# D3.5

# SMART CITY SERVICES FINAL PLATFORM

## May 2015

### ABSTRACT

This document keeps record of the development of the Smart City Services Platform.
The Platform architecture and its underlying specific and generic enablers, as well as Applications for testing of Scenarios as defined in D3.1 are presented.

This document is a deliverable of the FI-CONTENT 2 integrated project supported by the European Commission under its FP7 research funding programme, and contributes to the FI-PPP (Future Internet Public Private Partnership) initiative.

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# EXECUTIVE SUMMARY

This document aims to technically describe the Smart City Services Platform.

The Smart City Services Platform is a portfolio of technologies, designed to foster the development and bring powerful features to smart city applications. This portfolio consists of a set of technical features tackling the following subjects: OpenData, Contextualization, Recommendation, Data-aggregation, Social live information, Social interactions, Augmented Reality, User-Driven, and Event-Driven apps.

The final release of the platform provides 11 specific enablers:

- 3D-Map Tiles
- App Generator
- Asset Storage
- Content Enrichment
- Context Aware Recommendation
- Fusion Engine
- OpenCity Database
- OpenDataSoft
- POIProxy
- Recommandation as a service
- Social Network

The Smart City Services platform addresses both technical developers directly using the technologies provided, and non-technical users through an application generation portal.

This version lays out the specificities of the final platform.

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## ABBREVIATIONS

| | |
|---|---|
| **API** | Application Programming Interface |
| **AR** | Augmented Reality |
| **FTP** | File Transfer Protocol |
| **GE** | Generic Enabler |
| **HTTP** | HyperText Transfer Protocol |
| **IMS** | IP Multimedia Subsystem |
| **LAN** | Local Area Network |
| **POI** | Point Of Interest |
| **QoS** | Quality of Service |
| **QoE** | Quality of Experience |
| **R1** | Release 1 of the Smart City Guide Platform (available in September-October 2013) |
| **R2** | Release 2 of the Smart City Guide Platform (available in June.2014) |
| **R3** | Release 3 of the Smart City Guide Platform (available in March 2015) |
| **SE** | Specific Enabler |
| **SCG** | Smart City Guide |
| **SDK** | Software Development Kit |
| **TCP** | Transmission Control Protocol |
| **UML** | Unified Modeling Language |
| **WAN** | Wide Area Network |
| **XML** | Extensible Markup Language |

# 1 - INTRODUCTION

## 1.1 - Overview

We live in a changing world. Since the arrival of mobile devices, the IT ecosystem started to migrate to a fully connected model. 3G, 4G, or how to provide services anywhere, anytime. Apple changed the rules of Smartphones and Google made it accessible to anyone, especially low-cost devices. Now that (almost) every citizen is connected, we are moving towards an even more advanced state: connecting objects, from your keys, to your water-plants. Although bringing new innovative services has always been a very challenging task, it is becoming even harder for companies, NPOs, local authorities, or any person who came up with it: creation of internet and mobile applications, collection and exploitation of data. Having a short TTM (time to market) becomes an absolute necessity to maximize a project's chances to take its place on the market.

To cope with such new paradigms, the Smart City Services Platform is a unique platform allowing the apps of tomorrow to be created rapidly, providing both state of the art technologies (Enablers) focused around use, and a seamless integration of OpenData solutions. A technical team will choose to assemble and use the enablers of the Smart City Services Platform in their own app made from scratch, to match exactly their business model, whereas a non-technical team will rather choose to use the portal to generate innovative applications which have those technologies already built-in and ready to use, in the reach of just a few clicks. The Smart City Services Platform takes advantage of specific technical contributions (FIcontent Specific Enablers) and generic Future Internet technology (FIWARE Generic Enablers).

This deliverable is mainly an update to D3.4, now describing the final version of the software of the Smart City Services Platform.

Please be aware that this document is generated from the FIcontent Wiki [1]. Thus, the document may sometimes still refer to the FIcontent Wiki. All information in this document is also available online [2].

## 1.2 - Terminology

The following table contains terms, which are used in multiple deliverables. Therefore, we provide their shared definitions to ensure consistency across several documents.

| Term | Definition |
|---|---|
| Application or Application software | Software layered on top of one or several platforms for realizing various useful tasks for end-users |
| Architecture | A structure of functional elements organized in a given way and presenting well defined interfaces |
| Capability | The ability of a component to satisfy a requirement |
| Conceptual Model | A set of view with written description of the organization of the FIcontent infrastructure to offer services |
| Enabler Software | Module or web service providing well-specified functionality, accessible and usable by application developers through clearly-described APIs (Application Programming Interfaces) |
| Experiment or Experimentation | Concrete test with actual users of one scenario in one of the experimentation sites in a given time frame |
| FIWARE Tools | The tools put in place by FIWARE to send requests for Generic Enablers are based on a backlog list in the frame of an agile methodology |

| | |
|---|---|
| Functional requirement | Either calculations, technical details, data manipulation, processing or other specific functionality that define what a system is intended to accomplish |
| Generic Enabler | An enabler realized by the FIWARE project or its follow-up sustainability project |
| Platform | A comprehensive combination of technology infrastructure and Generic Enablers as well as Specific Enablers capable to host and to support development of application software |
| Point of Interest | A POI is a place, an area or a journey (short distance) which are geo-located. For example: a place (a restaurant, etc.), an area: a public garden, a journey (a hiking trail, etc.). A POI has possibly features such as : static features (opening hours, address, name description, etc.), dynamic features (price, menu, number of available places, the delay before the next bus, etc.), event features (a beginning and an end) |
| Scenario | Description of foreseeable interactions of users with one or several applications |
| Specific Enabler | An enabler realized by the FIcontent project. Specific Enablers may be layered on top of, or otherwise make use of, Generic Enablers. Please refer to the definition of a FIcontent Specific Enabler from deliverable D6.1 Architecture specification [3] |
| Interface | The connections between domains (or sub domain or functional elements) serving the actor’s actions by exchanging information |
| Interoperability | The capability of two or more networks, devices, applications to exchange and use information |
| Technology | A standard or industry specification that has the capability of addressing requirements |

# 2 - Smart City Services Platform Architecture

The Smart City Services Platform is:

- a set of integrated, modular Specific Enablers,
- a portal for non-technical users.

The platform is designed to aid building city-related and citizen-focused services and products.

The technologies developed within the Smart City Services Platform tackle the following subjects:

- OpenData
- Contextualization
- Recommendation
- Data-aggregation
- Social live information & heatmaps
- Social interactions
- Augmented Reality
- User-Driven, Event-Driven apps
- Real-time communication

The platform targets two typologies of users:

- Technical users:

The Smart City Services Platform is accessible for web and application developers and provides dedicated features to easily create Smart City Services with well-known and established technologies. The Specific Enablers are designed to work either as standalone or combined through specific use-cases.

- Non-technical users:

In addition to that, the platform takes advantage of eBiz services, such as the Design My App Portal together with the App Generator SE [4], to support non-developers by allowing them to create use-case-specific applications (mobile or/and web) with their content and according to their needs. Thereby, we introduce a shortcut for creative people realizing their ideas without requiring programming skills.

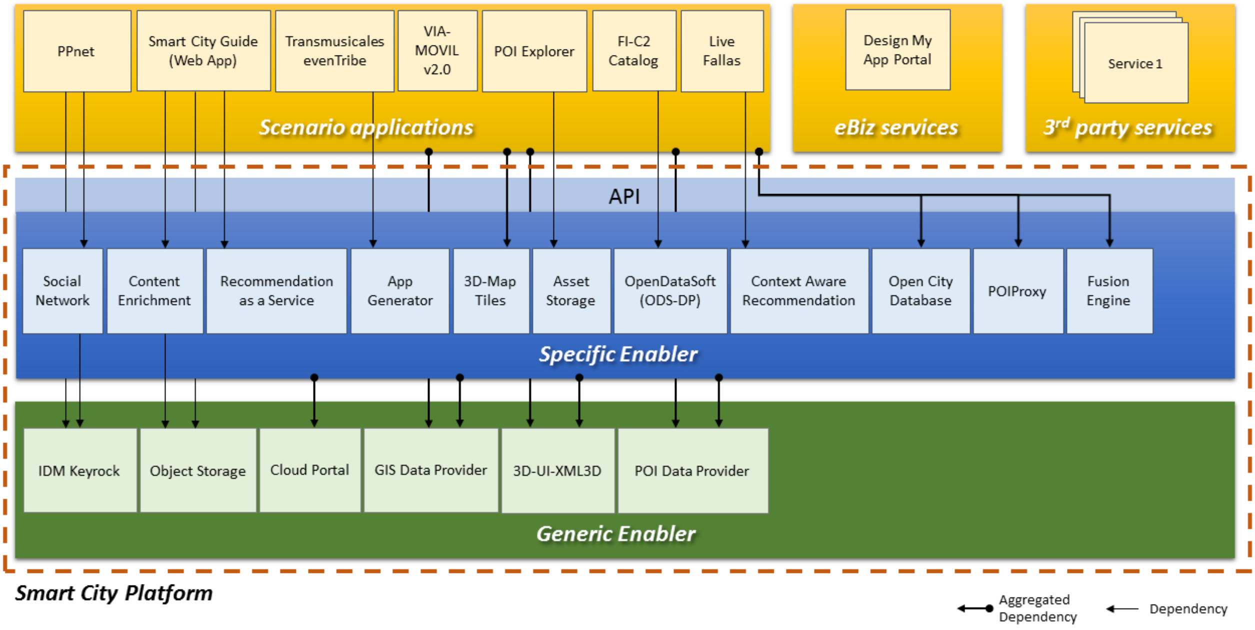


*Figure 1 High-level architecture of the Smart City Services Platform*

The Smart City Services Platform acts as an intermediate layer between the Generic Enablers provided by FIWARE and the applications built on top of the platform. Further, it exposes the APIs of the Specific Enablers shipped with the platform to the application developers. A selection of applications showcase specific features or Enablers of the platform as illustrated in the figure above. Each application is dedicated to one scenario of the Smart City Services Platform as described in detail in deliverable D3.1. Moreover, some additional services and concrete applications are exposed on the DesignMyApp (DMA) Portal for 3rd-parties to take advantage of supported SEs in a few clicks by generating their own applications.

