Forewords: The Dumb, the Craft and the Cognitive IoT by Raffaele Giaffreda

Craft IoT
This second wave, is still ongoing, fuelled by the widespread accessibility to cheap, connected, tiny, long-lasting battery powered devices which have created the turf for the mushrooming of creative but bespoke solutions with fitness, health and domotic applications leading the way. Many initiatives in these domains are fruit of the enthusiasm and entrepreneurial spirit of so called “makers” who are creating a plethora of bespoke applications, which usually come as self-contained sensing / hardware kit with associated application running on smart devices.

Cognitive IoT
So where are we heading with IoT? What will power the third wave of opportunities? With numbers of connected devices and sensor continuously increasing it is common thought that the scenarios that will best represent the advantages IoT can bring fit in the context of future smart cities.

As we move towards sensing capabilities that will have to resemble the ability of human nervous systems to autonomously function and continuously correct behaviours there will be need for what we call “cognitive IoT”.

Scaling up “craft IoT” will pose complexity challenges that will call for self-management solutions where the specification of only high-level constraints / objectives should suffice to automatically set, activate and maintain appropriate sensing. Cognitive IoT will also facilitate object reuse across application domains, leveraging on interoperability solutions and semantic enrichment of object descriptions.

Moreover it will need to realise the ability to interact with the infrastructure beyond automated object selection and activation. It will be characterised by means that also select the appropriate resources “behind the scenes”, such as communication and computing resources, to ensure a sustained and resilient data delivery tuned to the requirements of the demanding application.

A smart IoT is at the centre of the objectives of iCore project, seeking to empower IoT with cognitive technologies, as well as a broad target for many other existing projects. At IERC level contributions to such topics are gathered and periodically discussed within the Activity Chain on Cognitive Technologies for IoT (AC8).

Addressing these challenges and striving towards realising a cognitive IoT is of paramount importance to ensure IoT sustainability beyond hype and these are exciting times to get involved!

Raffaele Giaffreda
(CREATE-NET)

The IERC Activity Chain 1 (AC1) - “Architecture approaches and models” has been focusing recently on the “validation” of the IoT-A Architectural Reference Model (ARM) by other IERC projects. We have recently had two meetings, respectively in Regensdorf (November 2012) and in Delft (February 2013).

In the former, after presenting shortly the IoT-A ARM, the expectations from the IoT-A perspective (getting feedback from the other IERC project and detailed mapping or reverse-mapping toward the ARM) and the reporting tool (Redmine), we received already very interesting presen-
AC 02 «Catalogue of IoT Naming, Addressing and Discovery Schemes in IERC” Projects) by John Soldatos

The second Activity Chain (AC2) of the IERC cluster has recently released its first deliverable titled: «Catalogue of IoT Naming, Addressing and Discovery Schemes in IERC Projects» (deliverable code: IERC-AC2-D1). A total of eleven IERC/IoT projects have contributed to this deliverable, including ebbits, GAMBAS, iCore, IoT-A, BUTLER, IoT.est, IOT6, IoT@Work, OpenIoT, SmartAgriFood and CEN TC 225.

The document provides a catalogue of different naming, addressing and discovery schemes for the Internet-of-Things (IoT), notably schemes that are currently researched, validated and used by IERC projects. As part of the deliverable each of the contributing projects has provided an overview of the addressing and discovery solution(s) that it deploys, along with an assessment of each solution in terms of its migration and scalability. The various schemes include solutions based on legacy standards, semantic solutions that rely on emerging standards, as well as radically new solutions that focus on new propositions beyond existing and on-going standardization efforts. A clustering of the various solutions is also performed on the basis of the different naming and addressing standards that they adopt, as well as on the basis of their semantic power. Despite the heterogeneity of the various schemes, the projects’ solutions feature several commonalities (e.g., the use of naming standards such as URIs/URNs), and reveal certain trends (e.g., the use of semantic web approaches for IoT resource discovery). The document ends-up recommending areas for further research and investigation. At the same time, it briefly outlines the Activity Chain’s roadmap towards the elicitation and documentation of best practices associated with the deployment and use of the IoT naming, addressing and discovery solutions. The deliverable is public available for download at: http://www.theinternetofthings.eu/john-soldatos-ierc-activity-chain-different-naming-addressing-and-discovery-schemes-internet-things

As part of coming deliverables, the IERC AC2 will document experiences and best practices from the practical use of the various naming, addressing and discovery schemes in IoT applications. Furthermore, the activity chain will attempt to introduce a reference scheme for naming and addressing in IoT. The AC2 participants will also study and report solutions for the possible federation and interoperability of different naming, addressing and discovery schemes.

