IERC

European Research Cluster on the Internet of Things

Projects Portfolio

CONNECTED — EVERYTHING — EVERYTIME — EVERYWHERE

www.internet-of-things-research.eu

Index

Foreword

By **Thibaut Kleiner**
Network Technologies, DG CONNECT, European Commission

The Internet of Things (IoT) is the next digital revolution. Billions of connected and smart things will enable new innovative applications and services at work, at home, all impacting our lives. The European Commission has been pioneering research in that area since 2009. Our research agenda has supported the conceptual design and architecture of the IoT and has started to provide innovation support to make IoT a market reality. Significant EU funding was used to address technical and societal challenges, e.g. to support inter-operability, limit costs, to avoid market fragmentation while increasing trust and security.

The last funded programme's goal launched in 2013 was to facilitate wider uptake of IoT-based systems with an emphasis on sustainable smart city applications. The technological focus was also on scalable data management capabilities applicable to heterogeneous device platforms.
The results of the last call was the support of 8 medium size projects which complement large projects from previous calls and forming a portfolio of about 15 projects for a total of 75M € EC support.

The Internet of Things European Research Cluster (IERC) was set up in 2010 to help to the coordination of all these projects. I am happy to introduce to you the portfolio of projects, which can help market stakeholders to be part of the growing IoT "business" .

SMEs and start-ups, which want to innovate in the IoT area, might not have resources to invest in lengthy and costly research. They should consider exploiting and cooperating further with EU projects, which can offer ready-to-use solutions and best practices and even more when some solutions are free and open source. The Commission just launched an Alliance for IoT Innovation (www.aioti.eu) to support that process.

I hope in reading the following project cards, you can find useful project results that you can further exploit to develop the Internet of Things growing market. •

IERC
European Research Cluster on the Internet of Things

Bringing together the EU-funded projects and policy activities with the aim of sustaining Europe's leading position in the future **Internet of Things** within a global context

Supporting the development of multi-stakeholder ecosystems using common platforms for IoT applications.
Integration of various disciplines' results – Nanoelectronics, electronic components, future networks technologies (5G), virtualization, cyber-physical systems, Cloud technologies, Big data, privacy & security technologies.

HETEROGENEOUS	AUTONOMIC	STANDARDIZED	SECURED
			
Devices, hardware, access networks, software platforms	Self- X (-management, -configuring, -healing, -optimizing, -protecting)	Web services, APIs, web interfaces, identity, interoperability	Trust, privacy, integrity governance, authenticity, confidentiality

Future technology research:

Dynamically configured infrastructure, Self adaptive, robust, safe, interconnected smart network and service platforms, Heterogeneous integration of technologies and smart devices (sensor, actuators, robots, mobile vehicles, etc.)

Putting the Internet of Things forward to the next level (1)

The Internet of Things (IoT) is defined by ITU and IERC as a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual «things» have identities, physical attributes and virtual personalities, use intelligent interfaces and are seamlessly integrated into the information network. Over the last year, IoT has moved from being a futuristic vision - with sometimes a certain degree of hype - to an increasing market reality.

The EU has already for some time invested in supporting Research and Innovation in the field of IoT, notably in the areas of embedded systems and cyber-physical systems, network technologies, semantic inter-operability, operating platforms and security, and generic enablers. These research results are now feeding into innovation, and a series of components are now available, which could usefully be exploited and enhanced by the market.

As the Internet of Things continues to develop, further potential is estimated by a combination with related technology approaches and concepts such as Cloud computing, Future Internet, Big Data, robotics and Semantic technologies. The idea is of course not new as such but, as these concepts overlap in some parts (technical and service architectures, virtualisation, interoperability, automation), genuine innovators see more the aspect of complementarity rather than defending individual domains.

(1) Extract from article of IERC cluster book 2014. Introduction by Peter Friess & Francisco Ibanez European Commission
Download: www.internet-of-things-research.eu/documents.htm

On the current way towards «Platforms for Connected Smart Objects» the biggest challenge will be to overcome the fragmentation of vertically-oriented closed systems and architectures and application areas towards open systems and integrated environments and platforms, which support multiple applications of social value by bringing contextual knowledge of the surrounding world and events into complex business/social processes. The task is to create and master innovative ecosystems beyond smart phones and device markets. Multiple application sectors including potential new players, which do not exist today and service providers are called upon to play a role in such an endeavour.

