D3.1

SCENARIO, FUNCTIONAL AND TECHNICAL SPECIFICATIONS - RELEASE 2

January 2015

ABSTRACT

This document is an updated version of the release submitted in March 2014. This revision is provided for convenience due to the shifted focus of the redesigned WP3 in conjunction with other deliverables and in addition to the incorporation of the open call partners.

It describes the scenarios developed in the “Smart City Platform”.

SEVENTH FRAMEWORK PROGRAMME

FUTURE INTERNET PPP

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.

DISCLAIMER

DELIVERABLE DETAILS

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EXECUTIVE SUMMARY

This document specifies the “Smart City Services” platform’s scenarios and their technical requirements. Main scenarios introduced in this document have been identified with all WP3 partners, technical partners as well as experimentations site owners and feed into reference applications of the Smart City Platform.

Our overall idea of a “Smart City Services” platform is a set of services and respective applications that assist people and interest groups to find orientation, inspiration and help in urban environments assisted by connected devices.

The scenarios described in the document are: on site visit, social interactions, data fusion, real time social networks activity, activity aware POI and action recommendation, festival, app generator city guide, transit experience.

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ABBREVIATIONS

API	Application Programming Interface
AR	Augmented Reality
BLE	Bluetooth Low Energy or Bluetooth LE
FE	Fusion Engine
FTP	File Transfer Protocol
GE	Generic Enabler
HTTP	HyperText Transfer Protocol
IMS	IP Multimedia Subsystem
LAN	Local Area Network
OCD	Open City Database
POI	Point Of Interest
QoS	Quality of Service
QoE	Quality of Experience
SE	Specific Enabler
SCG	Smart City Guide
SUS	System Usability Scale
TCP	Transmission Control Protocol
UML	Unified Modeling Language
WAN	Wide Area Network
XML	Extensible Markup Language

1 - INTRODUCTION – PURPOSE OF THIS DOCUMENT

This deliverable mainly specifies the “Smart City Platform” scenarios and their technical requirements. Therefore, it describes scenarios developed in task 3.1 and also identifies experimentation sites specificities. Main scenarios introduced in this document have been identified with all WP3 partners, technical partners as well as experimentation site owners and are going to be realized as reference applications of the Smart City Platform. It is tightly coupled to the D3.3.2 which will deliver the results of the experiments of the scenarios.

The first iteration laid out the creation of the “Smart city guide”, mobile app (one of the Smart City platform reference applications) aimed at having functions before, during and after a visit to a city. The second iteration aims at extending those services to other devices (tablets, connected TV…), creating new services for citywide events, and allowing anyone to create their own concepts (and potentially their own city guide) through app generation.

“Reference mobile applications” have been developed to demonstrate the enablers of the Smart City Platform. Some are native android or iOS applications (evenTribe, FIC2-Catalog) and others are web applications based on Cordova/HTML5 (Valencia Demo, SCG Fokus).

1.1 - Overview

The following overview conserves the structure of the first document for reference. The experimentation section was updated.

Application of the user-centred design and development process

The process used to design and develop the Smart city applications uses user-centred agile methods. On the basis of the fact that agile methods and user-centred design have points in common (search of regularly feedbacks, process based on iterations, will to answer users’ needs), this method is a mutual integration of the user-centred design method (Annex A User Centred Design method) and the scrum agile method [3]. The aim of the user centred agile method is to enable regularly feedbacks from users through all phases of the project.

This process is divided into three phases: an early design phase, an agile development phase and an experimentation phase.
The two first phases follow the same agile approach although their implementation is specific for each scenario and left to involved partners to decide. Beyond M24, the approach will also be adapted to the constraints of Phase 3 experiments and relevant support needed from accelerators/SMEs.
Every experiment will have to answer to the following items for the least:

- Have a delimited perimeter.
- Create log files, analytics.
- Ask participants to complete feedback forms.

The experiments of the Smart City Service scenarios, applications and services (both past and future):

Date	Site	Scenario
September 2013	Berlin	On site visit
October 2013	Brest	Local information and recommendation
November 2013	Brest	Local information and recommendation
December 2013	Brest	Device to device
February 2014	Cologne	Social Network
February 2014	Barcelona	Local information and recommendation
March 2014	Berlin	On site visit
April 2014	Berlin	On site visit
December 2014	Brittany	Festival
February 2015	Barcelona	On site visit
February 2015	Lancaster	On site visit
March 2015	Barcelona	Merging and enriching content, Real time social networks activity
May 2015	Berlin	Activity and context aware POI and action recommendation
May 2015	Cologne	Transit Experience

For better readability, metrics are directly given within each scenario (2.2.x).

1.2 - Terminology

Application or **Application software** — Software layered on top of one or several platforms for realizing some (presumably) useful tasks for end-users.

Architecture — A structure of functional elements organized in a given way and presenting well defined interfaces.

Enabler — Software module or web service providing well-specified functionalities, 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.

Functional requirement — Either calculations, technical details, data manipulation, processing or other specific functionality that define what a system is supposed to accomplish.

Generic Enabler — An enabler realized by the FI-WARE project or its follow up sustainability project.

Platform — A comprehensive combination of technology infrastructure and - Generic and 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,
- An area: a public garden,
- A journey: a hiking trail.

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 FI-CONTENT2 project. Specific Enablers may be layered on top of, or otherwise make use of, Generic Enablers. Please refer to the definition of a FIcontent SE from deliverable D6.1 Architecture specification.
Interface	The connections between domains (or sub domain or functional elements) serving the actor's actions by exchanging information.

1.3 - Cooperation with other FI-CONTENT platforms

Deliverables 2.1 (Social Connected TV), 3.1 (Smart City Services) and 4.1 (Pervasive Games) share commonalities at many levels. For example, Augmented Reality may be equally applicable to tour guides as it is to games. A second connection, is the social component which requires synchronisation of multiple users using hand held devices or TVs. For example, while such synchronisation is potentially across multiple devices in D2.1, it is also useful for synchronising the view of AR across multiple users for D3.1 as well as D4.1. Further, new ideas such as leader-boards for gaming are potentially applicable to gamified tour-guide scenarios. As an example, one of the field tests held at Aulani Hotel in Hawaii was using reality mixer in a tour guide application, combined with an element of gameplay. Finally, at the core of providing a credible AR experience lies the ability to track objects in video at real-time. The advanced UI GE's provide such 3D web and tracking for points-of-interest. For example, the POI Data Provider GE is a key component in many tour-guide applications as well as games. Thus, the design of the GE's is versatile and ties the scenarios proposed in the three deliverables together at the level of functionality.

WP3 and WP2 Social Connected TV also cooperated in the on site visit scenario. This cooperation sees WP3 integrate the Second Screen Framework, developed in WP2, into the SCG app. This was used to create a connection between the SCG app on TV and mobile device, and was applied in the experiments during the Berlin Fall of the wall 25th anniversary in November 2014.

2 - SCENARIOS

2.1 - Overview

The following scenarios are user-centred use cases demonstrating and designed to be as concrete as possible to bring new services and applications to non-technical end users. They may take advantage of one to several Enablers.

2.2 - Description

We now have the eight following scenarios:

- Scenario 1 “On site visit” is based on the outputs of a HTML 5 Smart City Guide application focused on multi-devices and end user contribution capacities.
- Scenario 2 “Social Interactions” focused on user’s interaction in special interest groups.
- Scenario 3 “Merging and enriching content” focused the fusion of multiple datasets from different data providers.
- Scenario 4 “Real Time Social Networks activity” focused on displaying and evaluating real-time social network contributions.
- Scenario 5 “Activity and context aware POI and action recommendation” focused on real-time activity and context aware recommendations.
- Scenario 6 “Festival” focused on adding real-time, social, and AR technologies to serve festivals.
- Scenario 7 “App generator city guide” focused on allowing anyone to create his own city-guide app.
- Scenario 8 “Transit experience” focused on the introduction of BLE Beacon services in transports.

2.2.1 - On site visit scenario

Category/topic/context	“On site visit”
Owner(s)/contacts	Robert Seeliger (FhG/FOK), Chris Krauss (FhG/FOK), Miggi Zwicklbauer (FhG/FOK)
Abstract	Creating interactive content on SCG tour
Detailed description	The goal of the “on site visit” scenario is to aggregate personal user generated city data during a trip. Smart City Guide users can use their mobile devices like tablet or smartphone, or organize trips on a PC. The mobile version of the SCG is designed to be used during the trip. It is a web application running on modern HTML5 compatible browsers on iOS, Android and Windows devices. The displayed Points of Interests (POI) are aggregated from the Open City Database (OCDB) SE. The 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). The OCDB includes some of the Europeans capitals with their name, country, latitude and longitude, a city description and attached media files, like images or movies, and related POIs. Through the SCG Web-App, including the OCDB, the user gets access to information about Points of Interest in a city. A POI object contains name, description, media files, latitude and longitude, contact information, opening hours, fee, city information and the category of the chosen POI. The user can view Points of Interests (POI) on a map, in a gallery view or as a list. During the trip the user can use a smartphone or tablet to create and update POIs. One kind of update is to add new media, e.g. photos, to a POI. All mediafiles in a POI are displayed in the gallery view. With the Content Enrichment SE the user can add further information to interested sections in a mediafile. The preparation of a trip can be done on a smartphone, tablet or PC. The user creates a SCG account in the app and enters a set of criteria for an up-coming trip, for example, an area (a city or a specific section on the map), a budget and a time interval (specific dates or times). With this information the Recommendation as a Service enabler (RaaS SE) suggests different routes for the user. The user could, for example, receive three trip suggestions for three days. The first one being a walking route showing all important sights in the area near the hotel. The second one shows routes to a local event on the second day and the last route recommends renting a car in order to visit some districts at the other end of the city. For recommend a more personal trip, the SCG got some social components like rating, comment, like or check in thru a POI. User generated content like comments, social recommendations or interactive content can be added to existing POIs through the Web App based on functions provided by Content Enrichment SE.

