the progress plan of this activity chain.

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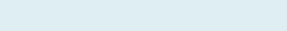
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Self-IoT workshop by Levent Gurgen

IoT will exponentially increase the scale and the complexity of existing computing and communication systems; manual management by humans with conventional tools will just not be possible in IoT. The autonomy is an im-

perative property for emerging IoT systems. However, there is still a lack of research on how to adapt and tailor existing research on autonomic computing to the specific characteristics of IoT such as high dynamicity and distribu-

tion, real-time nature, resources constraints, and lossy environments. Having this challenging requirements in mind, BUTLER, iCore and IoT.est projects co-organized the Self-IoT workshop, International Workshop on Self-



aware Internet of Things, in conjunction with one of the major conferences on autonomic computing, ICAC 2012, the 9th International Conference on Autonomic Computing (<http://icac2012.cs.fiu.edu/>). Self-IoT workshop aims at providing a highly interactive and multi-disciplinary forum so as to bring together researchers from academy and industry under one common objective: realizing plug&play, context-aware and autonomous Internet of Things that will be self-configured, self-organized, self-optimized and self-healed

without (or with minimum) human intervention. Two other European projects Self-awareness (<http://www.aware-project.eu/>) and OUTSMART (www.fi-ppp-outsmart.eu/) also sponsored the workshop. Self-awareness project sponsored the keynote talk given by Joerg Denzinger on "Testing cooperative autonomous systems for unwanted emergent behaviour and dangerous self-adaptation", while BUTLER project sponsored the panel session on "The challenges and future trends of autonomic computing for Internet of Things"

with the participation of Jorge Pereira Carlos from ATOS, Rui Zhang from PARC and Chetan Gupta from Hewlett Packard. More information on the workshop can be found at <http://www.iot-butler.eu/self-iot>

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Architecture approaches and models activity chain meeting *by Martin Bauer*

At the IERC Activity Chain 1 (AC1) - "Architecture approaches and models" meeting on September 10th, 2012 in Brussels, IoT@Work, iCore, Butler and IoT-A presented their architectural approaches. The IoT-A presentation focused on the Architectural Reference Model (ARM) that IoT-A is developing for the Internet-of-Things domain. The Architectural Reference Model consists of a Reference Model, a Reference Architecture and a Best Practice part that provides guidance on how to develop an instance archi-

ture from the ARM taking into account specific requirements. Following the presentations, it was discussed how the IoT projects can make use of the ARM and provide feedback to IoT-A in order to improve it, so that it can serve as a common basis for all the projects in the cluster. It was agreed that for the next AC1 meeting on November 22nd, 2012 at SAP in Regensburg, Switzerland, the attending project will try to graphically map their architectural approaches to the ARM and give a short presentation. In gen-

eral, the IoT-A project is collecting feedback (<http://oe160.iml.fraunhofer.de/iot-a>) from all interested people based on the current version of the ARM as presented in the IoT-A Deliverable D1.3, which can be downloaded from the IoT-A website (www.iot-a.eu/public/public-documents).

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Ethics session (report from IoT week) *by Rob van Kranenburg*

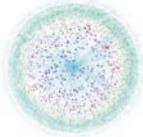
A workshop on ethics might seem a strange in a policy context. Some will claim that 'governance' as a term would cover the issues. However, the first and second wave of EU research into building some kind of 'total connectivity' (the research programs I3, Disappearing Computer and Convivio) showed that philosophical questions about what it means to be 'human' in Ambient Intelligence, ubicomp or Internet of Things are fundamental and need to be addressed by the highest politi-

cal echelons in precisely this way as IoT is setting forth a new ontology, a new relationship between men and the environment, that can not be addressed solely in the issues of privacy, security, safety, nor can it be addressed with in legal framework that does not engage in the new agencies and relationships that are generated by IoT. As such we find ourselves in a transition period where our old legal, policy and economic tools are stretched beyond their productive capacities and

new ones can not yet be validated or tested as the new terrain is not yet clearly visible. In times like that it is the task of any elite (and the IoT community is an elite) to discuss as openly and as honestly as possible what the consequences are of technological and social developments it has funded, fostered and facilitated.

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Announcing IoT Forum 3 *by Bernard Hunt*

Following successful events in Berlin and Venice, the organising committee are pleased to announce the third meeting of the IoT International Forum.

The IoT International Forum is the global meeting place for the IoT community, the users and customers of the IoT, and anyone with an interest in understanding and shaping the development of the IoT.