## 2.1 - History

Due to changes in the consortium, the focus of the Smart City Services Platform shifted slightly and the platform architecture was realigned during M12. In this context, several new concepts were introduced in particular regarding the use-case-specific app generation and the addition of new Specific Enablers.

*For previous versions of the Smart City Services Platform (M1-M12), please refer to previous versions of deliverables, such as D6.1 and D3.2. Moreover, the previous architecture description [5] is available in the FIcontent Wiki.*

## 2.2 - Architecture Description

FIcontent technologies along with the Smart City Services Platform are built around the idea that users need easy and direct access to their provided services. Consequently, a portal (FIC2Lab) was provided to enable developers to choose from a set of Enablers and create apps and web apps directly from there. As such, the user can experience the new features of the services immediately with no or very small development efforts. If the users need more features not yet available through the service use cases, open APIs are provided to make it easy to access their interfaces and use the Enablers programmatically.

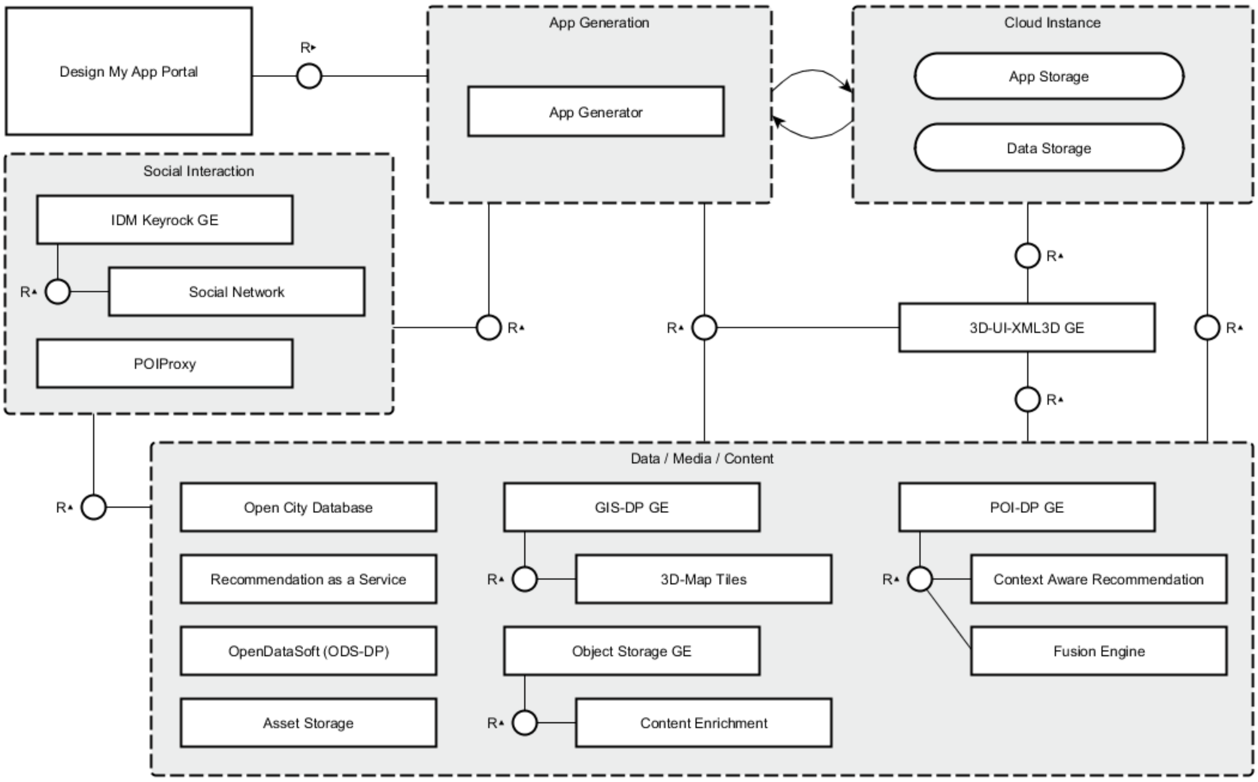


*Figure 2 Architecture of the Smart City Services Platform including the interaction of SEs with GEs from FIWARE*

This architecture also addresses the needs of the different typologies of users.

- The **end users** can use the non-technical portal and create apps using different enablers transparently and without development effort.
- **Event organizers** can enrich their applications with their own or third-party data from preconfigured formats.
- Since most of the Enablers have an open API, **developers** can dive deeper into the provided features, and build their own services and products on top of them.

### *2.2.1 -* App Generation

To be able to create Smart City applications in a fast and convenient way, the architecture of the Smart City Services Platform has the app generation process as one of its core components. In its center works the App Generator SE [4] that creates apps and web apps. The interface to the non technical user is driven by the DesignMyApp Portal [6].

### *2.2.2 -* Social interaction

On the lower left side of the Architecture diagram, the concrete services and features are shown.

For instance, the social interaction block consists of the Social Network SE [7] to create private, non-proprietary networks between end-users where they can share text and images.

To enhance the visual experience of the Smart City Guide applications, we provide a 3D/Augmented Reality module. XML3D in the shape of the 3D-UI GE provides the capability to use 3D artifacts within your application. Moreover, these can be placed into the camera view by the 3D-Map Tiles SE (Common Enabler) to turn your application into a full augmented reality experience.

POIProxy SE [8] improves the social interaction of smart city applications by providing a real time feed of content updates (text, photo, videos) from existing social networks: Instagram, Twitter, Flickr, etc. In the end it provides data to build components such as real time photo galleries of an event, users opinion or micro-videos of a live show.

### *2.2.3* - Data, Media and Content

Beside the functional components on the left side, we have possible data sources on the lower right side. Starting with the Data/Media/Content module, we have four main data sources to provide the capabilities of geo–localized services.

The POI Data Provider GE and the Open City Database SE [9] are turn-key solutions to store and retrieve Points of Interest in the vicinity of the user. Furthermore, the OpenDataSoft SE [10] accumulates open data sources and turns them into structured, harmonized data sets. The Fusion Engine SE [11] is able to gather information from multiple data sources and create a unified POI repository.

Including these and other possible data sources, the Content Enrichment SE [12] can create video annotations to enhance the multimedia experience of the applications. In addition, the Recommendation as a Service SE [13] provides a layer above the data sources to mine recommendations derived from the user behavior. The Context Aware Recommendation SE [14] provides final layer for POI and content recommendation guided by detected/recognized end user activity/context and POI/content attributes.

To be able to share data between multiple clients and enable real-time applications, we provide a Synchronization module. The Synchronization GE and Content Sharing SE [15] are able to share positioning details and generic data and replicate this data among different hardware. In addition, we use the Object Storage GE to store large-scale structured data into the virtualized cloud services of FI-LAB.

Overall, the app generation process supports the creation of virtualized Data Storage and App Storage instances that are orchestrated by the Design My App portal and is thereby a key feature of the Smart City Services Platform.

## 2.3 - Specific Enablers

We provide the following Specific Enablers through the Smart City Services Platform.

- Open City Database SE [9]
- Recommendation as a Service SE [13]
- App Generator SE [4]
- OpenDataSoft SE [10]
- POI Proxy SE [8]
- Context Aware Recommendation SE [14]
- Fusion Engine SE [11]

We use the following common Specific Enablers for the Smart City Services Platform.

- Social Network SE [7]
- Content Enrichment SE [12]
- 3D-Map Tiles SE [16]
- Asset Storage SE [17]

Legacy: As a result of previous work from Orange on the Smart City Services Platform, two additional Specific Enablers are available, but no longer considered for the realigned architecture of the Smart City Services Platform.

