Final Publishable Summary Report

FI-CONTENT

D1.5: Final publishable summary report

Grant Agreement number: 603662

Project acronym: FI-CONTENT 2

Project title: FUTURE MEDIA INTERNET FOR LARGE SCALE CONTENT EXPERIMENTATION 2

Funding Scheme: IP

Period covered: from: 1st April 2013 to: 31st October 2015

Name of the scientific representative of the project's co-ordinator, Title and Organisation: Serge Travert (Technicolor R&D France)

Tel: +33 2 99 27 30 56

Fax:

E-mail: serge.travert@technicolor.com

Project website address: http://mediafi.org/

SEVENTH FRAMEWORK PROGRAMME

FUTURE INTERNET PPP

TABLE OF CONTENTS

1 - EXECUTIVE SUMMARY

At the end of October 2015, the FIcontent FP7 project has come to an end, leaving behind a great legacy to the FIWARE community.

First of all, 28 FIWARE Enablers for Media and Content have been delivered, passing various success criteria. Those 28 enablers, among which most are open source, cover 3 major domains of application: Social Connected TV, Smart City Services and Pervasive Games.

One online portal has been set up: the FIWARE Media & Content Lab. This website allows any developer to test, develop and run applications that embed or use FIWARE Media & content enablers.

At the end of October 2015, over 20 Apps and 80 SMEs are using FIWARE Media & Content Enablers. The FIcontent website has been visited over 70 000 times, by more than 40 000 unique visitors. Since it has been released in June 2015, over 1 000 hours have been spent by web visitors on the FIWARE Media & Content Lab. The FIcontent YouTube Channel counts over 10 000 views, and we have 200 Facebook likes and 700 twitter followers, who are regularly updated with FIWARE Media & Content news and opportunities.

By the end of the project 46 experiments have been carried by all partners coordinated by the WP7 to ensure the stability of the enablers. The focus of our work in WP7 has been to provide six working experimentation sites in Brittany, Berlin, Cologne, Barcelona, Zurich and Lancaster for Social Connected TV, Smart City Services and Gaming trials, to run experiments with test users to validate the specific enablers as well as to give support to the Phase 3 accelerators and sub-grantees. In the first experimentation cycle, the partners focused on small scale trials and in the second experimentation cycle on large scale experiments such as Fall of the Wall in Berlin, Transmusicales in Brittany and Fallas in Valencia, involving thousands of users until March 2015, leading to a deployed smart App improving the Tenerife Transit Experience for 30.000 users by now.

The 28 FIcontent partners have been collaborating for 31 months towards providing and supporting the most advanced FIWARE Media & content enablers, for European SMEs and developers. Over 50 project deliverables have been written, as well as 36 scientific publications and 11 patents.

Having attended such international events as CeBIT, Eurographics, SIGGRAPH, ECFI and various NEM Summits, FIcontent has been significantly showcased in the media world over the past two years.

Regarding the 3 FIcontent application platforms (Social Connected TV, Smart City Services and Pervasive Games), promising figures testify the quality of the FIWARE technologies developed within FIcontent.

Social Connected TV

6 FIWARE enablers were developed for Social Connected TV (Audio Mining, Content Enrichment, Content Optimisation, HbbTV Application Layer, Second Screen Framework, and the TV Application Layer).

Since the start of FI-PPP phase 3, FIcontent partners contributed to events to support FI-PPP accelerators in Belgium, Germany, France, Ireland, Poland, Spain and the United Kingdom.

An excellent best practice guide was created in 2015 introducing Social Connected TV developers to best practice requirements when using FIWARE enablers for Media & content.

At the end of October 2015, at least 5 regional, national and international broadcasters were using FIWARE Social Connected TV enablers: Germany's public service network the ARD, Germany's largest children's channel KiKA, regional broadcasters RBB and MDR and international broadcaster BBC.

4 FIWARE Media & Content enablers are used in broadcast services: Second Screen Framework (rbb-text, ARD-EPG, ARD Mediathek), HbbTV Application Toolkit ('Fall of the Wall' from RBB, 'Verknallt & Abgedreht' from RBB and 'Sandmann' from KiKA), TV Application Layer (BBC's iPlayer) and Audio Mining (ARD Mediathek). In addition an average of 1 000 new HbbTV users connect to a second-screen device via the Second Screen Framework Enabler every month.

Finally, 25 international media outlets from 6 different countries (Austria, Canada, Czech Republic, Germany, Poland and Switzerland) use FIWARE Media & Content enablers (10 broadcasters, 10 service developers and content producers, 5 network providers).

Smart City Services

The Smart City Services platform has given birth to 8 FIWARE Enablers for Smart Cities: AppGenerator, Asset Storage, Context Aware Recommendation, Fusion Engine, Open City Database, OpenDataSoft, POIProxy, and Recommendation as a Service. They all combine over 500 000 lines of code, written to foster European SMEs competitiveness.

To support FIWARE accelerators, FIcontent Smart City partners have been involved in various bootcamps, startup weekends, hackathons and workshops. Over 600 people have used the EvenTribe mobile App at Transmusicales 2014 in Rennes, France, where 6 TVs were using the generated TV app displaying live information to the 60k+ attendees of the event.

A few months later, more than 10 000 users did use the mobile app (Android, iOS) specially developed by FIcontent partners for Las Fallas 2015 (Valencia, Spain), which received over 1 000 comments, check-ins and photos uploaded.

More than 10 apps are using the FIWARE Enablers developed by FIcontent for Smart Cities, among them: Veolia/M2O, Capico Kids, mapsquare, Time Square NYC billboards, Capitol Centre Court residential complex, Tenerife Transit Experience, Geoportal Comunitat Valenciana… Also, over 10 partnerships have been developed by OpenDataSoft with the brigades of Code for America.

Pervasive Games

12 of the 14 FIWARE Enablers developed by the FIcontent « Gaming » partners are open-source.

11 Augmented Reality games have been developed using FIWARE Media & Content enablers, being either board games or city-wide games. Here are a few titles that can be found on YouTube, or app stores: Augmented Resistance, AR Travelers, ARPix, Gnome Trader, Spider Game, Star Tours, Skye Wars, ARvatar, city-wide tower defense game, scavenger hunt…

Four hackathons have been organised, for students and developers to create AR Games with FIWARE, and provide interesting feedback to FIcontent partners. Those hackathons took place either in international events or at the occasion of dedicated experiments: NEM Summit 2013, Zurich 2015, Ludicious Game Festival 2015, and Barcelona 2015.

The cutting-edge technologies developed have been demonstrated and presented at large international conferences, such as: SIGGRAPH 2013, NEM Summit 2013, CeBIT 2014, Startup Fair 2014, Web3D 2014, ECFI 2014, CGVR 2014, Eurographics 2015 and Zurich meets New York.

The FIcontent Pervasive Games partners have known some successes, for instance, with the ARPix demonstration in the New York City Grand Central station, where an augmented reality photobooth has been held for 3 days, being seen by 1 Million people passing through. During SIGGRAPH 2013, over 2 600 attendees were present to see the Skye Wars augmented reality demonstration. 7 patents have been deposited.

2 - SUMMARY DESCRIPTION OF PROJECT CONTEXT AND OBJECTIVES

The content and media sectors are the main driver of Internet usage and take-up. Content consumption and creation drive technical improvements to the Net's low level protocols and increases demand for increased speed of consumer access.

People are consuming more media content than ever and media consumption is the only real reason that end users upgrade their network or hardware. While the actual manner in which content is accessed varies greatly between different age groups, professionally produced media content remains vital for end users, and will continue to do so for some time.

In FI-CONTENT Phase 1, we demonstrated real world tests and experiments in how people consume content, create experiences, and interact both physically and virtually with the network. We created new ways of giving viewers and listeners access to information about their content consumption, and built new content formats to delight and amaze audiences in a number of locations and scenarios.

For FI-CONTENT 2, we have consolidated efforts on a core set of platforms and content types (explained in more detail below) that build on the experiments from Phase 1. The infrastructure generated by the project has allowed for the development of an open ecosystem that will enable SMEs and developers to create new applications, services and experiences that exploit these future Internet platforms.

The project has focussed on 3 primary types of content:

1) High quality audio video and interactive media in the modern and future networked home environment
2) Location and context-sensitive content (e.g. in mobile usage situations, on a handset or laptop/tablet)
3) A range of interactive gaming content.

All future content and content-based applications are likely to be built on one or a combination of these three main content types. FI-CONTENT 2 reflects this by establishing three platforms, each built around one of these 3 scenarios, but providing the flexibility to mix and match where appropriate.

