Newsletter

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"Interoperability as a Service" – Connecting IoT infrastructures and smart objects

Editorial

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VICINITY is now in its most important phase, for several reasons.

First, we are in the process of finishing the requirements and specification phase.

Second, we are starting development of the software and getting more in-depth into modeling of the use cases.

Third, we are facing our first real review in September (I remind you that the last meeting with EC was just a technical review).

The newsletter gives a gentle introduction in the results and upcoming tasks so far. This includes the specification and platform decisions that take a large part of this newsletter. But it also covers the first publications that show the impact of VICINITY also on science and technology. A large part is also devoted to the test labs in which we, in future, plan to demonstrate and evaluate VICINITY.

I hope you get a lot of both valuable and interesting information from the newsletter and enjoy reading it!

Latest News and Upcoming Events

Latest news

- AAU presented VICINITY at the International symposium on power electronics, electrical drives, automation and motion 2016 (Speedam 2016) during 22-24 July 2016, in Anacapri, Italy.
- CAL on behalf of VICINITY participated in “Smart Metering: A Smarter Way Forward” organised by Future Cities Catapult on 7 December 2016, in London, UK.
- CAL on behalf of VICINITY participated in “Smart and Sustainable Cities and Communities Coordination Group” organised by CEN/CLC/ETSI on 17 January 2017, in Brussels, Belgium.
- VICINITY second General Assembly was held on January 24-25, 2017 in Bratislava, Slovakia.
- CAL on behalf of VICINITY participated in the 1st meeting of ISG CIM “Cross-cutting Context Information Management for Smart City Interoperability” on 9-10 February 2017, in Sophia Antipolis, France.
- VICINITY consortium participated in “IoT-EPI Challenge” on March 17, 2017 in Berlin, Germany.
- UNIKL on behalf of VICINITY participated in ITU-T Meeting on 13-23 March 2017, in Dubai.
- A Stakeholder Advisory Board webinar about the milestone was held on March 24, 2017.
- VICINITY booth at the IoT European Platforms Initiative village at SIdO during April 5-6, 2017 in Lyon, France.

Upcoming Events

- VICINITY booth at Hannover Messe Trade fair during 24-28 April, 2017 in Hannover, Germany

Interview with a SAB member

António Eduardo de Barros Ruano

University of Algarve

How did you develop an interest in Wireless Sensor Networks? How long have you been working with this technology?

– For several years we have been working in Predictive Control of HVAC systems in Buildings. This technique demands that several variables are sampled in real time. For that purpose, we started using wired sensors, then moved to off-the-shelf wireless sensors and finally designed our own, self-powerered.

You are a member of the Portuguese Associated Laboratory for Energy, Transports and Aeronautics (LAETA) and as Director of Centro de Investigação Tecnológica do Algarve (CINTAL) , Could you provide us more information about these institutions?

– The mission of LAETA is to set-up a research and development network with engineering know-how in all fields contributing to transports and energy and aerospace that will promote partnerships with SME's, European consortiums, national and international entities involved in regulation and standardization and public and private institutions involved in R&D in order to transfer new technologies, to implement new engineering procedures of project, design, manufacturing and testing of products and to promote the dissemination of knowledge and the education and training of technicians and engineers to overcome existing lacks in education and to acquire new competences.
Please see https://www.idmec.ist.utl.pt/laeta/CINTAL
- Centro de Investigação Tecnológica do Algarve, is a non profit private association, created in 1990, with the following main objectives:
- R&D in the areas of science and technology
- higher education and formation
- services and contracting in relation with industry.
Please also see www.cintal.ualg.pt

What motivated you to join the VICINITY Stakeholder Advisory Board?

– Close contacts/projects with Enercoutim.

What is your area of interest in VICINITY?

– Intelligent Buildings and Smart Energy.

What is, in your opinion, the ultimate goal expected to be achieved with the help of the VICINITY solution?

– The goal of VICINITY, building and demonstrating a standards-based, device-independent IoT platform that will offer "Interoperability as a Service" is a need for promoting IoT in Europe.