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AC 04 “Semantics Challenges and interoperability” by Philippe Cousin, Martin Serrano and Payam Barnaghi

The Internet of Things refers to objects (“things”) and the virtual representations of these objects on the Internet. IoT is mainly supported by advancements in wireless sensor networks and by manufacturing low cost and energy efficient hardware for sensor and device communications, which have created interest in integrating the physical world into the Internet. However, heterogeneity of underlying devices and communication technologies and interoperability in different layers, from communication and seamless integration of devices to interoperability of data generated by the IoT resources, is a challenge for expanding generic IoT solutions to a global scale. Within the IERC AC4 work, we review the recent efforts to define semantic frameworks and information models for IoT and discuss how semantic technologies can support data interoperability in the IoT domain.

The pervasiveness of the physical devices and objects, resource constraints such as memory and power limitations on daily life devices, heteroge-
neity of the platforms and communication protocols create new challenges in inter-networking technologies and interaction mechanisms that enable interaction between data providers and consumers in the IoT domain. IoT has raised new issues that are reflected in the recent architecture, design and development efforts for the Future Internet [1]. The research in this area has recently gained momentum and is supported by new communication protocols, standards and methods that consider the dynamicity and heterogeneity of the underlying devices and resources and enable inter-networking and interactions on IoT. However, the current IoT data communications often rely on binary or syntactic data models which are unable to provide machine-interpretable representation of the data. This hinders the creation of common tools and mechanisms to process and interpret the IoT data on a large scale that can be supported by different stakeholders in a global framework. In general, large-scale platforms require to support discovery and access to the resources, enable autonomous interactions with the resources, and use self-descriptive data and association mechanisms to process and interpret the IoT data, and integrate it into the high-level applications and service layers.

To achieve global IoT data distribution and utilisation, semantic interoperability between IoT resources and data providers and consumers is a key issue. This will also support effective discovery, query, interpretation and integration of the IoT data. Semantic interoperability ensures that data can be comprehended unambiguously by human users and software programs across different platforms [2].

Automated processing and interpretation of the IoT data requires common agreements on providing and describing the IoT data. To evaluate the quality aspects of data, the source provider, device and environment specific information also need to be associated to the data. Considering the diversity of data types, device types and potential providers in the IoT domain, common description frameworks are essential to describe and represent the data to make it seamlessly accessible and process-able across different platforms and stakeholders.

In general, to achieve automated and seamless integration of the IoT data in business applications and services, semantic description of different resources in the IoT domain is a key task. The aforementioned works are some examples of the recent efforts that have been made to address this issue. The semantic descriptions and annotations need to be provided at “Things” level (e.g. entity model described in [3], OGC O&M model), device and network level (e.g. W3C SSN ontology [4]), Service level (e.g. SemSoS [5]), and interaction and business process model (e.g. the IoT-aware business process modelling described in [6]) to enable autonomous processing and interpretation of the IoT data by different stakeholders in IoT business process lifecycle.

It is important to note that just providing semantic annotations alone does not provide semantic interoperability on a global scale. The semantic description still needs to be shared, processed and interpreted by various applications and services across different domains and by different stakeholders.

Semantic interoperability of the IoT data will ensure that data that is provided from different sources and by various providers is unambiguously accessible and process-able across different domains and stakeholders. The semantic annotation of the data can be created when an observation or measurement is created, or it can be added to the data when it is received via a middleware gateway node. The semantic annotation, however, is not only annotation of the observation and measurement data. Effective discovery, access, management and utilisation of the IoT resource require machine-interpretable descriptions of different components and resources in the IoT framework (e.g. sensors, actuators, and network resources). The semantic interoperable description of services and interfaces that enable communication between different components in accessing, managing and using the IoT data and resources is also another important aspect that is supported by defining common models and standard representation frameworks. The current semantic Web technologies provide mechanisms to represent and process the semantic data. Information modelling and ontology creation efforts also define and describe different aspects of the IoT data and resources.

