FI-CONTENT

D5.3: FI-CONTENT Phase 2 implementation plan -release 2-

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Abstract

This document presents the implementation plan for Future Internet PPP phase 2. The objective is to describe how each use cases will be experimented in several European test beds. For each domain, one or several test beds have been identified (see deliverable 5.1 : Phase 2 Implementation plan methodology). In the document the following aspects have been described for each use case : definition of the system, description of test objectives, user communities, test methodology, description of infrastructure, user feedback, analysis and evaluation.

It is the final release of D5.2 which has been delivered end of October 2012.

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Executive summary

FI-CONTENT Work Package 5 prepares Phase 2 of the PPP programme. Its objective is to identify and to define the test beds that should be used for a large pan-European experiment of FI-CONTENT use cases.

The first deliverable (D5.1) presents the methodology set up to perform that work as well as its application on a first set of test bed candidates.

The second one (5.2) presents what and how test beds will implement FI-CONTENT use cases and how they plan to experiment them with real user communities.

This final edition (5.3) aligns 5.2 with what has been submitted for phase 2 in terms of use cases and test beds.

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Abbreviations

ADSL	Asymmetric Digital Subscriber Line
Adv-3DUI	Advanced 3D User Interface
AdvUI	Advanced User Interface
AR	Augmented Reality
B2B	Business To Business
CAR	Connected Augmented Reality
CDI	Connected Device Interface
CMP	Device composition
CMS	Content Management System
DRM	Digital Right Management
DTTV	Digital Terrestrial TV
DVB	Digital Video Broadcasting
ENOLL	European Network of Living Labs
EPG	Electronic Program Guide
ETHZ	ETH Zurich
FTTH	Fibre To The Home
GE	Generic Enabler
GPS	Global Positioning System
GSMA	GSM Association
GUI	Graphic User Interface
HbbTV	Hybrid Broadcast Broadband TV
HD-PoI	High Definition Point of Interest
ILB	ImaginLab
IM	Instant Messaging
IPTV	Internet Protocol TV
LTE	Long Term Evolution (4G)
MC-DFP	Many Core Data Flow Processing
MWC	Mobile World Congress
OTT	Over The Top
PEGI 7	Pan European Game Information
SCG	Smart City Guide
SDSD	Scalable Dynamic Spatial Database
SME	Small and Medium-sized Enterprise
STB	Set Top Box
UGC	User Generated Content
UI	User Interface
UPC	University Politecnica Cataluña
VOD	Video On Demand
ZHdK	Zurich University of the Arts

Introduction

This document presents the revision 2 of the implementation plan for FI-CONTENT use case test. FI-CONTENT WP2/WP5 has initially identified a number of potential use cases in the 5 domain area and then has focus on a subset of them which have the most interest to be experimented in phase 2 of the Future Internet PPP. The objective of this document is to explain how the experimentation of the phase 2 selected uses cases could be done with real user communities and in the potential test beds identified in deliverable D 5.1. This second edition is aligned with the FI-CONTENT-2 proposal and propose business case scenarios which will be elaborated during FI-CONTENT-2 project lifetime.

For each use case, the document gives information on the following aspects :
1. Use case description (short version)
2. First stage testing :
    a. Definition of system
    b. Description of test objectives
    c. User communities
    d. Test methodology
    e. Description of infrastructure
    f. User feedback, analysis and evaluation
3. Wider testing plan
4. Adaptation plan for phase 3
5. Business model scenarios

In preparation to FI-CONTENT-2, we have consolidated efforts on a core set of platforms and content types that build on the experiments from Phase 1. The infrastructure generated by the project will allow 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 Phase 2 will focus 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.

We have carefully chosen a bouquet of six excellent running experimentation sites in Brittany, Berlin, Cologne, Barcelona, Zurich, Lancaster and Milan[1] (option), which are complementing each other by providing rural as well as urban testbed infrastructures with active user communities to run the early trials.
- Brittany with its ImaginLab, (ILB) has served as the first role model for the various FI test bed infrastructures listed in the FI-PPP Infinity Database
- Berlin is an excellent model of a Smart City involved in the open data initiative and with Fraunhofer FOKUS' outstanding iTV and mobile user lab.
- Cologne's Living Lab was established in the ICT IP Citizen Media by pioneering participatory media community applications with great support of local stakeholders and public authorities
- Barcelona is a prime example of the European Network of Living Labs (ENOLL) by providing the whole city as a Cultural Citilab

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[1] At the date this report was drafted, Milan is currently not part of FI-CONTENT 2, it is considered as an option for future extension.