Which challenges in your field of expertise can VICINITY address and how?

– My field of expertise is in intelligent control, with a relevance to system identification with computational intelligence based techniques. This means that in my area, we need to integrate data (maybe acquired in different locations), typically using different protocols and standards to create our models, and use them for different applications. The availability of VICINITY platform will surely solve some of our problems.

You are co-author of the papers "The IMBPC HVAC system: A complete MBPC solution for existing HVAC systems" and "An Intelligent Weather Station" What are the main findings and conclusions of these publications?

– The first paper details what we think is the first commercializable model predictive control (MPC) solution for HVAC control in buildings. The main finding is that the use of this approach demonstrated, in several real-time experiments, economic or energy savings of up to 50% while maintaining user thermal comfort.

– The second paper is relevant to the above area and to solar energy systems. The weather station is termed 'intelligent' since it provides, besides measurements, forecasts of weather variables (air temperature and relative humidity, global solar radiation) over a user-defined prediction horizon. It can be used for building thermal comfort, greenhouse environment control and solar energy forecast.

VICINITY Stakeholders Drivers and Barriers

Many of the stakeholders are facing decisions as to adaptation of new technologies, and decisions on matters they have little or no knowledge about. In today's dynamic world with so many large disruptive approaches and changing business models, it is difficult for decision makers to identify, prioritise and fully adapt and trust the new opportunities beyond viewing them as limitations.

The main challenge of moving from a plan- and frequency-based working method in public and private environments towards a conditional-based approach and work method is the amount of data generated. This, in turn, would lead towards continuously adjusting and evolving ways of performing tasks and reacting to operational changes in the public and private sector. This is relevant to all VICINITY intervention domains: Energy, Building, Transport and Healthcare.

Service rollouts provided by public entities require long implementation times and demand for such services naturally lags behind. Shared economies and new ways to deliver services could be enabled by the VICINITY solution in order to speed up the rollout of services as well as shorten implementation times. For example, the VICINITY consortium aims to demonstrate an extendable service for sharing available parking spaces through use cases at the pilot site in Tromsø, Norway.

Buildings are the objects that society spends most of its critical resources on, such as energy and capital. The VICINITY solution could facilitate ways to optimise these costs and enable better operations and management of these facilities while involving end users.

At the pilot site at the Oslo Science Park in Norway , VICINITY will test use cases that collect and combine information on energy systems and smart parking to find new and better approaches to some of these issues through the interoperable approach VICINITY would provide.

The pilot in Martim Longo, Portugal is focused on the transversal energy domain and municipal buildings management. The energy generating and energy consuming components could potentially form a municipal-scale smart-grid enabled by VICINITY. It aims to demonstrate value-added services that could be enabled through the VICINITY framework based on a renewable energy generation infrastructure. The aim is to cross leverage and create value through community-scale VICINITY enabled interoperability.

Barriers and Drivers

Building: Data capturing and sharing

Organizations are often characterised by the lack of systematic data capture and missing tools for handling complex data structures. Better information about the environment and the resources available and consumed should support optimal usage of the resources through data sharing between tenants and building facilities. IoT as a tool allows building owners to measure properties of building's; performance automatically. There is a potential to optimise their maintenance activities in small repetitive tasks. Overall better information about environment and resources should support optimal usage of the resources through data sharing with tenants.

Transport: Resistance and responsibilities

Barriers could include the lack of willingness of residents to share their parking space when not used. Complex ownership relationships and responsibilities can inhibit deployment of parking solutions. Bringing the IoT to the transport domain opens the door to new parking sharing services, which benefits visitors, parking space owners, rental companies and building owners/management.

Healthcare: Technical and social

For the Healthcare related use cases, it is difficult to convince elderly people to install IoT devices/sensors in their homes and to train them on their usage including handling and sharing of sensitive personal data. Drivers for the younger generation include the proliferation of affordable new technology equipment for fitness use, wider use of social networks and sharing of personal data. There is greater demand from the professional services providers by specialised staff (pathologist, dietitian) for health data monitoring for better services provision.

