ITEA 3

Project Results

# Web of Objects

## From IoT devices to WoO business applications

## Executive summary

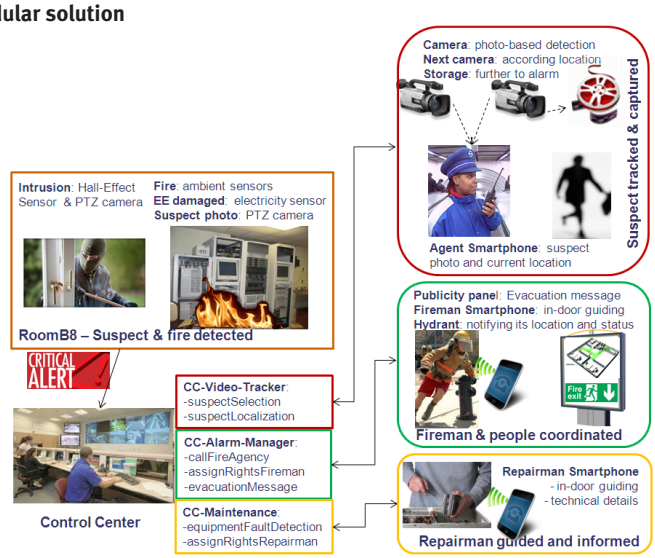
**The ITEA 2 project Web of Objects (WoO) set out to address specific issues relating to the increasing integration of internet-connected devices in existing business applications, proposing a modular solution kit to enable the development of industrial and consumer applications with smart objects as actors, across multiple layers from object nodes towards user application. While complying with standards across all the involved layers, the Web of Objects modular solution follows an M2M approach where devices are managed through the cloud.**

## Project origins

With more devices than people connected to the Internet since 2007, and with business development based on the IoT expected to reach full maturity by 2020, the need to integrate these internet-connected devices poses several challenges that were taken up by the Web of Objects project. In this highly business demanding context, the reuse of existing Web architecture as an appropriate platform has many advantages, such as enabling smart things to act as web servers and be directly accessible as web services, as well as multiple challenges, such as the interoperability of heterogeneous devices in such applications, the development of semantic-based service composition and reasoning functionalities as well as privacy concerns.

## Technology applied

The Web of Objects solution kit covers the entire scale from object nodes to final user application interface, enabling different technical choices for particular application needs. At device level, for instance,the WoO partners improved the network infrastructure to enable objects based on 6LoWPAN and ROLL specifications to be discovered and optimally connected to their neighborhood, also boosting the usage of the DPWSim by implementing an update of DPWSCore Web Services toolkit, a Web services Management over DPWS module, and DPWS Simulator allowing the definition and exposure of virtual devices. At Gateway level, an IoT SmartEngine enables data and events to be integrated from heterogeneous devices, ThingsGate generates a programmable composite virtual object from multiple IoT nodes, managing and exposing its instances and DLite proxy connects non-DLite devices to the BEC3 choreography. At Backend level, a BEC3 platform enables the definition and execution of choreographies for deployment on each device-convenient services while a mote placement optimisation tool calculates optimum deployment schemes for networks in environment-aware mechanisms. The defined WoO ontology models the objects' characteristics and services, with the developed iterative semantic technique enabling the implementation of the semantic-based business application logic, separate from the technologies of the respective devices' technologies.




## Making the difference

In the intelligent transition from IoT-based interconnected things to Web-based smart objects dynamically collaborating in complex application scenarios, an object is capable of acting with different behaviours in multiple applications, while an application can handle heterogeneous objects belonging to different owners. The WoO project used the Smartphone both as a platform with applications employing external IoT services and as a sensing device providing services to apps, and validated the solutions through four demonstrators.

One demonstrator was a new approach to fire incident management; its real-time alarm processing facilitates stakeholder coordination and can save lives and resources. Different from the traditional centralised approach, objects here are active players: cameras turn to the scene and notify security staff, the door closes, electrical equipment requests rescue, a water hydrant notifies its presence to fireman, etc. Moreover, this demonstrator was reproduced virtually in the Gare du Nord railway station simulated environment. Another demonstrator relates to building automation and enhances how users benefit from personalised services from the objects in their environment, whereby the user uses his NFC-enhanced smartphone to communicate with home, his car, parking, restaurants or shops. Based on the project semantic ontology and context awareness mechanisms, another demonstrator proposes an individualised approach for creating dynamic communities of users and devices whereby customer-centric service features (including IPTV services based on smart streaming) are proposed to specific users in categories such as able-bodied or handicapped persons, children, etc. Another example is the 'ClimaCon' demonstrator, which concerns climate control and energy saving by exploiting occupancy information in building.

In terms of business impact, Thales has taken advantage of the results of the project in its video-surveillance business while Odanata developed the Freemium business model for the Embedded service and resource framework to allow basic functionality as open source and for commercial added-value services. Sogeti HighTech has benefited from SmartEngine service licensing and from business collaboration with CityZeen and IBM. The Korean partners are driving user-centric service for smart buildings, and extending the Open IPTV service platform with smart home services. In Egypt, NMATEC is developing a new industrial offer based on the ClimaCon demonstrator while the Cairo University team is establishing a start-up company to commercialise building/home appliance control (IoT Spark) and SMARTEC is negotiating new contracts on smart cities. In Spain, Elecnor Deimos used the Gloo platform to deploy mobility services and Smartphone sensor access in IoT apps, Telespazio Ibérica improved the current smart metering platform solution, while Prodevelop released a smart city platform with device management support.

## Major project outcomes

### Dissemination

- 60 publications
- 16 presentations at conferences/fairs

### Exploitation (so far)

- 9 new products: Embedded service and resource framework, SmartEngine, ClimaCon, Gloo Platform, (see impact description), DPWS Simulator, BEC3 platform, WS-Management over DPWS module, ThingsGate gateway (see Technology section)
- 8 new services: green home service, wellness service and camera on demand service for the Open IPTV service platform, NFC-Based services on a car, Anomaly monitoring service, Vehicle verification service, Customer tracking in stores, reasoning on object description as a service.

### Standardisation

- 34 contributions to standardisation bodies

### Patents

- 14 patent applications filed

### Spin-offs

- 2 spin-offs: IoT Spark (Egypt) and Bec3.com (France)

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*https://itea3.org*

# Web of Objects

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**Partners**

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**Project start**
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**Project end**
December 2014

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