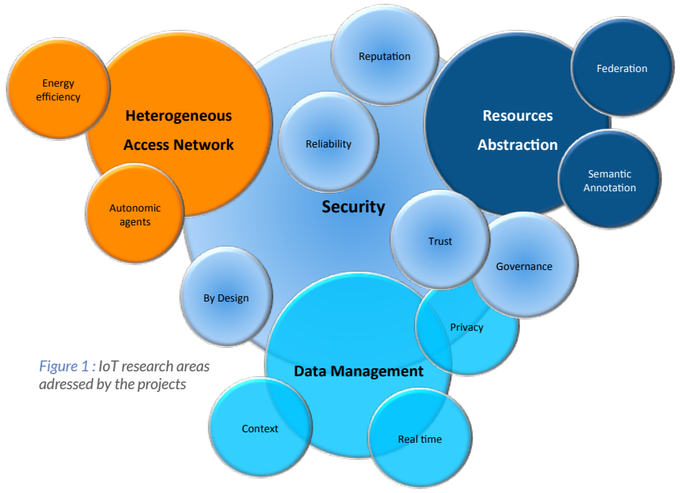


Figure 1 : IoT research areas adressed by the projects

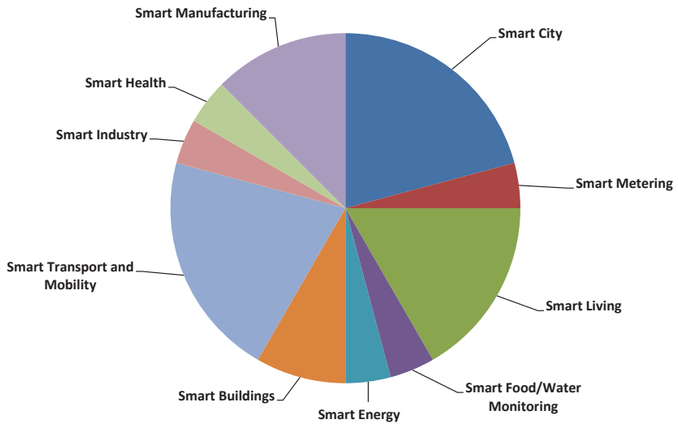


Figure 2: Application areas addressed by some IERC projects

The Internet of Things Technologies will foster European core industrial activities such as industry automation, factory/process automation, generation and distribution of renewable energies (Smart Grid), as well as the development and production of enhanced environmental technologies, cars, airplanes, etc. The future IoT will be a cornerstone for the development of smart and sustainable cities and smart and sustainable infrastructures in general. •

IoT-A — Need for an Architecture Reference Model (ARM) The IOT-A Project

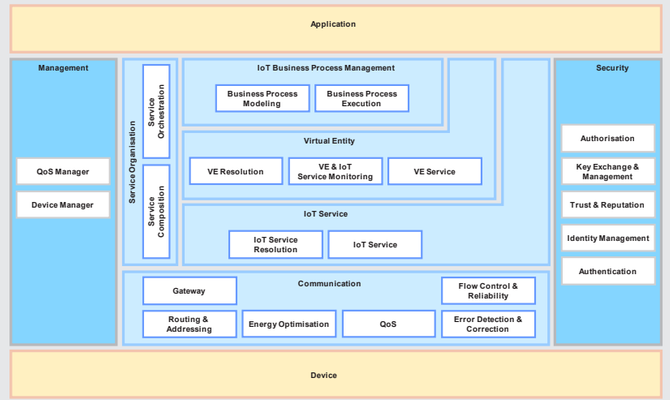


Figure 3: Diagram depicting the functional view of the IoT reference architecture.

It is felt that the absence of a uniform and coherent architecture will greatly threaten the Internet of Things (IoT) development. Therefore, a first step towards realising the IoT future vision is the development of an open architectural reference model, providing guidance for the technical decisions required to design and standardise protocols and algorithms that the envisioned IoT will be based on. This architectural reference model will represent a set of deliberate design choices out of many design alternatives. These choices will be informed by a thorough understanding of requirements on the IoT. Pursuing this approach IoT-A will also ensure that knowledge generated by the IoT will be modular and re-usable across domain-specific boundaries.

www.iot-a.eu

#smartcities #IoT #M2M #sustainability #bigdata #cloud

ALMANAC

Reliable Smart Secure Internet Of Things For Smart Cities

The ALMANAC IoT platform enables integrated smarter city processes for green, citizen-centric and sustainable urban ecosystems. The platform enables interoperation of different communication networks and heterogeneous IoT technologies. Experimentation of selected Smart City services and applications will be carried in the city of Turin, Italy.

Challenges

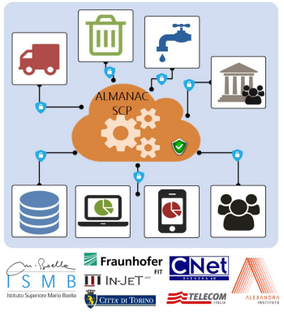
- Promote synergies among city services, infrastructures and resources to overcome their traditional segmentation
- Deal with heterogeneous IoT technologies while providing seamless interoperability among Smart City entities
- Manage data flows from Smart City resources generated by an ever-increasing number of connected IoT devices

AREAS

- Water Management
- Environment
- Waste Management
- Smart City
- Smart Living
- Big Data
- Citizen-Centric

Solutions and needed research

- Transparent virtualization of Smart City devices and resources through semantic modelling
- Interoperation of private and public networks through dynamic federation to support next-generation Smart City services
- Scalable data management to support event detection and real-time decision support, considering privacy and security aspects



Tangible outcomes

Smart City Platform

- Open SW platform enabling seamless integration of devices, services, and private and public data
- Easy access to Smart City services and to basic building blocks for third-party application development

M2M Platform

- Deployment and integration of ETSI M2M standard in heterogeneous and complex Smart City ecosystems

Federated Cloud

- Open federated cloud architecture enabling elasticity of Smart City services and offering efficient aggregation, processing, querying and analysis of data

Partners[1]: ISMB (IT), FIT (DE), CNET (SE), IN-JET (DK), TIL (IT), TRN (IT), ALEX (DK)
Duration: September, 2013 – August, 2016
Funding scheme: STREP
Total Cost: €4.1M
EC Contribution: €3M
Contract Number: FP7-SMARTCITIES-2013, Objective ICT-2013.1.4 no 609081

1: Istituto Superiore Mario Boella (IT), Fraunhofer Institute for applied Information Technology (DE), CNet Svenska AB (SE), In-JeT ApS (DK), Telecom Italia S.p.A. (IT), Citta' di Torino (IT), Alexandra Institute (DK)

Project Coordinator
Dr. Maurizio A. Spirito
Istituto Superiore Mario Boella
Tel: +39 011 2276 408
Email: spirito@ismb.it
Project website:
http://www.almanac-project.eu/

#ContextAwareness #IoTplatforms #Horizontality

BUTLER

uBiquitous, secUre inTernet-of-things with Location and contEx-awaReness

BUTLER aimed to design and demonstrate the first prototype of a comprehensive, pervasive and effective Context-Aware information system, operating transparently and seamlessly across various scenarios towards a unified smart urban environment.