The Social Connected TV platform offers attractive new application and content concepts for TV and online by integrating broadcast and future Internet Web-based technologies. Combined with the integration of personal devices into the TV environment, this creates an entirely new level of user experience for broadcast programmes, 3rd-party content portals and SmartTV applications, as well as providing developers with access to SCTV technologies.

The Smart City Services platform makes use of curated user-generated content and explores the future of mobile Internet services**.** Location and context-sensitive content is likely to embrace and demand user-generated content, as useful outputs cannot possibly be achieved by employing professional staff only (due to expense and logistics) – we believe that residents and visitors can add value to information about the areas they know well, or are visiting for the first time.

The Pervasive Gaming Platform demonstrates a strong mix of real life and Internet experience in a playful way and shows advances in 3D or virtual world environments in a way that becomes immersive and 'real.' The game platform focuses on multiplayer mobile gaming that leverages the future Internet technology in order to enable large groups of users to participate in innovative mobile gameplay experiences. A central theme of this new social gaming platform is moving beyond the traditional paradigm in which a user is fixed in front of a console or display. Instead, the game mechanics will blend virtual and real-world experiences so that location-aware games extend past our televisions, weaving the magic of gameplay into toys, fashion, and real world places such as the cities where we live. In this way, the game becomes an augmented version of the real world

that delivers a more compelling experience than traditional console games or the simplistic social games that dominate today's market.

The aim of this project was to set up working experimentation sites for phase 3 of the FI-PPP programme. It is based on the work performed in phase 1 on content related use cases and the core platform, both in terms of usage and of technologies (enablers).

The project has provided diverse application platforms running on several experimentation sites in Europe. It has also developed an associated deployment plan to provide support for the large-scale expansion of the experimentation platform usages.

The related project objectives defined initially were:

1. *Working experimentation sites building upon common components and Generic Enablers as provided under the Core Platform Objective complemented by the identified use case specific capabilities;*

   The project will provide application platforms working on several experimentation sites in several European regions. Those platforms will take advantage of the specific enablers already developed by the partners in phase 1 and of the generic enablers that will be made available by FI-WARE.

2. *Selected test applications implemented on these experimentation sites;*

   The sites chosen by the project will be used to validate the different platforms through early trials.

3. *Validation of the openness and versatility of the Core Platform and its software development kit, through implementation of mixed use case scenarios originating from more than one use case project;*

   The project will contribute to validate selected FI-PPP technologies (enablers) issued from phase 1 projects by integrating them on the application platforms. This will include both the (common) enablers provided by the core platform and those developed within use case projects (specific enablers).

4. *A detailed plan for how to move into phase 3, including detailed plans for the large-scale expansion of platform usage facilitated by local and regional stakeholders including SMEs.*

   As part of *Ecosystem building* (WP 5), the project addresses the plans to move into phase 3. Specific efforts will be made to involve in the related tasks the local/regional stakeholders of the experimentation sites (already present in WP7) in order to facilitate the appropriation of those sites by SME actors.

3 - DESCRIPTION OF MAIN S&T RESULTS

3.1 - Social Connected TV

3.1.1 - Media & Content Enablers for Social Connected TV

Six **Specific Enablers** are part of the final release of the Social Connected TV Platform:

- **Audio Mining** (AM) – focusing on extraction of topics and keywords from audio;
- **Content Enrichment** (CENR) – providing interactivity with on-screen content;
- **Content Optimisation** (CO) – focusing on enhancement of text with keywords;
- **HbbTV Application Toolkit** (HAT) – supporting HbbTV app development;
- **Second Screen Framework** (SSF) – providing interactive second-screen functionality;
- **TV Application Layer** (TAL) – supporting Smart TV application development for wide variety of devices.

Open Source

The TAL enabler is open source, and parts of the HAT enabler are open source. The Content Enrichment and Audio Mining enablers are commercial products, and the HbbTV Application Toolkit will become a commercial product with its next release.

3.1.2 - Application Platform and Scenarios for Social Connected TV

3.1.2.1 - Application Scenarios

The diagram below shows an overview of the architecture of FIC2's SCTV applications, the scenarios under which they were tested and the enablers which they use. The 'Rich Content' scenario focussed upon content enrichment, 'Multi-Screen Experience' focussed on extending the viewing experience across a variety of devices and 'Personalised Media' explored data privacy issues and personalisation.

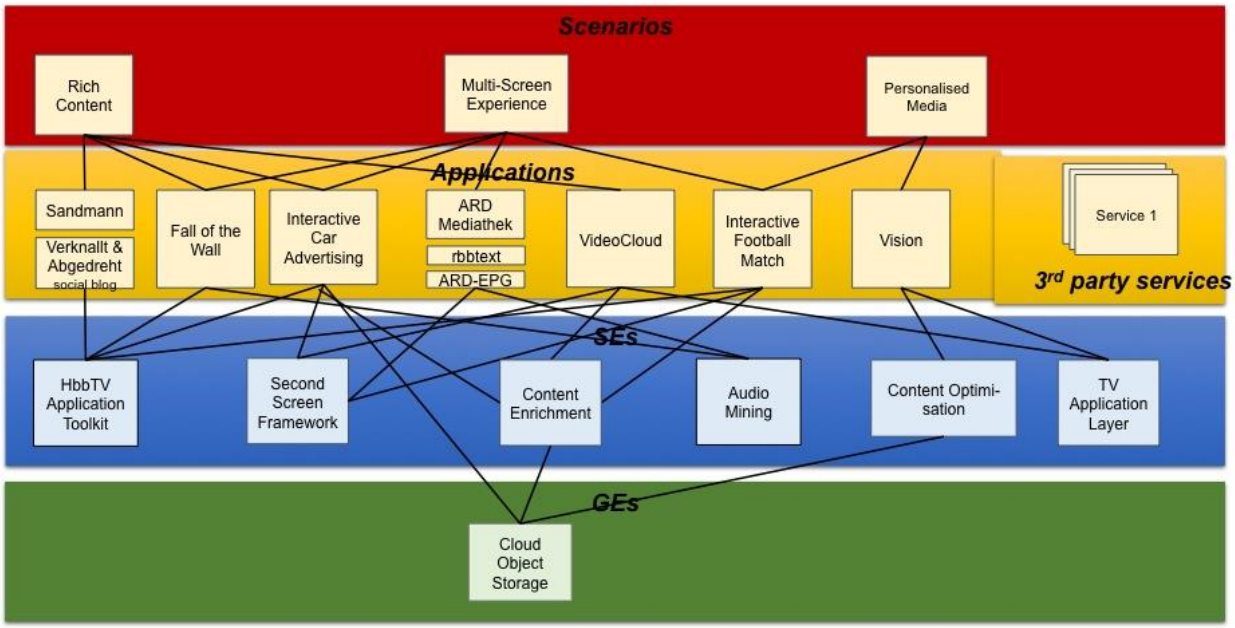

Figure 1 Social Connected TV architecture diagram

3.1.2.2 - Applications

The FIC2 SCTV platform consists of the following applications:

- the '**Sandmann**' HbbTV app, which is currently on-air nationwide via the German KiKA kids' channel. The app is graphic-driven, aimed at children and presents video-on-demand content from the popular 'Sandmann' series;
- the **'Fall of the Wall**' app accompanied a broadcast from regional German station RBB in November 2014 and, for the first time in an RBB broadcast, allowed social media interaction between users, including chat and posting of photos/videos, via HbbTV;
- the **'Verknallt & Abgedreht**' app accompanied the broadcast series of the same name, also from RBB, presenting additional material from the reality TV show, and allowing interaction between users and participants;
- the '**Interactive Car Advertising**' app, which makes on-screen objects interactive, presenting enriched content via a second device and delivering commercial possibilities for advertisers;
- the '**ARD-EPG**' app which presents the programme guide from the German ARD public TV network;
- the '**ARD Mediathek**' app which presents the (German national public service network) ARD video-on-demand catch-up TV service, and will be augmented by (FIC2's) Audio Mining functionality later in 2016;
- the '**rbbtext**' app delivered second-screen functionality for the HbbTV version of the classic teletext service;
- the '**VideoCloud**' app which enables joint synchronised video viewing from a variety of locations accompanied by social interaction in a user-created virtual room;
- the '**Interactive Football Match**' app which enables group viewing of a live event and includes video sharing and chat functionalities;

- the '**Vision**' app which presents an IPTV testbed providing such features as 'resume play', enabling seamless viewing experience across devices, platforms and geographic locations, as well as recycling live user data in personalised visualisations.

3.1.3 - Qualification of Enablers through Experimentations in Social Connected TV

The components of the Social Connected TV platform were tested under a variety of circumstances, ranging from small-scale lab tests to large-scale field trials. Each of the experiments provided useful results that helped further refine and strengthen SCTV applications and the enablers which they use.

