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Successful First Year Review

The IMPReSS project had its first review in February 2015 in Brussels. At the review meeting, the project demonstrated several components of the first IMPReSS SDP prototype and the Teatro Amazonas user application. The results achieved in the different work packages were also presented by the work package leaders. During this first 15 months of the project, a total of 23 deliverables has been produced and they were all accepted by the reviewers. The accepted public deliverables will be made available for download shortly. Keep yourself informed via the [IMPReSS website](#).

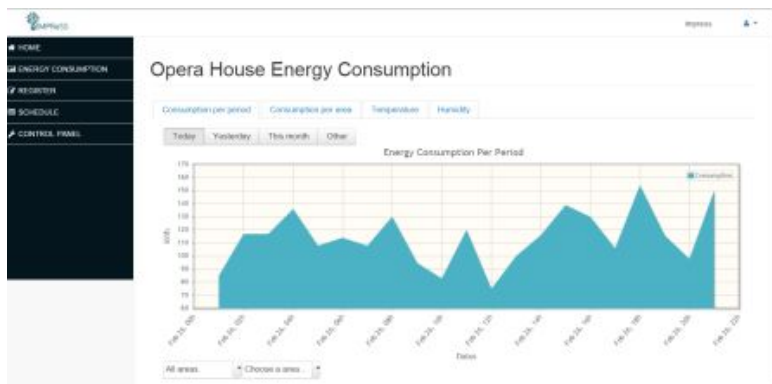
The development work on the second and final prototype and the UFPE pilot application is already underway and will take under consideration the discussions and feedback from the review meeting. This second period will focus on more complex elements of the use cases for the pilot sites. Particularly, the aspect of mixed-criticality will be emphasised, developed and tested.

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The Teatro Amazonas Pilot Application

The initial prototype for the Teatro Amazonas pilot application has been completed and was demonstrated at the review meeting.

Currently, it allows the user to extract information on the energy consumption in different rooms/areas of the theatre building for a specified period of time. It is also possible to see the energy consumption for different appliances across the entire building, for example, the energy consumption for all the air conditioning systems or all the lights.



While these functions may appear quite simple, they will nevertheless be a huge improvement to the current state of affairs as there is no energy monitoring or management system in place today. In other words, the management of Teatro Amazonas has no context information on the energy used in the building. The application developed using the IMPReSS SDP will allow the theatre to see for the first time how much energy different rooms, areas and electrical equipment consume. This type of information is a prerequisite for implementing ways to reduce the energy consumption.

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The Teatro Amazonas Public Display

The IMPReSS project believes that increasing the public awareness of energy consumption and the possibilities of saving energy should also be included in an innovative Smart

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Dissemination Events:

Accepted Papers:

The IMPReSS project has had four scientific papers accepted for publication:

[Extending Semantic Device Discovery with Synonym of Terms](#), published by IEEE and presented the 12th IEEE International Conference on Embedded and Ubiquitous Computer. The paper was produced by FIT.

[Semantic Interoperability Architecture for Pervasive Computing and Internet of Things](#), published by IEEE ACCESS. The paper was produced by VTT.

[IoTLink: An Internet of Things Prototyping Toolkit](#), published by IEEW: It will be presented at the 11th IEEE International Conference on Ubiquitous Intelligence and Computing in December 2014. The paper was produced by UFPE and FIT.

[Architecture for mixed criticality resource management in Internet of Things](#), published by the TRON Symposium. The paper will be presented at the TRON Symposium in December 2014. The paper was produced by VTT, FIT and ISMB.

Completed Events:

[TRON Symposium 10-11 December 2014, Tokyo, Japan](#)
The paper "Architecture for mixed criticality resource management in Internet of Things" written by IMPReSS partners VTT, FIT and ISMB was presented by Janne Takalo-Mattila (VTT) at the TRON Symposium on the 11th December.