- Recommendation Services SE
- Virtual/Mixed Reality SE

## 2.4 - Cooperation between Specific Enablers

Many of the enablers are able to cooperate with other enablers.For instance, the Fusion Engine SE natively uses POIProxy SE as input data source. The latter is able to capture data from global data sources (e.g. Flickr), as from local open data (e.g. Valencia Datos Abiertos, OpenDataCanarias) into the CitySDK format, which is supported by the Fusion Engine SE. The Fusion Engine SE is then able to export data to the OCDB SE.

The Fallas Festival (March 2015) was used as a large-scale experiment where several SE owners worked together to provide a backend service to the official Fallas mobile app for the citizens of Valencia.

The interactions between SEs depicted below represents this experiment and a perfect example of how WP3 technologies can be combined and used together.

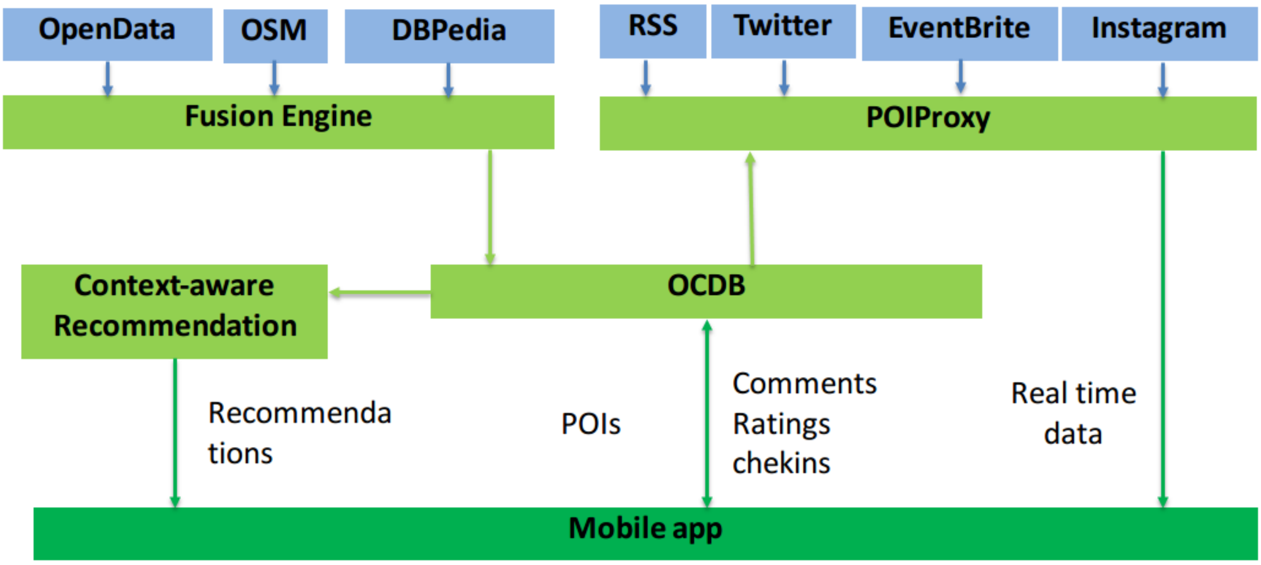


*Figure 3 Live Fallas general architecture*

## 2.5 - Generic Enablers

We take advantage of the following FIWARE Generic Enablers as part of the Smart City Services Platform:

- 3D-UI-XML3D GE [18]
- Identity Management Keyrock GE [19]
- Object Storage - FIWARE Implementation GE [20]
- POI Data Provider GE [21]
- GIS Data Provider - Geoserver/3D GE [22]
- Self-Service Interfaces - Cloud Portal GE [23]

# 3 - Smart City Services Platform - Release 04/15

The Smart City Services Platform was at the 09/13 milestone a portfolio of functions, designed to foster the development and uptake of Smart City Services based on Future Internet technologies.

The Release 06/14 of the Smart City Services Platform is at the crossroads of a portfolio of technical assets and an app-generation portal. It aims to show that on one hand, Enablers are fully operational, bringing state-of-the-art answers to real use cases and on the other hand a proof of the main concept of the redesigned WP3: "even non-technical people can build an App" with the newly introduced App Generator SE.

With this final release, the Smart City Services Platform aims to provide users with several kinds of ways to create Apps for citizens, to take advantage of the richness of the open data datasets and to mix together datasets, features, technologies to design new high-value services.

The following Specific Enablers are included in the April 2015 release of the Smart City Services Platform and provide the technological foundation and services for our smart city scenarios.

## 3.1 - App Generator

### *3.1.1* - What You Need

This service is able to deploy a complete application ecosystem on-the-fly:

- custom mobile apps with content (app name, icons, data…)
- custom webapps, backends…This tool changes the paradigm of app deployment, or "how to do n-times what I did once".

ex: Being the editor of a city guide application, I developed my webapp, backend and my mobile apps once. Using this SE, deploying a new city is a matter of minutes: new data, images, texts, and the AppGenerator takes care of the rest: deploying your webapp instances, creating your datasets, your new mobile apps ready for deployment.

### *3.1.2* - Why You Need It

The AppGenerator makes sense:

- If you need to quickly deploy powerful application ecosystems (mobile applications, backend infrastructures…) around a custom use.
- If you want to create new services focused on completely custom apps, or apps subject to changes (marketing tool, proofs of concepts).

### *3.1.3* - Documentation

- Technical Documentation of the App Generator SE [4]
- Developer Guide of the App Generator SE [24]

## 3.2 - Recommendation as a Service

### *3.2.1* - What You Need

The Recommendations as a Service (RaaS) SE provides the ability to create a professional recommendation engine with just a few mouse clicks and no programming skills. This SE can maintain your item and user data and will host your recommendation engine as a service in the cloud or on your own server infrastructure. Thereby, decision makers can choose whether to use ratings, likes, check-ins or implicit feedback, such as clicks or consumption time. In addition, they can adjust the way the personalization works by selecting from a wide range of well-explained algorithms.

#### *3.2.2* - Why You Need It

RaaS provides a hosted recommendation engine ready for tailor-made implementation into your app or service. A set of algorithms is available (e.g. collaborative filters) and can be used via the admin interface or via the built-in RESTful API, which is based on JSON or XML.

#### *3.2.3* - Documentation

- Technical Documentation of the Recommendation as a Service SE [13]

### 3.3 - Open City Database

#### *3.3.1* - What You Need

The Open City Database (OCDB) SE is an open source database management system for any smart city related data (e.g. points of interest, open city data and related media from various sources). Besides its database functionality the OCDB provides a comprehensive API to create, modify and request data sets for their integration with smart city guide apps or any other application or service that may take advantage of open city data.

#### *3.3.2* - Why You Need It

The OCDB is an open source solution built upon JavaScript-based and document oriented server side components. The OCDB can be used as hosted service or new instances can be installed. It provides a comprehensive API to create, modify and request open city data. Furthermore, it allows for the integration of UGC through bespoke applications.

#### *3.3.3* - Documentation

- Technical Documentation of the Open City Database SE [9]
- Developer Guide of the Open City Database SE [25]

### 3.4 - OpenDataSoft

#### *3.4.1* - What You Need

The ODS SE has been specifically designed for non-technical business users to share, publish and reuse structured data. To both create interactive data visualizations and feed external applications with data through a rich set of REST APIs.

#### *3.4.2* - Why You Need It

As a partner of the FI-PPP program or as a SME who want to leverage the resources provided by the FIcontent project, you have different ways to use the ODS specific enabler. You can directly use the FIcontent data portal which gathers some prepared datasets which can directly be reused. You can also request an access to your own data portal during the experimentation phase.

#### *3.4.3* - Documentation

- Technical Documentation of the OpenDataSoft SE [10]

### 3.5 - POIProxy

#### *3.5.1* - What You Need

The POIProxy SE is a service to retrieve Points of Interest from almost any public remote service that exposes geolocated data through a REST API or static files. Some examples of the kind of services that POIProxy can interact with: Open data portals (static files, OData APIs, REST APIs...), social networks

(Flickr, Panoramio, Instagram, 500px, Twitter, Facebook, Foursquare...), event services (LastFM, Nvivo, SongKick, Meetup, Eventbrite, ... ), and other services, including real time services (Wikilocation, Geonames, OpenWeatherMap, CityBikes, ...)

### *3.5.2* - Why You Need It

Currently there is a heterogeneous ecosystem of services including geolocated data providing each one their own request and response APIs. POIProxy allows application developers to have access to a wide catalogue of POI services without dealing with the implementation details of each one. POIProxy is also useful for POI providers, as it allows to configure any POI service or static file (CSV, KML, XML, GeoJSON, etc.) through a single API.

### *3.5.3* - Documentation

- Technical Documentation of the POIProxy SE [8]
- Developer Guide of the POIProxy SE [26]

## 3.6 - Context Aware Recommendation

### *3.6.1* - What You Need

This Specific Enabler consists of two server modules: 1. The Activity and Context Recognition server module which uses gathered contextual and sensory data for classification of user activity and context. 2. The Recommendation Matrix Preparation server module. Additionally, demo Android application is provided for collecting contextual/sensory data and presenting POI recommendation results.