Initial experimentation began with usability tests in preparation for large-scale field trials, which subsequently led to further follow-up tests based on the outcomes of field trials.

Experiments used the iTV lab at Fraunhofer FOKUS and facilities at RBB (both in Berlin, Germany) for lab tests involving close observation and in-depth analyses of user behaviour. Experiments involving user data were conducted in ULANC's 'living lab' in Lancaster, UK. Field trials involving large numbers of users used RBB's broadcast infrastructure and IRT's web servers to signal and deliver HbbTV applications. Large-scale field trials included the marking of the 25th anniversary of the fall of the Berlin wall by a 25-hour live HbbTV broadcast. Interoperability workshops hosted by IRT in Munich, Germany were used to further test HbbTV applications.

3.2 - Smart City Services

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 Smart City Services portal to generate innovative applications which have those technologies already built-in and ready to use, in the reach of just a few clicks.

If the Smart City Services Platform has such a strong real added value for its users, it is due to the fact that it mixes the most successful key concepts and technologies and channels them into taylor-made apps, for Mobile and Web users: Social Networking (public and private), Augmented Reality, 3D modelization, the use of OpenData, Crowd Sourcing, Story Telling, Social Sharing.

3.2.1 - Media & Content Enablers for Smart City Services

The Smart City Services Platform has two main user targets: technical & non-technical. Technical people are usually engaged into application developments to deliver innovative smart-city services, and are open to integrate new solutions and technologies to do so. To serve this goal, the WP3 developed a set of enablers, designed to work either standalone or in collaboration with other enablers. Therefore, technical users are able

to select the enablers matching their needs to create value and state-of-the-art features within their own products.

Non-technical people usually have a different approach. They are confronted with high time-to-market constraints: How to quickly deliver a software solution or service to experiment it on their target audience. To answer those needs, the Smart City Services platform proposes portals built on top of some SEs to allow those non-technical users to create their own applications (mobile, web) in a few clicks or even select and enrich data related to specific needs.

The final platform is a set of 11 enablers tackling the following subjects:

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

Here is the list of the **Specific Enablers** that are part of the final release of the Smart City Services platform:

- **AppGenerator** – « Instant deployment of custom applications »
- **Asset Storage** – « Manage 3d web content »
- **Context aware recommendation** – « POI recommendation based on activity and context »
- **Fusion Engine** – « Merge OSM, DBPedia and Open Data into single POI »
- **Open City Database** – « Smart city related data service with UGC POIs »
- **OpenDataSoft** – « Publish, share and reuse structured data »
- **POIProxy** – « Get POIs from almost any public remote service »
- **Recommendation as a service** – « Hosted recommendation engine ».

The platform takes advantage from Generic Enablers from FIWARE. During the development we have selected the required Generic Enablers that have been available at the time of development of the different releases. Here's a list of the Generic Enablers finally used in the platform: 3d-UI, GIS Data Provider, Identity Management, Object Storage, Poi Data Provider

3.2.2 - Application Platform and Scenarios for Smart City Services

Eight use case scenarios have been defined, as the basis for reference Smart City Service applications:

- Scenario 1 "On site visit" 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 on 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.

Several applications have been made to demonstrate the ability of the Smart city Services Platform to be useful in these Smart City focused scenarios. The figure below shows the main dependencies between the scenario applications and the Media & Content specific enablers:

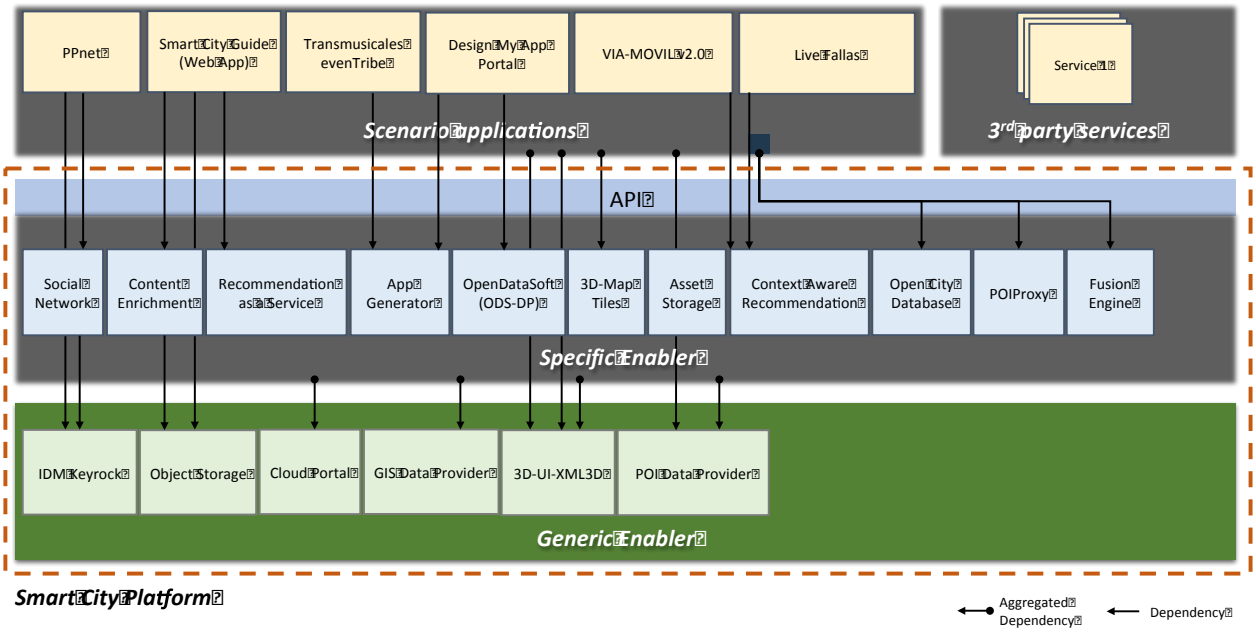

Figure 2 Smart City Services architecture diagram

The table below shows how the various use scenarios are addressed by the applications developed:

Scenario application	Related scenario(s)
PPNet App	Social Interactions
Smart City Guide Web App	On Site Visit
Transmusicales evenTribe Apps	Festival Real Time Social Networks Activity
VIA-MOVIL v2.0 App	Transit experience Activity and Context aware POI and Action Recommendation
Las Fallas App	One Site Visit Merging and enriching Activity aware POI and Action Recommendation scenario Real Time Social Networks Activity
DesignMyApp Portal	App generator city guide

3.2.2.1 - PPNet App

The PPNet Application is designed to provide the functionality of social interactions in the digital world - like posting status messages and images - apart from the major, proprietary social networks, like Facebook.

The PPNet provides this set of features:

- Authentication to the Social Network
- Access to the status messages
- Post of status updates: text, images, etc.
- Follow the users of the Social Network
- Comment on posts
- Like posts.

This Application has been tested on Cologne experimentation Site, during the Carnival experiment.

3.2.2.2 - Smart City Guide Web App

The Smart City Guide App was meant to be used before and during the trip. It is a web application running on modern HTML5 compatible browsers on iOS, Android and Windows devices.

Before a trip, the user creates an account in the app and enters a set of criteria for an up-coming trip, for example, an area, a budget and a time interval (specific dates or times). The App 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 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.
During the trip, the user gets access to information about Points of Interest in a city and can directly create and update POIs.
User generated content like comments, social recommendations or interactive content can be as added to existing POIs through the Web App as well.

This Application has been tested on the following experimentation sites: Berlin, Barcelona and Lancaster.

3.2.2.3 - Transmusicales evenTribe Apps

The evenTribe Apps consist in a set of 4 four Android apps, each focused on a specific target:

- Contributor, for the festival staff.
  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. evenTribe 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, for all locations (Restaurants, bars, Merchandising…).
  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, displaying valuable information on all festival screens.
  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.
- evenTribe, for all public attendees.
  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...

This set of applications has been tested on Brittany experimentation Site, during the Transmusicales 2014 festival.

3.2.2.1 - VIA-MOVIL v2.0 App

The VIA-MOVIL App targets several sort of users: 'Visually Impaired Person', a foreigner, or a regular user interested, for example, in cultural events.

The mobile application collects the beacons data and then the system 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.

This Application has been tested in Tenerife (linked to the Cologne experimentation site).

3.2.2.2 - Las Fallas App

The Las Fallas App is designed to improve the attendees' experience of a festival in the City. It integrates four key services:

- Fallas: Find and locate Fallas on a map, filtering by activity, etc. It also allows user interaction and includes an automatic recommendation tool;
- Events: Shows the official events of Fallas (from March 1st to march 19th);
- News: Shows RSS news associated to Fallas;
- Activity map: Shows real-time social activity on the map, in order to find activity hotspots in the city of Valencia.