Energy: Communicating advantages

Optimisation of energy generation and consumption through the use of sensor data across domains promises positive outcomes. It is difficult to list all of the benefits that could be obtained upfront and quantify the synergies. It is widely anticipated that greater cross-domain interoperability would allow for the overall energy cost reduction and new services to evolve; Real-time data and monitoring promise a greater impact on consumers energy-resource use-patterns with a more efficient and rational use of energy. The common concern in IoT deployments are the ethical issues of collecting data within buildings and potential use of information related to people's behaviour.

Overall, privacy and security issues, trust, complexity, data ownership and compatibility concerns are among of the most frequently raised concerns. According to the interviews, stakeholders' expectations becom apparent from trying to understand stakeholders perceptions of the strengths and weaknesses of the proposed solutions. The following statements summarise the general perception of VICINITY by stakeholders:

- "Strengths: efficient, time-saving, minimising environmental impact, cost saving and providing better quality of life".
- "Risks: Loss of privacy and security, compatibility, complexity and legislation, dependence on technology, disruption of existing business models; complexity, developing legislation regarding ownership of data".

VICINITY Requirements

There are three types of requirements in VICINITY that are relevant for system design. The table below outlines the types and levels of requirements while identifying some considerations. Sources of the operational requirements in VICINITY were stakeholder interviews, workshops and advisory board members and the extended partner's networks.

High level Solution expectation

Requirements Type: Operational

Considerations:

- User point of view implicit and explicit

- High level user goals and expectations

Business impact more detailed
Requirements Type: Business
Considerations:
- Stakeholder point of view
- Scope of the project
- Business objectives

Detailed System Functionality
Requirements Type: Functional
Considerations:
- Functional (what the system does)
- Non-functional (how well the system does it)

VICINITY Business Requirements

VICINITY has defined several use cases that will be addressed in the different pilots. Interviews were conducted with a number of stakeholders, and the outcomes have taught us a lot about identifying business requirements and features that will be required in the VICINITY platform. These requirements will shape the final platform. To achieve this goal, tools based on SysML (https://en.wikipedia.org/wiki/Systems_Modeling_Language) will be applied and used for testing.
The specifications will also be used to identify the system components of the VICINITY platform. This includes abstraction of physical devices and services, and best practise related to security, privacy, user experience, performance, availability and maintainability fields. Furthermore, the specifications will influence implementation of internal interfaces between the VICINITY components. The same applies to external interfaces available for surrounding systems, including adapters for integrating IoT infrastructures. These infrastructures may consist of both devices as well as third party components providing value added services to the VICINITY ecosystem.

Value-Added Services Implementation Plan

Within the scope of the pilot site demonstrations, VICINITY will implement a set of innovative value-added services, showcasing how the VICINITY platform enables the creation of diverse services across different IoT domains, offering interoperability as a service for diverse stakeholders. These value added services have already been identified during the pilot site surveys and audits performed during the first year of the project, defining their main functionalities and scope in each of the pilot use cases.
During the second year of the project, these Value-Added services will be defined in detail, specifying the technical details needed for their implementation, such as the IoT devices and the data acquired from the pilot sites, algorithms and data analytics for the processing of the

information along with the User Interfaces needed to be implemented to present the information and interact with the addresses stakeholders (e.g. doctors, end-users, citizens etc.), ranging from mobile applications for smartphones to web or desktop applications. Furthermore, the deployment requirements will be extracted, setting a feasible plan for the required installation and setting in each of the selected pilot sites.
Finally, VICINITY will organise Open Calls to attract external entities to participate in the implementation of some more innovative and cross-domain value added services built on top of the VICINITY platform. The requirement and technical and managerial procedure for the organisation of the open calls will be defined in order to facilitate the process.