### *3.6.2* - Why You Need It

Since modern mobile devices accompany their owners throughout the day and during all day-to-day activities, analyzing contextual/sensory data collected from them can be used for precise recognition of user's activity. The SE enables developers to adapt POI and action recommendation to end user's current context and activity.

### *3.6.3* - Documentation

- Technical Documentation of the Context Aware Recommendation SE [14]
- Developer Guide of the Context Aware Recommendation SE [27]

## 3.7 - Fusion Engine

### *3.7.1* - What You Need

The Fusion Engine (FE) is able to fusion Points of Interest (POIs) from different data sources. The main objective is to build Open City Databases (OCDs) with different POIs obtained from different data sources (OSM, DBPedia, etc). Matching POIs will not be replicated. Categories of POIs can be set up in order to fusion and retrieve only interesting POIs. The FE Specific Enabler is implemented as a backend service, there is no normal interaction with a normal user, but an administrator.

### *3.7.2* - Why You Need It

The FE SE enables a new way of grouping POIs from different data sources. Any application that deals with POIs would have to inquiry different endpoints with probably different interfaces and also suffers the inconvenience of replication (the same POI appears multiple times). The FE SE provides an offline process to select all interesting data sources and store such information for later retrieval. Thus the external application will only contact one single FE inquiry frontend. Note that the FE also allows selecting those categories that are really relevant for your special application.

#### *3.7.3* - Documentation

- Technical Documentation of the Fusion Engine SE [11]
- Developer Guide of the Fusion Engine SE [28]

### 3.8 - 3D-Map Tiles

#### *3.8.1* - What You Need

The 3D-Map Tiles SE supplies map tiles of the ground in an OpenStreetMap-like manner. These tiles are a 3D representation of the scene geometry in contrast to usual image tiles of OSM. Moreover, the 3D-Map Tiles SE supports different backend data providers to offer different kinds of tiles, such as projected OSM-tiles and laser-scanned elevation data with textures. Therefore, the 3D-Map Tiles SE incorporates the GIS-DP GE from FIWARE.

#### *3.8.2* - Why You Need It

When moving from traditional 2D-map applications towards geo-referenced interactive 3D-applications, a representation of the environmental ground (i.e. terrain) is needed. The 3D-Map Tiles SE addresses this requirement in a flexible approach and an easy-to-use way for web-based applications. It seamlessly incorporates with the 3D-UI GE from FIWARE and thereby preserves full control over rendering in the client application.

#### *3.8.3* - Documentation

- Technical Documentation of the 3D-Map Tiles SE [16]
- Developer Guide of the 3D-Map Tiles SE [29]

### 3.9 - Social Network

#### *3.9.1* - What You Need

The Social Network SE Core (or SNE) is a REST Service with a Web interface that gives end users the opportunity to communicate with each other. Unlike monolithic infrastructures (like Facebook) the SNE provides not only full autonomy of the user data but also gives the opportunity to run it as a federated service.

#### *3.9.2* - Why You Need It

This enables a social network of your own design with absolute data sovereignty. You own your own data and have total control over the design and functionality.

#### *3.9.3* - Documentation

- Technical Documentation of the Social Network SE [7]
- Developer Guide of the Social Network SE [30]

### 3.10 - Asset Storage

#### *3.10.1* - What You Need

The Asset Storage SE is a system for storage and conversion of polygonal 3D models. It offers a REST interface to add and retrieve models, where HTTP content negotiation is used to determine the input and output format(s). Its current primary use is to import 3D models into its own storage format, and export them to something usable on the web

### *3.10.2* - Why You Need It

Assets are a crucial for all kind of 3D applications. In the field of 3D on the web, new approaches are necessary to handle content creation and delivery. The Asset Storage SE provides a solution for the latter while preserving established pipeline of content creation using well-known tools. In particular, it allows the storage, management and delivery of 3D assets in a service-like fashion for 3D applications on the web.

### *3.10.3* - Documentation

- Technical Documentation of the Asset Storage SE [17]
- Developer Guide of the Asset Storage SE [31]

## 3.11 - Content Enrichment

### *3.11.1* - What You Need

Content Enrichment provides functions to create, distribute and play interactive video content across platforms and devices by making objects in the video clickable for their viewers. It also provides interfaces to incorporate Web 2.0 capabilities and community functionalities. Thus, the enabler acts as a common building block in future video and multimedia infrastructures. It allows seamless, platform-independent and convenient enrichment of any type of video content using any type of device for a plurality of application cases.

### *3.11.2* - Why You Need It

Content Enrichment is a hosted solution to create interactive video content consisting of a PHP and mySQL based backend. Interactive content can be created through an HTML5 based tagging tool that uses Java Script and communicates with the RESTful API via JSON to create and store metadata. Interactive video players can be implemented in HTML supporting the JSON player API.

### *3.11.3* - Documentation

- Technical Documentation of the Content Enrichment SE [12]

# 4 - Smart City Services Platform prototypes and applications

Based on the Smart City Services platform and their enablers, the following set of prototype applications have been built to demonstrate the capabilities of the platform.

## 4.1 - Smart City Guide Web App

This demo shows the capabilities of a web based smart city guide. Using a standard web browser on a smart phone or tablet a user can access, edit and enhance information about a city. As the app incorporates several enablers developed in the FI-PPP programme it offers users several options. Information on places of interest comes from an open city database enabler, this means any user can add a location as a new point of interest or complete information about an existing POI. The content enrichment enabler means that users can enhance a POI description with enriched video content and thanks to the FIWARE Object Storage enabler, this enriched video content can be stored in the cloud. The app has an intuitive user interface that also offers the user various ways to view data – as lists, galleries or a map.

### *4.1.1* - Screenshots

**Smart City Guide**

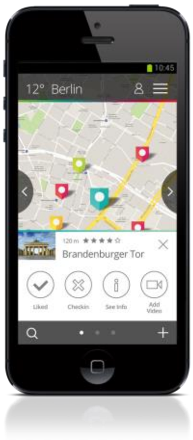


*Figure 4 Smart City Guide Web App – Social components*

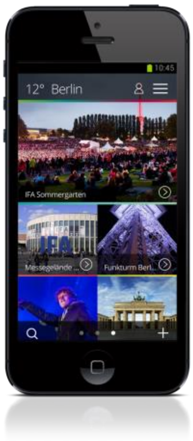


*Figure 5 Smart City Guide Web App – Gallery view*

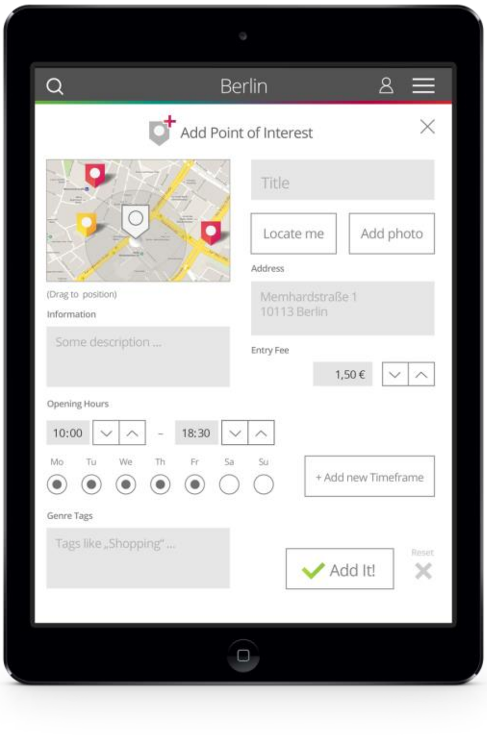


*Figure 6 Smart City Guide Web App - Add POIs to the OCDB*

**Content Enrichment**

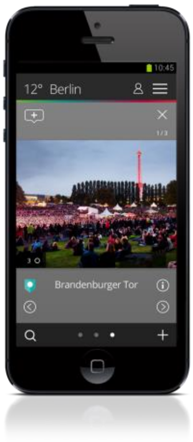


*Figure 7 Smart City Guide Web App - CENR*

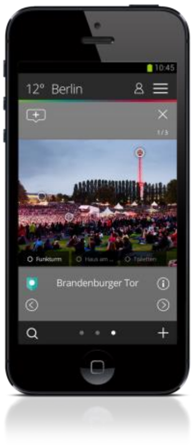
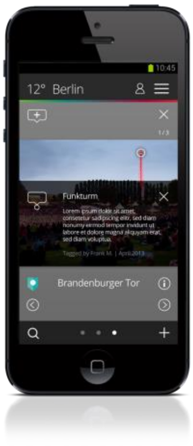


*Figure 8 Smart City Guide Web App – CENR create new tag*



Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua.

Tagged by Frank M. | April 2013

*Figure 9 Smart City Guide Web App – CENR display further tag information*

## 4.2 - FIcontent AppGenerator Sample Apps

The following sample apps have all been generated from the original generic template, or a slightly evolved version with extra features not published on the public DesignMyApp portal.