Planned experimentation		
01.	Experimentation site(s) Estimated schedule Maturity of implementation Content, provider, availability	Berlin 1st experimentation cycle (IFA trade fair Sep. 2013, Lab trials March 2014) Concept, lab test, Existing content from Open City Database provided by FhG/FOK and UGC taken by visitors via the app
02.	Experimentation site(s) Estimated schedule Maturity of implementation Content, provider, availability	Barcelona April 2014 Field Trial Existing content from Open City Database provided by FhG/FOK and UGC taken by visitors via the app
03.	Experimentation site(s) Estimated schedule Maturity of implementation Content, provider, availability	Barcelona February 2015 Field Trial Crowd sourced creation of user generated content (e.g. POIs, media related to POIs, social recommendations / comments) using Content Enrichment SE and RaaS SE. Content aggregation and storage via Open City Database SE .
04.	Experimentation site(s) Estimated schedule Maturity of implementation Content, provider, availability	Lancaster February 2015 Field Trial Crowd sourced creation of user generated content (e.g. POIs, media related to POIs, social recommendations / comments) using Content Enrichment SE and RaaS SE. Content aggregation and storage via Open City Database SE .

Functional requirements and their candidate enablers

Functional requirement		*Candidate enabler*	*GE/SE/Gap*
01.	Browse, show and add a Point of Interest; Like, check in, comment on and rate a POI	Open City Database	SE
02.	Plan a trip	Recommendation as a Service	SE
03.	Add media (photo/video) to a POI	Object Storage	GE
04.	Enrich media with further content	Content Enrichment	SE

Justification for inclusion		
01.	Audience and cultural criteria / justifications	• provides the user with more information on various European cities • user extend the database with content (POIs, pictures, comments, check ins, ratings, information) • smart travel guide with personalized recommendations before, while and after a journey • easier way to explore a known or unknown city
02.	Academic criteria / justifications	• looking for open content to enrich the POI database • automatically generate information (public transport, opening hours, etc.) add by USG • research how users interact with a digital city guide using their smartphone, tablet or PC • Gather results on which content parts should be displayed where? • Gather results on how to present the content? • Gather results on interaction paradigms?
03.	Commercial criteria / justifications	• creates new business models for museum, restaurant, sightseeing, theater etc.

Performance requirement	
Type	*Requirement*
Hardware	
Software	The Smart City Guide Web App runs on a node.js server located at Fraunhofer FOKUS in Berlin. The web app needs a stable and robust Internet connection (3G, LTE, Wifi) on mobile devices in an HTML5 browser. Without this or with a lower connection (like EDGE) the app itself and the communication between the app and integrated enabler (Open City Database SE, Content Enrichment SE, Recommendation as a Service SE and Object Storage GE) will be interrupter. A minimum level of administration rights is required allow users edit entries and to help prevent abuse of the system. A user ID is required to add a Point of Interest to the Open City Database. This ID is also necessary to write, delete or edit a POI in the database. For example, apart from the OCDB administrator, only the owner of the POI can delete it in the Open City Database or any User can modify any public user generated POI.
Miscellaneous	The SCG Web App receives its cities and Point of Interest data from the Open City Database. This database deployed at Fraunhofer FOKUS needs qualitative and quantitative data. The structure of a POI in the Open City Database should have a unified format (JSON format).

A minimum of information must be defined to ensure any new POI entries by users are relevant, i.e. each description must contain sufficient information to make it useful to other users. To add a POI in the SCG app the user has to edit a form with required fields like name, description, position (latitude, longitude), city, category, public or private and a photo. The photo is taken by the integrated camera of the mobile device or uploaded on a locale placed picture of the mobile device gallery.

Screenshots:

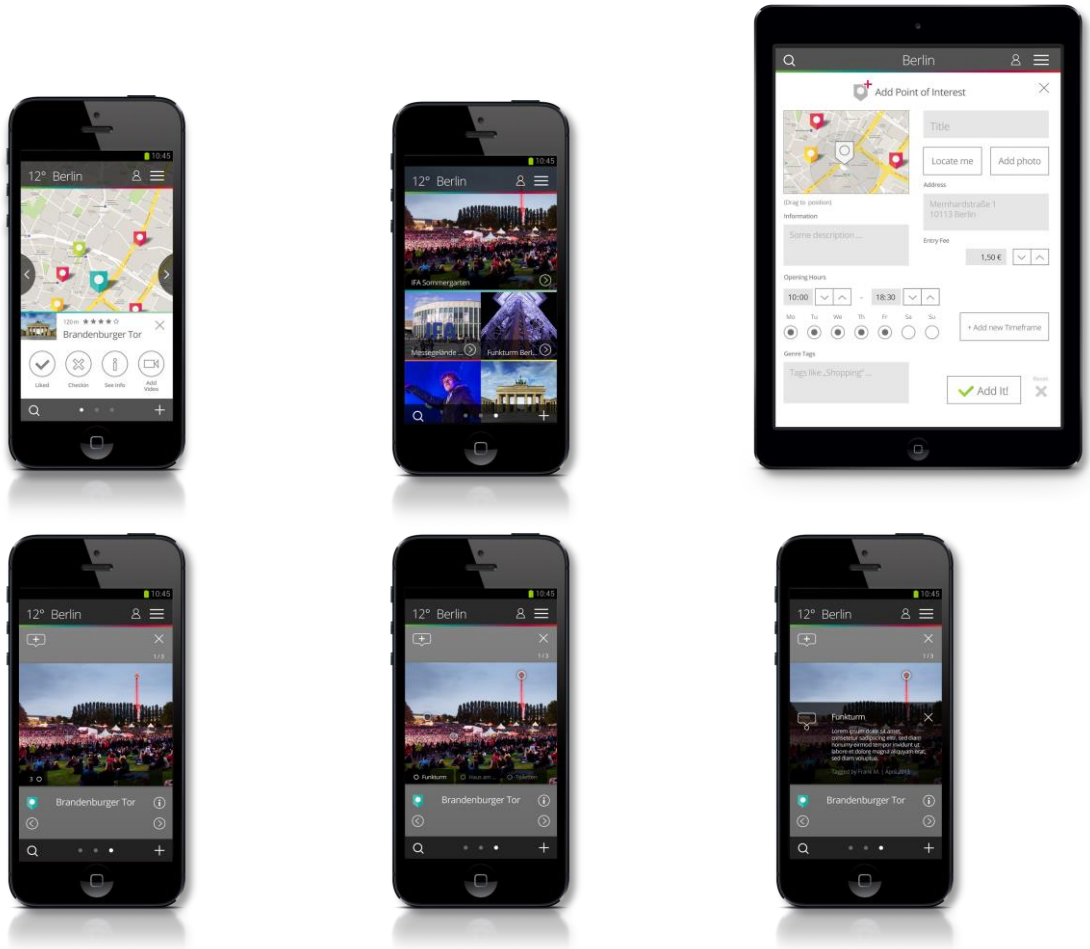


Figure 1: UI of the Smart City Guide on a smartphone

2.2.2 - "Social Interactions" scenario

Category/topic/context	Framework to establish social networking functionalities
Owner(s)/contacts	Dirk Krause (PIX)
Abstract	The "Social Interactions" scenario is enabled by the Social Network enabler, a middleware that can be used to create a social network, either temporarily or permanently for a group of users.
Detailed description	It provides the functionality of social interactions in the digital world (like posting status messages and images) apart from the major, proprietary social networks (like Facebook). It is particularly useful for intra- or extranet based social networks since users maintain the sovereignty about their own data.

Planned experimentation

01.	Experimentation site(s)	Cologne
	Estimated schedule	March 2014
	Maturity of implementation	Small scale experiment, working prototype.
	Content, provider, availability	Carnival experiment with server parts hosted at FI-LAB

Functional requirements and their candidate enablers

	Functional requirement	*Candidate enabler*	*GE/SE/Gap*
01.	User social network management	Social Network	SE
02.	Identity management	Identity Manager	GE

Justification for inclusion

01.	Audience and cultural criteria / justifications	The Social Network Enabler is targeted towards use cases that require social network capabilities in software infrastructures and political environment that excludes or forbids the usage of the big corporate proprietary networks (like Facebook). Since the SNE is free and open source, maintainers and end-users won't be forced to give their personal data to the big social media networks. This is particulary important for end-user groups of non-adults (e.g. pupils).
02.	Academic criteria / justifications	The SNE helps to enable and measure a set of social interaction tools for the end-users. The research conducted on the user data is abstracted from personal data and evaluated in a qualitative way.
03.	Commercial criteria / justifications	The very liberal, open source MIT licence makes it easy for SMEs to use the software without limitations.