Challenges

- Personalized and Dynamic Demands: handling large and varying demands for personalized information with heterogeneity of context?
- Privacy and Security: maintaining transparency to users while ensuring the privacy and security of information?
- Behaviour Modelling: optimizing the impact that IoT can have in influencing human behaviour?

AREAS

- Smart Home
- Smart Cities
- Smart Transports
- Smart Health
- Smart Shopping

Solutions and needed research

- Improving/creating enabling technologies to implement a secure, pervasive and context-aware IoT
- Integrating/developing a new flexible smartDevice-centric network architecture.
- Building a series of field trials, which progressively integrate and enhance state-of-the-art technologies.

Tangible outcomes

- The open-platforms.eu portal referencing the open technologies that can be used to create Internet of Things applications.
- The BUTLER service oriented gateway providing an open unifying platform that bridges the communication between the physical and virtual worlds.
- Large scale deployment in the City of Santander: a system able to alert merchants about the optimal moments for sending notifications to citizens based on an analysis of city context information.

Partners: inno AG (DE), Ericsson Espana (ES), Telecom Italia (IT), Gematlo (FR), CEA LETI (FR), Oulu YLIOPISTO (FI), FBConsutling (LU), ISMB (IT), Hochschule Luzern (CH), STMicroelectronics (IT), Université du Luxembourg (LU), Universiteit Leuven (BE), TST Sistemas (ES), Jacobs University Bremen (DE), ZigPos (DE), Maya Technologies (FR), Tecnalia (ES), Banco Santander (ES), Ayuntamiento de Santander (ES)
Duration: October, 2011 – October, 2014
Funding scheme: IP
Total Cost: €14.4M
EC Contribution: €9.7M
Contract Number: INFSO-ICT-287901

Project Coordinator
Bertrand COPIGNEAUX
Inno AG
Tel: + 33 4 92 38 84 29
Email: b.copigneaux@inno-group.com
Project website: http://www.iot-butler.eu/

#LargeScaleData Analytics #SmartCityApplications

CityPulse

Real-Time IoT Stream Processing and Large-scale Data Analytics for Smart City Applications

The CityPulse project aims to design, develop and test a framework which support the easily development (by city application developers or even citizens which have a minimum technical background) of IoT based applications for smart cities. The framework contains tools which can be used for discovering, processing and interpreting the IoT data sources (e.g. weather data, traffic data) and social data streams (e.g. Twitter).

Challenges

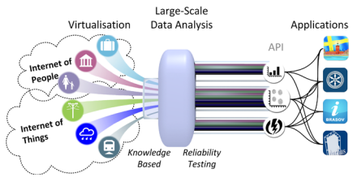
- Bridge the gap between the application technologies on the IoT and real world data streams
- Support the integration data sources and automatically adapt the processing rules based on user current context (e.g. user at home, user using public transport)
- Interpret and extract meaningful knowledge and perceptions from large sets of heterogeneous data streams

AREAS

- Smart Cities
- Public/private transport
- Ambient assisted living
- City infrastructures (electricity/water distribution, public lighting, etc.)

Solutions and needed research

- Virtualisation: Semantic description of heterogeneous data which supports automated discovery of data sources
- Smart Adaptation: change in real-time the data processing rules based on user current context and preferences
- User centric decision support: provide decision support based on user current context and preferences (e.g. while riding the bicycle recommend routes that are not polluted and crowded)
- Reliable Information Processing: Test and monitor the accuracy and trust of the city data sources



Tangible outcomes

Contextual Filtering: this component identifies what changes in the real world (detected events) can affect users' decision process. It does that by capturing city events and evaluating their relevance and criticality for the user depending on his/her changing context.

Visualization: The component gives a tangible result for people who are interested in understanding, and exploiting the smart city infrastructure. The visualization showcases actual services that can be developed, on top of CityPulse framework, and used by users in their everyday life.

Partners: UNIS (UK), AI (DK), ERIC (SE), DERI (IE), UASO (DE), BR (RO), AA (DK), SIEMENS (AT/RO), WSU (USA)
Duration: September, 2013 – August, 2016
Funding scheme: STREP
Total Cost: €3.7M
EC Contribution: €2.5M
Contract Number: CNECT-ICT-609035

Project Coordinator
Dr Payam Barnaghi
University of Surrey
Tel: +44 1483 683460
Fax: +44 1483 686011
Email: p.barnaghi@surrey.ac.uk
Project website: http:// www.ict-citypulse.eu

#SocialInternetofThings #IoTdataManagement #IntelligentThings #PredictiveAnalytics

COSMOS

Cultivate resilient smart Objects for Sustainable city applicatiOnS

COSMOS enables smart city applications and developers to take full advantage of IoT technologies by enhancing the capabilities of devices (Things) to behave more intelligently, acquiring human-like abilities like social interactions, re-use of experiences with each other, understanding of their conditions of operation and acting in an autonomous way.