The event will take place on 28 - 30 November 2012 in Bled, Slovenia, a strategic spot between Central and South East Europe, immediately following the Living Bits and Things 2012 conference.

This 3rd event will feature 3 days of presentations and discussions around technological, scientific, social, business and legal aspects of the IoT, and the application of the IoT.

Top level speakers providing impetus for targeted discussions in working group sessions include:

- Luis Rodriguez-Rosello, Head of Unit "Network

Technologies", DG CONNECT, European Commission

- Marijan Turk, Director of National Directorate for Information Society, Slovenian Ministry of Education, Science, Culture and Sport
- Alexandra Deschamps-Sonsino, designswarm, Internet of Things & Interaction design
- Dr. Keiji Tamada, Vice President, C&C Innovation Initiative, Central Research Laboratories, NEC Corporation & Professor at Nara Institute of Science and Technology, Japan
- Luis Fernandez Lopez, University of Sao Paulo, Brazil

Working Group sessions will feature presentations, discussions, brainstorming, and workshop sessions around topics of societal, economic, legislation and governance, and technology importance to the IoT.

Ongoing activities from previous meetings include IoT education, standardisation,

engagement of the global governance communities, and best practices for running a successful IoT business.

For the first time, this meeting will also feature a session dedicated to application of the IoT, with a focus on Smart Cities.

In addition to influencing the future of the IoT, this is also the place to shape the future of the IoT International Forum, with the opportunity to become involved in the running of the Forum and be seen as an ambassador for the Internet of Things.

Participation in the Forum event is free and open to all, subject to capacity, but pre-registration is mandatory.

For further details on the Forum and the Bled event, including free registration, please visit the Forum website at <http://iot-forum.eu/>

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IPv6 & the Handle Care are excellent companions for scalable IoT *by Latif Ladid*

While IPv6 provides a scalable connectivity protocol to connect to individual IoT objects/services and making them accessible over the Internet, a secure scalable global identifier service is essential for the registration, discovery, and management of these objects/services. A global identifier service for IoT allows the separation of identifier and address for each individual IoT object/service, hence making their identification more persistent and manageable over time. A global identifier service can also facilitate IoT registration/discovery over IPv6 and IPv4 networks and making them

transparent across IPv6 and IPv4 network boundaries, as well as aggregating other approaches to referencing IoT services, such as RFID.

"Handle System and IPv6 are two excellent companions to scale IoT where it should go" states Latif Ladid, President IPv6 Forum

To address various needs of IoT applications, the global identifier service must be scalable to support resolution/administration of billions or even trillions of IoT objects/services. It must also provide a standard interface to allow

secure delivery of information about the identified IoT object/service, and an interface to provide protection of this information whenever needed. A standard interface for identifier registration and attribute management is also important to support the dynamic nature of many IoT applications.

The Handle System is a global identifier service that is designed to provide a scalable identifier service for any kind of digital objects in the Internet. It is one of the three main components of the Digital Object Architecture and has been deployed on the Internet for over a decade (see <http://>

hdl.handle.net/4263537/5041). Scalability of the Handle System is not only reflected in its highly distributed service architecture, but also in an extensible data model that will support any kind of applications.

Information registered about IoT objects/services may not always be intended for the general public. Protecting this information from unnecessary exposure and unauthorized changes can be critical in many IoT applications. The Handle System provides a secure identifier resolution service that not only protects service integrity, but also provides options for data confidentiality and authenticity. Applications using the Handle System don't have to worry

about data being corrupted during the resolution process. Further, they can protect both their communications as well as their data from unwanted public exposure. The data model of the Handle System also allows each handle record to be authenticated, a scenario that could fit well with many IoT applications.

The Handle System provides a standard interface that allows access control to be defined for attributes registered for each individual object in an IoT context. Higher level access control for any IoT object/service can be defined in terms of handle attributes, which may vary from application to application. The standard interface for identifier registration and attribute man-

agement allows real time information to be updated in a secure and timely fashion, a necessity in many IoT applications.

Scalability, data security, access control and privacy protection have been major issues facing many IoT implementations. The Handle System and IPv6 provide an interoperable solution that not only answers these challenges, but also paves the way for the migration to a future Internet infrastructure.

More information available at <http://www.handle.net/>

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IoT and IERC News

IoT applications – value creation for industry Workshop, 24 October, 2012, Wuxi, China.