Performance requirement

Type	*Requirement*

Hardware	Cell phone of Nexus 5 class-type
Sofware	Android 4.4.2
Miscellaneous	- Number of concurrent users: 20 in small scale, 1000 in large scale. - Bandwidth per hour per client: 100 MB - Time to onLoad event: under 2 seconds - UI quality perception by end user: better or equal to 'good' - Overall quality perception by end user: better or equal to 'good'

List of functionalities:

- I connect to the SNE
- I disconnect from the SNE
- I access status messages
- I post status updates (text, images, etc.)
- I follow users
- I comment on posts
- I 'like' posts

Screen shots

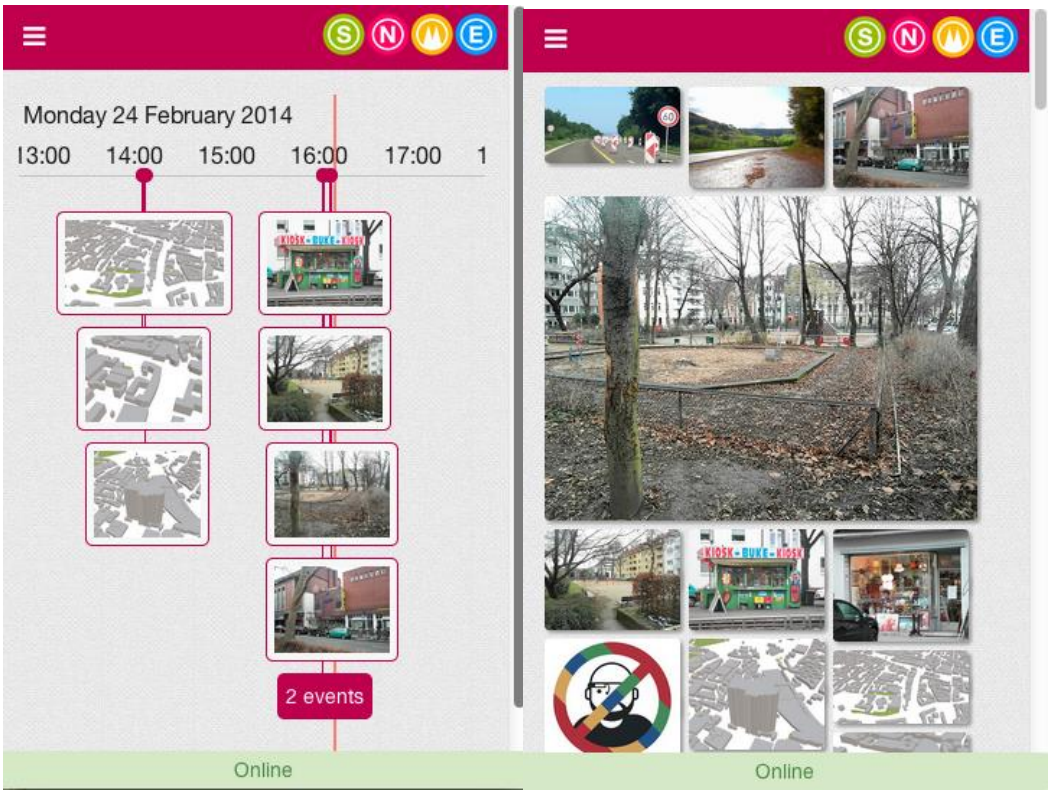


Figure 2 Social network app screen shot

2.2.3 - Merging and enriching content scenario

Category/topic/context	Tool to provide enriched information about POIs
Owner(s)/contacts	Benjamin Molina (UPVLC)
Abstract	The data fusion scenario is linked to the Fusion Engine enabler, the POIProxy enabler and the OCDB specific enabler. The FE is a middleware used for building OCDs from multiple input data sources. The user has therefore the perception of accessing a repository of enriched POIs, with more accurate date and even removing (or at least reducing) the duplication of POIs. The POIProxy enabler allows user to access social activity around an area or certain relevant POIs. The OCDB enabler facilitates the involment and participation of users by inserting comments, ratings and chekins that may link to POIs
Detailed description	The FE merges information arriving from multiple input data sources into a single one, providing a single access point for enriched data to the user. The FE works also with POIProxy to link (semi)static data with live (real time) data from social networks. Therefore a user can access not only static POIs (e.g. monuments) but also current data that is being produced in the vicinity of a given place (e.g. pictures, twitters, etc.) The user can filter POIs by category or relevance to access only those POIs that match his/her needs. The user can also search for services related to a particular POI (e.g RSS feeds) Though the FE is a backend service there is a sample app deployed in Valencia as demo to show how a user accesses the merged data.

Planned experimentation

01.	Experimentation site(s)	Valencia
	Schedule	March 2015
	Maturity of implementation	Working prototype.
	Content, provider, availability	Valencia demo.

Functional requirements and their candidate enablers

	Functional requirement	*Candidate enabler*	*GE/SE/Gap*
01	Data fusion	Fusion Engine	SE
02	Data provisioning	POIProxy	SE
03	User participation	OCDB	SE

Justification for inclusion

01.	Technical criteria / justifications: • Multiple sources aggregation, • POI duplication avoidance • Single interface towards apps	Normal users just want to access a single service that wraps and provides all data related to a POI, instead of a tedious lookup in multiple sources.
02.	Academic criteria / justifications	It is difficult to provide to users single UIs that merge different kinds of information in single app in a simple way to be attractive.

03.	Commercial criteria / justifications	The Apache open source licence makes it easy for SMEs to use the software without limitations.

Performance requirement	
Type	*Requirement*
Hardware	Cell phone: Android (SDK 19 support). iOS also supported as the app has been built using the Ionic framework

List of functionalities:

- I select static content (e.g. Fallas content) through the Fusion Engine:
  - I can sort the obtained POIs
    - By category
    - By location
    - By any other piece of common property available in that POI type
  - I can access detailed information of the given POIs
  - I can place the POIs on a map
  - I can search for dynamic content related to that POI
    - Social activity in the vicinity (link to POIProxy and social networks)
- I select dynamic content (e.g. social activity) through POIProxy
  - I can see the latest information (e.g. tweets, images, etc.) in a certain location (typically my position)
  - I can represent heat activity maps in a city

Screen shots (mobile app)

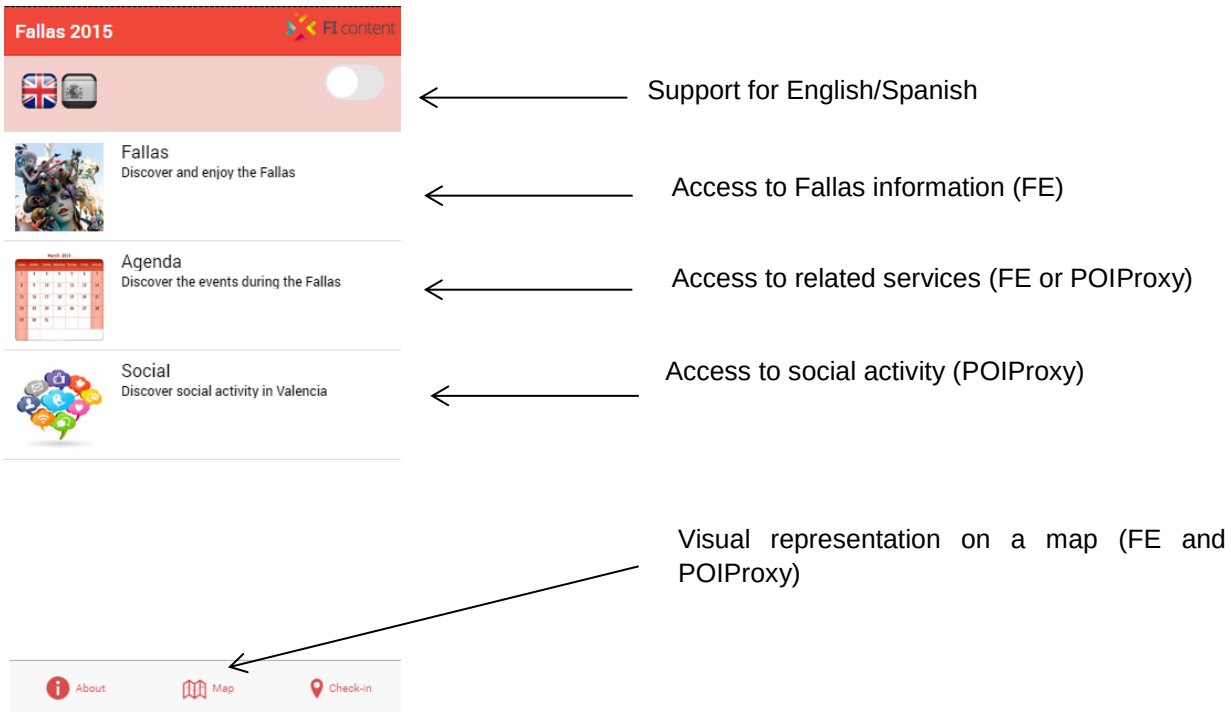
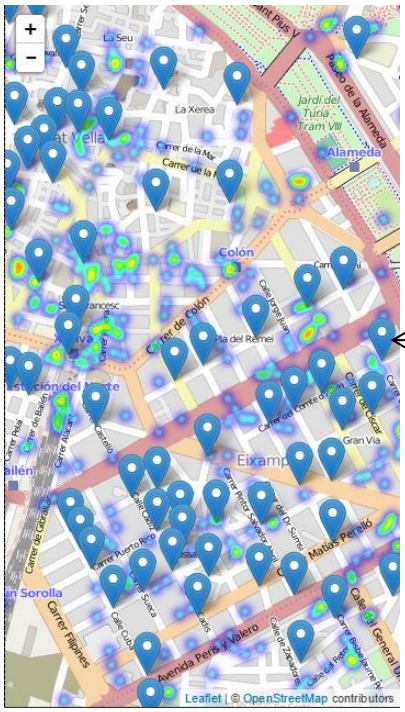
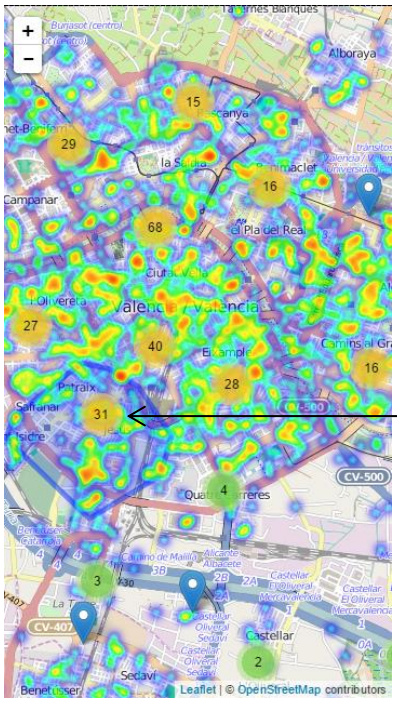