As IoT environments are often dynamic and pervasive, updating and managing the semantic descriptions is another key challenge for the resource providers. As discussed earlier, scalability of the solutions is a significant concern in designing solutions for IoT. This requires further efforts to define global standards, description models and representation frameworks that can describe the IoT data and services and provide optimised solutions which take into consideration the constraints and dynamicity of the IoT domain.

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IoT World meets in Brazil São Paulo, 21st-24th May 2013

A 4 days meeting on Internet of Things technologies interoperability, benchmarking, road mapping, development, business and interdisciplinary

Organized by FP7-288315 PROBE-IT EU Project and the Brazilian IoT Competitiveness Forum

In cooperation with IoT-A European project, the IoT International Forum, the European Telecommunications Standards Institute (ETSI), the Brazilian CPqD, the USP’s Cidade do Conhecimento and iRIoT initiatives

Sponsored by ITS Instituto de Tecnologia de Software

We invite you, your colleagues and other interested parties, to take-part of a 4-day multifaceted activity with presentations, debate and demonstrations concerning key aspects of the Internet-of-Things (IoT).

On May 21st and 23rd, at the CPqD facilities will be held the Interoperability Plugtest (Interop), jointly organized by CPqD, ETSI and the PROBE-IT project.

The plugtest will focus on the RFID technology and during these two days 3 different scenarios will be exercised: Comparative performance of FHSS (used in Brazil) and 4 channel plan; Analysis of the interference between RFID and GSM; Performance evaluation of RFID technology in logistics using door portals and conveyors.

On May 23rd, at the Medicine Faculty facilities will be held the IoT: Today, Tomorrow and Way Forwards. European experts and practitioners, Brazilian companies and academia will discuss issues related to the Internet of Things.

Participants will look first at current status of IoT focusing on benchmarking of existing IoT deployments worldwide and then foresee the future of IoT via roadmaps focusing especially on Architectures, Interoperability, Business Models and Regulations and presenting outstanding cases for future uses of IoT.

Finally, participants will explore the mechanism in-place to move IoT forward, e.g. IoT Forum, Experimentation Infrastructures and Worldwide Standardization initiatives.

Last but not least, there will be a presentation by CPqD and ETSI about the Interop plugtest event.

On May 24th, at the Medicine Faculty facilities, experts from the European IoT-A project will lead the IoT-A Meet-up tutorial/workshop in which the state-of-art in terms of IoT architectures, reference, domain, information, communication, functional models, use cases and best practices.

In addition, a panel on open-source/bottom-up/hacker, artistic and design will be formed with European experts and researchers from the USP’s iRIoT and Cidade do Conhecimento initiatives.

IoT Week 2013 – The Event on IoT technologies and Innovation and Businesses

17-20 June 2013, Helsinki

Internet of Things is no longer talking to the innovation or trend watching units. The business units have gone beyond optimising and fine-tuning efficiency to the utmost. They are sensing a huge market.

In line with current strategic developments in the Internet of Things, the programme of the IoT Week 2013 is based on four topics:

General opening keynote addresses by policy actors and industry representatives as well as presentations from a global perspective of the Internet of Things IoT technologies with several sessions on actual research undertaken on IoT architectu re, IP and cognitive technologies, semantic interoperability, etc...

IoT solutions as the essential and core ingredient and motor of the Smart Cities concepts IoT & entrepreneurship & business models

During plenary sessions and interactive workshops participants from all over the world and with various background will have the chance to participate to debates like:

What will be the balance between intelligence in the Cloud (end to end) and intelligence at the edges (in the robotic?) devices? How will a general audience react to a world where 'everything talks to everything'? Is privacy still a concept that developers can work with? Will IoT cut more jobs in an unstable economic climate or can it kick start a young and IT savvy generation to build apps and services with open data coming from real-time sensor streams? Which domains are currently most successful? How can we ensure interoperability? What are the main standardisation efforts? How far are the benchmarking efforts and strategies of smart
cities? What should I be looking out for if I am a City Council? A citizen? A developer?

