SEVENTH FRAMEWORK PROGRAME

Specific Targeted Research Project

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D7.3.1 Report on Cluster and Standards Contributions V1

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Draft	Gregor Schiele	NUIG	31/05/2014	Ready for EC submission

TABLE OF CONTENTS

LIST OF TABLES

TERMS AND ACRONYMS

AC	Activity Chain
ARM	Architecture Reference Model
CVOs	Complex Virtual Objects
FIA	Future Internet Assembly
GSN	Global Sensor Networks
ICO	Internet-Connected-Objects
IERC	European Research Cluster in the Internet of Things
IoT	Internet-of-Things
M2M	Machine-to-Machine
SC	Smart Cities
SSN	Semantic Sensor Networks
Vos	Virtual Objects
W3C	World Wide Web Consortium

1 INTRODUCTION

1.1 Scope

VITAL is focusing on the use of IoT technologies for the development, deployment and operation of integrated added-value smart cities applications. As an IoT-focused project, VITAL is participating in the IERC cluster, sharing information and insights with other EU projects working in the IoT domain. We contribute to various aspects of the cluster, based on a variety of different modalities. In this deliverable we report on the project's contribution to the IERC cluster activities since the start of the project in September 2013. We also provide an outlook for the future activities and contributions of VITAL in terms of its participation in the cluster and its collaboration with other projects of the cluster.

In addition to reporting the project's IERC contribution, the deliverable provides also a brief presentation of the project's intended contribution to standardization. While several IERC activities and activity chains provide opportunities to influence standards, VITAL will also endeavour to use its research results in order to influence specific standardization bodies and efforts. These include follow-up to the standardization efforts of the W3C SSN (Semantic Sensor Networks) incubation group, as well as de facto standardization efforts addressed to the open source community. A first report on these efforts is also provided as part of the deliverable.

Note that the present document corresponds to the first release of deliverable D7.3. Two more releases of this deliverable will be produced as part of later stages of the project's work plan, which will report on subsequent activities and contributions of the project to standards and the IERC cluster.

1.2 Audience

This deliverable targets the following audience(s):

- VITAL team members, who may read this deliverable in order to understand how their research efforts are reported, provided and contributed to the efforts of the pan-European IERC cluster.

- IERC cluster coordinators (including the EC side coordinator), who may use the document (as informative input) in order to audit the project's contributions to the cluster.

- Other IERC projects, which could find in this document information about VITAL's contributions to the IERC.

- EU project researchers and engineers, who are interested in detailed reports about IERC events organized/supported by VITAL, as well as in understanding how the VITAL IoT project contributes to the IERC efforts and other standardization initiatives.

1.3 Summary

This deliverable illustrates the contributions of the VITAL project to the IERC cluster during the first nine months of the project's lifetime. These include participation and contribution to IERC meetings and activity chains, active presence in events relevant to the IERC (e.g., IoT Week, FIA), bi-lateral collaboration with other (IERC) projects, as well as contribution to IERC documents and publications. Along with a description of the project's IERC contributions, this deliverables provides VITAL's general plan for contributing to IERC till the end of the project.

In addition to IERC participation and contributions, the present document provides also an overview of the project's envisaged contribution to standardization. This includes activities towards de-facto standardization in the open source community. The present version of the deliverable constitutes its first release. Two more releases of the document are planned later in the project's lifetime in order to report on future/planned achievements and contributions.

1.4 Structure

The deliverable is structured as follows:

- Section 2, following this introductory section illustrates the ways in which VITAL will contribute to the IERC cluster.

- Section 3 reports the VITAL contributions to the IERC cluster including participation in meetings and joint activities of the various activities chains. The presented contributions refer to the first nine months of the project's lifetime.

- Section 4 outlines VITAL planned contributions to standards.

- Section 5 is the final and concluding section of this deliverable.

2 ORGANIZATION OF VITAL PARTICIPATION IN AND CONTRIBUTION TO IERC AND STANDARDIZATION

2.1 IERC Participation

In the following paragraph we briefly outline the organization/structuring of VITAL's contributions to the various activities of the cluster.