This Application has been tested in Valencia (linked to the Barcelona experimentation site) during the Las Fallas festival.

3.2.2.3 - DesignMyApp Portal

The DesignMyApp portal allows users to easily create an application including any open data or custom data sources.
For instance, they could create their own Brussels city guide app, in just a few clicks. Customizing the app icon, name, loading splashscreen, and POIs 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, and search through existing POI data, show POI images.
With this portal, 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).

This Application has been tested continuously on the Internet.

3.2.3 - Qualification of Enablers through Experimentations in Smart City Services

Experimentations were performed with two target user populations: technical (integration), and non-technical. The experimentation sites were Berlin, Barcelona, Lancaster, Brittany, Valencia, and Tenerife.

Here are three examples of applications' experimentations and the kind of features used:

- The Transmusicales experimentation:
  - Site: Brittany
  - Size: 600+ users and 60 000+ attendees

    - Features: Augmented Reality view of POIs, Social Wall with nearby social interactions, Automated bluetooth count, display of schedule and next concerts;
    - Enablers: App Generator SE, POI Proxy SE, POI Explorer SE, 3D-UI GE, POI Data Provider GE, 3D-Map Tiles SE, GIS Data-Provider GE, Content Sharing SE.
- The VIA-MOVIL experimentation:
    - Site: Tenerife
    - Size: 16 000+ users
    - Features: Live Social interactions, nearby points of interest, Live routing recommendation;
    - Enablers : POI Proxy SE, Fusion Engine SE, POI-DP GE, Context-Aware Recommendation SE.
- The Fallas experimentation:
    - Site: Valencia
    - Size: 10 000+ users
    - Features: Live Social wall with nearby social interactions, Full schedule and guide for the festival, Live routing recommendation;
    - Enablers: POI Proxy SE, Fusion Engine SE, OCDB SE, Context-Aware Recommendation SE, Leaderboard SE.

For non-technical users, the experiments were rather oriented towards the AppGenerator and its templates: propose non-technical users the possibility to create their own valuable apps through a simple web portal.

The experiments not only provided great insights about City-Guide services, they also opened the door to new use-cases, all citizen-centered, focused on Festivals, Transports, and City-wide Events, which were not even planned when the project had just started.

With this in mind, the design of the Smart City Services platform makes sense in a world of micro-services. It is a highly valuable set of technologies, easily composable, which will be much useful in a world of constant IT innovation and high time-to-market constraints.

3.3 - Pervasive Games

3.3.1 - Media & Content Enablers for Pervasive Games

The Pervasive Games Platform consists of a number of Specific Enablers that are relevant for games on mobile devices with a focus on AR, Social Interaction, Content and Geospatial components. With the goal to enhance the development of pervasive games we have created a categorization of three tiers to reflect different technical challenges for a number of scenarios:

- Tier 1: Digital Consumer products for small scale indoors settings;
- Tier 2: Location Based Experiences for controlled environments;
- Tier 3: City-wide Gaming to bring the gaming experience everywhere.

The platform takes advantage from Generic Enablers from FIWARE as well as Media & Content Specific Enablers. During the development we have selected the required Generic Enablers with exhaustive testing of the available services offered at the time of development and re-iterated the selection in the consecutive releases. Find below a list of the GEs used in the platform, for all the details and dependencies please refer to the architecture section provided in deliverable D4.5 and
Figure 3:

- Cloud Portal allows quick deployment of our services on the cloud;
- IDM Keyrock for identity management;
- Synchronization (FiVES) to synchronize data between clients over the network;
- Advanced Middleware offers high performance middleware;

- GIS Data Provider and POI Data Provider to enable fast retrieval of geospatial queries;
- 3D-UI and 2D-UI to support the visualization of content;
- Hardware Support providing access to GPU and parallel computing;
- Complex Event Processing for real-time event data analysis.

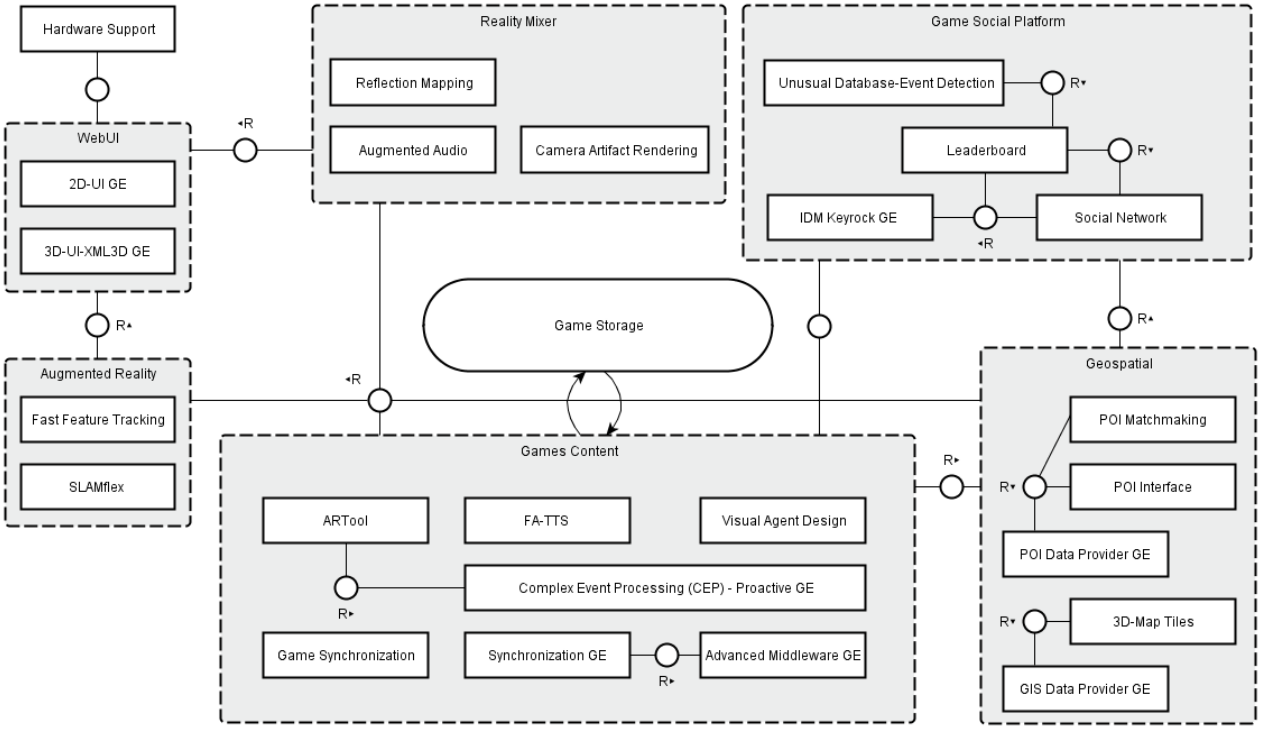

Figure 3 Architecture of the Pervasive Games Platform including the interaction of SEs with GEs from FIWARE

Find here the list of all the **enablers** released in the Final Release of the platform grouped into a set of categories that reflect their focus area. For all the additional details please refer to D4.5 and previous platform release deliverables.

- **Reality Mixer** provides seamless mixing of virtual and real
  - The **Reflection Mapping SE** takes environmental lighting into account;
  - The **Camera Artefact Rendering SE** applies effects to computer generated content to mimic the behavior of the device's camera and enhance the integration;
  - The **Augmented Audio SE** improves immersion by adding correctly located sound effects.
- **Geospatial** provides API to support location based features in games
  - The **POI Matchmaking SE** (formerly: Spatial Matchmaking SE) helps to find other players ready for a game in the vicinity;
  - The **POI Interface SE** provides a set of commonly used functions to interface and access the POI data;
  - The **3D-Map Tiles SE** is a tile server for 3D data in a map context.
- **Augmented reality** is dedicated to tracking algorithms
  - The **Fast Feature Tracking SE** provides efficient markerless 2D-feature tracking;
  - The **SLAMflex SE** provides detection and tracking of dominant planes on smartphones;
  - The **Marker Tracking SE** provides detection and tracking of image markers.

- The **Games Content** enablers focus on providing quick and accessible ways to create and improve games content such as animation and networking
    - The **Game Synchronization SE** provides a simplified way to ensure that all game objects and properties have the same state on all devices;
    - The **Flexible and Adaptive Text To Speech SE** is a Text To Speech server that enables simple and fast creation of synthetic speech starting from text;
    - The **ARTool SE** enables the creation and deployment of AR applications from a user-friendly design platform;
    - The **Visual Agent Design SE** provides the bricks to visually design the behaviour of agents in Unity 3D;
    - **Phenomobile Character Manager** allows the simple and fast creation of characters in story-based games;
    - **Phenomobile Dialog Manager** allows the simple and fast creation of text dialogues in story-based games
- Game social platform focuses on interaction between players
    - With the **Leaderboard SE**, high scores can be submitted and retrieved;
    - The **Social Network SE** provides an implementation of a social platform;
    - The **Unusual Database-Event Detection SE** is a monitoring service of a database.