VICINITY Standardization and Platforms

IoT Standards

As described in an earlier article, VICINITY Pilots will be set up in the domains of ehealth, smart transport, smart energy and smart parking.
Recommendations on standards are included in VICINITY Deliverable D2.1 – "Analysis of Standardisation Context and Recommendations for Standards Involvement". Standards recommendations are divided into two parts:
The first covers standards groups in which VICINITY partners are actively involved and will contribute:

- AIOTI (Alliance for Internet of Things Innovation) was set up by the EC in early 2015 in an attempt to generate a consensus on the standards needed to deploy the IoT globally. The following working groups may be relevant to the VICINITY: WG3 (Standardisation), WG4 (Policy), WG5 (Smart living for Ageing Well), WG7 (Wearables), WG8 (Smart Cities), WG9 (Smart mobility), WG12 (Smart Energy), WG13 (Smart Buildings and Architecture).
- ETSI TC SmartM2M was set up to develop specifications for M2M services and applications focusing on IoT and Smart Cities. TC SmartM2M is currently mapping SAREF (Smart Appliances Reference Ontology) to the oneM2M Base Ontology and is also in the process of evolving SAREF and extending it to different domains. It has been agreed that it would be useful for VICINITY to participate in SmartM2M rather than in oneM2M to ensure that SAREF meets the requirements of the architecture and pilots.
- W3C - OGC & WoT Interest Groups. The World Wide Web Consortium (W3C) is the main standards organization that develops standards for the Web. Two of its main activities are relevant to VICINITY: the Web of Data and the Web of Things. From the Data activity (and its predecessor the Semantic Web), VICINITY will use the set of standards defined for representing data on the Web describing ontologies that give meaning to such data (Web Ontology Language, OWL), querying such data (SPARQL Protocol and RDF Query Language), and providing REST interfaces to access them (Linked Data Platform, LDP).
- ITU-T SG20 - IoT and applications including smart cities and communities. SG20 has drafted an IoT Standards Roadmap. The services offered and the objectives of

VICINITY trials could be contributed to SG20 with a view to developing new ITU Recommendations or Supplements.

- IEEE IoT WG - P2413 Architectural Framework for the IoT. VICINITY will contribute to the further development of this architectural framework.
- CEN TC 278 / ISO TC 204 ITS Standards. CEN TC 278 is heavily integrated with ISO TC 204 and covers Transport Telematics and Traffic, which may be relevant to the VICINITY Smart Grid and Parking use case.

The second group covers standards groups that will be monitored during the lifetime of the project:

- ISO/IEC JTC1 SC27 (Information Security) and WG10 (Internet of Things). ISO/IEC SC27 covers development of standards for the protection of information. This includes generic methods, techniques and guidelines to address both security and privacy aspects.
- OneM2M Partnership Project base ontology. The work on semantics/ontologies is carried out in WG MAS (Management Abstraction and Semantics). This is developing a Base Ontology based on the requirements of specific ontologies such as SAREF.
- Continua Health Alliance. The Continua Health Alliance standard addresses the fundamentals of data exchange between medical devices. This standard is required for the VICINITY eHealth at Home pilot.
- USEF Universal Smart Energy Framework. USEF partners are working together to deliver the foundations of one integrated system which benefits all players - new and traditional energy companies and consumers.
- CECED European Committee of Domestic Equipment Manufactures.
- ITS (Information Technology Services) groups in ETSI, ITU, BSI.
- CEN/CLC/ETSI SSCC-CG (Smart and Sustainable Cities and Communities Coordination Group) which is looking at standards for cross-domain use cases in smart cities.

Comparison of SW/HW platforms for the IoT gateway

Towards achieving interoperability at lower, device level VICINITY has been considered one of the following IoT software frameworks:

- OpenHAB SmartHome Framework.
- AllJoyn.
- DeviceHive IoT Framework.
- OpenRemote.
- Iotivity.

To meet the requirements for an IoT Hardware Platform, the following candidates have been considered:

- Banana Pro.
- Cubieboard 3 (Cubietrack).
- RaspberryPI3ModelB.
- Pine A64.
- Intel Edison.

A final decision on which platform to use will be made after the requirements of the VICINITY pilot sites are identified.