Figure 3 Initial screen of Fallas app



Single POI representing a Falla (monument). Clicking on it provides detailed information (accessing the FE). The FE provides also related POIs in the vicinity (hotels, museums, etc)

Figure 4 POI representation in Fallas app



POIs grouped under a certain polygon due to social activity (POIProxy). Making further zoom provides single POI view

Figure 5 Social heat map in Fallas app

2.2.4 - Real Time Social Networks Activity Scenario

Category/topic/context	City guide, social networks
Owner(s)/contacts	A. Romeu, M. Montesinos (PRO)
Abstract	What's happening and what places of interest are around me?
Detailed description	Currently there are lots of social networks where regular people can share their thoughts, opinion, photos or videos, related to any event that is taking place, a location, a situation, etc. Some of these social networks are mass market oriented (Twitter, Instagram, Foursquare), others are niche market (Meetup and many others) but all of them provide information that visualized together can help to know what's happening right now around me. A nice visualization can be a "heatmap" where locations with more "social activity" (people is sharing more photos, videos, comments) are highlighted. In this way, citizens or tourists coming to a new city are able to identify real time events that are happening in the city in order to "join the party" or just "avoid it" directly from a map view. Other nice visualization can be a real time gallery of photos and videos taken by people directly from a concert, a festival, or any event. So other people (assistants or not) can get a real view of what's happening there. A part from this, there are lots and lots of public services that provide points of interest or information (weather, events, monuments…) related to places. Having a single endpoint to get all this data makes possible to enrich existing city guides. Providing tools for third parties to include this information into their applications is also a point to take into account.

Planned experimentation		
01.	Experimentation site	Barcelona
	Estimated schedule	March 2015
	Maturity of implementation	Live experimentation during large scale event
	Content, provider, availability	Real time social network data to create heatmaps and other activity maps related to Fallas (monuments in the city)
02	Experimentation site	Tenerife
	Estimated schedule	May 2015
	Maturity of implementation	Small scale experiment, working prototype.
	Content, provider, availability	Social content to enrich the VIA-MOVIL content
03	Experimentation site(s)	Transmusicales de Rennes
	Estimated schedule	December 04-07. 2014
	Maturity of implementation	Working prototype
	Content, provider, availability	Real time social network data to create a photo gallery of the event

Functional requirements and their candidate enablers		
Functional requirement	*Candidate enabler*	*GE/SE/Gap*

01.	Real time social networks content access and other POI sources	POIProxy	SE
02.	POI storage	OCDB	SE
03.	Heatmaps rendering	GIS Data Provider – Geoserver	GE

Justification for inclusion		
01.	Technical criteria / justifications:	Non existing APIs to access non-standard POI services Need of a single API to access different social networks API either real time or not Caching and indexing data in real time
02.	Academic criteria / justifications	Explore new user interfaces and APIs to access and visualize huge amounts of data in real time
03.	Commercial criteria / justifications	The Apache open source licence makes it easy for SMEs to use the software without limitations.

Performance requirement	
Type	*Requirement*
Hardware	Cell phone of Nexus 5 class-type, Ubuntu server
Sofware	Apache Tomcat 6.0 or higher, POSTGIS
Miscellaneous	- Number of concurrent users: 50 in small scale, 1000 in large scale. - Overall quality perception by end user: better or equal to 'good'

List of functionalities :

- View photos, videos, comments around me
- Visualize a heatmap representing hot spots where people is sharing contents through social networks
- View points of interest around me
- View events and other real time information (weather, bike parkings, etc.) around me

Screen Shots:

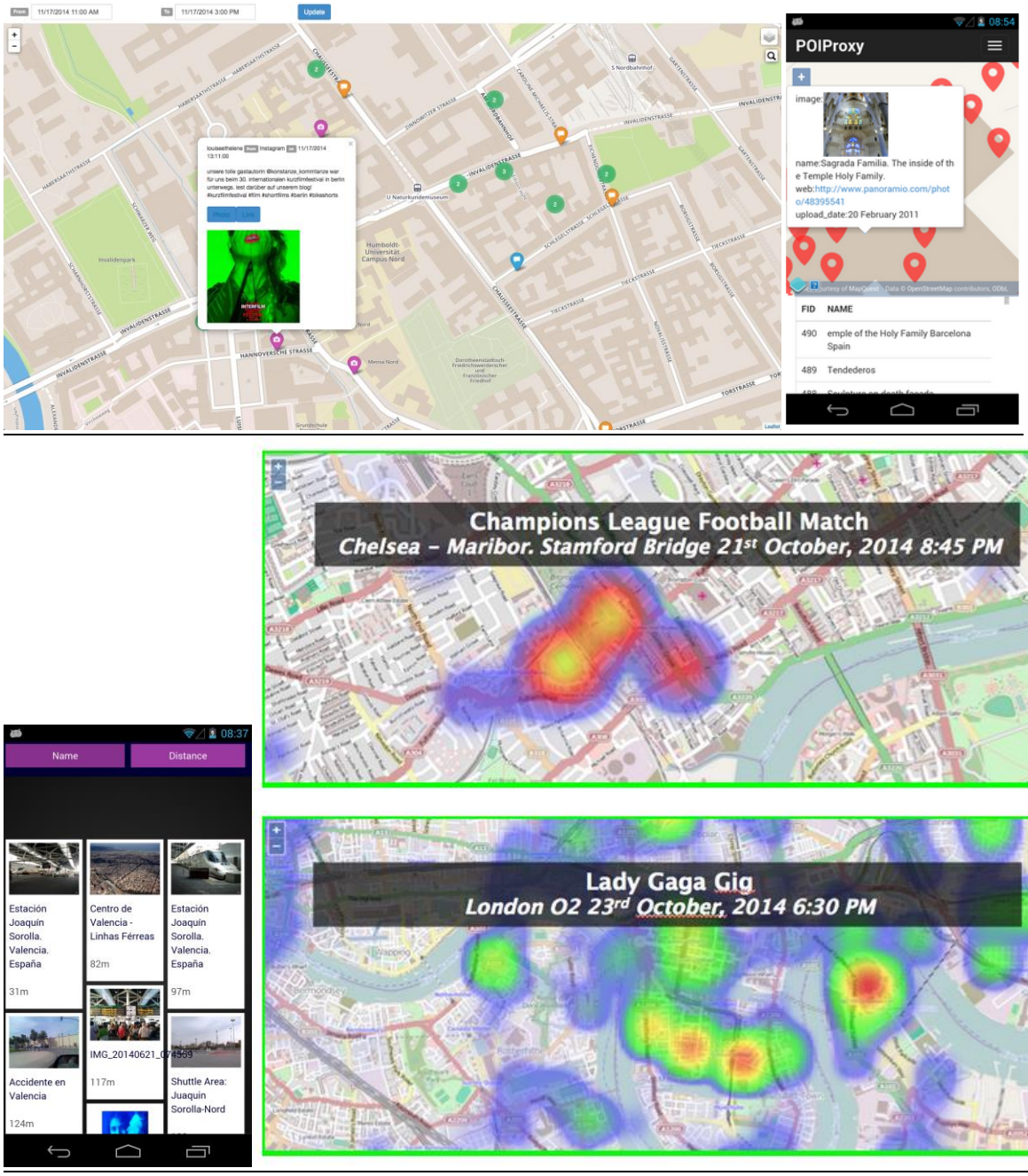


Figure 6 Real time social networks activity screen shots

2.2.5 - Activity and Context aware POI and Action Recommendation scenario

Category/topic/context	"Activity Aware POI and Action Recommendation"
Owner(s)/contacts	Dragan Boscovic (LCI), Milenko Tosic (LCI), Ognjen Ikovic (LCI)
Abstract	Providing user activity aware POI and action recommendation for Smart City guide-like applications and event-focused applications
Detailed description	The demo mobile application collects contextual and sensory data (GPS, accelerometer and surrounding WiFi networks) and provides map-like user interface presenting contextual and activity aware map overlays (POI and action recommendation placed on a map). The user interface also has a menu for manually selecting POIs of certain category to pre presented on top of the map of the area as well as triggering activity aware POI and action recommendation. The mobile application collects contextual and sensory data and sends them to the cloud service/platform. The cloud/server side of the use case comprises activity recognition machine learning model which, based on collected contextual and sensory data, classifies user's activity. The recognized activity class is then used for adapting the POI/activity recommendation matrix by adjusting weights of POIs and activities with certain attribute values. Activities and additional POIs can be defined by event organizers and application developers and collected from open databases, social networks and other web sources. The adapted POI/action recommendation matrix is used for deciding which POIs and actions to recommend to end users through the application's user interface. Event organizer can define different classes of actions to be recommended to users of event-focused application. These action classes should be put in correlation with activity classes as well in order to speed up the unsupervised learning process of the machine learning model used for constructing proper recommendation matrices. Mobile user installs the application and registers for the service (automatic registration of the mobile application onto the server/cloud services for activity recognition and recommendation). If the application is a generic smart city guide, contextual and sensory data collected from the user through application utilization and from open city databases would be used for classifying user's current behaviour/activity/context. Based on the learned correlation between user activity/context classes and different classes of POIs in the city, context and activity adapted POI recommendation will be provided to end user. More users use the application the unsupervised learning model for correlation between POI and activity classes will have faster learning curve which will lead to better POI recommendation. If the application is developed for a particular event within a city, the event organizers would participate in definition of event-specific POIs and actions as well as correlation between users' activity/context and POI/action classes in order to speed up the learning processes behind the application. The server/cloud side of the solution will provide real time activity and user context recognition/classification and trigger activity and context aware event-related POI (i.e. music festival stage, ticket sale offices, event related parties and gatherings, food stands etc.) and action (go to particular event POI now,

	switch waiting lines, hydrate yourself) recommendation. Data collected from the application and users' feedbacks can be used by event organizers to better plan next events and proactively solve identified issues and challenges. Additionally, the context aware POI and action recommendation scenario is also applicable to smart city transportation service providers (i.e. taxies, coaches, shuttles etc.). City transportation providers (taxis, coaches, busses, shuttles and tourist tours) are very flexible when compared to public transportation (i.e. city metro) in a sense that they can adapt their routes, their offerings and travel plans to accommodate client's needs. However, addressing the needs for every client is a cumbersome job which often leaves impression of intrusion into client's privacy. What city transport service providers need is a service and/or platform which offer them comprehensive insight into contextual information regarding clients' profiles, needs and preferences. This scenario will promote business potentials of cooperation of city transportation service providers with other service providers (i.e. hotels, restaurants, tourist sites, museums, galleries, shops etc.). We start from the fact that city transportation services (taxis, coaches, hotel shuttles and tourist tour busses) are the first city service used by majority of visitors as well as citizens on their way to reaching desired destination. Therefore, transportation service is in unique position to provide its users with recommendations on where to go and how to further utilize city resources and provide them with POIs. This potential of city transportation service can be used by other city service providers to promote their service offerings and attract new clients/customers/visitors through personalized offers, discounts and opportunities. We are implementing voucher-based system for POI recommendation for users of city transportation services who use Smart City Guide-like application. Transportation service for driving passengers to and from city airport provides recommendation for POIs (events, hotels and restaurants etc.) in the current city or in the city to which the passenger is traveling. Users of the experimental mobile application will receive personalized recommendation while other passengers will receive recommendations based on collective users' behavior and preferences (knowledge derived through previous recommendations and profiling). Passenger can download recommended vouchers (one or several) and use them in hotels and/or restaurants recommended by the city transportation service provider.
Planned experimentation	

01.	Experimentation site(s)	Berlin (Novi Sad, Belgrade and Chicago)
	Estimated schedule	May 2015
	Maturity of implementation	Demo validation/ controlled live validation with selected groups of users. Validation with small scale music and art festivals. Validation with real city transportation service provider.
	Content, provider, availability	Existing content from city databases, social networks and wiki pages. Event specific content provided by event organizer. POIs and vouchers defined by city transportation service provider.

Functional requirements and their candidate enablers

Functional requirement		*Candidate enabler*	*GE/SE/Gap*
01.	Collect contextual data from mobile devices	Context Aware Recommendation	SE
02.	Recognize end user activity and context	Context Aware Recommendation	SE
03.	Collect and classify POIs	POI Proxy	SE
04.	Store and access POIs and action descriptions related to events	POI Data Provider	GE
05.	Adapt recommendation matrix to identified activity and context	Context Aware Recommendation	SE
06.	Recommend POI/activity to end user	Recommendation as a Service	SE

Justification for inclusion

01.	Audience and cultural criteria / justifications	• Works in any city and can be easily adapted to specific events • Activity and context aware recommendations are the best way for providing adaptive and personalized services • No need for long questionnaires and interviews for profiling end users for enabling service personalization • Contextual city map overlays focus on event specific POIs and actions and ease user's orientation in urban environment and at city events
02.	Academic criteria / justifications	• Train and validate machine learning models for unsupervised classification of end user's activity and context • Validate new role of mobile devices and mobile applications as sensors for non intrusive collection of

		contextual data necessary for service provision adaptation and personalization • Investigate impact of different contextual overlays and their presentation on user's ability to orient in urban environment and at certain event
03.	Commercial criteria / justifications	• POI and action recommendation can be used for creation of new business models allowing different smart city service providers (i.e. transportation service providers and restaurant owners) to define joint offerings tailored to user's needs • Event organizers can create custom map overlays and define event-related actions and POIs. This allows organizers to guide application users/event attendees towards better service resource utilization

Performance requirement	
Type	*Requirement*
Hardware	Mobile devices for running application (Android and iOS based). Bluetooth Low Energy beacons for precise micro location derivation. Server/cloud platform for deploying/hosting server side of the solution.
Software	Android and iOS applications are based on Cordova framework and Cordova plugins for measuring and collecting contextual and sensory data. The application needs a stable and robust Internet connection (WiFi, LTE, 3G). Server/cloud platform needs to be able to host Python code and provide communication with POI Proxy and RaaS SEs over their REST APIs. It also needs to be able to host database for storing collected contextual data used for derivation of end user activity class.
Miscellaneous	Availability of data from the POI Proxy SE and social networks whose APIs this SE utilizes. A minimum of contextual and sensory information has to be provided by the mobile application in order for the activity recognition model to be able to derive end proper end user activity class. This minimum includes GPS coordinates, device characteristics, accelerometer and SSID of WiFi networks surrounding user's device. POI classes and activities need to be put in relation with activity classes through unsupervised learning process (the process is faster if there are more users and they use the provided service actively) and/or by specifically defining correlation during the use case realization.

2.2.6 - Festival scenario

Category/topic/context	Artistic Festival apps
Owner(s)/contacts	O. Duvoid, L. Ortola (eBiz)
Abstract	Delivering valuable apps to bring new services and create a new experience of festivals for both attendees and staff members.
Detailed description	The use case scenario demonstrates a set of four roles, for music festivals, using dedicated apps. It has two purposes: • To create a new experience for attendees. • To include different typologies of people and devices (crowds, staff, phones, tablets, screens) to make this experience live and meaningful using crowdsourcing. The use case that came out of this is very simple: Be able to know the affluence of each location and service of your festival at any time. Enable festival attendees to use augmented reality to move from one location to the other. Create valuable information on all festival screens, with real time updates, and monetize it with a dedicated space for your sponsors and partners. The five apps are detailed below, with the following codename: BT counting, for crowd counting at specific locations using Bluetooth. Contributor, for the festival staff. Stand, for all locations (Restaurants, bars, Merchandising…). Screen, displaying valuable information on all festival screens. EvenŦribe, for all public attendees. Details: Contributor: Volunteers and security staff are the key to a successful festival. They are at the heart of the festival and make sure everything goes well. EvenŦribe provides them with an amazing tool to improve their efficiency: they can send live messages to all screens and apps, and manage different crowdsourcing operations easily. Stand: The staff needs to be focused on their job: serving customers. Their app allows them to broadcast offers and messages to all attendees through screens, in a fast and intuitive way. Screen: Communication is great. In real time… even better. Festival screens become the true communication tool they should have been since the beginning. Enable the broadcast of real-time updates, display social feeds, see the following shows and venues, show your festival map and advertise your partners and sponsors. EvenŦribe: A festival is way more than concerts. Let the attendees benefit of a ground-breaking immersive experience through the app: Augmented reality view, real time updates, social feed, schedule... BT counting: Organizers need to know how the different festival locations are crowded in order to ensure attendees security and make their festival as comfortable as possible. BT counting provides them with a very simple and secure tool to count number of people at specific locations, based on counting the number of detected Bluetooth devices. Using the App Generator SE and MBTiles Generator, such an ecosystem (the four apps and the backend) can be created and generated within

	minutes, in just a few clicks.