- The [workshop](#) was organised with the support of IERC at the 3rd International Conference on the Internet of Things (IoT2012). A complete report will be presented in the next IERC Newsletter.

Announcing Living Bits and Things' 2012

- We invite you to join us to discover the **potential of Internet of Things (IoT) and Smart Living in Central and South East Europe**. After a huge success in 2011 in Ljubljana with over 150 registered attendees the Living bits and things is going to host the next edition of the major Internet of Things events in Central and South East Europe in November this year in **Bled**. This year the event focuses on the **Smart applications and services** which are the foundation of the future sustainable and inclusive growth not only in Europe but also worldwide. We are glad to announce the **Living bits and things 2012 is part of The Smart Living Europe Days 2012**, whole week activities dedicated to Internet of Things in Bled. Read all about it and register at <http://livingbitsandthings.com>.

IoT-A Stakeholder workshop 5

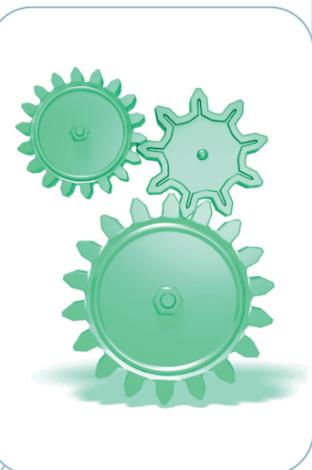
- The workshop will be organized on Monday 26th, November in Bled in conjunction with Living bits and things (Tue, 27th Nov) and will be followed by a three days IoT Forum event, from 28th to 30th Nov 2012. The first section will consist of input from the Stakeholders. The second slot will consist of socio-economic validation, including an interactive exercise on privacy Issues. The third slot will consist of business validation and the relevance of IoT-A's architecture for developing and facilitating new business models. It will address cost issues and tentatively show why using/implementing IoT-A models and modelling is a financial benefit.

BUTLER keynote speech in ETSI M2M workshop

- IoT is creating new business eco-systems and exert social influence going well beyond the internet as it is known today. BUTLER project acknowledge this and the BUTLER partner Swisscom has been selected to present approaches for Business Model Generation for M2M Applications during a keynote speech taking place at the next ETSI M2M workshop taking place in Sophia-Antipolis on October 24-25. The speech will be given by Katharina Liebrand.

Activity chain "Architecture approaches and models" Meeting

- A new activity chain meeting will be held in Regensdorf, Switzerland on the 22nd of November, hosted by SAP Research.





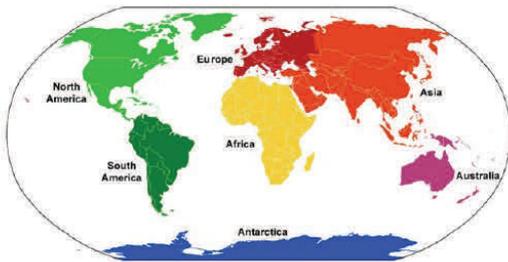
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ABOUT IERC

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 on going 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

November'12

- 07th - 9th, IT IS-2012, Dolenjske Toplice, Slovenia, <http://itis2012.fis.unm.si>
- 12th - 16th, EU Internet Week, Brussels, Belgium. <http://www.euinternetweek.eu>
- 12th -13th, 4th Annual IoT Europe, <http://www.iotconference.eu>, Brussels, Belgium
- 13th, IEEE Internet of Things workshop, Milano, Italy. <http://standards.ieee.org/events/iot/index.html>
- 27th, Living Bits and Things' 12, Bled, Slovenia, <http://www.livingbitsandthings.com>
- 29th - 30th, 3rd IoT International Forum, Bled, Slovenia, <http://www.iot-forum.eu/events/iot-international-forum-event-3>

December'12

- 04th, LeWeb'12 Internet of Things, Paris, France. <http://paris.leweb.co>

March'13

- 25th - 28th, International Workshop on Pervasive Internet of Things and Smart Cities, Madrid, Spain <http://ants-webs.inf.um.es/conferences/pitsac/?m=1>

April'13

- 11th—12th, Remote Encounters, Cardiff, UK. <http://remote-encounters.tumblr.com/>

May'13

- 11th—12th, Remote Encounters, Cardiff, UK. <http://remote-encounters.tumblr.com/>

June'13

- 16th—20h, IoT Week, Helsinki, Finland.

July'13

- 03th—05th, FuNeMS'2013, Lisbon, Portugal. <http://www.futurenetworksummit.eu/2013/>



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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