- Zürich is a well established academic-industrial gaming lab cluster initiated by Disney with the support of the two local technical and art universities, the City of Zürich and the Swiss Arts Council Pro Helvetica.
- Lancaster has, for more than ten years, contained a well established rural Living Lab with a university campus, the smart village Wray and a regional network of 1500 households testing Social Connected TV and mobile applications.
- Milan (option) as chosen city for the Expo 2015, is an ideal site to experiment innovative services for citizens as well as for visitors in the area of Social and Smart spaces, with the support also of Leonardo Campus within the Polytechnic of Milan and its academic-industrial community.

Table 1 – Phase 2 Experimentation Sites Overview

| Experimentation Sites Overview							
Experimentation Sites	**Brittany**	**Berlin**	**Cologne**	**Barcelona**	**Zürich**	**Lancaster**	**Milan** (option)
Test Social Connected TV Applications	Yes	Yes	Yes	No	No	Yes	No
Test Smart City Guide Applications	Yes	Yes	Yes	Yes	No	No	Yes
Test Gaming Applications	No	No	Yes	Yes	Yes	No	No
Number of active members in local Focus Group preparing Trials	10	30	40	40	40	15	20
Number of Organisations joining FI-CONTENT 2 User Advisory Board	2	3	5	8	3	2	TBD
Support of Local Public Authorities	Yes	Yes	Yes	Yes	Yes	Yes	TBD
Number of trials	3 (**)	3 (**)	3 (*)	3 (***)	4	4	2
First Experimentation Cycle (month 6-12)							
First trial	MO 6	MO 6	MO 6	MO 6	MO 6	MO 6	MO 6
Second trial	MO 7				MO 9	MO 10	
Second Experimentation Cycle (month 15-22)							
Next trial	MO 15	MO 15	MO 15	MO 15	MO 15	MO 15	MO 15
Next trial		MO 18	MO 18th	MO 18	MO 18	MO 18	
Size of test user panel for mobile outdoor trials	50	30	25	30	40		50
Size of test user panel/ households for indoor trials	50	30+	20	20	N/A	1000	20
User experience evaluation based on experimentation data sharing policy..	Yes	Yes	Yes	Yes	Yes	Yes	Yes
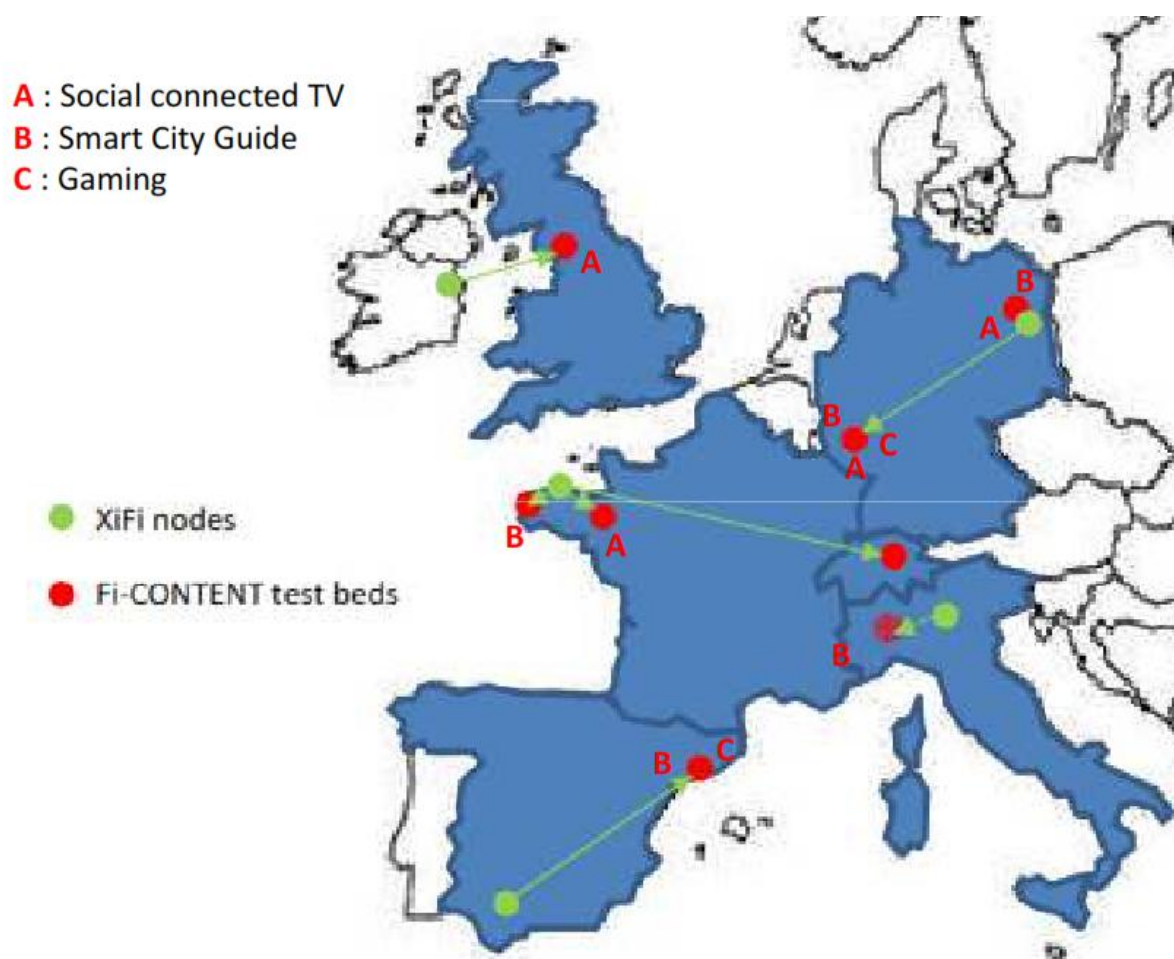
Figure 1 - FI-CONTENT Phase 2 Test Beds map