[The 11th IEEE International Conference on Ubiquitous Intelligence and Computing 9-12 December 2014, Bali, Indonesia](#)
Ferry Pramudianto, FIT, presented the IMPReSS paper, IoTLink: An Internet of Things Prototyping Toolkit, at the UIC 2014 conference. The paper,

Energy Management system.

The project has therefore developed a unique interactive public display system designed to inform the public of the current and historical energy consumption in the building; the public can choose to view the energy consumption for specific areas inside or outside the building.



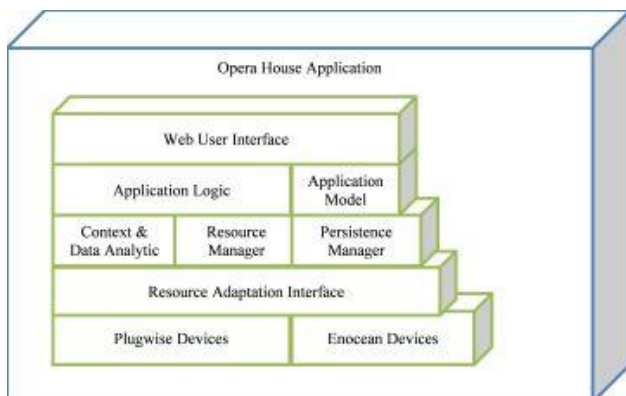
The figure above shows the front page of the Teatro Amazonas public display screen. The figure below shows the building drawing which gives an overview of the energy consumed in the different areas of the theater. Users simply use their hands to navigate on the public display. Visitors can also select an area on the building drawing to display data on the energy consumption for that particular area.



The next step in the development process is to enable the public display to show how much energy has been saved as a result of the implemented Smart Energy Management system. The energy savings will be illustrated by numbers and by graphs. This function is particularly important as we believe that a visual illustration of the energy savings will have a particularly strong impact on the viewer's awareness of energy usage and on ways to save energy. Teatro Amazonas is an excellent show case for this because of its many visitors from both Brazil and the rest of the world. In addition, its location in the Amazon region creates a unique context for raising public awareness not only of CO2 footprint but also of the importance of protecting the Amazon rain forest.

Developing the IMPReSS Public Display

Several IMPReSS components were used to develop the public display application as depicted in the figure below:



In the bottom layer - the resource adaptation layer - the Resource Adaptation Interface (RAI) provides a unified software interface communicating with plugwise and enocean devices. Above the RAI, IMPReSS components such as Context and Data Analytics modules are used to simplify the development of the application logic. The Context Manager provides rule templates that can be extended to define the policy for controlling lighting based on room occupancy, the amount of daylight coming from the window, and the schedule specifying when the rooms are to be used. The data analytics module provides algorithms used

which was written by IMPReSS partners FIT, UFABC and UFPE, addresses the need of a development toolkit that allows inexperienced developers to develop IoT prototypes rapidly.

EU-BR Cooperation Consultation Workshop

10 November 2014, Brussels, Belgium
IMPReSS was presented at a workshop on the EU-Brazil Cooperation in the area of ICT by the IMPReSS Project Co-ordinator, Markus Eisenhauer, FIT.

EUBR 2014

28-31 July 2014, Brasilia, Brazil
FIT and UFPE represented the IMPReSS project at the EUBR 2014 workshop in Brasilia in July 2014. The IMPReSS consortium was invited to give a presentation on the project's aims and objective in the session entitled "EU-Brazil Cooperation in the area of ICT - Coordinated Calls". The IMPReSS project also had a booth in the Exhibition area which allowed the project partners to network and discuss the project in more detail with other participants.

IoT Week 2014

16-20 June 2014, London, UK
IMPReSS was presented at the IoT Week 2014 in London in conjunction with Almanac project. The IoT Week originated in the European IoT Research Cluster to become the pre-eminent event attracting industry and researchers from around the world.

CeBIT 2014

16-20 March 2014, Hannover, Germany
IMPReSS was presented at CeBIT 2014 in Hannover, Germany in conjunction with the GREENCOM project. CeBIT is the world's largest and most international computer expo. It is considered a barometer of the state of the art in information technology.