Challenges

- Applications having to combine data from diverse devices, with different protocols, different capabilities and different sensors
- Making Devices aware of their status, state, potential problems and act to improve them, with help from others
- Increased data security and ability to filter the exposable information levels

AREAS

- Smart Building Heat consumption and Energy Management (Camden City and Taipei IoT Applications)
- Smart City Urban mobility for citizens (Madrid City IoT Application)

Solutions and needed research

- Giving small devices the ability to overcome their structural limitations through linking them with powerful centralized computing services with complementary characteristics (targeted at historical and/or real-time data)
- Predicting future problems that may occur from the currently available data
- Ability to communicate with similar devices to identify and share solutions in a collaborative manner

Tangible outcomes

- Framework for making devices more human-like, enabling social behavior aspects, discovering and retrieving suitable solutions from their friends, while monitoring and ranking reliability and reputation of the contributors
- Device side hardware-based security enablers and flexible software-based privacy filters
- Intelligence extraction mechanisms, enhancing management and adaptation in behavior
- Reusable business application structures exploiting the aforementioned capabilities for diverse needs, improving efficiency and cost reduction

Partners: 10 partners from industry, academia and city authorities belonging to 5 European countries (ES, GR, IL, RO, UK) and Taiwan
Duration: 36 months
Total Cost: €4,729,461
EC Contribution: € 3,188,000
Contract Number: FP7-SMARTCITIES-2013

Project Coordinator
Andrea Rossi
(Smart Objects Lab. Research & Innovation. Atos.)

#InternetOfThingsAndExperimentation #TestbedsToolsAndApplications

FIESTA-IoT

Federated Interoperable Semantic IoT/cloud Testbeds and Applications

FIESTA works towards providing a blueprint experimental infrastructure, tools, techniques, processes and best practices enabling IoT testbed/platforms operators to interconnect their facilities in an interoperable way.

Experimentation as a Service

- FIESTA is opening new opportunities in the development and deployment of experiments that exploit IoT data and capabilities from multiple testbeds at a EU (and global) scale.
- FIESTA focuses on opening new horizons in the development and deployment of IoT applications for experimentation.
- FIESTA project works on integrating IoT platforms, testbeds and their associated IoT data silos and vertical applications.

AREAS

- "FIESTA Project empowers Experimentation-as-a-Service (EaaS) paradigm for sharing and reusing IoT data"
- "FIESTA Project works close to the research industry and academic researchers to share and reuse data from diverse IoT testbeds in a seamless and flexible way"
- "FIESTA brings Experimentation as a Service close to users by means of Orchestration and Federation APIs"

Tools, Techniques and Best Practices

- FIESTA aims to provide to researchers with tools for accessing IoT data resources (including Linked sensor data sets) independently of their source IoT platform/testbed.
- Enable execution of experiments across multiple IoT testbeds, based on a single API for submitting the experiment and a single set of credentials for the researcher.
- Portability of IoT experiments across different testbeds, through the provision of interoperable standards-based IoT/cloud interfaces over diverse IoT experimental facilities.

Expected Impact

- FIESTA's experimental infrastructure available not only European experimenters but World Wide.
- Facilitate the execution of experiments across multiple IoT testbeds.
- IoT experimentation across different testbeds and the provision of interoperable standards-based IoT/cloud interfaces

Partners: NUIG (IE), ITINNOV (UK), INRIA (FR), UNIS (UK), Com4Innov (FR), Unparallel Innovation (PT), EGM (FR), NEC (UK), UNICAN (ES), FOKUS (DE), AIT (EL), SDR (ES), SODERCAN (ES), KETI (KO)
Duration: February, 2015 – January, 2018
Funding scheme: FIRE
EC Contribution: €5.132.584
Contract Number: CNECT-ICT-643943

Project Coordinator
Dr. Martin Serrano
National University of Ireland Galway,
Insight Centre for Data Analytics (DERI)
Tel: +353 91 49 5130
Email: martin.serrano@nuigalway.ie
Project website: www.fiesta-iot.eu

#ContextAwareRealTimeDataManagement #FactoriesOfTheFuture #FIWAREforIndustry #EUmanufacturingDomain

FITMAN

Future Internet Technologies for MANufacturing

The mission of FITMAN is to provide the EU community of IoT developers and system integrators with a set of 10 industry-led use case trials and more than 55 business processes which could guide them in the application of next generation OSS software components offered by the Internet of the Future (www.fiware.org) to future developments in the domains of Smart, Digital and Virtual Factories.

Challenges

Cost-effective development and operation of advanced business process functionalities based on standard and modular IoT and FI technology components for manufacturing & logistics:

- extract data from real production systems and generate events and notifications;
- access & exploit heterogeneous datasets during the lifecycle;
- collaboration and interoperability to modern business ecosystems and value networks.

AREAS

- Industry
- Manufacturing

Solutions and needed research

The FITMAN project will experiment on:

- More than 30 standard **Generic & Specific OSS** software components organised in a **Modular Reference Architectures** for **Digital Business Process** development in an **Open & Programmable Internet**
- 3 FITMAN Reference Platforms conceptually describing the interconnection between the FIWARE and FITMAN enablers for Smart, Digital and Virtual Factories.
- 10 FITMAN Trials Platforms as instantiation and deployment of the selected Generic and Specific Enablers

Tangible outcomes

FITMAN main outcomes for the ICT and Manufacturing industry community are organized in four main streams:

FITMAN Academy: an easy to access repository of scientific assets (concepts, methods and tools) supporting the adoption by SMEs of FI Technologies, useful for further research and innovation in the field

FITMAN Lab: an open source project linked to the FIWARE community and proposing components (15 specific enablers) and reference architectures (smart-digital-virtual factory of the future) for FI for Manufacturing application developers

FITMAN Hub: a web platform for delivering as a Service several functions typical of Smart-Digital-Virtual Factories environments

FITMAN Showcase: a collection of best practices and success stories in the adoption of FI technologies in 10 manufacturing sectors and application domains