1 - Game Platform

1.1   Description

Recent trends in social media indicate that gaming appeals to a wide range of demographics, and one in four European adults consider themselves to be "gamers" (Interactive Software Federation of Europe Consumer Survey 2010, http://www.isfe.eu/). Naturally, the statistics rise even higher with teenagers and children.

We envision a multiplayer mobile gaming platform that leverages the future internet technology in order to enable millions of users to participate in innovative mobile gameplay experiences. A central theme of this new social gaming platform is moving beyond the traditional gaming 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.

Our use case is designed to enable new gaming experiences that are not possible without the future internet infrastructure. Creating these new experiences creates at the same time new business and monetization possibilities. For example, by bringing connected gaming experiences to traditional toys we open new markets for the sale of toys, trading cards, extension packs, and other physical objects that then have an impact on the connected gaming world.

In this Future Internet Game Platform focus we organize our scenarios into a 3-tiered structure, which provides a scalable product framework of layered building blocks necessary to implement compelling authentic gaming experiences aligned to business uses. The tiers are defined as follows:

Tier 1: Consumer Products - This tier targets augmented-reality games based on toys, fashion, and other connected, digitally enhanced physical products. Games will use the product as a known and structured environment/level and include a limited number of networked uses. Further, capturing close visual, audio and physical user interactions with toys to further enhance magical gameplay. Toys of particular interest are those including characters/pets with intelligent responses and constructive design toys permitting engrossing and rewarding user generated content.

Tier 2: Location-Based Installations - Here, we target games developed in an installation such as a historic monument in which connected, cooperative game experiences are used to make the visit more compelling. This tier builds upon the first tier with interaction and sensing of real-world locations and a greater number of users. This tier connects to other use cases related to education and learning. Immersive ways of experiencing such locations are key to this tier.

Tier 3: City-Wide Games - The third tier targets citywide games in which larger numbers of players interact in unstructured environments. Testing will take place in large-scale testbeds. This tier is the most challenging, as it requires a high degree of mobile connectivity as well as game dynamics implemented in unstructured locations. Accurate localization of key points of interest across large-scale environments is a focus of this tier, requiring new hi-resolution, and structure and content localization methods.

Concept illustrations of potential games that fall into the three tier categories are shown in Figure 2.

Tier 1   Tier 2   Tier 3

Figure 2: Illustration of the 3 Tier approach.