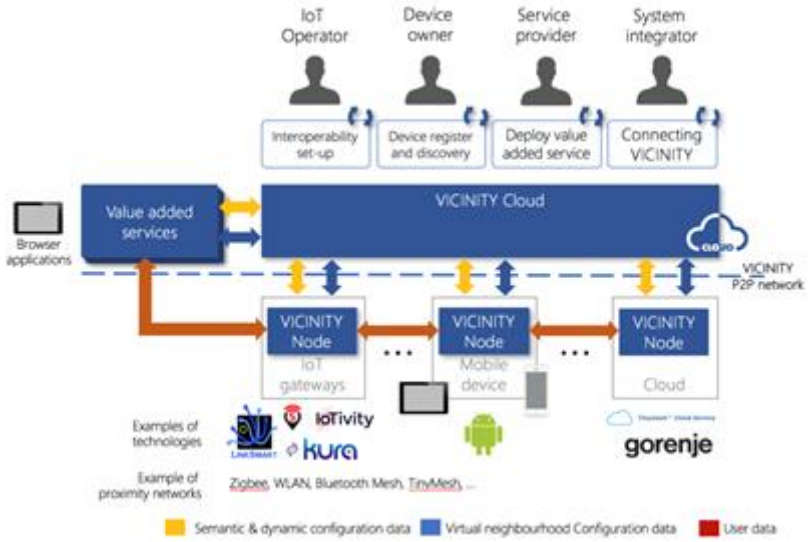


Figure 1: VICINITY "Interoperability as a service" Architecture.

The H2020 project VICINITY aims at providing "Interoperability as a service" through VICINITY Cloud services to setup semantic interoperability including device discovery and peer-to-peer network of VICINITY Nodes to exchange context-aware user data in secure and privacy preserving manner.

The VICINITY Cloud is the infrastructure that provides 'Interoperability as a Service', by providing services that enable:

- Configuring the virtual neighbourhood of integrated infrastructures and value-added services (including setting-up the sharing access rules of any IoT objects) - like in social networks.
- Semantic search (discovery) of IoT objects in the virtual neighbourhood.
- Characterization of new IoT objects and generation of the necessary thing descriptions (following the Web of Things approach) based on the VICINITY ontologies.
- Configuring the VICINITY Nodes based on IoT object description (such as data-integration and privacy services), sharing access rules (for accessing IoT objects in the peer-to-peer network), and configuring the communication with the integrated infrastructure or value-added services (such as encryption and data integrity features).
- Auditing changes and events in the virtual neighbourhood (such as new integrated infrastructure request, change of sharing access rules, new device or service in virtual neighbourhood events) including user notification of such important events.

The VICINITY P2P Network provides a closed and secure common communication network for the VICINITY Nodes and the VICINITY Cloud to exchange user data between them. The communication is based on the share access rules defined in the VICINITY Cloud services,

and transmission of control and configuration messages.
This includes encryption and privacy features, control communication channels within P2P network, configuration of communication between VICINITY Nodes and integration infrastructures between the VICINITY Nodes and the VICINITY Cloud.
The VICINITY Nodes are the set of software components providing different services to integrate IoT infrastructures (IoT gateways/ middleware, Mobile devices, Cloud service) and/or value added services into the VICINITY Cloud, such as:

- Remote IoT object context-aware semantic discovery to look-up for the objects provided by other integrated infrastructures and/or value-added services;
- User data forwarding within the P2P network according to the share access rules defined in VICINITY Cloud;
- Encryption and data-integration services for forwarded user data to ensure secure transmission of the data within VICINITY P2P Network;
- Configurable of auditing and logging of exchanged user data.