The DesignMyApp portal is a public portal targeting non-technical users. This portal is based on the AppGenerator SE and demonstrates the technical ability to generate apps on the fly by everybody.

The DesignMyApp portal uses the **ODS SE [32]** to manage the data needed for the generated apps.

### *4.2.1.1 - DesignMyTrace*

With Design My Trace, you can create your own and personal Trace. Start the application and your travel will be saved by creating Points of Interest (POI). You can freely edit each POI by adding:

- one or more pictures taken by your device,
- a description of the POI,
- a phone number or a web link,
- enriching the POIs to be more accurate.

You can export the data of your travel (POIs and/or trace). By exporting data, you can re-use them to create custom applications with the DesignMyApp public portal.

*This application is available on the Google Play Store.*

#### *4.2.1.2 - OpenCyclo*

OpenCyclo shows the availability and status of all bike stations managed by JC Decaux in over 20 locations around the world. OpenCyclo regularly updates the status of each bikes station by showing you the number of bike and parking places available. For each station, you can consult the StreetView and the distance by foot or by bike between you and the selected stations. Manage your favourite places-to-be by adding the nearest bike stations to your favourite list. OpenCyclo supports more than 10 cities in France including Paris, Marseille, Nantes, Toulouse… and more than a dozen cities in others countries including Brussels (Belgium), Seville (Spain), Vilnius (Lithuania), Toyama (Japan).

*This application is available on the Google Play Store and the Apple AppStore.*

#### *4.2.1.3 - ILoveNY*

I Love New York contains more than 1400 Points of interest (POIs) about attractive places through New York City. You want to find your way to the People's Improv Theater or just the Simpson Street? Just use the research bar to find the place and start the navigation. I Love New York provides some information about each POI on the interactive map based on a data source on the web updated frequently.

#### *4.2.1.4 - OpenParis*

Who has not faced a strike or an incident while waiting the subway. Moreover, in this situation, your internet connection is slow and you cannot find an alternative. Why take the subway with several changes when you can take a direct tram or bus? OpenParis offers an interactive map of all available means of transportation around: Metro, Bus, Train, Tram, Velib' … A touch on the base station and the arrival point and check on the layout of the lines that will help you reach your destination. You can also discover all the bus lines which stop near your favourite place.

*This application is available on the Google Store*

#### *4.2.1.5 - Paris Beer Week*

The Paris Beer Week is a French Event gathered bar and brewery offering multiple activity during a week at the end of May. Plan your route through Paris via the App Paris Beer Week. Consult the list of all the events proposed by each places participating to this event. Find the best brewery corresponding to your expectations by consulting a short description and a picture of each place integrated in the App.

*This application is available on the Google Play Store for the 2014 and 2015 edition*

#### *4.2.1.6 - Zoo Parc de Beauval*

You want to visit the Zoo of Beauval but you do not have a plan? Zoo Beauval provides you an interactive map of this Zoo.  Use the Search bar to find the animal you want to see and find their exact location marked by a Point of Interest (POI).You want to go back in the Zoo and find your favourite species? Add some POI to your favourite list and find your way up to them more easily.

*This application is available on iOS and Android.*

### 4.2.2 - Screenshots

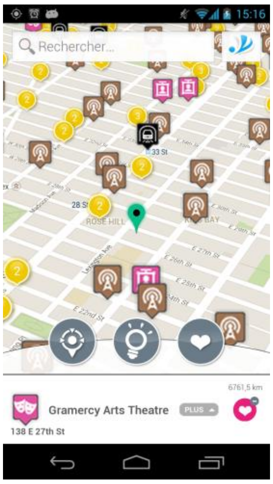
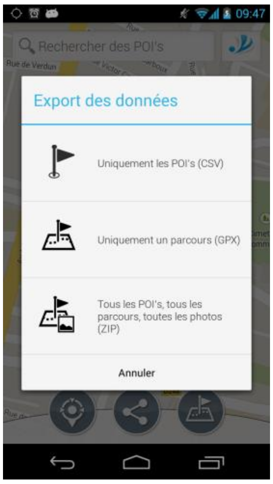


*Figure 10 – ILoveNY screenshot*

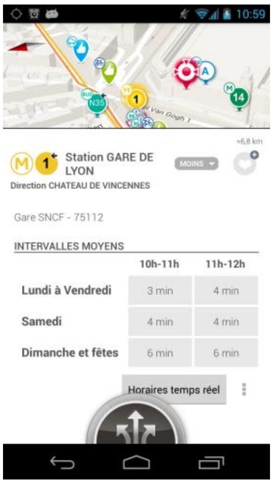


Uniquement les POI's (CSV)

Uniquement un parcours (GPX)

Tous les POI's, tous les parcours, toutes les photos (ZIP)

*Figure 11 DesignMyTrace screenshot*



Direction CHATEAU DE VINCENNES

Gare SNCF - 75112

INTERVALLES MOYENS

| | 10h-11h | 11h-12h |
|---|---|---|
| Lundi à Vendredi | 3 min | 4 min |
| Samedi | 4 min | 4 min |
| Dimanche et fêtes | 6 min | 6 min |

*Figure 12 OpenParis screenshot*

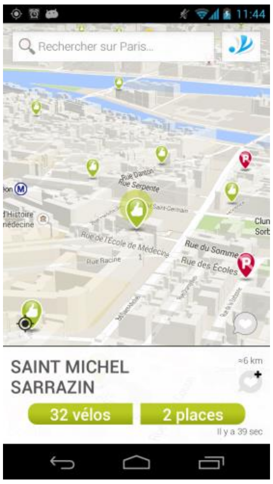
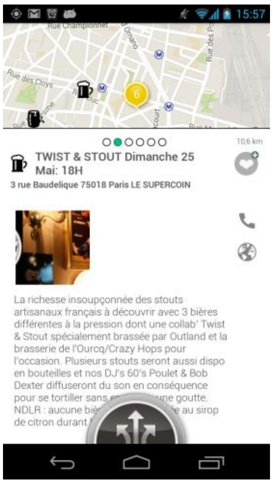


Figure 13 OpenCyclo screenshot



TWIST & STOUT Dimanche 25 Mai: 18H

3 rue Baudelique 75018 Paris LE SUPERCOIN

La richesse insoupçonnée des stouts artisanaux français à découvrir avec 3 bières différentes à la pression dont une collab' Twist & Stout spécialement brassée par Outland et la brasserie de l'Ourcq/Crazy Hops pour l'occasion. Plusieurs stouts seront aussi dispo en bouteilles et nos DJ's 60's Poulet & Bob Dexter diffuseront du son en conséquence pour se tortiller sans [illegible] une goutte. NDLR : aucune biè[illegible] au sirop de citron durant [illegible]

Figure 14 ParisBeerWeek screenshot

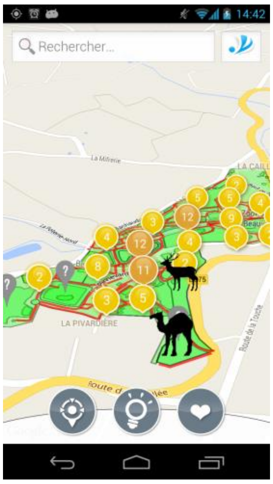


Figure 15 Beauval screenshot

### 4.3 - Live Fallas

Live Fallas is a multi-platform app (Android, iOS) to enhance the visitors experience during Las Fallas 2015 festival in Valencia.

The app is built on top of different Smart City specific enablers to provide unique and integrated information in real time related to the festival.

**POIProxy [33]** is used to:

- Gather open data information provided by the official Smart City Services Platform of Valencia.
- Read from different event and news services.
- Analyze real time streams from social networks (Twitter, Flickr, Instagram) to provide a heatmap of social activity during the festival.

**Fusion Engine [34]** is used to:

- Read and merge data in order to create an Open City Database of points of interest

**Open City Database [35]** is used to:

- Store points of interest
- Authenticate users
- Provide additional functionalities for user participation: Comments, ratings, check-ins and upload photos of any Falla in the city

**Context Aware Recommendation Service [36]** is used to:

- Recommend the users of the app, the best Fallas to visit based on the ones most visited and rated by other users and their own previous ratings and visits.