One of the main objectives of the platform was to make available scientific knowledge as software bricks, black boxes that the developers can just plug and play to enhance their applications. We achieved that with the publication of this rich set of enablers. In addition, since all the source code is available, we give the developers also the chance to tweak and modify these bricks for their own purposes.

Open Source

Another important goal achieved is that the majority of these enablers were released as open source on GitHub. We envision the participation of the open source community to keep the enablers up to date and perhaps provide new interesting collaborations in the future. SMEs and interested developers can access directly the sources, branch them out and start developing and tweaking the enablers to their own specific purposes. It is also worth mentioning that most partners will continue to update and maintain their enablers.

Unity Asset Store

The Unity sided enablers of the platform have also been published in the Unity Asset store, giving them some more visibility and redirecting the interested people to FIWARE Media & Content Lab for documentation, examples and more enablers. From June 2015 when the SEs were published we had an average of 150 downloads every month.

3.3.2 - Application Platform and Scenarios for Pervasive Games

3.3.2.1 - Application Scenarios

The figure below shows the high level architecture of the platform with a focus on the application scenarios.

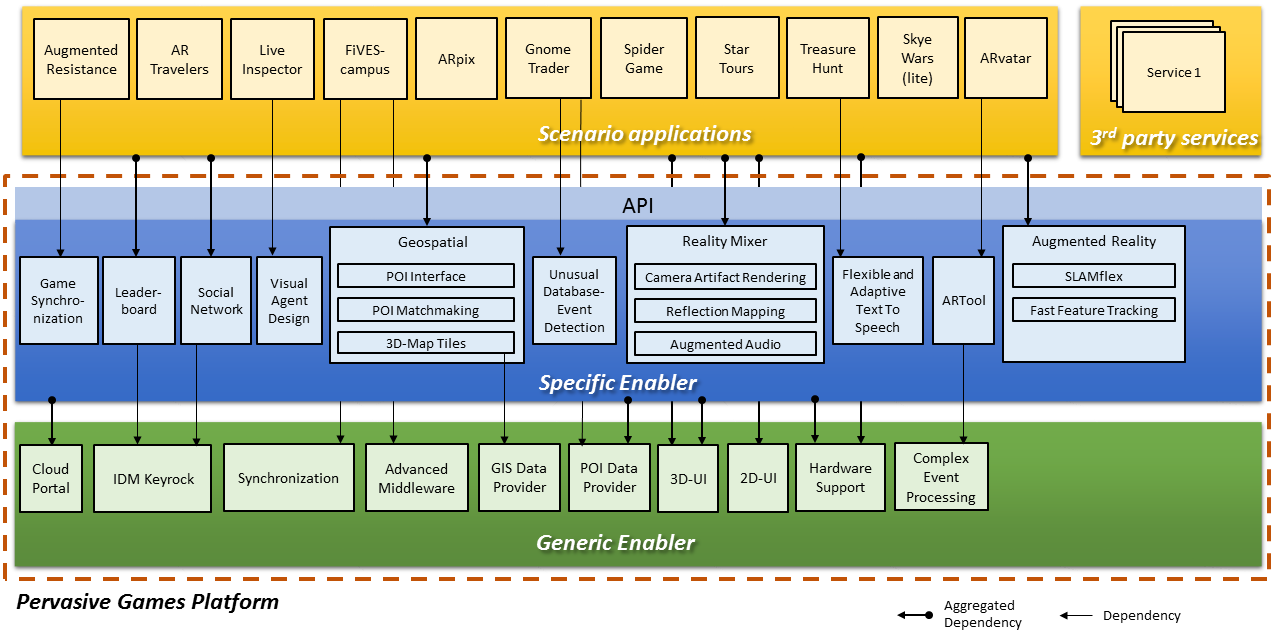

Figure 4 High-level architecture of the Pervasive Games Platform

Below is reported a brief description of the application scenarios as defined in deliverable D4.1 and how they were realized to serve as early trials of the platform, demo showcases, and experiments as reported in D4.4 (and its iterations). For a more detailed description of the following please refer to those deliverables. These application scenarios are grouped in accordance with the categorization of three tiers:

- Tier 1: Digital Consumer products for small scale indoors settings;
- Tier 2: Location Based Experiences for controlled environments;
- Tier 3: City-wide Gaming to bring the gaming experience everywhere.

3.3.2.2 - Digital Consumer Products

- **Tabletop AR Games**
  This application scenario was implemented in several production ready application prototypes: Augmented Resistance, AR Travellers and Live Inspector.
- **Seamless AR on the Web**
  This scenario was implemented with the SkyeWars Light application. It demonstrates AR running on a Web Browser taking advantage of the XML 3d GE and the Augmented Reality and Reality Mixer enablers.
- **Creating SLAM Based AR Games**
  The ARvatar game was developed in the web creation tool ARTool. It takes advantage of the SLAMflex SE to show the augmentations on a plane (for example a street pavement or a table top).
- **Virtual Character Synchronization on the Web**
  It was one of the first application prototypes deployed for early testing of the platform.
- **Interact with Avatar**
  This scenario validates the Phenomobile enablers.

3.3.2.3 - Location based Experiences

- **Attractions Driving Content Sharing**
  The ARPix application implemented for this scenario demonstrates a Tier 2 use case. This application served for many experiments and showcases, most notably the event ETH meets **NY** and the user studies that brought as a result a scientific publication in MIG'14 IEEE Conference.

- **Immersive Control Systems**
  The dragon flight demo was the only prototype developed in this context. It featured the concept of the Immersive Controls SE that was not developed further, but it was instead used to test and validate the Networked Virtual Character SE and used as a demo showcase in many events. It has also recently tech transferred to a SME to be a showcase for a special input gaming chair.
- **Location based Virtual Reality**
  SkyeWars VR provides the same experience of SkyeWars but on a mounted head display. It demonstrates the commercial opportunity of a Tier 2 game with a low cost VR experience.
- **Augmented Reality in the Wild**
  SkyeWars is a location-based game that takes advantage of the markerless tracking offered by the Fast Feature Tracking SE. It was deployed during SIGGRAPH 2013 as an application downloadable from the Apple store, but also shown on the big screen in a conference room with over 2000 people.

3.3.2.4 - City Wide Gaming

- **City Wide Economic Game**
  In the scope of exploring City Wide gaming the Gnome Trader application prototype demonstrates a Tier 3 application that brings the novelty of a pervasive gaming experience in a city environment.
- **Adjacent player discovery**
  This Tier 3 scenario combines POI and AR content by matching players by location. It was developed as a demo for the POI Matchmaking SE.
- **Augmented reality physics games downtown**
  This scenario is a Tier 3 game that was meant to demonstrate new ways of AR games as a combination of GPS and image based localization.
- **City Wide Scavenger Hunt Game**
  This game is another example of Tier 3 City wide prototype. It was deployed in the context of a Games Festival during the Zurich experimentations.
- **Augmented TTS technology into City wide games**
  This scenario was introduced by the open call partners and implemented as part of the Scavenger Hunt game as described above to validate the technology of the TTS SE.
- **City Wide AR Strategy Game**
  This scenario was implemented as a conceptual prototype to show the integration of SLAM, POI and AR visual effects in the context of a city environment.

3.3.3 - Qualification of Enablers through Experimentations in Pervasive Games

All the enablers of the Games Platform were tested during the two experimentation cycles. The tests were performed in different scale settings, ranging from small-scale user tests to big events such as the Skye Wars app during SIGGRAPH 2013 or ARPix during the ETH meets NY event. We have focused our tests to target both the end-users (non technical) and the developers as two separate categories in order to be able to analyze and collect different types of feedback from different perspectives. Each one of the tests we have conducted led valuable feedback that resulted in many improvements and refinements of the existing functionalities of our enablers as well as new use-cases and feature requests.

Finally, a tangible indicator of the success of the games platform has been to see its enablers being incorporated on big applications already available on the app stores. It is worth mentioning that the Star wars application from Disney Interactive features a “selfie” module that uses an evolution of the Reflection Mapping SE. Also ARpix, one of the application scenarios from the project, has been used in many movie theatre events by Disney Germany for the launch of Inside Out. Takomat, one of the open call partners, has already deployed various applications and serious games featuring the platform enablers for their clients. Many other enablers are being used and tested by SMIs all across Europe and worldwide thanks to the Accelerators, the

communities created from the Hackathons as well as the numerous gaming related events we have attended. All the partners have clear individual exploitation plans but one of the main goals we have achieved is that the platform can be exploited as a whole consistent set of pervasive gaming building blocks.