The finale programme is under finalisation and still needs some more input from IERC projects. More information about the programme, registration, exhibition and sponsoring can be found at www.iot-week.eu. Projects are more than welcome to present their topics, showcase their use-cases and experiments and actively participate to the exiting sessions.

The objective of the IoT Week is to unite the IoT community by offering a platform for presenting the latest news on relevant research topics, providing political and societal insights and offering networking opportunities. The event is organized by the European Integrated Project IoT-A (Internet of Things - Architecture) together with several research projects from the IERC European Research Cluster for the Internet of Things, such as BUTLER, Icore, PROBE-IT, IoT-Est, IoT6, CALIPSO. Consequent support and input for discussions will be insured by the IoT Forum (www.iot-forum.eu)

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The sounds of smart environment: Acoustic sensing within large scale IoT networks
by Philippe Cousin

The EAR-IT project is an EU FP7 funded project working over a 2 years period (oct 2012-Oct 2014) on the exiting challenges of using acoustic sensing in smart cities and smart building. With innovation and research in this area, the project will experiment in the city of Santander (Spain) and for intelligent building in Geneva, applications improving security, energy saving, traffic management and more. The project idea will conduct a large-scale ‘real-life’ experimentation of intelligent acoustics for supporting high social value applications fostering innovation and sustainability in two existing test beds with the FP7 projects SmartSantander (www.smartsantander.eu) and Hobnet (www.hobnet-it.eu). Research will also be carried out on IoT network qualification and benchmark.

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The IoT Day by Rob van Kranenburg

Internet of Things is moving fast and getting real. Who would have believed in 1974 that barcodes would be on basically every item? How unbelievable, at the end of the nineties with expensive database storage, ideas about unique identifiers and full traceability? Every thing to be connected to every thing, surely science fiction, or some strange engineering dream? It just does not seem so unreal now, as IoT is moving from hype to market. Still, it is relatively unknown. If you are working somewhere, anywhere - you will see a little bit more connectivity in every part of your job. New clients seem to appear quicker and from different directions. You are beginning to wonder if your product will be the same in three years? What services will you be offering in two? What will Internet of Things mean for you?

Let's talk about that on April 9th.

Go for coffee with a neighbour, a friend, or colleagues.

Upload your event @ http://www.theinternetofthings.eu/postscapes-and-council-present-internet-things-day-april-9-2013

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**IoT and IERC News**

- **Can your “IoT world” talk and understand other IoT worlds?** As indicated within the community, IERC AC4 discussions are split over 2 groups, AC4-T1 (With the objective not only to talk but to put semantic interoperability in practice, AC4 is organising thanks to great support of Probe-IT, OpenIoT and IOtest an interoperability event on April 15. The event will focus on practical ontology design and processing. Useful tools for ontology engineering, compatibility checking, processing and visualisation will be introduced. The interoperability tests and evaluations will be based on semantic models and there will be possibilities on testing and evaluating interoperability between gateway and sensor nodes components in an IoT experimental environment. We will check developing ontologies and semantic models in the IoT domain and participants could get involved in developing modules and practicing interoperability evaluations between different models. For this purpose, testing interoperability of existing ontologies or models developed by participants with some of the common ontologies such as W3C SSN ontology or IoT-A models will be carried out. Come at the 2th IoT Interoperability Semantics Guildford 15th April@ EWC 2013

- **IoT Days in Rotterdam:** Is Internet of Things (IoT) a technology or a concept? During the Rotterdam IoT-Days we’ll discuss altogether what IoT is, how it works and above all why it has to be there. It is expected that IoT will have a major impact on people’s lives and societal domains. When we want IoT to be of meaning for us all, we should take control and create new ways of life and work. Join the Rotterdam IoT-Days to experience and share ideas, concerns and thoughts of future living in a hybrid world! More information @ http://iotrotterdam.nl