**Leaderboard [37]** is used to:

- Add gamification features during a real time competition to know who are the users who visit every single Falla all over the city first

### *4.3.1* - Screenshots

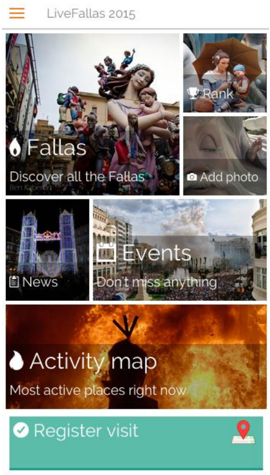
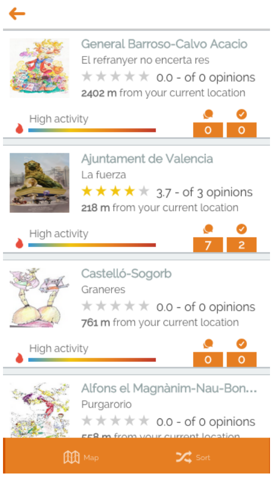


*Figure 16 LiveFallas 2015 – screenshot 1*



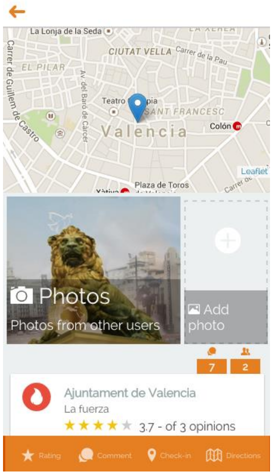
General Barroso-Calvo Acacio
El refranyer no encerta res
★★★★★ 0.0 - of 0 opinions
2402 m from your current location
High activity 0 0

Ajuntament de Valencia
La fuerza
★★★★★ 3.7 - of 3 opinions
218 m from your current location
High activity 7 2

Castelló-Sogorb
Graneres
★★★★★ 0.0 - of 0 opinions
761 m from your current location
High activity 0 0

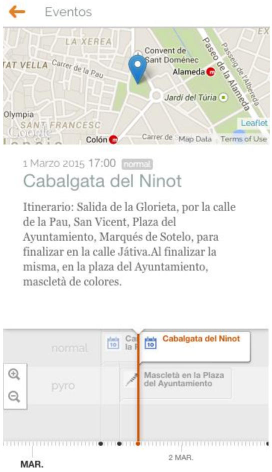
Alfons el Magnànim-Nau-Bon…
Purgarorio
★★★★★ 0.0 - of 0 opinions

*Figure 17 LiveFallas 2015 – screenshot 2*



Ajuntament de Valencia
La fuerza
★★★★★ 3.7 - of 3 opinions

*Figure 18 LiveFallas 2015 – screenshot 3*



1 Marzo 2015 17:00 normal

Cabalgata del Ninot

Itinerario: Salida de la Glorieta, por la calle de la Pau, San Vicent, Plaza del Ayuntamiento, Marqués de Sotelo, para finalizar en la calle Játiva.Al finalizar la misma, en la plaza del Ayuntamiento, mascletà de colores.

*Figure 19 LiveFallas 2015 – screenshot 4*

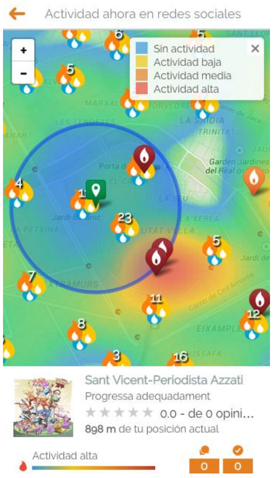


*Figure 20 LiveFallas 2015 – HeatMap 1*

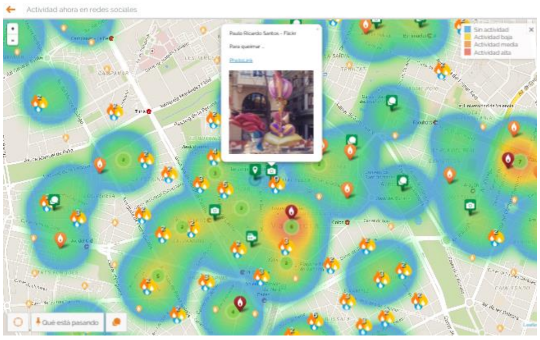


*Figure 21 LiveFallas 2015 – Heatmap 2*

### 4.4 - Via Movil 2.0

Via Movil 2.0 brings new geo-localized services based in BLE technology, and improves the experience of current VIA-MOVIL App transit users.

The scenario includes:

- The installation of BLE beacons both inside the vehicles and at MTSA stops.
- The adaptation of the Via-Movil system and App for integration and the development of new functions.

The VIA-MOVIL users can select these new services directly from the App or from the Front End (profile menu). It could be a ‘Visually Impaired Person’, a foreigner, or a regular user interested, for example, in cultural events.

The mobile application collects the BLE beacons data and sends them to the central platform. The server side selects the relevant user interface to send back to the mobile according the user profile and the beacon detected. For example, if the user is a visually impaired person, the system will send a message when it detects the arrival to a stop, informing the stop name and the next tram arrival time. Even the system can propose him to validate the trip if he detected inside a tram.

The experiences received combine geo-localized dynamic data (stops, tram, line and direction) and transit service information (offers, incidences in the line, transfers between lines, POIs in the city, special events, etc.)

Also, the system can provide useful information of fraud estimation and transport demand (by origin-destination) for internal management of the operator and the relevant public office

**POIProxy [33]** is used to:

- Gather open data information provided by Open Data Canarias and others sources.

**Fusion Engine [34]** is used to:

- Read and merge data in order to create a Database of points of interest

**POI Data Provider [38]** is used to:

- Store storing information related to locations
- Serving queries by location and other criteria

### *4.4.1* - Screenshots

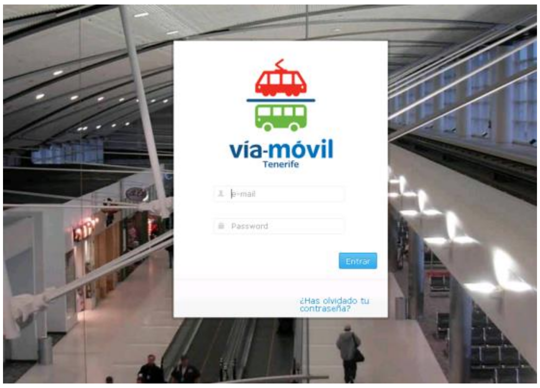
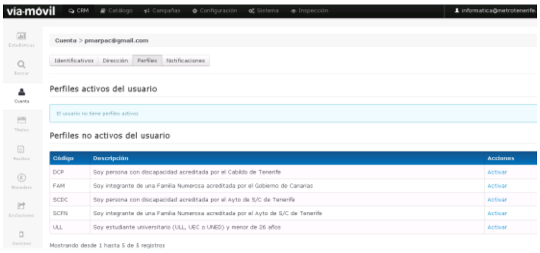


*Figure 22 Via-movil accueil*



Cuenta > pmarpac@gmail.com

Perfiles activos del usuario

El usuario no tiene perfiles activos

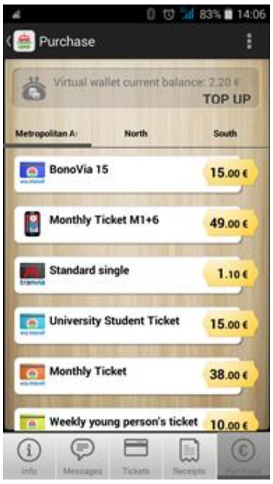
Perfiles no activos del usuario

| Código | Descripción | Acciones |
|---|---|---|
| DCP | Soy persona con discapacidad acreditada por el Cabildo de Tenerife | Activar |
| FAM | Soy integrante de una Familia Numerosa acreditada por el Gobierno de Canarias | Activar |
| SCDC | Soy persona con discapacidad acreditada por el Ayto de S/C de Tenerife | Activar |
| SCFN | Soy integrante de una Familia Numerosa acreditada por el Ayto de S/C de Tenerife | Activar |
| ULL | Soy estudiante universitario (ULL, UEC o UNED) y menor de 26 años | Activar |

Mostrando desde 1 hasta 5 de 5 registros

*Figure 23 Via-movil web*

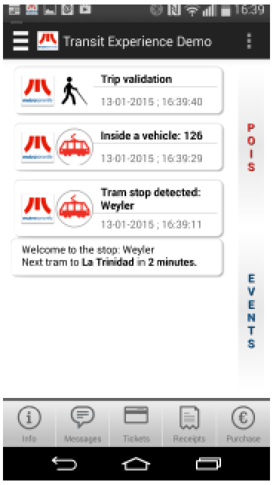
*Figure 24 Via-movil mobile app 1*



Virtual wallet current balance: 2.20 €

| | |
|---|---|
| BonoVia 15 | 15.00 € |
| Monthly Ticket M1+6 | 49.00 € |
| Standard single | 1.10 € |
| University Student Ticket | 15.00 € |
| Monthly Ticket | 38.00 € |
| Weekly young person's ticket | 10.00 € |