2.1.1 Activity Chains Contributions

Activity chains within the IERC are thematic working groups, which focus on the development and promotion of the pan European approach in certain aspects of the internet-of-things (IoT). Currently there are more than eight such working groups in the IERC, each one focusing on a different IoT topic/aspect. VITAL is committed to follow the developments of all the activity chains and to contribute to them on the basis of its results. However, the project will primarily focus on three of the activity chains, in particular:

- **Activity Chain 1 (AC1)**, which has produced and validated an Architecture Reference Model (ARM) for designing IoT architecture. This result of AC1 is now taken up by the IoT Forum, which focuses on the development of different flavours/profiles of the ARM towards addressing different IoT application requirements. Furthermore, AC1 continues its activities towards the structuring and organization of several IoT platforms as part of a wider open platforms initiative. VITAL is contributing to both of the above aspects of AC1. In particular, VITAL takes into account the ARM principles and building blocks as part of the developments of the architecture of the VITAL platform. The alignment of the VITAL platform architecture to ARM is illustrated in deliverable D2.3 of the project. Moreover, VITAL plans to contribute its IoT based smart cities platform to the open platforms initiative.

- **Activity Chain 2 (AC2)**, which deals with models, technologies and techniques for naming, addressing and discovery in IoT. VITAL is playing a leading role in this activity chain, since it will be in charge of its coordination. VITAL will contribute to AC2 on the basis of its intelligent discovery schemes for ICOs in smart cities that are currently studied in WP4 of the project and which include discovery techniques that address mobile sensors.

- **Activity Chain 4 (AC4)**, which deals with the semantic interoperability of IoT systems. VITAL will take advantage of IoT semantic interoperability in order to enable the integration of different IoT systems in smart cities (i.e. silo integration). Hence, the experiences of the project from integrated smart cities implementations will provide significant new insights in AC4 in terms of the use of semantic interoperability techniques in the smart cities domain.

The following table provides an overview of VITAL's (planned) contributions to the above-listed activity chains. Note that the table is an updated version of a respective table included in deliverable D7.1.

IERC Activity Chain	Topic	Planned VITAL contributions
AC1	IoT Architectures and Open IoT platforms	• Alignment of VITAL Architecture to the ARM; Provision of Feedback and Comments. • Registering VITAL platform as one of the available IoT platforms at EU level; Provision of relevant support.
AC2	Naming, Addressing and Discovery	• Coordination of the Activity Chain. • Contribution of Intelligent Discovery Schemes for ICOs in Smart Cities; Contribution of schemes dealing with mobility aspects.
AC4	Semantic Interoperability	• Exploitation of semantic interoperability techniques for integrated applications in the smart cities area. • Contribution of designs and technologies for the semantic interoperability of disaggregated smart cities silos (IoT-based)

Table 1: VITAL Planned Contributions in IERC Activity Chains

2.1.2 Participation in Events

VITAL will participate in all IERC meetings. We also plan to participate in meetings organized by the activity chains where the project participates. At the same time, VITAL will be actively participating and contributing to conferences and workshops organized by the IERC cluster, such as the IoT Week.

2.1.3 Contributions to Documents and Publications

IERC publishes several documents on a regular basis, including:

• The IERC newsletter, which includes news, updates and latest information from the various IERC projects.

• The IERC cluster book, an annual publications produced by the cluster. The cluster book has a technical and scientific orientation and includes state-of-the-art IoT topics.

• Strategic Research Agendas, outlining forward-looking research topics, which define the EU IoT vision and elaborate on roadmaps to achieve the vision.

VITAL will contribute to the above-listed documents and publications. These contributions will be reported in subsequent versions/releases of this deliverable.

2.1.4 Collaboration with other IERC projects

The project's participation in the IERC cluster will provide opportunities for strengthening the collaboration links between VITAL and other projects of the cluster. Indeed, frequent participation in joint meetings and activities provide ample opportunities for the projects to exchange experiences, best practices and results. VITAL has already established collaboration links with other IERC projects (such as FP7 OpenIoT, FP7 iCore, FP7 Gambas), sharing knowledge in terms of best practices, software design and software implementation. At the same time VITAL is keen on facilitating access to its own results for other projects as a means of boosting the exploitation and wider adoption of the VITAL technological achievements.

2.2 Contribution to Standards

In terms of standardization beyond the IERC, VITAL plans a number of contributions. We discuss these contributions in the following sections.