Partners: TXT (I), INTEROP-VLab (B), PT INOVACAO (P), Engineering (I), POLIMI (I), VTT (FI), IT Inno (UK), ATOS (S), NTUA (GR), Innovalia (S), Piacenza (I), Softeco (I), APR (F), Univ. of Lyon 2 (F), Consulgal (P), Uninova (P), TANET (UK), Coventry Univ. (UK), COMplus (G), IPK Fraunhofer (G), Univ. of Bordeaux (F), AIDIMA (S), UPVLC (S), Volkswagen (G), TRW (S), Whirlpool (I), AgustaWestland (I), Geoloc (F), FZI (G), DFKI (G), Nissatech (Se), BIBA (G), Datapixel (S), Holonix (I), UIBK (A), DITF (G)
Duration: April, 2013 – September, 2015
Funding scheme: IP
Total Cost: €18M
EC Contribution: €12.8M
Contract Number: FP7-604674

Project Coordinator
Sergio Gusmeroli
TXT e-Solutions Research Labs

Tel: +39 02 25771310
Email: info-FITMAN-FI@txtgroup.com
Project website: www.fitman-fi.eu

#IoTservices #PredictiveIoT #CognitiveComputingAndIoT

iCore

Empowering IoT through Cognitive Technologies

iCore proposes a cognitive framework for the creation and management of smart IoT services on top of virtualised objects. In particular the project main results contribute to the automated deployment and adaptation of IoT services leveraging semantic knowledge to find and use the most suitable object resources.

Challenges

- Study the use of cognitive technologies in support of IoT services
- Reduce user intervention in the design and deployment of advanced IoT services and applications
- Produce solutions for Real World Knowledge management and predictive modelling
- Virtualisation of objects and aggregation into basic composite services

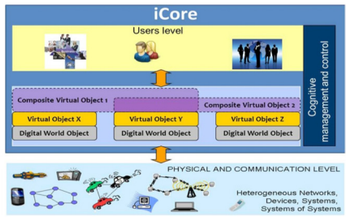
AREAS

Due to the technological nature of the work results can find applicability in many areas but have been prototyped mostly in :

- Smart home and assisted living
- Smart asset management
- Security and safety in Urban scenarios
- Smart logistics
- Smart vehicles in smart cities

Solutions and needed research

- At a wider EU scale iCore contributes to the next wave of IoT services and applications, those that can evolve autonomously fostering adoption from more “general public” users rather than just early adopters.
- Further research is needed to leverage advances in the cognitive computing domain and apply these to the IoT i.e. producing predictive modelling for early anomaly detection (i.e. health, manufacturing, traffic etc.)



Tangible outcomes

The usefulness of project results was also directly showcased in the context of field trials;

- one run in Athens and Santander showcasing how iCore features would enable quick and scalable creation of cognitive IoT services for tourists;
- one deployed in the context of a hospital unit in Trento (Italy) for the tracking and maintenance of medical assets;
- one supporting decision making with IoT gathered knowledge (emultaion in Thales Labs – Paris) in the context of urban security threats and promoted by two of the biggest European industrial Partners of iCore.

Partners: CREATE-NET (I), Ambient (NL), Alcatel Lucent Bell Labs (B), ATOS (E), CRF (I), ZIG-POS (D), JRC (I), IT21 (D), SAG (D), SIEMENS (RO), Thales (F), TelecomItalia (I), TNO (NL), TU Delft (NL), Uni. of Surrey (UK), UPRC (GR), VTT (FI), NTT (Japan), SSS (China), M3S (I), Trilogis (I), Arago (F), KAIST (Korea)
Duration: Oct. 2011 – Oct. 2014
Funding scheme: IP
Contract Number: INFSO-ICT-287708
Total Cost: €13.4M
EC Contribution: €8.7M

Project Coordinator
Raffaele Giaffreda
CREATE-NET
Tel: +39 0461 408400 (ext. 1501)
Email: raffaele.giaffreda@create-net.org
Project website: www.iot-icore.eu

#IoTArchitecturalReferenceModel #IoTArchitecture #IoTPlatform

IoT-A

Internet of Things Architecture

The IoT-A project was the European flagship project on Architecture for the Internet of Things. It aimed at establishing an IoT Architectural Reference Model (ARM) that can be used –following a comprehensive methodology- for deriving concrete IoT system architectures. The ARM has been used by most of the FP7 IoT projects and is being used in projects from the Smart City call as well. The ARM is being maintained and evolved within the IoT Forum.

Challenges

- To provide an Architectural Framework (common grounding and reference point) for deriving IoT systems architectures
- To enhance the level of interoperability between vertical Silos
- To research and provide a framework-compliant horizontal software platform made of generic enablers for supporting the project concepts

AREAS

- All IoT Areas

Solutions and needed research

- Architectural Framework for deriving interoperable IoT systems that outlines principles and guidelines for the design of its protocols, software components and interfaces
- Architecting methodology
- Scalable and semantic-enabled Resolution Infrastructure
- Generic enablers that follow the framework principles

Tangible outcomes

- Architectural Reference model (ARM) made of a set of Models, Views and Perspectives for deriving interoperable IoT architectures
- Methodology supporting the ARM principles for easing ARM adoption within the IoT community
- ARM-compliant Platform components with semantic support
- Implementation of Real-Life use-cases demonstrating the benefits of the developed ARM

Partners: Alcatel Lucent (BE, FR), CEA (FR), CFR (IT), CSE (GR), FhG IML (DE), Hitachi (UK), IBM (CH), NEC (UK), NXP (DE, BE), SAP (DE), Siemens (DE), Sapienza University of Rome (IT), University of St. Gallen (CH), University of Surrey (UK), University of Würzburg (DE), VDI/VDE-IT (DE), VTT (FI)
Duration: 1st September, 2010 – 31st August, 2013
Total Cost: €18.6M

Contact person
Dr. Francois Carrez
University of Surrey
f.carrez@surrey.ac.uk
Project website: www.iot-a.eu

#InternetOfThingsAndSemantics #OpenSourceProject

OpenIoT

Open Source Cloud Solution for the Internet of Things

www.openiot.eu

OpenIoT is a first-of-a-kind (award-winning) open source blueprint platform supporting semantic interoperability between sensor data silos and also for enabling Internet of Things semantically-annotated services in the cloud.