Planned experimentation		
01.	Experimentation site(s)	Brittany
	Schedule	December 04th to 07th 2014
	Maturity of implementation	Final deployment, concept validation
	Content, provider, availability	Existing content from collaboration with the festival NPO and GreenCopper (official app provider)

Functional requirements and their candidate enablers			
	Functional requirement	*Candidate enabler*	*GE/SE/Gap*
01.	Social feed	POI Proxy	SE
02.	Augmented Reality View	POI Explorer	SE
03.	Cross-platform rendering of 3D content	3D-UI	GE
04.	Retrieve updates of relevant POIs	POI Data Provider	GE
05.	Visualizing georeferenced information of venue and surroundings	3D-Map Tiles	SE
06.	Customized georeferenced information of venue	GIS Data Provider	GE
07.	Counting number of attendees at specific locations	Content sharing	SE

Justification for inclusion		
01.	Audience and cultural criteria / justifications	• A music festival is not just concerts : it is also food, entertainment, and different services (bar, merchandising, ATMs, camping, shuttles, restrooms…). Often, this becomes a node of constriction and a potential danger for crowds as services are inequally used. The use case proposes a new approach and invites attendees to exploit less used locations. • There are many screens, projectors, and TVs in a festival and all around. They lack real-time information and cannot be advertised properly. The use case proposes a way to increase the value of those screens and make them marketable for sponsors and partners.
02.	Academic criteria / justifications	• Festivals are in constant search for new technologies to crawl the youngest generations. Augmented Reality, real time information represent an obvious interest for them. • Festivals are always on a tight budget, as most festivals are managed by NPOs. Bringing new services to advertisable

		spaces will enable to create new sources of income. • Understanding the crowd mobility and interactions between visitors using terminals has been and is of interest of a large research community, in networking and social domains.
03.	Commercial criteria / justifications	Thousands of festivals take place every year. Pre and post Feedback from both the organizers of Transmusicales and the attendees is very promising.

Performance requirement	
Type	*Requirement*
Hardware	Screens: Any TV, VideoProjector with HDMI port. An Android HDMI key.
Sofware	Apps: Android >= 4.0 iOS 8
Miscellaneous	In terms of technical performance, the main backend has been tested for all profiles: Attendees and staff, and eventribe has been certified by the Gatling stresstool. 100% success rate is guaranteed for up to 3000 concurrent users and 100 concurrent administrators for only one server. Acceptable response time (<0.1s) is optimal for XXX concurrent users and XXX concurrent administrators.

Scenario	Load: 500 users and 50 admins 1x Ramp of 500 users over 30 seconds each doing 6 requests (of different services) for 40s. 1x Ramp of 50 admins over 40 seconds each doing 4 post requests over 15s	Load: 3000 users and 100 admins 3x Ramp of 1000 users over 5 seconds each doing 6 requests (of different services) for 40s. 25x Ramp of 4 admins over 40 seconds each doing 4 post requests over 15s
Server	Eventribe production	Eventribe production
Total response success	100%	100%
Resp time (min - max - mean) in ms	4-134-**8**	10 - 1140 - **839**
Charge Server	Low (<25%)	Medium (<50%)

List of functionalities :

Screen :

- I see the live map with the affluence level of all services and locations.
- I see logos and adverts.
- I see the planning and venue of the current and next shows.
- I see the news feed the staff decided to put on.

Staff / Contributor :

- My staff or volunteers update the status of each location.

- I can push featured news and update the screen's news feed.

Stand :

- I can identify my location with a QRCode.
- I can push updates with a very simple 3 button UI.

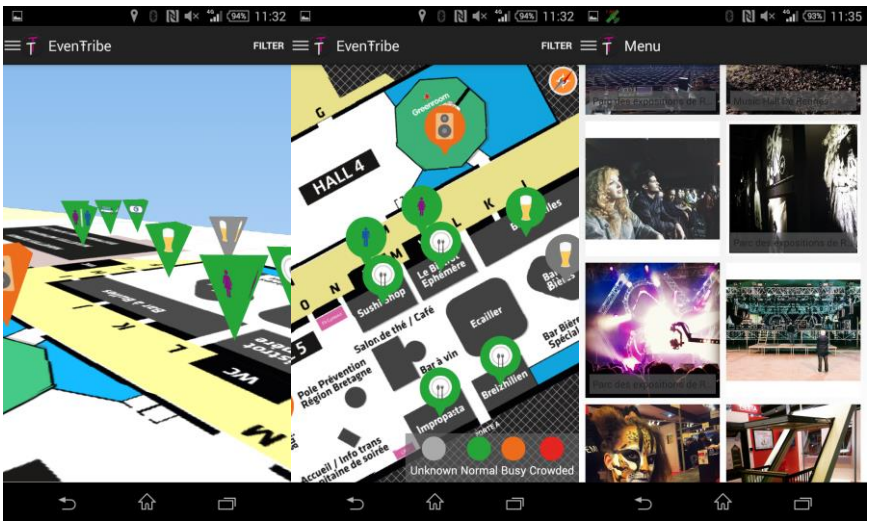
EvenŦribe :

- I see the live map with real-time info overlays around my location.
- I can launch the augmented reality view of the map.
- I witness what people are putting on social networks during the festival.
- I check the current shows, and the ones coming right next.
- I see a planning of all the shows of my festival.
- I see my partners logos and a QRCode to share the app with my friends.

BTCounting :

- I can detect attempts to connect to the BT access.
- I can estimate the number of persons around the BT access in real time.

Screen shots:



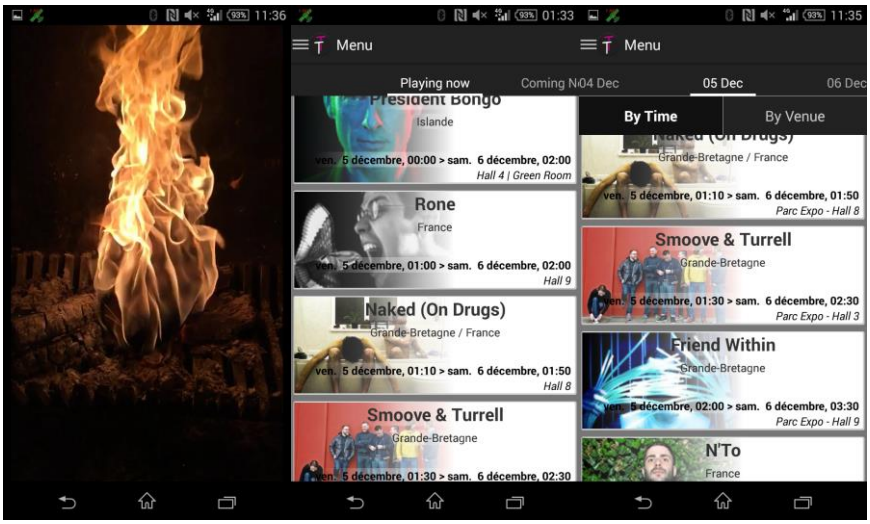


Figure 7 Eventribe screen shots

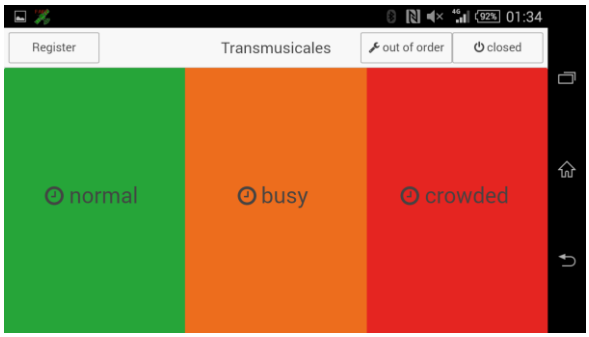


Figure 8 Eventribe Stand screen shots

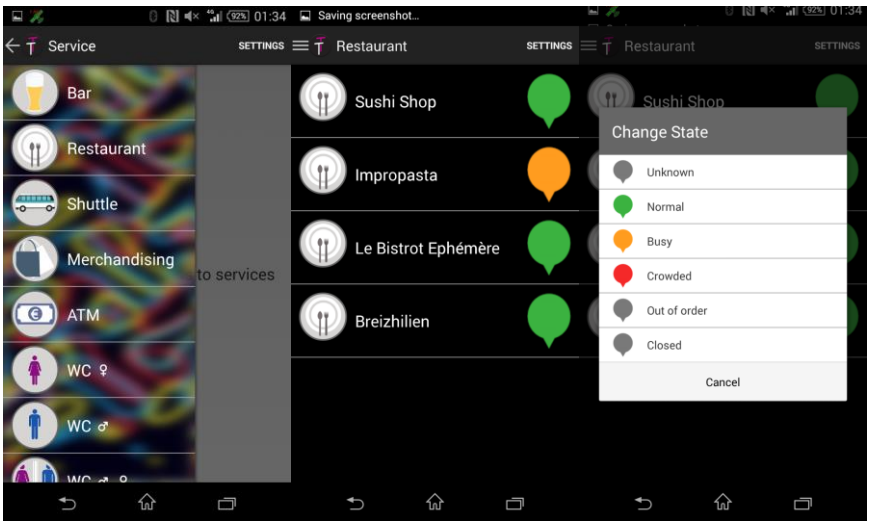


Figure 9 Contributor screen shots

2.2.7 - App Generator City Guide Scenario

Category/topic/context	City Guide, Mobile App Generation
Owner(s)/contacts	O. Duvoid, L. Ortola (eBiz)
Abstract	A single themed city application
Detailed description	Creating a city guide or a POI related app can be useful whether you are a local authority, a citizen, a merchant or even a SME. Strengthened by the fact that cities are now producing many datasets of OpenData, creating such apps are becoming less challenging in terms of content. The difficulty that remains is mostly technical: how can we build such an app at an affordable price. Using the Smart City Portal, anyone can easily create an application including any opendata or custom datasources. Content and service providers can also offer services to their customers to generate their personal app using the relevant provided content (i.e. Bike rental service let its customers generate a tour guide with preloaded traces). Use case: The city of Brussels wants to create its own official tourism application for residents and tourists. Using both custom datasets provided by locals and OpenData, they have all necessary content at their disposal (public places, restaurants, shops, museums, hotspots...=). Using the DesignMyApp portal, they can create their own Brussels city guide app, in just a few clicks. Customizing the app icon, name, loading splashscreen, POI is only a matter of seconds. Through the generated app, anything you can do in a City Guide is already possible: Browse your POIs, add POI filters, search through existing POI data, show POI images etc...

Functional requirements and their candidate enablers		
Functional requirement	*Candidate enabler*	*GE/SE/Gap*

01.	App Generator	App Generator SE	SE
02.	OpenData Provider	ODS, OCDB	SE
03.	Augmented Reality View	POI Explorer	SE
04.	Cross-platform rendering of 3D content	3D-UI	GE
05.	Retrieve updates of relevant POIs	POI Data Provider	GE
06.	Visualizing georeferenced information of venue and surroundings	3D-Map Tiles	SE
07.	Customized georeferenced information of venue	GIS Data Provider	GE

Justification for inclusion		
01.	Audience and cultural criteria / justifications	Cities, SMEs, NPOs don't have the means nor the skills to create their own cityguide apps. By using the app generation, we can provide them with a solution to create such apps and come up with new concepts and real use cases.
02.	Academic criteria / justifications	App generation is the only way to achieve low cost app creation. It allows non technical users to create their own apps on-the-fly, without any need for human intervention.
03.	Commercial criteria / justifications	Multiple business cases can be imagined using app generation scenarios.

Performance requirement	
Type	*Requirement*
Hardware	N/A
Sofware	City Guide: Android > 2.3
Miscellaneous	The App Generator engine is fully scalable and completely stateless. Infinite instances could be imagined to answer to real QoS challenges.

List of functionalities :

- I can customize my icon, splashscreen, application name, and insert my own datasets, images…
- I can input geolocalized data from : OpenData web services, any other JSON web services, Google Spreadsheets, JSON or CSV files
- I can add Trace data from GPX files
- I am notified when near different Points of Interest
- I can synchronize my Data
- I can use Augmented reality
- I can use the in-App Search engine
- I can use the data displayed

Screen Shots:

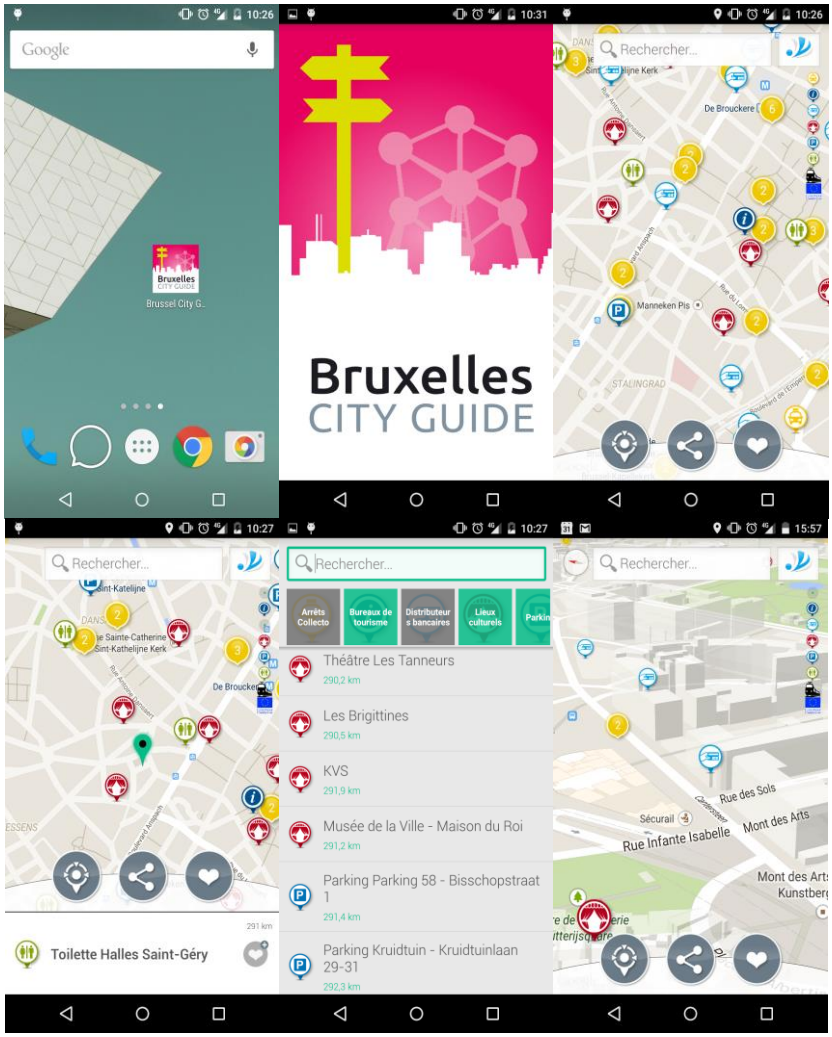


Figure 10 Application city guide screen shots

2.2.8 - Transit Experience Scenario

Category/topic/context	Transit Experience Scenario
Owner(s)/contacts	Pablo Martín (MTSA)
Abstract	Bringing new geo-localized services based in BLE technology, and improve the experience of current VIA-MOVIL App transit users.
Detailed description	The scenario include: • The instalation of BLE beacons both inside the vehicle 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 user experience 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

Target users:

 Visually impaired person  Tourist or foreigner  Regular user

The use cases that came out of are:

What is the name of this stop?	
When does the next tram arrive?	
Is there any incident in the line?	
Which one is this tram?	
Where is this tram going?	
Can I validate my trip without reading the QR code?	
Which Points of Interest are during my trip?	
Has this user validated the trip?	
Which Points of Interest are in the next stop?	
Is there any discount in shops around the next stop?	
Is there any interesting event this week?	
In which stop this user got off the tram?	
Which transfers with the bus do I have in this stop?	

Planned experimentation

01	Experimentation site(s)	Cologne (Tenerife)
	Estimated schedule	May 2015
	Maturity of implementation	Small scale experiment, working prototype.
	Content, provider, availability	Users of existing VIA-MOVIL application

Functional requirements and their candidate enablers

	Functional requirement	*Candidate enabler*	*GE/SE/Gap*
01	Data POI provisioning	POI PROXY	SE
02	Data fusion for POI and events	Fusion Engine	SE

Justification for inclusion

01.	Audience and cultural criteria / justifications	VIA-MOVIL system has more than 33.000 registered users and handles approximately 7.000 trips daily (16% of our daily demand). This percent is rising every month. The main profile of our existing users is a student or young people that use smartphone.
02.	Academic criteria / justifications	This Project will build a system based in a proximity service over Bluetooth 4.0 beacons technology. It provides customized experiences to app users depending on the beacon type detected, distance from the beacon, user profile, etc. The detection can trigger actions in apps, with content either stored in the app or from a cloud based CMS.
03.	Commercial criteria / justifications	This new system will be allocated on the existing VIA-MOVIL transit system already in exploitation in MTSA to accommodate new features and services.

Performance requirement	
Type	*Requirement*
Hardware	Cell phone with BLE technology
Software	Minimum Android 4.3
Miscellaneous	- Number of concurrent users: 200 in small scale. In large scale: all of our users with BLE compatible phone.