Figure 25 Via-movil mobile app 2



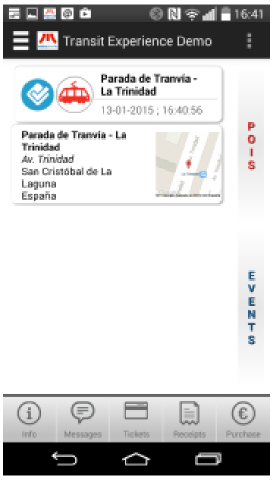
Trip validation
13-01-2015 ; 16:39:40

Inside a vehicle: 126
13-01-2015 ; 16:39:29

Tram stop detected: Weyler
13-01-2015 ; 16:39:11

Welcome to the stop: Weyler
Next tram to **La Trinidad** in **2 minutes.**

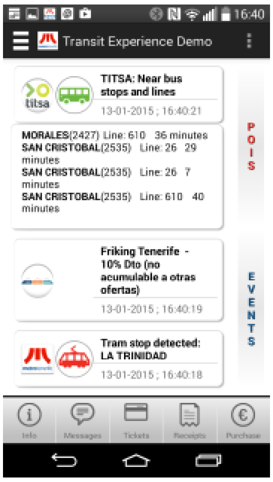
Figure 26 Via-movil mobile app 3



Parada de Tranvia - La Trinidad
13-01-2015 ; 16:40:56

**Parada de Tranvia - La Trinidad**
*Av. Trinidad*
San Cristóbal de La Laguna
España

Figure 27 Via-movil mobile app 4



TITSA: Near bus stops and lines
13-01-2015 ; 16:40:21

MORALES(2427) Line: 610 36 minutes
SAN CRISTOBAL(2535) Line: 26 29 minutes
SAN CRISTOBAL(2535) Line: 26 7 minutes
SAN CRISTOBAL(2535) Line: 610 40 minutes

Friking Tenerife - 10% Dto (no acumulable a otras ofertas)
13-01-2015 ; 16:40:19

Tram stop detected: LA TRINIDAD
13-01-2015 ; 16:40:18

*Figure 28 Via-movil mobile app 5*

# 5 - INTERACTION AND COOPERATION WITH OTHERS FICONTENT PLATFORMS

With regard to the effort in platform development, there is an overlap between the Smart City Services Platform (WP3) and Pervasive Games (WP4) Platform. In particular relevant for city focused apps, for instance, might be the cooperation with Work Package 4. We address these synergies in various fashions:

**Common Specific Enablers.** First of all, we promoted certain Specific Enablers, such as the Social Network SE [7] or the 3D Map Tiles SE [16], as Common Specific Enabler of FIcontent due to the fact, that multiple platforms take advantage of them. Social and 3D subjects are central in the work of the WP3 and WP4. Even though the issues to be addressed are different, the technical needs are the same.

**Technology Transfer.** Moreover, the platform made by the WP3 aims to deliver advanced features based on the Augmented Reality concept. Because the WP4 develops groups of Specific Enablers related to this concept, such as the Augmented Reality SEs and Reality Mixer SEs, we cooperate with WP4 on the requirements for these SEs to be usable within the Smart City apps.

Finally, few partners, which are driving the technological platform development and being involved in multiple work packages, act as bridge with regard to common requirements and sharing efforts between those work packages.

# 6 - Deployment of the Smart City Services Platform

The figure below illustrates where the Enablers are located, i.e. where they are installed and running. On the left side the cloud services are listed that mostly have a RESTful API to be used by clients or other services. The right side shows Enablers that are running purely on the client side (and generated apps). The center contains Enablers that simplify the interface and need to run code both on the client and server side.

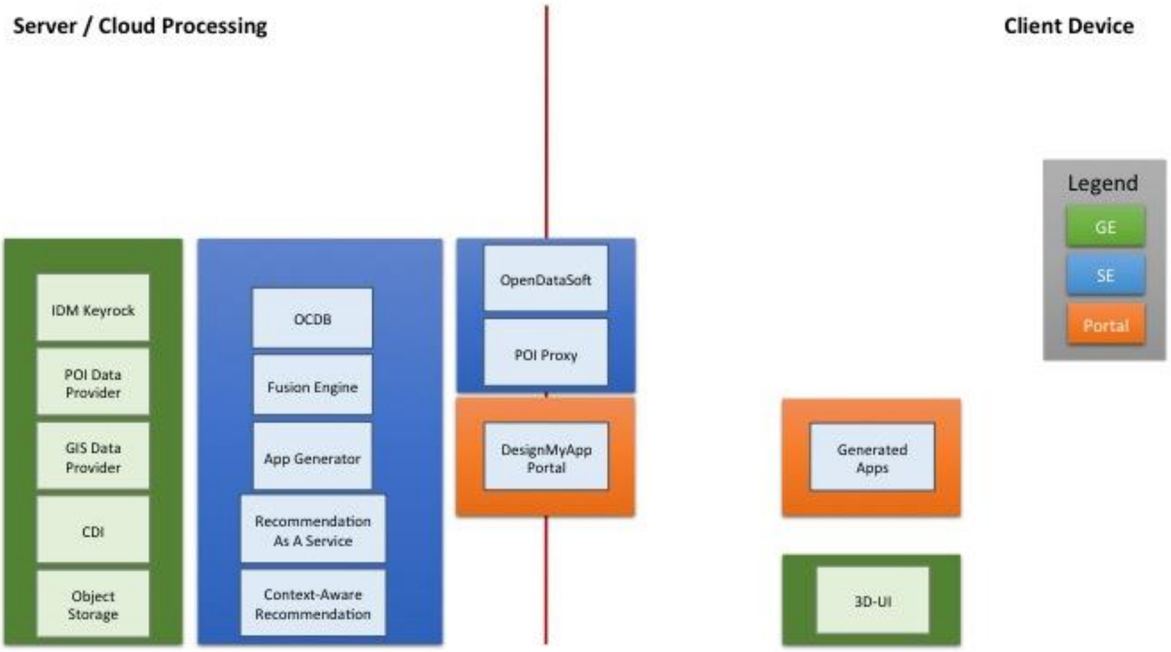


*Figure 29 Deployment sites of Enablers of the Smart City Services Platform*

## 6.1 - Client Side Enablers

There is no Client-side Specific Enabler developed by the Smart City Services Platform. However, some client apps generated by non-technical users through the DesignMyApp portal may be considered as Client-side. Also, the App Generator SE and DesignMyApp templates use the 3D-UI GE which is client-side.

## 6.2 - Server Side Enablers with a Shared Instance

Not Applicable in the Smart City Services Platform.

## 6.3 - Server Side Enablers with a Global Instance

Some Specific Enablers are cloud services and have to be deployed by the smart city developers. The deployment guide of each enabler is available on the enabler's detail page. These Enablers are:

- Open City Database SE [9]
- Recommendation as a Service SE [13]
- App Generator SE [4]
- Context Aware Recommendation SE [14]
- Fusion Engine SE [11]

## 6.4 - Enablers on Both Client and Server Side

Some Enablers are located at the interface between client and server and, therefore, consist of both a server side cloud service as well as a library part which is used on the client. The enablers are:

- OpenDataSoft SE [10]
- POI Proxy SE [8]

## 6.5 - Deployment Lab

To facilitate the test, tweak, experimentation, and use of all enablers, a dedicated Lab has been launched in April 2015. This missing milestone had become critical in order to help developers to bootstrap their use of all the Social Connected TV, Smart City Services, and Pervasive Games platform technologies.

The FIC2Lab:

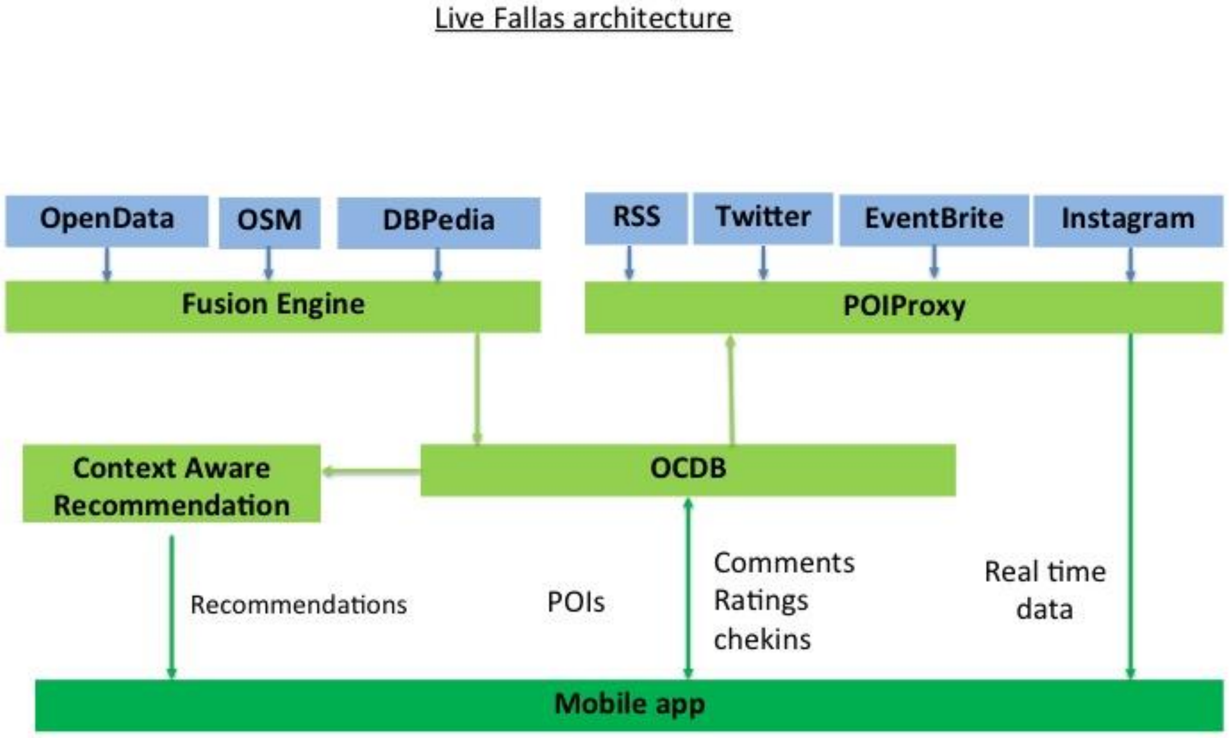
- Centralizes all enabler documentation / deployment recipes / docker instances.
- References the demo instances of all enablers.
- Allows to tweak all client-side enablers directly in the browser.
- Allows to instantly deploy server-side enablers on both public and private clouds, via the use of Docker Images and Chef Recipes.