Scientific and Technical Publications

- “Drivers, Standards and Platforms for the IoT: Towards a digital VICINITY”, Carna Radojicic, Aida Mynzhasova, Christopher Heinz, Christoph Grimm, Juan Rico, Keith Dickerson, IEEE Technically Sponsored Intelligent Systems Conference (IntelliSys) 2017, 7-8 September 2017, London, UK.
- “A Novel Hierarchical Control Strategy for the Internet of Things based Home Scale Microgrid”, Yajuan Guan, Juan C. Vasquez, Josep M. Guerrero, IEEE International Symposium on Industrial Electronics (ISIE 2017), 19-21 June 2017, Edinburgh, UK.
- “An Open Virtual Neighbourhood Network to Connect IoT Infrastructures and Smart Objects – VICINITY”, Yajuan Guan, Juan C. Vasquez, Josep M. Guerrero, Natalie Samovich, Stefan Vanya, Viktor Oravec, Raúl García-Castro, Fernando Serena, María Poveda-Villalón, Carna Radojicic, Christopher Heinz, Christoph Grimm, Athanasios Tryferidis, Dimitrios Tzovaras, Keith Dickerson, Marek Paralic, Marek Skokan,Tomas Sabol, Global IoT Summit (GIoTS-2017), 6-9 June 2017, Geneva, Switzerland.

Test Labs Ongoing Activities

Lab test: AAU Microgrid IoT Laboratory

AAU Microgrid (MG) IoT Laboratory is divided into four parts: a living room, a kitchen, a control room and a low voltage direct current office. 2 kW PV panels and a 2 kW wind turbine are installed on the roof of the laboratory. Electrical and hot water based floor heating systems are going to be equipped and tested concerning the heat efficiency.

Electronic appliances (laptops, cellphones, LED lights, home entertainment systems and white goods) are already placed in the living area and kitchen area. Smart power outlets are tested through a REST API and proxy server. A Matlab-based interface will be developed in order to smoothly integrate into MG energy management systems (EMS).

Once smart devices start to interact with consumers' daily routine, the smart devices and EMS can detect their presence, learn their habits, and act accordingly to optimize the energy consumed in the MG.

Read More

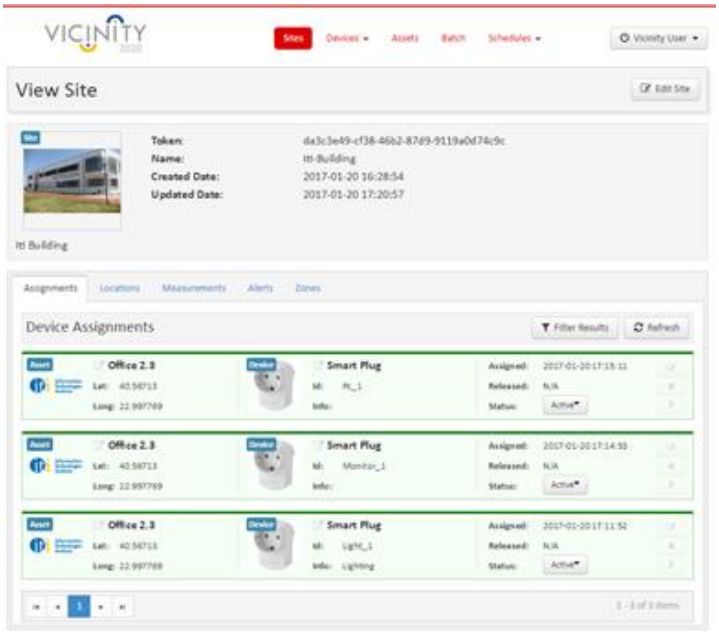
Lab test: CERTH Test Laboratory

CERTH/ITI Test lab infrastructure will support the integration of the first VICINITY Agent/Adapter prototype, by providing 3 different available IoT platforms/solutions for thorough testing and experimentation. In particular:

Linksmart Middleware solution has already been integrated at CERTH/ITI building, and allow the integration of many different types of IoT sensors and building assets, such as monitoring and control of HVAC and lights, sensors for temperature, humidity, luminance, CO2, appliances energy meters, etc.

SiteWhere (Open Platform for IoT) is available connected to a number of SmartPlugs to allow monitoring and control of different types of office and home equipment.