In realisation of our tiered usage areas, we will offer open source access to each of our specific enablers which will be developed upon the realization of our Game Platform architecture. This access will grant all (or in some cases the most usable) code elements of these technologies arising. Third parties will be able to access these advanced and refined services arising from our development of specific enablers focused on the 3 tiers of use cases (digital toy, location-based & city wide gaming). At this stage, we identify these to include accelerated 3D user interfaces (Adv-3DUI), many core data flow processing (MC-DFP), high-definition point of interest (HD-PoI), 3D toy tracking (AdvCAP) and semantic physical interaction (Sem-RVI) each progressing from advanced developments upon the associated Advanced User Interface generic enablers (AdvUI) from FI-WARE. Further, connected AR spaces (CAR), community analysis adaption (ADP), device composition (CMP) and physical fabrication (FAB) are concerted efforts to achieve wider adoption of the Game Platform in the future internet. The Game Platform marketplace of open components will be provided for use case testing at our Zurich hosting site, in addition to the wider deployment platforms.

1.2   First stage testing

1.2.1 - Definition of system

In order to extend gaming and virtual environments one has to address the challenge of efficiently engineering networks to support online, interactive & shared virtual world which can host literally thousands of users all running around in the same game world doing whatever the game offers them to do. This is reflected in the design of a massive multiplayer mobile gaming and virtual reality platform on a Future 3D-Internet designed to enable a large population of users to participate in innovative gameplay and collaborative online world experiences.

The platform is designed in a modular way to support a wide variety of different games with the common focus on blending real-world and virtual gameplay. The use case functionality are designed to support a tiered testing structure in which prototypes of increasingly challenging gaming scenarios are developed and tested in turn. Each prototype will be a vertical slice that demonstrates the functionality of the system mechanics with a single target level/scenario, similar to vertical slice development used by commercial game studios. We consider:

- **Consumer Products**: this tier targets augmented-reality games based on toys, fashion, and other physical products. Games will use the product as a known and structured environment/level and include a limited number of networked uses.
- **Location-Based Installations**: this tier targets games developed in installations such as a museum in which connected, cooperative game experiences are used to make the visit more compelling.
- **City-Wide Games**: this tier targets city-wide games in which larger numbers of players interact in unstructured environments.

Figure 3- Game Platform Architecture Overview

Our system architecture supports these gaming community scenarios and integrates with future internet platform services, enablers common to content usage areas and critical components of the game application's focus. We illustrate this arrangement as the basis for gameplay tests, in the layered Figure 3 and in further detail in Figure 4. In the first stage testing, we focus on consumer product types of games, and well as do some preliminary testing for Location-Based installations.
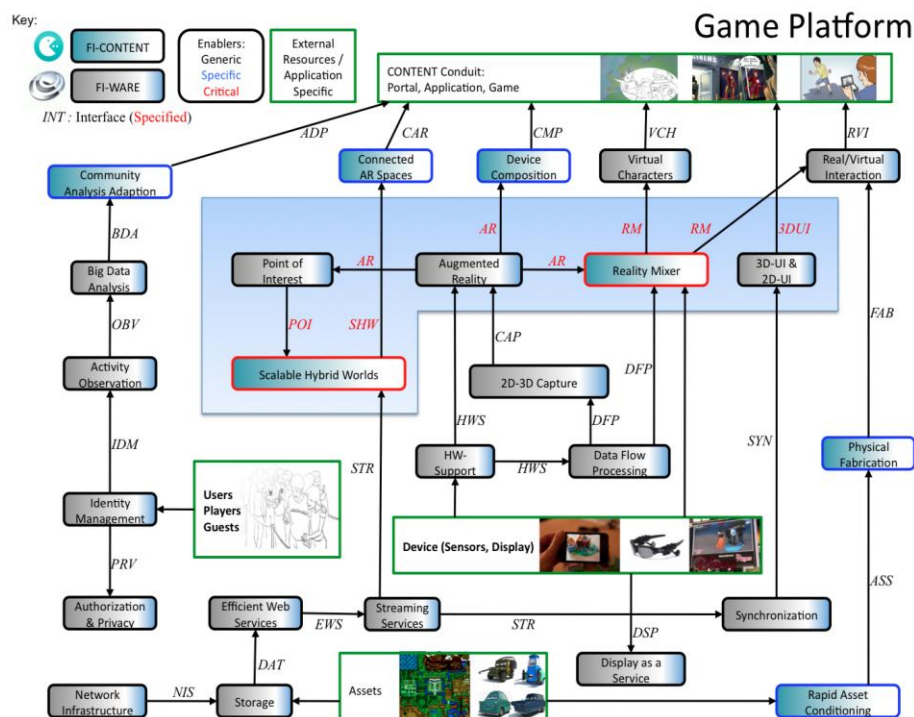