2.2.1 W3C Semantic Sensor Networks (SSN)

The VITAL coordinator has been a prominent contributor to the W3C SSN incubator group, which produced the W3C SSN ontology and provided guidelines for its wider adoption and use [Compton12]. The group has underlined the importance of the adoption and deployment of this ontology in practical applications. VITAL provides a tangible opportunity for such a practical deployment, which will serve as a basis for reporting back to W3C regarding the SSN ontology.

2.2.2 Open Source (De Facto) Standardization

VITAL intends to become a de facto open source standard for the development of integrated interoperable IoT applications in smart cities. As such it intends to contribute to open source (de facto) standardization. To this end, VITAL will exploit and build upon relevant open source projects of the partners, which are already used by the IoT open source community. These include the OpenIoT platform.

2.2.3 Eclipse Foundation IoT Group

The Eclipse Foundation has recently refocused its Machine-to-Machine (M2M) activities to the Internet of Things, renaming the Eclipse M2M group to Eclipse IoT. VITAL is collaborating with Eclipse IoT in the context of the Eclipse Ponte project, namely by providing support and know-how for interoperable (meta)data models for sensors and actuators based on semantic technologies and the SSN ontology. This activity also gives us the opportunity to get into direct contact with a large international developer community that can provide value feedback to VITAL.

3 REPORT ON IERC PARTICIPATION AND CONTRIBUTIONS

3.1 VITAL's Participation in IERC Meetings

Since the project's commencement, VITAL has been actively participating in all IERC meetings. Participation in these meetings is a mechanism for staying up-to-date regarding the overall strategy and main activities of the cluster. Furthermore, discussion and presentations associated with the various activity chains are also taking place as part of the meetings. Table 2 lists the IERC meetings, where VITAL members have been participating and contributing. It also provides an outline of VITAL's participation and contribution.

Date, Location	Meeting's Goal and Overview	VITAL Project Participants	Scope of VITAL Presentations and Contributions
Zurich (Switzerland) September 15th, 2013	• Planning of Activity Chains Output in 2013-2014 • Presentation and planning of IoT's related activities as part of the Horizon 2020 programme	• John Soldatos (AIT) • Jorge Pereira Carlos (ATOS)	• Initial presentation of the VITAL project goals and objectives. • Announcement of the project's start.
Vilnius (Lithuania), November 7th, 2013	Discussion of priorities for IoT topics as part of the Horizon 2020 programme	• John Soldatos (AIT) • Gregor Schiele (NUIG)	No specific presentation/discussion on the VITAL project progress
Brussels (Belgium), January 24th, 2014	• Presentation of position papers from the fourth and fifth activity chains (AC4, AC5). • Planning of the outputs of other activity chains (AC1, AC2, AC3).	• John Soldatos (AIT) • Jorge Pereira Carlos (ATOS) • Gregor Schiele (NUIG)	The VITAL project manager was appointed co-coordinator of the second activity chain (AC2)
Athens (Greece), March 21st, 2014	• Presentation of and updates on position papers from several activity chains (AC2) • Initial planning of IERC's participation in the IoT week	• John Soldatos (AIT) • Jorge Pereira Carlos (ATOS)	Contribution to a session proposal for the IoT Week 2014 on the basis of results from the second activity chain of the IERC.

Table 2: Overview of VITAL's Participation and Contribution to IERC Meetings

VITAL plans to continue its active participation in IERC meetings, where it intends to report its work and contributions to the various IERC activity chains. Through its active participation in IERC meetings the project will ensure that its contributions are topical and aligned to the overall strategic directions of the cluster. Furthermore, VITAL will exploit the opportunity of participating in IERC meetings for networking and knowledge exchange with other projects.