Programmable CISCO Router (Cisco 829) for IoT applications, running a lightweight version of Linux, is connected to proprietary hardware developed by CERTH, comprising of people counters sensors developed and one/three phase smart energy meters.



Lab test: ATOS IoE Laboratory

The Internet of Everything Laboratory has installed an air pollutant measuring station at ATOS-Spain facilities to obtain continuous measurements of the main air pollutants that affect to the health of Madrid citizens (i.e. NO2, NO, CO, O3 and particulate matter). The station offers an API interface to obtain real sensor data information and allows its remotely configuration.

Besides contribute to the IoE lab permanently sensor data source catalogue and adding this new station to the network already present in the city of Madrid, the obtained data will help to create temporary and spatial models of pollutants predictions, offering to citizens information on present and future pollution episodes and how to avoid them based on users healthy profiles.

Read More

Milestone

- VICINITY 2nd General Assembly, 24-25 January 2017, Bratislava, Slovakia.
- 1st version of the VICINITY WoT mapping ontology published, 28 March 2017.

New EU Privacy Regulation and VICINITY

Society is about to see a major shift in the accountability of organisations that make use of individuals' personal data. Currently people give implied consent for the use of personal data on many occasions, such as when they accept the terms and conditions associated with downloading a new app. Less than 1% of people understand what personal data might be collected and how it might be used. In future organisations will be required to show clear evidence that they have received informed consent from data subjects in relation to the data collected and its allowed use.

European Union member states are passing into national law the requirements of the General Data Protection Regulation (GDPR) which comes into force in May 2018. Organisations based outside Europe must also comply with these regulations if they handle personal data relating to people living in Europe.

Furthermore, data subjects will have the "right to be forgotten". An individual can revoke an agreement to allow their personal data to be used, and all historic personal data held must then be deleted. Where someone's personal data has been fully merged with data from other individuals then it need not be eradicated. But if there is any way that the original data can be reconstituted and associated with an individual, then it is considered to be personal data. The VICINITY Ethics Advisory Board has put in place a coaching and review procedure to require privacy by design for our trials. A fast reporting process will be used, should we suffer a leak of personal information. Our architecture and other outputs from the project that might be deployed in future IoT systems must be GDPR compliant. Further challenges that we face include the adoption of a practical approach to obtain informed consent efficiently without the need for completion of a multiple-choice questionnaire before accessing a service. If people decline to allow their personal data to be used, should they be allowed to access a reduced version of the required service? Or should they pay for a service which the service provider would normally provide free of charge, on the basis of being able to sell-on the personal data collected? How can we be sure that no rogue devices are attached to the IoT that might be able to extract and use personal data in an unauthorised way?

First open call for VICINITY

VICINITY will engage new partners through 2 Open calls with a budget of €500K. One open call will be devoted to system integrators for Integration of IoT infrastructures deployed at public facilities in the domain of healthcare, smart grids, transport or intelligent

buildings. Another open call will look for value added services over IoT infrastructure in the domain of healthcare, smart grids, transport or intelligent buildings.
The open calls will be held in 2018 Q1 and 2019 Q1. We will publish relevant information on our web-site and more widely.
Also, check the http://iot-epi.eu/open-calls/ to find further information on current Open calls from other IoT Epi projects.

BIG IoT

Funding: 750.000 €
Schedule: April 2017 – June 2017
Industries of Interest:
Mobility, IT

bIoTope

Funding: 750.000 €
Schedule: 1st June 2017 – 10th October 2017
Industries of Interest:
Energy Efficiency, Electric Cars, Traffic and Mobility, Safety, Infrastructure, Management, Smart Buildings

Agile

Funding: 400.000 €
Schedule: 1st September 2017 – 30th April 2018
Industries of Interest:
Home/Office Automation, Smart Buildings, Environment Monitoring, Healthcare & Wellbeing, Smart Retail, Transport & Logistics, Smart Agriculture

TagItSmart!

Funding: 600.000 €
Schedule: September 2017 – December 2017
Industries of Interest:
Retail, Recycling

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