EU-Brazil Workshop

11 November 2013, Brasilia, Brazil
The IMPReSS project was invited to participate and present the project's aims and visions at a high-level EU-Brazil workshop in Brasilia in November 2013. One of the objectives of the workshop to formally launch the four EU-Brazil projects, IMPReSS included, that have received funding under the 2nd EU-Brazil Call.

Deliverables released:

The following deliverables have been completed:

- D1.1. Project Quality & Risk Management Plan (confidential)
- D1.2.1 Intermediate Reports for the Commission (confidential)
- D1.3.1 First Activity, Management and Financial Report (confidential)
- D1.4 Plan for Managing Knowledge and Intellectual Property (restricted)
- D2.1.1 Initial Requirement Report (public)
- D2.1.2 Requirement and Lesson Learned Report (public)
- D2.2.1 SDP Initial Architecture Report (public)
- D2.3 Validation framework (public)
- D3.1 Resource Adaptation Interface

to determine the users' occupancy pattern. This will allow regulation of the air conditioner to pre-cool the rooms before the users enter.

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The IMPReSS Debugging Tool

One of the objectives in the project is to develop a high-level debugging tool which allows developers to trace events and interactions between distributed components.

Event Management is a crucial function in the IoT ecosystem in general, enabling both loosely coupled communications and data management. In highly distributed systems involving large numbers of devices and actors, the possibility of doing event traceability and debugging is important. For this reason the IMPReSS platform researches and designs mechanisms and tools that support the developers tracing and debugging event patterns and event history, using the LinkSmart event processing architecture. As the first cycle in the project has come to an end, an initial prototype of the IMPReSS Event Debugging Tool has been developed.

There are two basic parts of the Event Tracing and Debugging Tool:

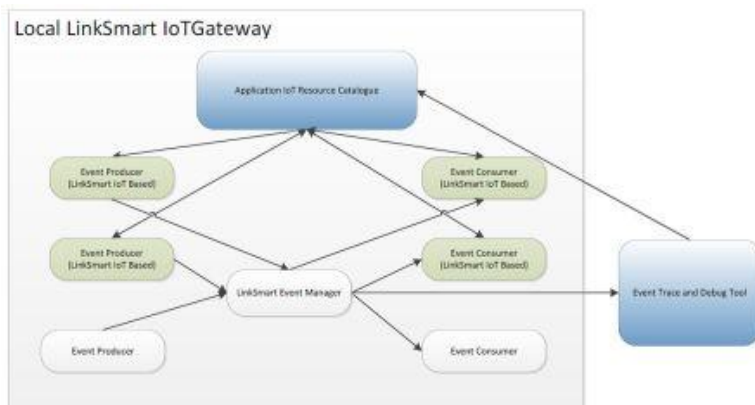
- 1) The Event Manager Eavesdrop: Provides the functionality of listening to and processing all events passing through an Event Manager. This also contains a simple browser with query capabilities.
- 2) The Event Network Browser: Provides functionality to query which events have been created or consumed by individual event consumers/producers.

We will here present only the Event Network Browser. For information on the Event Manager Eavesdrop you may download the deliverable D7.4.1 Initial Design and Implementation of the IoT Event Debugging Tool.

The Event Network Browser part of the Event Trace and Debugging Tool provides functionality to look inside individual event producers and consumers to see which events they have created or consumed. This is very useful when debugging complex event problems where it is not clear who created the event and who consumed it. Typically this functionality can be used to pin point which component is not behaving as expected, i.e., not consuming or creating the correct events.

Applications for energy management systems are the primary interest for the theatre. Any management system will be an improvement over the present status.

The Event Network Browser part uses functionality in LinkSmart to find and connect to the different event consumers and producers that are part of the LinkSmart network, see the figure below.



The basic principle used by the Event Network Browser is that it uses the Application IoT Resource Catalogue, which is part of LinkSmart, to find all the LinkSmart based event producers and consumers currently on the network. Using the information returned from the catalogue the Event Network Browser is able to contact the individual producers and consumers.