To start discovering, hacking and using the enablers, go to FIC2Lab *[39]*

## 6.6 - How to set up a concrete infrastructure for a Smart City scenario

The Smart City Services Platform has multiple ways of combining its enablers in concrete use cases. In particular, different scenarios have been established.

This infrastructure page lays out the infrastructure of the Fallas experiment scenario, and details both the deployment process and the enabler interactions of the scenario.



Live Fallas architecture

*Figure 30 Live Fallas Architecture schema*

The Fallas App services are provided by different enablers.

Regarding the technical infrastructure used for the Valencia Fallas Festival, PRO, UPVLC and LCI have connected different infrastructures to run the experiment: the main venue for serving the mobile application is located in Amazon EC2 infrastructures, but there was also support from UPVLC site and Google App Engine cloud, as depicted below.

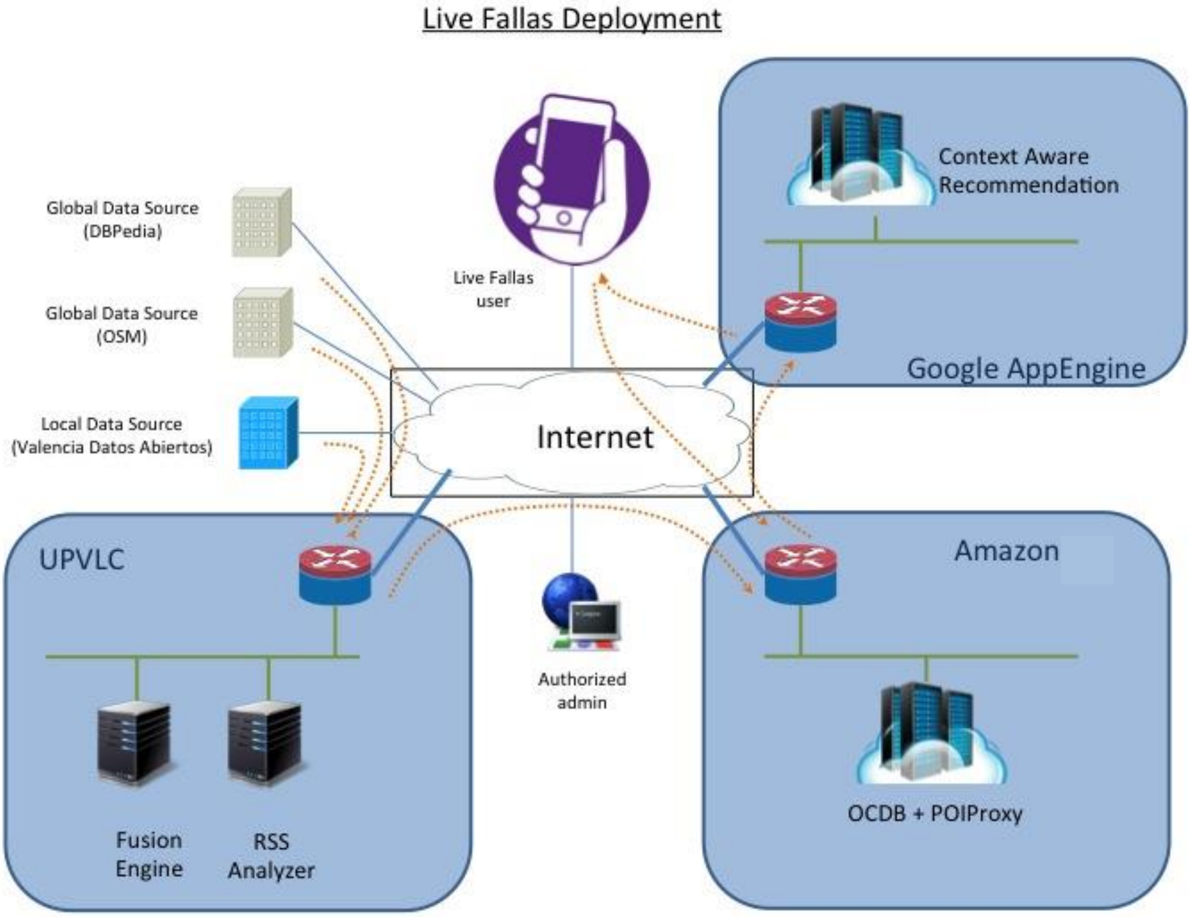


*Figure 31 Live Fallas Deployment Schema*

Different data sources have been used for the experiment:

• Global data sources, such as DBPedia and OSM

• Local data sources, provided by the Open Data Portal of the City Council of Valencia. Here the most relevant dataset is the Fallas monument dataset.

Previous data has been merged by means of the Fusion Engine enabler located in UPVLC premises. This process has been run offline in order to have all available data merged into one single repository. The data obtained after the fusion is then exported into the OCDB located in Amazon EC2 premises. UPVLC premises also deployed another server called RSS Analyser, which analyses every 12 hours local news (RSS feeds) that may relate to Fallas. If there is a match, the update is exported to Amazon S3. In fact, POIProxy enabler located there periodically pulls for updates from the RSS Analyzer. No strong requirement is needed for both servers located at UPVLC premises (i3 CPU, 4GB RAM).

The Amazon EC2 stores the OCDB and the POIProxy enabler. Amazon allows to dynamically reconfiguring resources to absorb high client demands. Partners from FIcontent would have liked to use FILAB but it was not an exploitation environment to support reliably a high traffic demand. PRO had experience with Amazon environments and therefore created a virtual/logical (cloud) server integrating both OCDB and POIProxy enablers. The OCDB stores the information about the Fallas provided by the Fusion Engine, but also provides user interaction to rate, comment, upload photos and do check ins. POIPproxy provides real time information about news, events and activity in social networks. For the latter functionality, a cache was built within POIProxy for making social activity analysis each 15 minutes to determine hot spots.

Mobile users can participate with the Live Fallas app either as registered or unregistered users. As registered users (just providing an e-mail), user have full access to all functionalities; they can perform actions on any Falla: comment, rate, upload picture and checkin. A competition was established in order to engage people to interact with the app. Non-registered users were able to consume all information from the app (e.g. locate Fallas, see Fallas details, see social activity, etc.), but were not allowed to interact (comments, ratings, etc.)Mobile users typically request data from this Amazon server, though user recommendations are provided from the Context Aware Recommendation enabler.

The Context Aware Recommendation instance is deployed on the Google App Engine platform in order to ensure scalability for this large event. The GAE Python SDK is used for implementing the SE and necessary handlers for establishing APIs between the SE instance, mobile application and the OCDB instance.

Two hooks are implemented in the OCDB instance in order to collect contextual data about users' actions (Fallas ratings and check-ins) which were used for updating the recommendation matrix. Data necessary for constructing the recommendation matrix was stored in the Google Datastore.

Recommendations are requested by end users through the application. Unregistered users were recommended with three closest Fallas from most relevant categories while registered users received Fallas recommendation based on their previous actions, their current location and through collaborative filtering capturing overall trends in Fallas check-ins and ratings from all registered users.

Mechanism for estimating Fallas recommendation success was implemented by logging and comparing time-stamps of recommended Fallas and subsequent users' actions (Fallas ratings and check-ins).

# 7 - Conclusion

In this document, a technical description of the final Smart City Services Platform has been presented.

Firstly, the overall architecture of the platform has been laid out, listing the groups of Specific Enablers and Generic Enablers involved, as well as how they interact with each other.

Secondly, the enablers themselves have been described, with a high-level description of the Specific Enablers provided by the partners behind the Smart City Services Platform. For a detailed description of Specific Enablers, please refer to FIcontent Wiki. Description of FIWARE GEs is available in the FIWARE catalogue.

Finally, we have discussed the possibility of the platform deployment, the condition of the enablers (server and/or client side) and illustrated a concrete use-case deployment of the Fallas experiment. This deployment guide lays-out how and where enablers are setup and how they interact with each other.

## REFERENCES

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