- **IoT track @ GLOBECOM’2013:** The objective of this subcommittee is to facilitate a global definition of IOT architecture and governance; investigate the sensitive security and privacy issues; and explore different technology scenarios and impacts when enabling Internet protocols over the emerging generations of IoT devices and networks in order to reach harmonization and end to end transparency through IPv6 (For this purpose, this TC will be supported by IPv6 Forum@www.ipv6forum.org). This subcommittee will pursue a global collaboration with IEE ComSoc and non-IEEE organizations from academia and industry. For this purpose, current members from the TPCs in the GLOBECOM 2013 IoT Symposium track will be invited as well as members from industrial alliances such as IPSO Alliance, Open Mobile Alliance (OMA) and standardization groups such as ETSI M2M, oneM2M and IETF. The worldwide research community such as the European IERC community will be invited (http://www.internet-of-things-research.eu/). This multi-discipline of the members from this TC will promote a common understanding to enable harmonization and convergence on governance, integration and security of the Internet of Things. More info at http://www.comsoc.org/about/committees/emerging and http://www.ipv6forum.com/iot/index.php/site-map. CfP at http://www.ieee-globecom.org/2013/cfp.html/#UVClixlorUH.

- **BUTLER, European Project FP7 Looking for an additional partner!:** The BUTLER project currently active in the Seventh Framework programme of the European Community for research, technological development and demonstration activities contributing to the creation of the European research area and to innovation (2007-2013) requires the participation of a new partner to carry out certain tasks within the project. Please note that the Seventh Framework programme offers part-funding not full-funding of research activities. We have a vacancy in our consortium for a partner established in an EU Member State or FP7 Associated State, and having comprehensive expertise in the integration of Internet of Things technologies and conduct of end user trials. More information for the call @ http://www.iot-butler.eu/events/21/open-call

- **Industry’s declaration of interest in IoT international collaboration:** The IERC, the IoT European Research cluster is engaged for many years in international collaboration and liaisons have been established between many European and foreign universities in research activities. Within IERC activities thanks to its portfolio of FP7 projects, regular conferences, workshops and face2face meetings are organised with countries such as Japan, USA, Korea, China just to mention few ones. We would like to use such opportunities to strengthen cooperation between industrial partners and not only with academics. Should you represent a business organisation, large one or SME we would like to get your opinion and look for your participation in our international activities. We would appreciate if you can answer to the questionnaire available online @ https://docs.google.com/forms/d/1OhN9VAA4F8 80yBpdKWNtdi5dD 7rct -f_KJC9a8/viewform? sid=3bc425d599e283b8&token=FslAgj0BAAA.oN2xVIVulEjeVReZGarOzASq7THGyr6dU/VmDB QRCf53g
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 organizational level.

IoT Events

- **April’13**
  2nd-5th, IEEE 8th Intelligent Sensors, Sensor Networks & Information Processing (ISSNIP’2013), Melbourne, Australia
  9th: IoT Day more info at www.theinternetofthings.eu
  11th-12th, “Remote Encounters”, Cardiff, Scotland.
    Info @ http://remote-encounters.tumblr.com
  9th-12th, “The IoT: What, How and Why?”. IoT Days in Rotterdam, NL.
    Info @ http://www.iotrotterdam.nl
  15th: 2nd Interoperability Semantics, Guildford @ EW’2013
  16th-18th: European Wireless 2013 hosted by CCSR @ Uni. of surrey.
    Info @ http://www.euwireless2013.org
  22nd-24th, IoT China in Beijing, China
  26th, IoT Taiwan, Taipei, Taiwan

- **May’13**
  08th-10th: Future Internet Assembly (FIA), Dublin, Ireland
  http://www.fi-dublin.eu/
  21st-22nd: “RFID Interop”, Campinas, Brazil.
    Info @ http://www.probe-it.eu/interop
  23rd: Probe-IT workshop, Sao Paulo, Brazil
  23rd: IoT meet-up, Sao Paulo, Brazil
  24th: IoT-A meet-up - Architecture Workshop organised by IoT_A in Sao Paulo, Brazil

- **June’13**
  16th-20th: 3rd IoT Week, Helsinki, http://www.iot-week.eu

- **July’13**
  03rd-05th: Future Network and Mobile Summit 2013, Lisbon, Portugal
  http://www.futurenetworksummit.eu/2013/

- **November’13**
  06th-08th: ICT 2013: Create, Connect, Grow, Vilnius, Lithuania
  http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=9153