Main Objectives

- OpenIoT focuses on the convergence between Internet of Things and Cloud Computing areas by using Semantics.
- OpenIoT was incepted in 2010 to ensure semantic interoperability of diverse services and sensor data streams.
- Enable semantic interoperability integration across diverse IoT applications and sensor streams.

Value Chain Proposition for The Internet of Things

- To ensure **Semantic Interoperability** of diverse **IoT data** services and **sensor data streams** in the cloud,
- An implemented **Reference Model** to provide configurable IoT solutions using **sensor-data sets** (i.e. Linked Sensor Data),
- Delivery of IoT applications enabling **Sensing as a Service** through **Cloud-based Platforms** on a **Utility-based Pay-as-you-Go model**

AWARDS

2013 Winner OPEN SOURCE ROOKIE OF THE YEAR BLACKDUCK

- OpenIoT Project awarded "2013 open source rookie of the year in the area of Internet of Things" by Blackduck Software Co.
- "Best Semantic Interoperability solution"at 2014 IoT Week Hackathon, London, UK and "Third best IoT product / solution at 2014 IoT Hackathon in MIT Media Lab, Cambridge, MA, USA.

Main outcomes

- Ready-to-go OpenIoT platform, a totally open source platform, is a joint effort of prominent open source contributions.
- The OpenIoT Open Source Software Project and building community are the main vehicle for realising the project's impact.
- The OpenIoT Software Development Kit (OpenIoT-SDK), A virtual environment, test OpenIoT platform in few clicks, was developed for academic purposes, it is portable and easy to configure.

Partners: NUIG (IE-Coordinator), EPFL (CH), Fraunhofer-IOSB (DE), CSIRO (AU), SENSAP (EL), AcrossLimits, (ML), UniZ-FER (HR).
Duration: December, 2011 – February, 2015
Funding scheme: STREP
Total Cost: €4.755.555
EC Contribution: €2.505.170
Contract Number: INFSO-ICT-287305

Project Coordinator
Dr. Martin Serrano
National University of Ireland Galway,
Insight Centre for Data Analytics (DERI)
Tel: +353 91 49 5130
Email: martin.serrano@nuigalway.ie
Project website: www.openiot.eu

#smartcities #iot #security #privacy #reliability #trustworthiness #robustness

RERUM

Reliable, Resilient and Secure IoT for Smart City Applications

RERUM

RERUM *increases the trustworthiness* of IoT providing an overall security, privacy and trust framework to address the citizens requirements for advanced, reliable, resilient and secure smart city applications that respect their privacy improving both devices and middleware functionalities.

Challenges

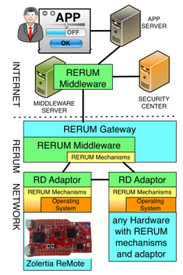
- Ensure data availability in an overcrowded radio spectrum within city environments
- Embed advanced security and privacy mechanisms on resource constrained IoT devices
- Provide opportunities for users to control their data in the IoT
- Minimize attacks on constrained devices and the impact of attacks on the system performance/decisions
- Support device heterogeneity and scalability

AREAS

- Smart City/Traffic Congestion
- Smart City/Urban Noise Maps
- Smart Environment Monitoring/ Air Pollution
- Smart Environment Monitoring/ Weather Station Network
- Smart Buildings/Indoor Climate Control
- Smart Buildings/Intelligent Fire Alarm
- Smart Living/Energy and Water Use

Solutions and needed research

- Secure the IoT data lifecycle (gathering, transmission, storage, processing)
- Ensure interoperability maintaining privacy with user consent
- Model trustworthiness of users/devices
- Reliably interconnect a large number of heterogeneous devices, minimizing energy consumption and ensuring spectral efficiency



Tangible outcomes

- An innovative, powerful and low-power IoT device built using project specifications
- An enhanced security framework and the corresponding building blocks that enable the deployment of secure and privacy-preserving IoT-based Smart City Applications
- Intelligent resource allocation mechanisms for enabling the interconnection of a large number of heterogeneous smart devices
- Adaptation of Cognitive Radio technology for IoT devices to minimize wireless interference and improve spectral efficiency

Partners: Eurescom (DE), Atos (ES), Siemens AG (DE), University of Bristol (UK), Linköping University (SE), University of Passau (DE), Zolertia (ES), FORTH (GR), Cyta (GR), Ajuntament de Tarragona (ES), Heraklion Municipality (GR), Siemens SRL (RO)
Duration: 3 years
Total Cost: 5,196,176
EC Contribution: 3,497,000
Contract Number: CNECT-ICT-609094

Project Coordinator
Adam Kapovits
Email: kapovits@eurescom.eu
Voice: +49 6221 989 260
Mobile: +49 171 286 1785
Eurescom GmbH, Wieblinger Weg 19/4, 69123 Heidelberg, Germany
www.eurescom.eu

#IoTcocreation #SocIoTal #CommunIoT

SOCIOTAL

Creating a socially aware and citizen-centric Internet of Things!

SocIoTal designs key enablers for a reliable secure and trusted IoT environment facilitating the creation of a socially aware citizen-centric Internet of Things. It takes a citizen-centric approach towards creation of large-scale IoT solutions of interest to the society. SocIoTal provides secure and trusted tools that increase user confidence in the IoT environment.