3.4 - The FIWARE Media & Content lab: the home for Media & Content enablers geared towards the needs of Phase 3 accelerators and subgrantees

For promoting the results of FI-CONTENT2, facilitating access to the software modules produced and supporting the community of Media & Content developers, FI-Content has developed and released the FIWARE Media & Content lab (in short FIC2Lab).

The FIWARE Media & Content Lab targets the needs of developers of Web and Mobile Applications by offering a comprehensive set of Media & Content related software modules.

Initially announced at Netfutures in March 2015, the FIWARE Media & Content lab has been released a few months later. Since June 2015, the FI-Content2 project exploits and promotes the FIWARE Media & Content lab. The FIC2Lab portal targets the App development community (Web Apps and Mobile Apps) with resources and tools for easing access to the Media & Content related software modules realized by the FI-Content2 project and facilitating their usage. FIC2Lab is designed for shortening the time for finding and selecting modules and for reducing the effort for setting up test instances of the software. For this purpose, FIC2Lab combines into one single comprehensive platform documentary resources, APIs, working images and instances, source code, tools for launching and tweaking the modules on the FIWARE lab cloud or elsewhere, and on-line support procedures.

Currently the Lab hosts 28 enablers (enabler is the FI-PPP term designating a software module packaged for addressing a specific need) and attracts around 50 visitors per day. Each of the enablers featured on the platform have passed a suite of quality assessment to make sure that:

- the documentation is understandable by the target population;
- the supplied images are working;
- the documentation is up to date;
- the demos and SaaS operations are working correctly.

In order to guarantee the desired level of quality for third party developers, the software and documentation proposed on FIWARE Media & Content Lab is qualified by automatic qualification procedures, using state of art qualification methods, and finally cross-checked manually.

For continued support of the Phase 3 accelerators and subgrantees over the remaining time of the FI-PPP program, the suppliers of Media & Content enablers featured on the platform have agreed to grant free usage licences to Phase 3 subgrantees and to reserve a budget of time to technically help the Phase 3 community and maintain operation of their enablers. Concretely the partners have agreed on a "best effort" basis 1) to react promptly to requests for information and bug requests, 2) to monitor operation of demos and SaaS, 3) to keep documentation and code in sync in case of upgrade.

The operation of the Lab is implemented partly on FI-WARE lab Lannion node (runner, tweaker, demos) and a partly on the mediafi.org server provided by Sigma Orionis (concretely hosted at OVH). Both organizations have agreed to maintain operation till end of Phase 3. It is foreseen that the operation will be carried over to VIVITnet before the end of the project.

To allow further development of the FIC2Lab platform itself either by the partners of the project or by third parties, the code of the platform is released under Open Source Terms & Conditions on GitHub.

VIVITnet will monitor the operation of the platform and monitor the requests for support done via the platform. In case of failure or non response, VIVITnet will contact the stakeholders and try to solve the problem (i.e. restart of faulty servers and urge the suppliers to provide answers in case of slow processing of requests).

4 - POTENTIAL IMPACT, DISSEMINATION AND EXPLOITATION OF RESULTS

4.1 - Potential impact

The overall expected impact from the FI-PPP projects cover 6 targets as listed in the work plan.

Each of the experiments addressed by the project has fully contributed to those targets as is illustrated below.

*Target 1: Significant **increase of the effectiveness of business processes** and novel approaches to the operation of infrastructures and applications of **high economic and/or societal value**. This will be supported by reappraised Internet architectures, services and technologies in **large-scale application** contexts;*

- The TV ecosystem has developed rapidly during the project lifetime. Global trends include the rise of new streaming services and the increased efforts of large internet players to push into the TV domain with HDMI sticks/boxes firmly embedded into their respective vertical value chain.

  Consequences are manifold: third-party companies can potentially become gatekeepers for content and service access; end-users often end up being locked into a specific platform; and media companies are forced to spent ever-increasing efforts in order to stay present and relevant on all relevant platforms. At the same time, most vendor-specific solutions by consumer electronics manufacturers have not gained a substantial significance. Nevertheless, market fragmentation remains a key hurdle, especially for smaller content/service/application providers and hampers innovation in the Connected TV domain.

  To overcome these issues, and to open up the market for new entrants, the FIcontent project partners have focussed on open and standardised solutions, such as the Open Web Platform (HTML5 & co) and related specifications like HbbTV. Future Internet technologies have been developed and provided to third parties in order to create new user experiences for Social Connected TV. Key topics included the seamless integration of second screens into the TV experience as well tools for enriching and discovering content. Large scale public experimentations were made accessible to millions of interested end-users. The various applications have demonstrated the innovation potential of cloud-based solutions for TV applications to creative companies, media and the public alike.

- An important aim of the Smart City Services Platform is to make the Future Internet a place where Europe citizens can take on economic roles. The Smart City Services Platform provides the services and interfaces that will promote this for future European competitiveness. The Smart City Services Platform will enable a wide spectrum of European users, communities, companies and organisations to adopt new economic roles within the whole range of Smart City Services, and allow and support users easily to adopt different roles or user contexts (home dweller, traveller, consumer, contractor, co-creator, seeker, collaborator etc.).

- Today, one in three Europeans play computer and video games regularly, and predictions by the Interactive Software Federation of Europe indicate that Europe will continue to lead high growth rates in gaming over the next several years (http://www.isfe.eu/industry-facts). The **Game Platform** will facilitate the growth of a broader market with wider demographic profiles through the development of **greater immediacy of game play**, more concrete, context aware interaction mechanisms with physical interaction and scalable infrastructure. Tangible pervasive game play and interactive virtual worlds beyond traditional input and display devices already show the potential for **transformative impact in the economic and social context of the creative industries** supported by increased participation and player empowerment. This impact is evidenced by the huge influx of augmented-reality technology over the past four years. The game platform connects this novel interaction methodology to both business processes (monetization of AR technology) as well as societal impact (democratization of real/virtual experiences).

*Target 2: Reinforced industrial capability **on novel service architectures and platforms**, building on the longer-term requirements of the Internet and encouraging players in Europe to embrace the challenges of smart infrastructures;*

- The **Social Connected TV** platform has extended TV towards the 'Connected Home' paradigm. It connects in-home and mobile media consumption and extends connectivity towards smart home networks on a device and application level. These services demand low latency networks and intelligent streaming solutions. Combined with the now-inherent support for multiscreen scenarios in HbbTV 2.0, seamless multiscreen experiences can be created by any media company and 3rd party developer alike.

- The **Smart City Services platform** answers multiple needs for content providers (whether the content is UGC, Open Data …), Telco's, device manufacturers, network platform manufacturers. Smart City will rely on experimentation to lead those actors and service developers to **promote innovative platforms** that the general public will use to access to live contents and data and could add their own in a dynamic way. Live data creation and sharing, context awareness, cloud capacities, LTE and high broadband, fixed and mobile convergent capacities … will be used to offer the best to end-users.

  Those who benefit from this emerging Smart City services are, for example, network operators like Orange by new and increased traffic based on the new open innovation business models, broadband providers offering new services to include local community formation and economic activation, device and media content suppliers that activate more co-creation activity from users in networked communities that will have important future economic roles. Cities could value their Open Data through contextualized adapted services in which access and use by end-users will be facilitated and animated.

- The Game Platform design takes advantage of recent changes in cloud computing, as detailed by the 2012 North Bridge Venture Partners Cloud Computing Report (http://northbridge.com/2012-cloud-computing-survey). The **Game Platform** utilizes newly developed energy efficient shared **computation infrastructure** and **high bandwidth, low latency content distribution networks** within Europe and worldwide. This setup fortifies efforts of platform and content providers towards a **smart Internet infrastructure**. Demonstrated results including networked games such as AR Travellers show the potential for this technology in the field of gaming and the ease with which it can be instantiated into new products.

*Target 3: **New opportunities for novel business models** based on cross-sector industrial partnerships built around Future Internet value chains, **involving users and public authorities** at local, regional and national levels, and providing SME players with opportunities to offer new products, equipments, services and applications.*

- By facilitating the promotion of Media & Content technologies and the interaction between suppliers and customers, the FIWARE Media & Content Lab opens the perspectives for novel, Open Software based, business models.

  Indeed, the application developer needs 1) to be capable to find technologies suitable to solve his needs, 2) to be capable to access and try these technologies, 3) to have reasonable guarantees on quality and durability, 4) to be capable to deploy the technologies under favourable conditions, and 5) to get technical and business support. Whereas the suppliers' main concerns are promotion, trust and support: how to reach the – huge - community of developers in the Media & Content area, how to scale support services for building trust.