3.2 VITAL's Participation in IoT Week

VITAL partners NUIG and AIT have proposed a session for the IoT Week 2014 (http://www.iot-week.eu), which has been accepted by the organizers. The session focuses on the discussion of IoT naming and addressing issues, as part of the position papers and issues discussed in the scope of the second activity chain of the IERC. The main goal of the session is to solicit third-party feedback on the results (i.e. position paper) of the IERC AC2, including feedback from Chinese experts (participating in the EU China collaboration) and from standardization bodies working on identification issues. The tentative agenda for the session is as follows:

Wednesday, June 18th, 2014

14:00 – 14:15	Welcome and Introductions (Dr. Gregor Schiele, Research Fellow / Adjunct Lecturer, INSIGHT @ NUI Galway)
14:15 – 14:50	"Identifier Services in IoT applications", (Sam Sun, Corporation for National Research Initiatives (CNRI), USA)
14:50 – 15:30	"Global identifiers and Interoperability", (David Weatherby, Business Consultant, GS1 UK)
15:30 – 16:00	Afternoon refreshment break/networking
16:00 – 16:40	"Understanding and Discussion on Internet of Things Identifiers in China" (Dr. Yuming GE, CART, China)
16:40 – 17:00	IERC Projects Solutions on IoT Identification and Discovery, (Prof. John Soldatos, Athens Information Technology)
17:00 – 17:20	Q&A and Discussion: «Outlook on IoT Identification and Discovery»»
17:20 – 17:30	Conclusions and Next Steps in IERC AC2

Table 3: Tentative Agenda of the IERC AC2 Session during the IoT Week 2014 (held Wednesday June 18th, 2014 and co-organized by VITAL)

3.3 VITAL's Contribution to IERC AC1

VITAL has already started work on the alignment of its architecture to the ARM of the IERC. This work has been undertaken as part of the architecture specification task in WP2 and is reported in deliverable D2.3. On the basis of this work VITAL will provide feedback for improving and fine-tuning the ARM, as well as for creating different flavours of the ARM in smart cities. This feedback will be provided following the conclusion of the VITAL architecture work in WP2, and during the use of the VITAL architecture in other work packages (notably WP3, WP4, WP5 and WP6) of the project. The feedback will be provided to the IoT Forum, which has taken up the ARM.

During the reporting period, VITAL has also participated in initial discussions regarding the setup of the open platforms initiative within the IERC, an initiative linked to IERC AC1. VITAL is participating on structuring and organizing the various IoT platforms of the IERC, while it intends to adopt guidelines set as part of the initiative in order to render its platform part of the portal/directory of open platforms that the initiative will produce.

3.4 VITAL's Contribution to IERC AC2

Members of the VITAL consortium (from AIT and NUIG) jointly coordinate and lead AC2. Therefore, VITAL, of course, contributes actively to all activities of the activity chain. As described before, among other activities, we are organizing a session at IoT Week 2014 and are preparing a position paper on naming, addressing and discovery of IoT resources. This aligns with VITAL's activities in naming and discovery, namely in WP3 (naming) and WP4 (discovery).

3.5 VITAL's Contribution to IERC AC4

VITAL has already adopted several principles of the semantic web manifesto published by the fourth activity chain, including the use of a sensor/IoT ontology for semantic interoperability, the adoption of URIs for IoT identification at the application layer, as well as the use of the OpenIoT blueprint middleware infrastructure for baseline semantic interoperability. These principles are reflected in the VITAL architecture and will also be exploited in the design and development of VITAL results in other work packages of the project. As a first step, VITAL will provide to IERC AC4 feedback on the use of the semantic interoperability principles and infrastructures of the activity chains in the scope of practical smart cities applications contexts. Furthermore, VITAL will contribute its extended developments (in terms of the VITAL ontology and middleware platform for integrated semantically interoperable smart city applications) to the activity chain. Based on these contributions, VITAL intends to provide input in subsequent versions of the IERC AC4 manifesto and position papers.

3.6 VITAL's Contribution to other IERC ACs

Besides the aforementioned activities in AC1, 2, and 4, VITAL also contributes to all other activity chains, e.g. by providing input to position papers or questionnaires (e.g. for AC3).