Challenges

SocIoTal addresses a diverse set of technology and socio-economic challenges:

- How can a useful IoT system emerge from building blocks deployed by people and how it can be grown into a trusted eco-system?
- How can an IoT be designed so that it prevents people from being exploited in an Orwellian nightmare?
- How can an IoT be designed to entice individuals to contribute while retaining control on these shared assets?

AREAS

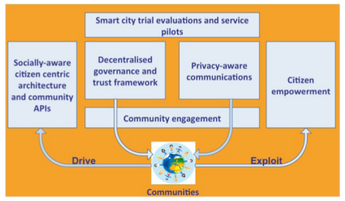
- City
- Community
- Society engagement

Solutions and needed research

SocIoTal defines two orthogonal frameworks that complement each other:

- a decentralised governance, trust and reputation framework and
- a privacy-preserving context-sensitive communication framework.

Together these frameworks ensure that the privacy and integrity of the full IoT data and information life cycle are maintained.



Tangible outcomes

- A novel framework for dynamic managing and supporting the integration of IoT devices within the citizens' and entities' environment (including temporally usage of IoT devices form the infrastructure) configuring community and trust zones and its implications over the privacy and trust in the existing and future relations and communications of the citizens.
- Tool for citizens to create, network and share their personal IoT, making it organic with the ecosystem in which public and private IoT can merge by means of composition, re-distribution, sharing, of data and devices.

Partners[1]: UNIS (UK), CEA (FR), CRS4 (IT), DNET (SRB), RD (NL), UC (ES), UME (AUS), UMU (ES), SEN (ES), NS (SRB)
Duration: September, 2013 – August, 2016
Funding scheme: STREP
Total Cost: €3.7M
EC Contribution: €2.8M
Contract Number: CNECT-ICT-609112

Project Coordinator
Prof. Klaus Moessner
University of Surrey
Tel: +44 1483 683468
Fax: +44 1483 686011
Email: k.moessner@surrey.ac.uk
Project website: http:// www.sociotal.eu

#InternetOfThingsAndVirtualization #FutureOfSmartCities

VITAL-IoT

Smart, Secure and Cost-effective Integrated IoT Deployments in Smart Cities

In the VITAL project, the future of Smart Cities, we are developing a novel virtualization layer for the next generation of integrated and technology independent smart city operating systems in Europe.

Challenges for Future Smart Cities

- The VITAL project focuses on novel solutions towards integrating heterogeneous IoT systems.
- VITAL deals with data integration, interoperability, and optimisation for enabling integrated IoT services, towards realisations of smart city operating systems.
- VITAL project bridges technological and organizational applications in smart cities, through the continuous integration of User Experience.

AREAS

- "VITAL realizes a radical shift in the development, deployment and operation of IoT applications for smart cities"
- "VITAL project represent a major effort to jumpstart the cost efficient development, deployment and operation of next generation Smart City Applications"

VITAL Approach using Internet of Things

- VITAL increases the return of investment (ROI) of the usually expensive smart city infrastructure(s) through reusing and repurposing existing sensors and IoT systems without requiring extensive changes in the deployed infrastructure.
- VITAL concentrates on developing technology and tools for building applications that leverage virtually any sensor infrastructure within a smart city, regardless of the underlying architectures or platforms.

Expected Impact and Main Outcomes

- VITAL assist the European smart city industry by facilitating the replication of IoT services across different infrastructures in the cities.
- VITAL enables IoT system integrators to easily work with different IoT architectures and ecosystems.
- VITAL provides a European solutions/approach for integrating application silos in smart cities.

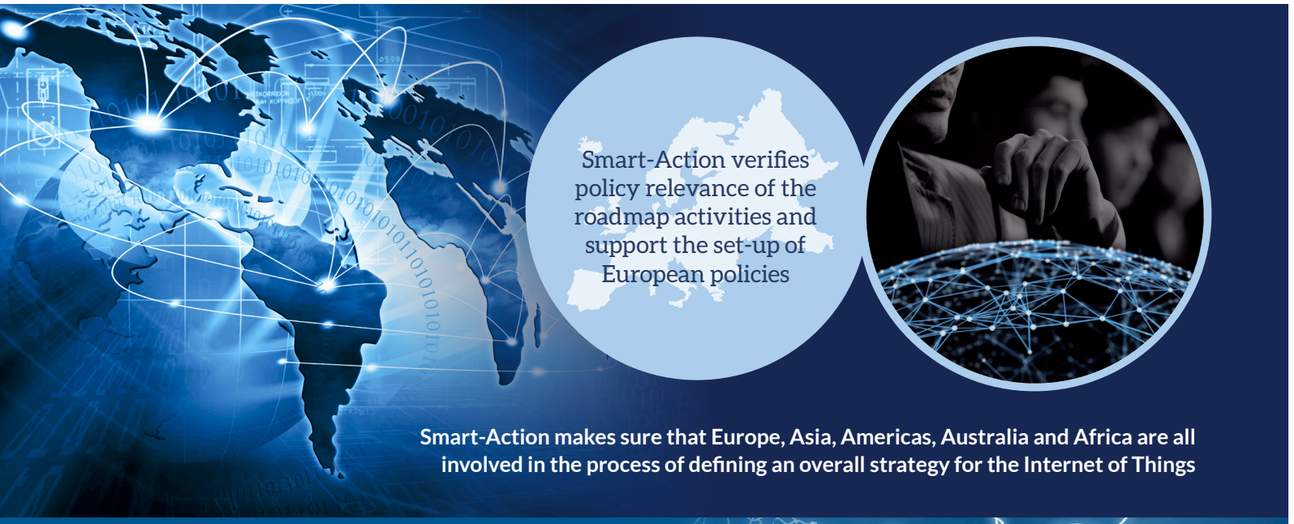
Partners: NUIG (IE), INRIA (FR), SanterReply SPA (IT), SingularLogic (GR), Atos (ES), AIT (GR), Images&Co Ltd (UK), IMM (TR) Camden Town (UK), ITU (TR)
Duration: September, 2013 - August, 2016
Funding scheme: STREP
Total Cost: €4.190.359
EC Contribution: € 2.695.000
Contract Number: CNECT-ICT-608602