List of functionalities and target users:

What is the name of this stop?

When does the next tram arrive?

Is there any incident in the line?

Which one is this tram?

Where is this tram going?

Can I validate my trip without reading the QR code?

Which Points of Interest are during my trip?

Has this user validated the trip?

Which Points of Interest are in the next stop?

Is there any discount in shops around the next stop?

Is there any interesting event this week?

In which stop this user got off the tram?

Which transfers with the bus do I have in this stop?

Screen shots:

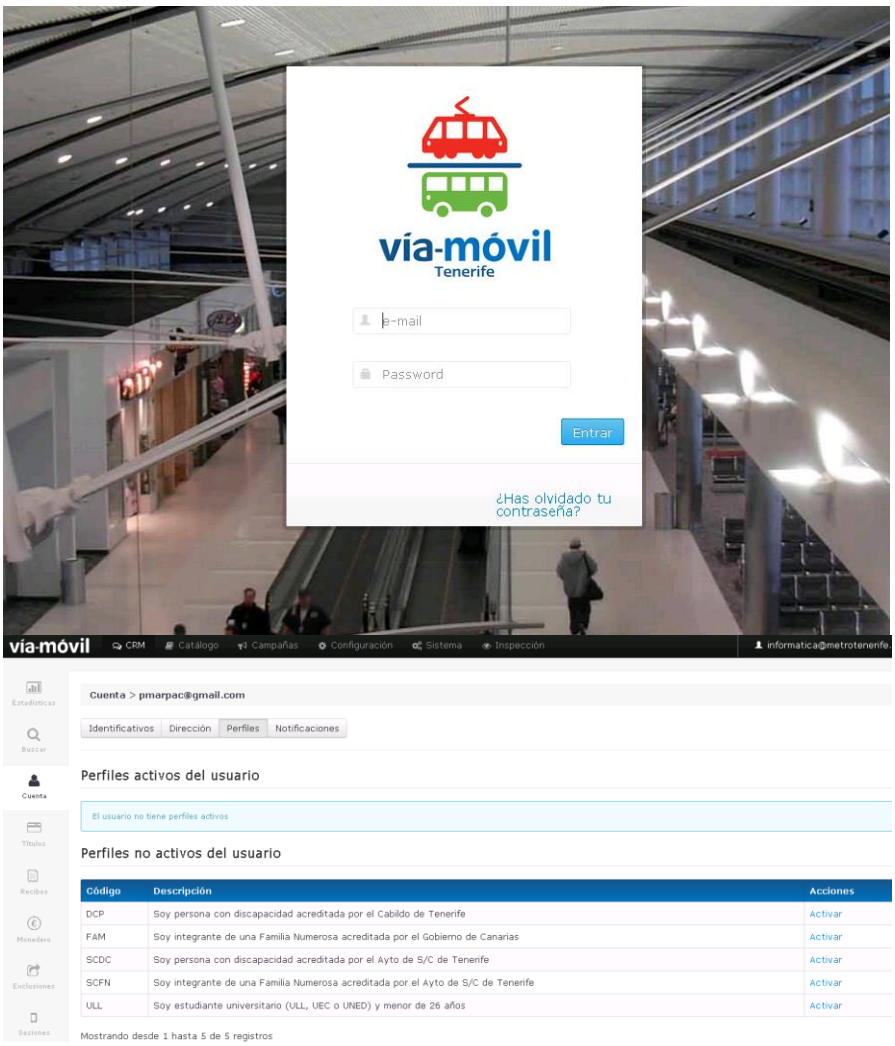


Figure 11 Via-Movil user Front Office screen shots

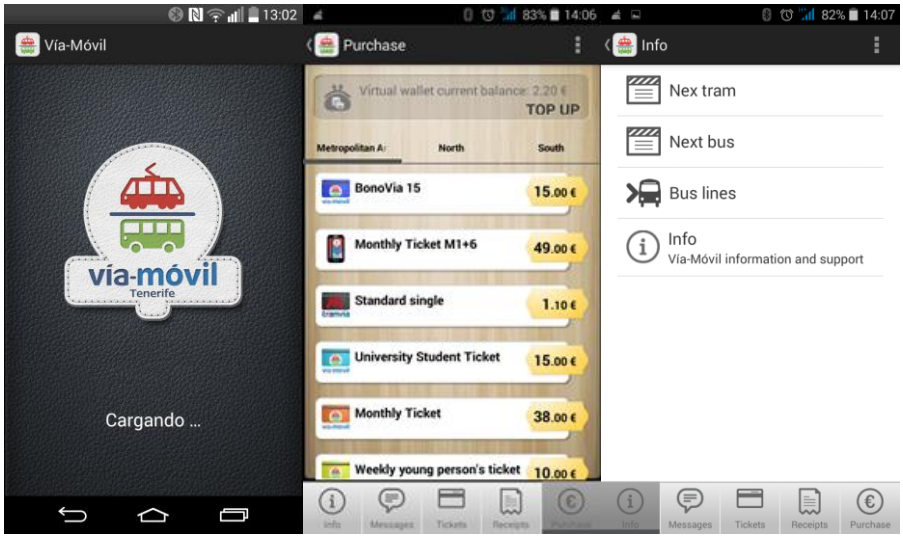


Figure 12 Via-Movil APP new features screen shots.

3 - CONCLUSION

In 2013-2014 the small-scale experiments in the first experimentation cycle successfully demonstrated the stability of WP3 technologies.

Since 2014, and after the withdrawal of Orange as WP3 leader, experiments with +1000 users in Europe were made (more details in D3.3.2 for each experiment).

More will be conducted in 2015, and reference apps (i.e: evenTribe, MTSA ViaMovil) are released as the result of joint exploitations between partners.

WP3 partners commit on providing support for phase 3 to maximize the use of their enablers to create more services for citizens, along with the experimentation of their latest technologies.

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Annex A USER CENTRED DESIGN METHOD

User-centred design (UCD) is an approach to the design and development of interactive systems. The process is guided by knowledge of the end users, their use contexts and their needs, with the aim of designing systems offering usefulness and ease of use. What is crucial in this method, is to meet users regularly all along the project in order to offer the user the most positive experience possible with the product or service.

The UCD method is described in the norm ISO 9241-210 [ISO 10]. According to this norm, UCD is a process which has four main stages, and which is iterative on all or some of these stages, as illustrated by the following diagram (Figure 4).

1. Understanding and specifying the context of use phase: there are three goals in this phase. One aims at understand characteristics of the future users in relation to the service to be designed. One consists in specifying the characteristics of the tasks relative to the future system; one intends to identify the environment in which the future system will be used.
2. Specifying the user requirements: the goal of this phase is to write requirements that are constraints stemming from data gained in the first phase and from the knowledge relating to the ergonomics and the user interface.
3. Producing design solutions: on the basis of the previous stages, the objective here is to define the user tasks in relation to the system and to design a version of the product or service.
4. Evaluating the design: This phase consists in meeting users and make them evaluate the product or service provided by the previous phase. Products or services can be evaluated through various formats depending on the degree of design progress. The improvement points identified during the evaluation serve to validate a solution which satisfies the user requirements or serve as a basis for the design of the next version.

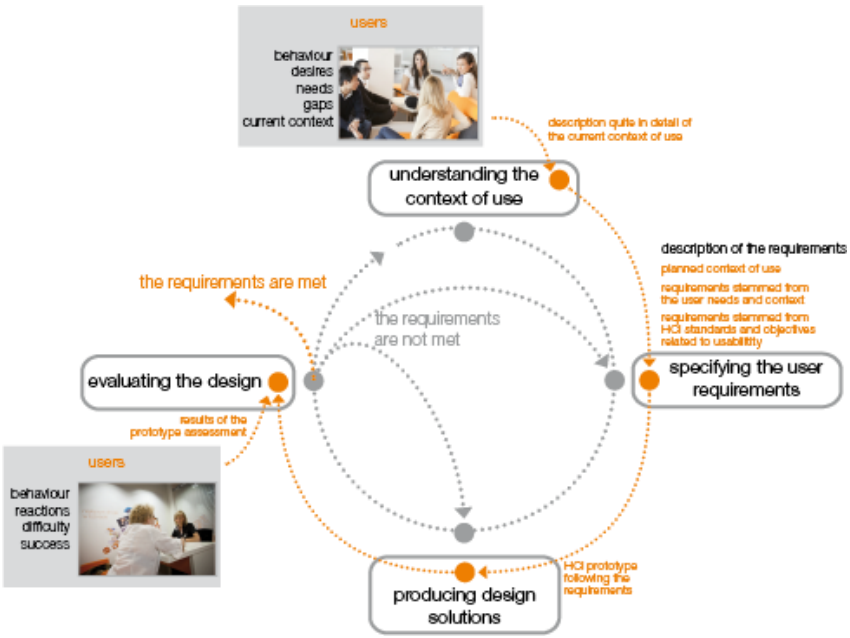

Figure 2: The four main phases of UCD, based on the schema given in ISO 9241-210 [10]

As written in the norm ISO 9241-210 [10], the benefits of applying UCD are many and are regarded as increasing the return on investment (ROI) [ISO 10].

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