Figure 4- Game Platform architecture

The overall architecture and context for Game Platform is shown in Figure 4 above. The following sections describe the highlighted (red) interfaces provided by Game Platform specific enablers and related FI-WARE epics of this architecture. In achieving real-time feedback of intensive interactive experiences through web distribution, we arrange reality Mixer, SDSD, Augmented Reality (including artifact recognition and tracking), 3D Web and Streaming services in close proximity to the composition of device capabilities, making use of hardware abstraction services, and services for accelerated processing of image, video, sound and graphical data. Often processing data equivalent in volume to Big Data, but more demandingly transient and time critical, with pre-processing and caching mechanisms being key to performance. Many-core processing and cloud content processing fall within the scope of services underlying implementations of rapid and responsive applications.

Above this, the Point of Interest HD-URL enabler makes use of Augmented Reality services and spatial database infrastructure to achieve sufficiently accurate localization for stable, anchored 3D overlay of virtual content on the real-world not currently possible with GPS or Wi-Fi triangulation alone. This contributes to a standard accurate positioning service for virtual world content and so the basis for synchronization of multiple remote shared views of the same AR world, which is continuously streamed according to live participant movements and actions.

We further consider the support of tools and services to reduce the costs of massively multi-player online worlds, including real/virtual physical interaction methods making the web's user interface more natural and transparent, virtual autonomous characters for rich living environments as service that are common across many application areas.

1.2.2 - Description of test objectives

We consider the following sets of test objectives:
On a general level, we want to understand the usability and quality of both the game platform and the applications created using it. Developers using the platform are provided a number of tools to monitor the user experience and assess the quality of their product, in order to learn how to improve their applications. We consider two distinct analysis methods: Metric-Based Analysis and Community-Based Analysis. These methods are complementary and aim to gain a widespread range of information.
Given the context of the three tiers (AR Toys, installations, and city wide games), we want to assess the capabilities of the platform at each stage. To this extent, we set as first stage of testing the goal to validate the platform with at least two AR demos (tier 1 and tier 2/3), as well as doing at least one field trial involving a user community.
As described further in section 1.2.5, a number of enablers are part of the game platform architecture. Integrating and validating these enablers is part of the test objectives.
The Game Platform will provide at least one module for the monitoring and validation of the applications being developed within the platform, and as such will be employed in testing of the applications statistical and functional behaviors of the set of achieved enablers within the architecture. At least one field trial will be performed to gain understanding of direct user engagement with applications built upon the Game Platform.

1.2.3 - User communities

Broadly, European citizens enjoy video games. We target wide accessibility, inclusive of PEGI 7 demographic range without advanced expertise or know-how required. We assess players want to achieve, gain status, share, chat, role-play, nurture, follow and have real-world transferable gains.

We consider the following test environments as the locations where our user communities will be established.

1. **Zurich** is the primary focus for game experimentation, given the expedient co-location of DRZ and ETH Zurich with strong local support from the City of Zurich, the Zurich

University of the Arts (ZHdK) and the Swiss Arts Council Pro Helvetia, with further partners building upon paths to this location established in Phase 1.

Modern game development draws together diverse disciplines such as game design, software engineering, digital art, storytelling, and user experience to create a range of forms of interactive entertainment. At the heart of a successful game team is a strong peer relationship between art and technology in which both challenge and inspire the other. A key goal of game design is to provide surprising or novel experiences, which has led to the early adoption of emerging platforms and driven the development of new hardware. As such, the strong connection to the Zurich University of the Arts and the Swiss Arts Council Pro Helvetia is a cornerstone of our Game Platform experimentation plans.

On the technical side, ETH Zurich will provide the cloud infrastructure to permit scaling of services hosted in the programme of experiments. Opportunistically, Cologne and Barcelona provide locations attractive to the city-wide game scenarios of our third Game Platform tier.

2. **Cologne** is our second experimentation site, and will perform cross-platform early trials testing – toghether with the other platforms - the Gaming one.