Solving these issues and questions have been the main design principles for FIC2Lab.

- In 2009 the Hybrid broadcast broadband Television (HbbTV) Consortium was founded to harmonise and further develop interactive TV on smart TVs. The HbbTV specification was recognised by the ETSI in 2010 and has continued to evolve since. The Social Connected TV platform has researched

and developed extensions to HbbTV and related standards, which provide a reliable foundation for new services & applications running across Connected Devices.

In addressing additional requirements which emerged from exchanges with third parties, the FIC2 project played a major role in the specification process of the latest HbbTV release (HbbTV 2.0). This standard now directly supports such features as automatic device discovery in the home network and the launch of applications on a TV from a personal device. With the possibility of tightly integrating rich multi-screen applications with live TV programmes, potential use cases go far beyond that which Chromecast and other solutions can currently deliver. Through FIcontent, various additional support measures for interested developers have been established to ease the entrance into this market segment for developers and creative production companies.

These measures support operators and aggregators in sourcing high end broadcast quality content from the open Internet. SMEs and new players are able to add their content to that of existing broadcasters, providing consumers with greater choice and operators with greater freedom to innovate.

- The **Smart City Services platform** addresses different forms of exchanges including:
  - Open Data coming from cities (but that could also come from firms and any territory actor);
  - User Generated Content involving end users;
  - Aggregated and Contextual content coming from social networks and local data.

  Associated with the facilitation of communication, sharing and exchange possibilities, this will bring new opportunities to create new types of business.
  Furthermore, UGC today addresses mainly young people, we would like to experiment how these new possibilities will enlarge and motivate a bigger part of the population and actors of a city or a territory.

- The **Game Platform** will contribute to the durable capability of secure monetisation pathways enabling **peer achievement communities generating value for digital consumable economies** to further game-to-retail markets of user-generated and professional consumer products and large scale co-media events. Examples of public/private partnerships such as the Skye Wars app (featured in the App iOS App Store[1] and shown in the image below) show the potential for collective, immersive experiences enabled by the platform technology. In this case, a partnership between Disney Research, ETH Zurich, and the ACM SIGGRAPH conference allowed thousands of participants from 77 different countries to take part in a novel collective activity.

*Target 4: Creation of **new European-scale markets**, overcoming potential fragmentation, for smart infrastructures, with integrated communications functionality, contributing to economic growth and to **European leadership** in global ICT applications markets.*

- Market and technology fragmentation remain to hamper innovation in the TV sector for many media companies. Also smaller service and application providers have substantial difficulties to access the Connected TV domain ecosystem. Technologies developed in the project target open platforms like the Web and HbbTV - a specification for hybrid and connected TV applications. Web and TV application developers of any given size and profit from the results of the project. To sustainably overcome fragmentation, key use cases and technical solutions have been contributed to standardisation – most notably to HbbTV and W3C.

  Today, more than 95% of Connected TVs sold in Germany support HbbTV version 1.x. Derived from the experimentations in FIcontent, project partners, substantially contributed to the definition process towards revision 2.0 of HbbTV which was eventually released by ETSI in fall 2015. A key result is that

[1] https://itunes.apple.com/us/app/skye-wars/id672970985?ls=1&mt=8

future HbbTV-capable television sets and set-top boxes coming to the market next year and beyond will have built-in support for 3rd party TV application launch. Applications developers are no longer bound to negotiate with individual manufacturers or service providers. TV applications can be launched from any mobile device – similar to Chromecast, yet in an open environment without the need for additional devices. Combined with the now-inherent support for multiscreen scenarios in HbbTV 2.0, seamless multiscreen experiences can be created by any media company and 3rd party developer alike. Also the usability for pairing devices has been improved to enable automatic device discovery in the home. Furthermore, project developments remain available to interested developers.

- The **Smart City Services Platform** addresses the residential mass market that should cover the **overall European market** as far as every European country is now equipped with fast fixed and mobile Internet.
  The Smart City Services platform is deeply grounded in the open innovation area, consequently the technology developed within FI-CONTENT2 will be fed into Open API Frameworks and therefore being directly available for European Citizens for immediate and uncommitted usage and exploitation. Moreover, the Smart City Guide impacts on widening market opportunities for content and service related SMEs by involving them in open innovation. A central challenge for these SMEs is the length and breadth of the Long Tail, and how to identify markets, create appropriate services for them and then target customers. By providing tools for aggregating the Long Tail, making it easier to create innovative applications and services, through interface improvements, search and retrieval, and by supporting entrepreneurs, the Smart City Services platform will in particular make markets more accessible to those SMEs.

- The wealth of production markets of the **Game Platform** are location agnostic with content accessible to the mass consumer populace. This is **only achievable through focused platform delivery** with a European scale approach. Our three-tiered approach targets limited deployment in restricted areas as a stepping-stone toward broader citywide rollout. In particular, based on market analysis noted above, we aim to open new European-scale markets in each of the three tiers that form the bases of the Game Platform testing. In Tier 1, our Augmented Resistance prototype shows the type of nextgen connection between physical toys and virtual experiences that are made possible by the Game Platform's technology. The Eva Superhero Scientist tested in New York's Grand Central Station with hundreds of participants shows how nextgen location-based experiences (Tier 2) can be crafted using the platform. The Treasure Hunt city-wide game, unveiled at the Ludicious Game Festival, provides a nextgen community experience with cultural connection to the city's history. All examples build upon cloud computing analysis that guides the overall Future Internet infrastructure.

*Target 5: **Evolution** (not clean slate) of **Future Internet infrastructure** compatible with the emergence of open, secure and trusted service platform for building networked applications that can be leveraged through user-centred open innovation schemes;*

- Professionally generated content requires the extension of existing experimental infrastructure, or currently closed network features, to a more diverse and open platform. Metadata standards and content contribution systems need to work with downstream features such as QoS and content provenance checks to allow a trusted and professional standard experience for end users. The involvement of our viewers and users in large scale field trials drives the take-up of these services, further opening the market to newcomers.

- The **Smart City S**ervices platform includes specific technologies such as aggregators for context-aware information, social networks, recommendation services, but also advanced **Internet features** such as authentication, security management, distribution management, storage, search engines, which cannot be absent in the future Internet. The challenge of the project will be to assemble these technologies and allow them to interact and scale.

- The **Game Platform** has been built on the background competencies of the participants in usability analysis, game delivery, framework and context awareness research advancement. Advanced IT development at ETH Zurich continues to focus on open, secure, and accessible platforms. This will integrates deeply with communications services originating in the platform partners **to evolve and mature mechanisms closer to the customer**. Testing sessions conducted throughout the project guided the advanced development of game platform's architecture, feature set, and end-user experience. Hackathons conducted in Zurich, Barcelona, and globally (via online registration) resulted in platform components that serve as technological building blocks for crafting interactive experiences. Usability testing, such as the evaluation of AR mixing technology[2], guided the user experience modules.

*Target 6: A **comprehensive approach towards regulatory and policy issues** such as interoperability, openness, standards, data security and privacy within the context of the Future Internet complex and 'smart' usage scenarios. This may also address the required methodologies, procedures and best practice needed to address trans-national aspects where a high degree of public-private co-operation is needed. Participation of the public sector in the PPP will be a key asset to progress in these non-technological issues.*

- The **Social Connected TV** platform drives openness by developing extensions to HbbTV and further related standards; HbbTV is the standard supported by most CE manufacturers and the FIC2 project played a major role in the specification process of the latest HbbTV release (HbbTV 2.0). In addition the public service broadcasters in the project, with the support of commercial partners, have delivered best practice guidelines for European broadcasters and service providers relating to usability, tracking user actions and privacy in the hybrid TV environment.

- One of the main requirements of the Smart City Services is to rely on standards especially for "open data" related models in order to ensure any application will be able to interoperate with the created content.
  In addition, it should use open data provided by administrations which would also be standardized APIs in order to access to any of them in any town of any European countries.

- Engagement and drive for open communication, computation and control systems **standards and protocols** supporting our **Game Platform** underpin the future Internet. Establishing and growing a collaboration infrastructure on future creative industries technology development in Europe is a goal of the project. Results were disseminated in appropriate academic and public venues following non-aggressive intellectual property processing and mass-market product launches. In particular, we have designated testing plans to ensure that third parties such as students or small SMEs can utilize the Game Platform to create novel game content. This was achieved by publishing all the Specific Enablers as open source software publicly available on GitHub and promoting the usage of the platform through events such as Hackathons where the participants were a mix of students, independent developers and SMIs.