Project Coordinator
Dr. Martin Serrano
National University of Ireland Galway,
Insight Centre for Data Analytics (DERI)
Tel: +353 91 49 5130
Email: martin.serrano@nuigalway.ie
Project website: www.vital-iot.eu

SMART ACTION

Innovating beyond IoT

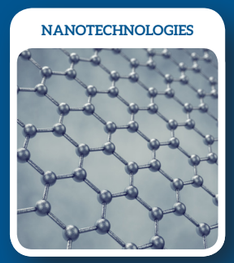
Smart-Action is a member of the IERC project's cluster and is providing support for International Road Mapping of the Research Agenda and Policies of the Internet of Things.



Smart-Action verifies policy relevance of the roadmap activities and support the set-up of European policies

Smart-Action makes sure that Europe, Asia, Americas, Australia and Africa are all involved in the process of defining an overall strategy for the Internet of Things

Smart-Action encourages cross fertilization between IoT and other areas such as biotechnology, social sciences and nanotechnologies



NANOTECHNOLOGIES

BIOTECHNOLOGIES

COGNITIVE SCIENCES

UNIVERSITÄT DUISBURG ESSEN
Open-Minded

easy global market

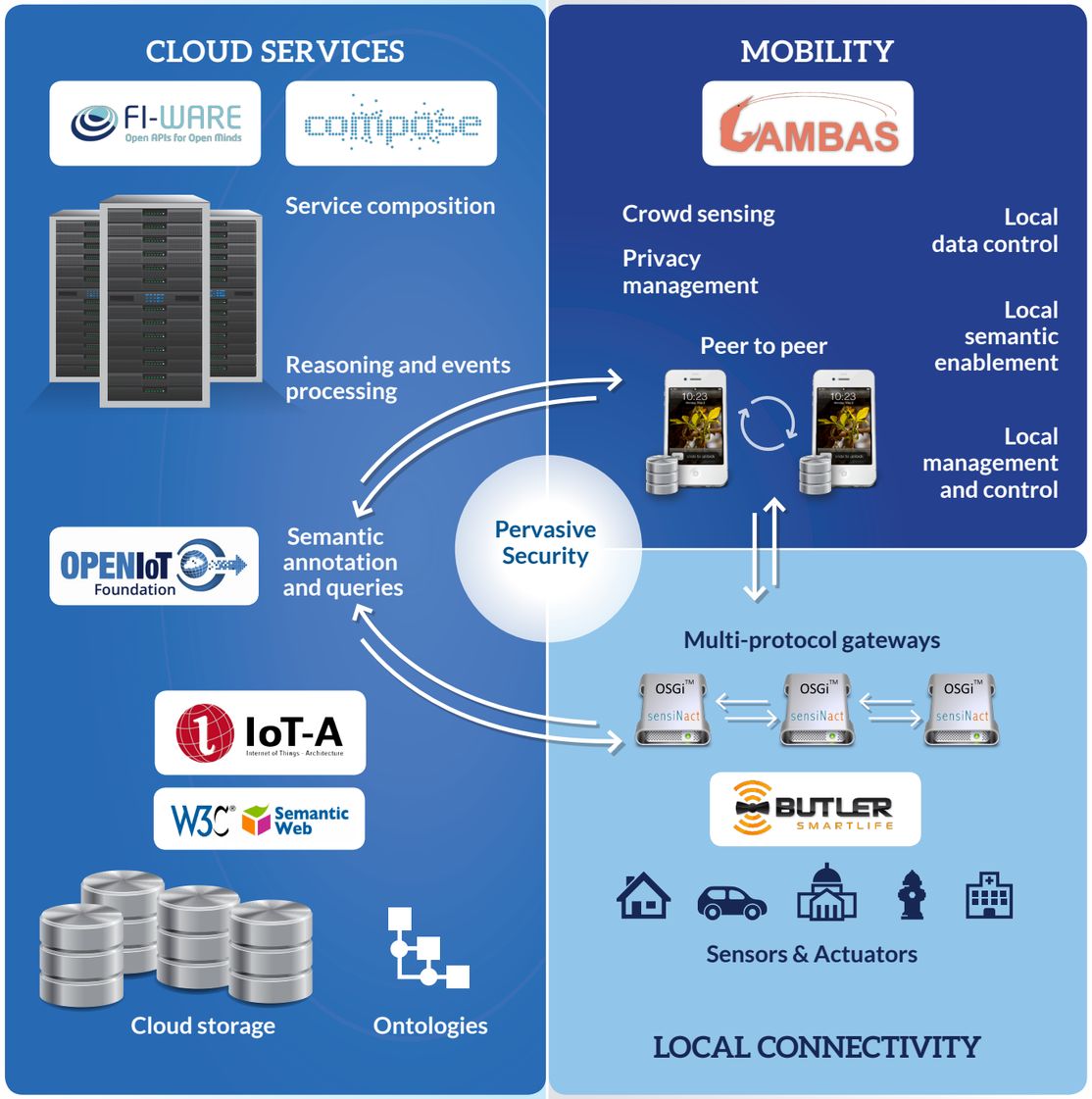
SINTEF

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 609024

www.smart-action.eu

Cloud enhancement

Local management & control



Smart-Action collective demonstration is integrating sustainable outcomes of EU funded projects to showcase value of a complete ecosystem built upon projects' main strengths.

www.internet-of-things-research.eu