The first experiment builds around the preparation, performance and presentation of a student field trip in the city including the testing of the gaming platform targeting games developed in an installation such as a historic monument in which connected, cooperative game experiences are used to make the visit more compelling. The first idea for the early trial is to create a motivating gaming scenario, where the student team plays a treasure hunting game called Mediacaching on a virtual geo-map combined with real explorations in streets discovering with mobile devices the cultural heritage sites in the local region. The game master has prepared the media caching game by placing on the virtual geomaps different digital surrogates representing the historical links to the cultural heritage sites. The idea of the game is for the class to discover the hidden media objects of the local cultural hot-spots by using their mobiles testing the AR applications. They can enhance or replace them with own novel media objects from the actual cultural site today. Credits will be given for completing the game in a fixed timeframe and special points for the most creative presentations of the cultural sites today

3. **Barcelona** experimental site will provide an attractive location to the wide area game scenarios of the third Game Platform tier. In particular, we share with Cologne the interest in testing City-wide Games. Our approach goes in the direction of gamification of the global tourist industry in the city, and, in particular the professional visitors and its events. The GSMA has defined the city of Barcelona as the Mobile World Capital until at least 2016. It includes the annual celebration of the annual Mobile World Congress gathering the bulk of mobile industry actors. Games are one of the main driving forces of mobile industry.

i2CAT is building for the MWC a Mobile World Lab, an experimental and independent open laboratory for testing 4G and next mobile technologies, applications and services around the city with the collaboration of all kind of companies and general public. We will be interested in designing a gamification scenario where professional visitors of the MWC and also local citizens could play using broadband mobile applications and services.

In the local community we will also include an active group of advanced users and developers in the area of gaming from the UPC, the main technological university in Barcelona, with experience in the Global Game Jam and an active community of young users from primary and secondary schools at Citilab, a citizen laboratory in metropolitan Barcelona.

1.2.4 - Test methodology

We define and implement the testing criteria and feedback analysis relevant for the Game Platform. We consider two distinct analysis methods: Metric-Based Analysis and Community-Based Analysis. These methods are complementary and aim to gain a widespread range of information.

Metric-Based Analysis consists in the automatic collection of data from the users playing a given game. We consider quantitative, measurable, data organised in the following categories: User Data, Session Data, and Game Data. Data collection follows a best effort strategy.

Community-Based Analysis consists of the collection of qualitative feedback through interaction with playing communities. This requires the user to actively share their experience. Various forms of interaction are considered: Direct feedback, Portal feedback, and Social Network feedback.

Validation. The goal of these analysis instruments is to validate the games and the platform on a technological and qualitative level, as well as provide developers with appropriate tools to monitor the user activity.

1.2.5 - Description of infrastructure

Primarily, the Zurich test site at ETH will see the development of the necessary infrastructure for test deployment of the Game Platform. Necessary components of this include:

- A cloud architecture for game hosting and deployment (initial architecture in Figure 5)
- Compute servers and Internet infrastructure to deploy the Game Platform
- Storage systems for the core Game Platform, game-specific data, and testing information
- Feedback collection mechanisms for user testing
- Mobile hardware (iPad, Android, etc.) for game testing
- Define requirements how XIFI can enhance the infrastructure configuration for the large scale experiments in phase 3 of the FI-PPP

The testbed with hardware made available to others will comprise scenario-specific platforms that can be packaged as virtual machines and be installed in another datacenter.