4.2 - Summary of main dissemination activities

FI-CONTENT 2 is acknowledged in 36 papers and has given birth to 11 patents. The consortium has organised or participated in over 50 events, with various types of public (researchers, industries, citizens…) from the three domains targeted by the project. To fit with the FI-PPP communication guidelines, FI-CONTENT 2 has put its commercial name "FIcontent" in the background of the FIWARE scene in favour of the unique "FIWARE" naming and identity. Besides several materials created (for printing and online purposes), the project dissemination has been very active on the web, more particularly on Twitter with over 750 followers and on YouTube with over 11 000 views, over 130 blog posts, quarterly newsletters, and a serious involvement in FI-PPP communication actions. The mediafi.org website represents and summarises most of the project

[2] Influence of Animated Reality Mixing Techniques on User Experience. Fabio Zünd, Marcel Lancelle, Mattia Ryffel, Robert W. Sumner, Kenneth Mitchell, Markus Gross. ACM Proceedings of Motion in Games, 2014

dissemination activities and results. Finally, the consortium has created the “FIWARE Media & Content Lab”: an online catalogue of the FIWARE Media & Content enablers developed under the project (and potentially beyond), and a playground for all developers to test, tweak and run these technologies. Both websites will be maintained at least two years after the end of the project.

4.3 - Exploitation of results

Thanks to the ideas and synergies that flourished in the consortium along the project, FI-CONTENT 2 has been the cradle of various products developed by partners, should they be exploited individually or jointly. At the end of the project, a few solutions built by FI-CONTENT 2 actors are already creating value on the market, mostly in the broadcasting industry. As most of the FI-CONTENT 2 results intend to be open-source to answer FIWARE requirements, lots of project developments had for first target to be exploited by the growing FIWARE community. However, these developments also led to research progress in various fields (namely Augmented Reality and Connected TV). Finally, an important exploitable result of the project is the portal known today as the "FIWARE Media & Content Lab", which potential exploitation is still under discussion within the consortium. Two potential customers have been identified: on the one hand, suppliers of technologies (enablers) who would pay through membership fees or possible fees on commercial transactions to use the Lab for community building, promotion of their technologies or web referencing; on the other hand, App and web developers who would pay for a commercial grade hosting SLA, strategic or technical consulting, training, or software realization.

The results produced are software modules and experience acquired by experimenting applications based on these modules in the user experimentation sites.

- The foreground is primarily used by the developers of the modules for developing their respective businesses.
- The modules are further made available either by ways of source code or by ways of SaaS hosted services for use by third parties via clear terms and conditions.
- Finally a majority of the modules are published under Open Sources terms allowing third parties to use and modify them to adapt to their own needs.

The Intellectual property produced belongs to the developers of the modules and is protected by the Terms and Conditions described in Deliverable D5.4 and published on the lab.mediafi.org portal.
Most of the software modules will continue to be sustained and further developer by their initial developers. In addition to the continued development by the initial developers, the Open Source modules will possibly also be enhanced and further expanded by the user community of these modules.

Below table summarizes the results produced:

Type of Exploitable Foreground[3]	Description of exploitable foreground	Exploitable product(s) or measure(s)	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
Commercial exploitation of R&D results	3D Map Tiles	Has been used in other research projects and demonstrators as part of DFKI exploitation strategy. Potential incorporation into FIWARE portfolio of WebUI GEs.	Already in use	None	DFKI

[19] A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

Type of Exploitable Foreground[3]	Description of exploitable foreground	Exploitable product(s) or measure(s)	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
Commercial exploitation of R&D results	App Generator	**mapsquare.io**: is being used to launch on-demand Map Server infrastructures onto any cloud	Already in use	None	eBIZ
Commercial exploitation of R&D results	ARtool				DNET
Commercial exploitation of R&D results	Asset Storage	Has been used in other research projects and demonstrators as part of DFKI exploitation strategy. Potential incorporation into FIWARE portfolio of WebUI GEs.	Already in use	None	DFKI
Commercial exploitation of R&D results	Audio Mining	Has been and will be used in other industrial and public funded research projects as part of IAIS exploitation strategy.	Already in use	None	IAIS
Commercial exploitation of R&D results	Augmented Reality - Fast Feature Tracking	DFKI: Has been used in other research projects and demonstrators as part of DFKI exploitation strategy. Potential incorporation into FIWARE portfolio of WebUI GEs.	Already in use	None	ETH, BLRK, DFKI
Commercial exploitation of R&D results	Content Enrichment	Parts of this enabler will be used in other funded research and industrial projects. The CENR API will also extended in funded research projects.	Already in use		FOK
Commercial exploitation of R&D results	Content Optimisation	Parts of this enabler have been used in other industrial and public funded research projects as part of IAIS exploitation strategy.	Further use of enabler uncertain	None	IAIS
Commercial exploitation of R&D results	Context Aware Recommendation	Activity recognition/classification, framework for definition of custom recommendation matrices, APIs for connecting different content sources with recommender engine, mobile app development SDK	Already in use	Patent applications in preparation for custom recommendation matrix preparation framework and mechanism for dividing open street or google maps into polygons	LCI
Commercial exploitation of R&D results	FIC2Lab documentation qualification pipeline	Toolset has been advertised to FIWARE/FI-CORE for improving their documentation quality in the catalogue.	No date set.	None	DFKI
Commercial exploitation of R&D results	FIC2Lab portal	The portal is operated for Phase 3 accelerators and subgrantees. The code of the portal is provided as open source software, and can be used by	Currently in use		VIV

Type of Exploitable Foreground[3]	Description of exploitable foreground	Exploitable product(s) or measure(s)	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
		other projects for creating catalogues of software modules.			
Commercial exploitation of R&D results	FIC2Lab Runner		Currently in use		TCF
Commercial exploitation of R&D results	FIC2Lab software qualification pipeline		Currently in use		IAIS
Commercial exploitation of R&D results	FIC2Lab Tweaker		Currently in use		PIX
Commercial exploitation of R&D results	FINCONS Applications	Results are permanently demonstrable at FINCONS Innovation Lab (Vimercate - Italy), potential customers interest collected and meetings are being scheduled	mid 2016	none	FINCONS
Commercial exploitation of R&D results	Flexible and Adaptive Text to Speech	Has been used in other projects	Already in use	None	MIVOQ
Commercial exploitation of R&D results	Fusion Engine	Has been used in other research projects and PhD lessons in our university	Already in use	None	UPVLC
Commercial exploitation of R&D results	HBB TV Application Toolkit	Parts of this enabler will be used in other funded research and industrial projects	Already in use	None	FOK, IRT
General advancement of knowledge	Leaderboard		Already in use	None	ETH
Commercial exploitation of R&D results	Open City Database	Based on this enabler a component was developed for an industrial project to enhance streaming media delivery	Already in use	None	FOK
Commercial exploitation of R&D results	OpenDataSoft	Over 60 customer accounts in production (City of Paris, City Of Brussels, ...)			ODS
Commercial exploitation of R&D results	Phenomobile Dialog Manager	The enabler is used in two commercial games (a civic participation games, (already online) and an Aquarium Simulation Mobile Game (to be published in 2016) and one research project that combines games with real-world engineering.	Already in use	None	TAK
Commercial exploitation of R&D results	POIProxy	Tenerife Transit Experiment in VIA-Mobil 2.0, POI for Geoportal Communitat Valenciana			PRO
Commercial exploitation of R&D results	Reality Mixer - Augmented Audio		Already in use		ETH, BLRK

Type of Exploitable Foreground[3]	Description of exploitable foreground	Exploitable product(s) or measure(s)	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
General advancement of knowledge	Reality Mixer - Camera Artifact Rendering		Already in use	None	ETH
Commercial exploitation of R&D results	Reality Mixer - Relection Mapping	DFKI: Has been used in other research projects and demonstrators as part of DFKI exploitation strategy. Potential incorporation into FIWARE portfolio of WebUI GEs.	Already in use		ETH, BLRK, DFKI
Commercial exploitation of R&D results	Second Screen Framework				IRT
Commercial exploitation of R&D results	SLAMflex				DNET
Commercial exploitation of R&D results	Social Network	ECFI, Project Ray			PIX
Commercial exploitation of R&D results	TV Application Layer	Currently underlying BBC iPlayer, BBC Sport and other BBC TV applications	Already in use		ULANC
General advancement of knowledge	Unusual Database-Event Detection		Already in use	None	ETH
Commercial exploitation of R&D results	VideoCloud	Results have been incorporated in other projects and products	01/11/2015	-	BT

5 - PROJECT PUBLIC WEBSITE

The FI-CONTENT 2 website developed during the project life is accessible at the following address:
http://mediafi.org/
http://lab.mediafi.org

end of the document