3.7 Contribution to EU-China collaboration

As part of its participation in the IERC AC2 activities, VITAL is also engaging in bilateral discussions with Chinese experts on «IoT Identification and Discovery». The objective of these discussions is to develop a joint position paper on identification and discovery issues, which shall reflect the viewpoints of both sides. VITAL has already participated in two teleconferences where experts from both the EU and the Chinese side participated. Basic information about these two audio-conferences are provided in the following table:

Date, Time	Organizers	Agenda Topics

January 16th, 2014
 	
11:00-12:30 CET
	• Philippe Cousin, EU International Partnerships Coordinator, (philippe.cousin@eglobalmark.com)
	
	• Shirley, CATR, China Side Coordinator (zhangxueli@catr.cn)
	
	• John Soldatos, IERC AC2 Coordinator
		• Scope of the collaboration / expected outcomes & deliverables
		
		• Exchange of Information (e.g., collaborative spaces)
		
		• Technologies for globally unique identification (naming and addressing)
		    o Status in EU, Status in China, Indicative Reference projects
		
		• Technologies for discovery
		    o Status in EU, Status in China, Indicative Reference projects
		
		• Identification of main challenges in naming/addressing (e.g., heterogeneity of ID technologies, governance, virtual sensors/entities)
		    o Challenges from EU perspective, Challenges from Chinese perspective, Common points / Differences / Consolidation
		
		• Setting of Agenda for Future Thematic (more focused discussion)

| February 26th, 2014 10:00-12:00 CET | • Philippe Cousin, EU International Partnerships Coordinator, (philippe.cousin@eglobalmark.com)

 • Shirley, CATR, China Side Coordinator (zhangxueli@catr.cn)

 • John Soldatos, IERC AC2 Coordinator | • Continue/finish the discussion on EU Position Paper

 • Discussion on "China IoT ID white paper" - Questions and comments from EU experts

 • Identification of main challenges in naming/addressing/discovery (e.g. heterogeneity of ID technologies, governance, virtual sensors/entities)

 • Initial approach to the expected outcomes & deliverables i.e. a joint white paper topic on IoT ID between EU and China. |

Table 4: EU-China Teleconferences on Identification and Discovery Issues, where VITAL members have participated

3.8 Bi-lateral Collaborations with other IERC projects

In addition to networking with other IERC projects during IERC meetings and collaborating with them as part of the activity chains of the cluster, VITAL has already established directly collaboration links with IERC projects with a view to exchanging experiences and reusing its results.

3.8.1 VITAL-OpenIoT Collaboration

During the first nine months of the project's lifetime, VITAL has established very close collaboration links with the OpenIoT project, with a view to reusing parts of the open source OpenIoT platform (available at: https://github.com/OpenIotOrg/openiot), towards designing and building the VITAL platform. This bi-lateral collaboration has been substantiated through:

• Participation of OpenIoT consortium members (notably members of the implementation team such as Nikos Kefalakis from AIT and Danh Le Phuoc from NUIG) in technical discussions of the VITAL teams. To this end, the OpenIoT members have attended VITAL WebEx teleconferences, where the detailed VITAL architecture and technical specifications have been discussed. The aim of the participation of OpenIoT members to the VITAL discussions was to ensure the proper exploitation and reuse of selected OpenIoT modules (such as the X-GSN platform/library and the OpenIoT ontology) in the scope of the VITAL architecture. Note that in order to facilitate the technical discussion, several documents have been exchanged between the members of the two projects.

• Discussions between the VITAL project manager (Gregor Schiele) and the OpenIoT project management (Martin Serrano) on the technical capabilities of the OpenIoT platform, but also on issues associated with licensing and reuse.

- Provision of support from the OpenIoT project to VITAL members, notably VITAL members experimenting and/or validating selected functionalities of OpenIoT that are relevant to VITAL. As a concrete case of support, the VITAL team at INRIA, received support in its effort to integrate data streams from the FIT platform to the OpenIoT cloud. Note that this represents prerequisite prototyping work, which will be exploited towards the realization of the first proof-of-concept implementation of the VITAL platform.

As evident from the description of the above-listed activities, the interaction between VITAL and OpenIoT has been greatly facilitated from the partners that participate in both projects (i.e. NUIG and AIT), which have both strong interest and will to exploit and extend the award winning OpenIoT open source platform in the scope of the VITAL implementation.

3.8.2 VITAL-iCore Collaboration

VITAL maintains also very close links to the iCore project, based on partner ATOS, which is an active contributor to both projects. VITAL will leverage the work done in iCore with the focus pointed to the following topics:

- Discovering and accessing to virtual objects based on their semantic description.

- Discovering and accessing to Complex Virtual Objects (CVOs), which offer a means for rendering the application request, to fulfill the request from VITAL.