To allow the Event Network Browser to query the producers and consumers, a new service has been created within the LinkSmart IoTResource class library which exposes a Web Service and REST interface where queries on events created or consumed can be made, see below:

Framework (public)

- D3.2 Resource and Service Discovery Solutions (public)
- D4.1.1 Initial Application Classification Language (public)
- D4.1.2 Final Application Classification Language and Tool(public)
- D4.2 Device and Subsystem Resource Management (public)
- D5.1.1 Initial Data Analysis & Knowledge Repository Technical Specifications & Guidelines (public)
- D5.1.2 Updated Data Analysis & Knowledge Repository Technical Specifications & Guidelines (public)
- D5.2 Data Analysis and Forecast for Energy Consumption (public)
- D5.3 Data Mining and Machine Learning Tools (public)
- D6.1 Machine Learning for User Behavior and Occupancy Analysis (public).
- D6.2 Implementation of Sensor and Data Fusion Module (public).
- D6.3 Context Management Framework Architecture and Design of Context Templates (public).
- D6.4 Implementation of Context Reasoning Engine (public).
- D7.1 Integration and Test Plan (public).
- D7.2.1 Integrated First Proof of Concept IMPReSS Platform (public).
- D7.3.1 Initial Design and Implementation of the Configuration and Composition Manager (public).
- D7.4.1 Initial Design and implementation of the IoT Event Debugging Tool (public).
- D8.1 Specification of Proof-of-Concept Application (public).
- D8.2 Application Architecture for Energy Management (public).
- D8.3.1 Application Development: The Teatro Amazonas: Initial Prototype (public).
- D9.2.1 Initial Dissemination Report (public).

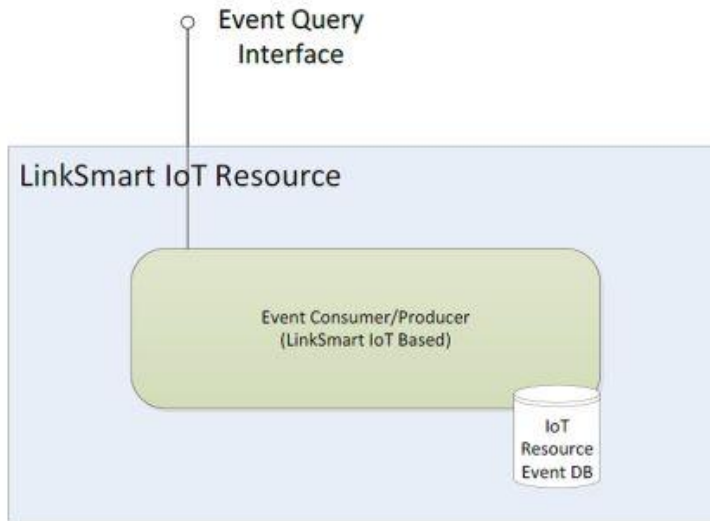
Public deliverables can be downloaded from the [project website](#) after they have been reviewed and approved by the EC.

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The IMPReSS project is a 30-months EU-Brazil cooperative research project which started in 2013. The project is partly funded by the European Commission under the 7th Framework Programme in the area of EU-Brazil Research and Development cooperation under Grant



All LinkSmart IoT Resource based components will automatically get this added functionality without changes to the original IoT Resource. It only requires the developer to update the LinkSmart libraries used. Note also that this functionality not only provides the interface but also provides the actual storage of events created or consumed.

The Event Debugging and Tracing Tool provide a simple web based interface for browsing for IoT Resources and to look at events created or consumed by the resource.

The information shown in the tool contains the resource name, the resource type and a link to show the events processed by the resource. Clicking Show Events will display basically the same event browsing tool used by the Event Manager Eavesdrop, but with the exception that filters for received or sent events can be selected. The information displayed is retrieved directly from the IoT Resource itself using the Event Query Interface.

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