- VITAL access to CEP techniques built/developed in iCore.

3.8.3 VITAL-IoT Forum Collaboration

VITAL will establish close links to the IoT Forum, with a view to discussing potential contributions of the VITAL architecture to the IoT ARM. As a first step, VITAL will participate to the dedicated IoT ARM session on Semantic Interoperability & Security/Privacy/Trust aspects, which will be organized in the scope of the IoT Week (Wed, June 18th, 2014, London UK).

3.9 Participation in Future Internet Assembly (FIA)

VITAL co-organized a pre-FIA workshop during FIA Athens 2014, entitled: "IoT as a proponent of new Business Models and Social Engagement in Smart Cities (SC)" and co-organized by several FP7 IoT/Smart Cities projects (namely VITAL, RERUM, CityPulse, COSMOS). It was held on Monday, March 17th, 2014 (9:30-13:00). Leveraging the expertise of four FP7 projects the workshop covered the topics:

- IoT as enabler of new business opportunities in SCs.

- Role of SC stakeholders in the development of a successful business ecosystem.

- Role of communities and social media/networks in IoT applications.

- Incentives and barriers for citizens' engagement in SCs.

VITAL participated in the workshop on the basis of a presentation titled: «*Social Networks as a means for Citizens Participation in smart cities*» (given by John Soldatos). The project participated also on one of the panel discussions dealing with the topic of: «The citizen's role in a truly smart city».

Details of the pre-FIA workshop are available at: https://www.fi-athens.eu and https://www.fi-athens.eu/program/workshops/iot-proponent-new-business-models-and-social-engagement-smart-cities.

4 REPORT ON STANDARDS CONTRIBUTIONS

4.1 W3C SSN

At the time of writing this deliverable, VITAL has commenced work towards extending the W3C SSN ontology for use in the scope of integrated smart city applications. This is the first step to the practical deployment and use of the W3C SSN work in smart city applications.

4.2 Open Source

VITAL has (as part of WP6 of the project) commenced the specification of its open source infrastructure. This will serve as a basis for the open source contributions of the project.

4.3 Eclipse IoT

VITAL has started cooperation with the Eclipse IoT group and specifically the Eclipse Ponte project. VITAL's project manager (Gregor Schiele) is actively discussing with the Eclipse Ponte project leader (Matteo Collina) with respect to semantic (meta)data models and interoperability between VITAL and Ponte.

5   CONCLUSIONS

VITAL acknowledges the importance of its active participation in the IERC and its activities. In particular, the project views its active involvement in the IERC as a first class opportunity towards:

- Aligning several of its results to EU wide best practices and standards such as the IERC ARM model for IoT architectures. VITAL is already pursuing the alignment of its architecture with the ARM as illustrated in deliverable D2.3 of the project.

- Contributing to the development of a pan-European approach in IoT areas such as naming, addressing and semantic interoperability. To this end, VITAL is contributing to several working groups (i.e. activity chains) of the IERC.

- Strengthening its collaboration with other IERC projects and engaging with them in the reuse of their results. This approach holds the promise to maximize the project's value for money at the end of VITAL's lifetime. Note that VITAL has already established very close collaboration links with other IERC projects such as FP7 OpenIoT and FP7 iCore.

- Providing part of or even the whole VITAL platform as an open platform, through relevant mechanisms established within the IERC (such as the open platforms initiative of the cluster). This could greatly facilitate the sustainability and wider take-up of the project's results.

With these considerations in mind, VITAL is actively participating in the IERC cluster activities with an emphasis on activity chains one (AC1), two (AC2) and four (AC4). Note that VITAL has the leading/coordinating role in AC2, where it also has a leading role in the collaboration of the activity chain with experts on IoT addressing from China (as part of the EU-China collaboration). Furthermore, VITAL will have an active participation in meetings and events organized (or co-organized by the IERC), notably IERC meetings and the IoT Week. In addition to its participation in IERC, VITAL will pursue to have an impact on the SSN incubator group of the W3C, the open source community and the Eclipse IoT group. VITAL is already undertaking relevant work towards this impact. Subsequent versions/releases of this report will illustrate additional contributions of the project to all these activities.

REFERENCES

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