As shown in the Figure 5 below, the platform is organized in a server centric model, where a server communicates with a number of clients over the network. The client runs on portable, handheld device, with computing and sensing capabilities, such as today's smart phones and tablets. The server runs as distributed service on the cloud, and deals with heavy computation tasks involving content processing and interaction among large numbers of clients. The platform provides the necessary sub-modules, such as client-server communication, authentication and security, transmission of video data and image processing, assets storage and management.
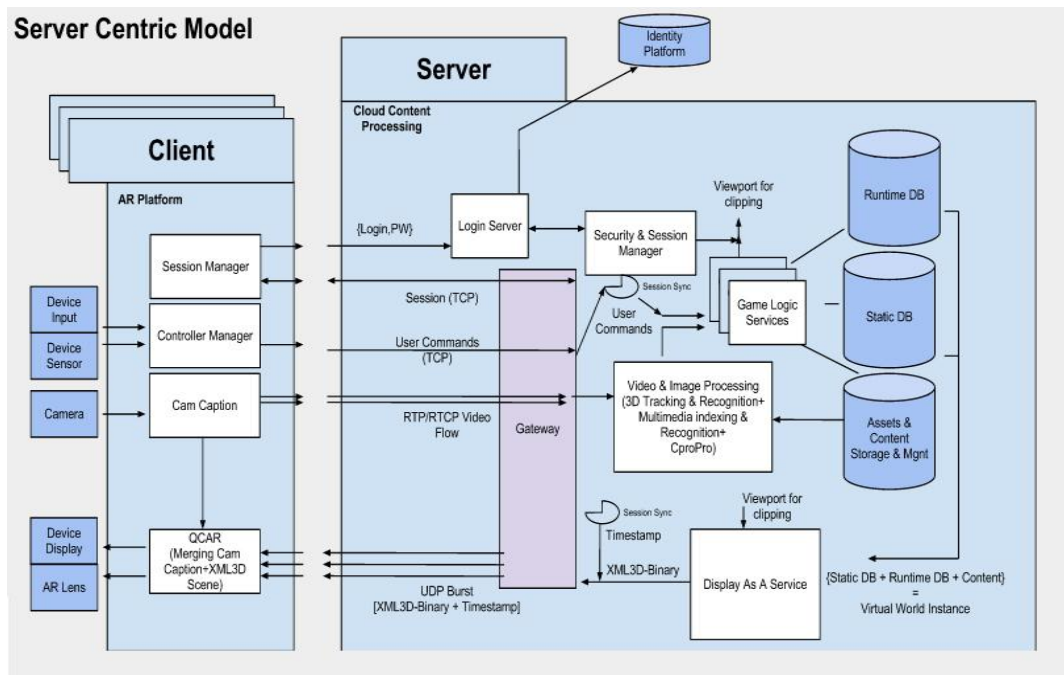
Figure 5- Game Platform Server centric model

1.2.6 - User feedback, analysis and evaluation

As described in 1.2.4, we consider Community-Based Analysis as methodology to collect user feedback, utilizing three forms of interactions: Direct Feedback, Portal Feedback, and Social Network Feedback.

User feedback is generally a mix of quantitative and qualitative data. It may be collected in form of textual description of the experience, rating of specific aspects of the applications and experiments, or as general interaction over the community portal and social networks.

Developers will be provided with tools to visualize such feedback, to directly interact with the communities. Moreover, the platform will allow sharing data and accessing the experience of developers creating similar applications and tracking improvement over time. Links to marketplaces will provide additional statistics and represent a user feedback in terms of customer appreciation. The anonymous monitoring, analysis and statistical response also forms a focus of our specific enabler engagements for Community Analysis Adaption.

The collective developer experience will represent valuable assets especially in Phase 3, when new developers will gain access to the platform, and will become an essential component in the learning process.

1.3   Wider testing plans

As discussed in 1.2.1, we envision a three-tiered use-case testing scenario that includes:

1. Consumer Products
2. Location-Based Installations
3. City-Wide Games

The first stage of testing will include full experimentation Tier 1 and initial testing for Tier 2. The wider testing plan include additional testing and experiments for Tiers 2 and 3, growing from specific locations in Zurich to wider areas and other testbeds.

Location Based Installation will be tested in Zurich at specific point of interests. This may include Museums, Movie Theatres, Sightseeing locations, or specific commercial activity locations suitable for the specific application. This Tier builds upon the first stage of testing with real-world locations and greater numbers of users. Given its nature, this type of applications and games connect with other use cases related to education and learning.

City-Wide Games are applications in which larger numbers of players interact in unstructured environments. Testing will take place in large-scale experimentation sites such as Zurich, Cologne, or Barcelona. This tier is the most challenging as it requires a high degree of mobile connectivity as well as game dynamics implemented in a unstructured locations.

The plan is to grow slowly but steadily from small to large, having rapid prototyping cycles, and explore new options as the experimentation sites grow mature.

Zurich Experimentation Site

Zurich will be the main experimentation site for all stages of testing of the Game Platform. In the context of experimentation, the local partners will have the following functions:

- DRZ: will coordinate the experiments, monitoring the execution and keeping track of the user experiences.
- ETHZ: will provide the technical support to run the experiments and grant access to its existing infrastructure. It will also provide a user community of technical students enrolled in engineering disciplines connected to Games and Augmented Reality.
- ZHdK: will provide access to a user community of young Game Designers.
- City of Zurich: will support the project by allowing the deployment of tests in public spaces.
- Swiss Art Council Pro Helvetia: through its "Game Culture" program, it will provide access to a user community of Swiss game developers, assisting in the expansion of user communities for Phase 3.

Zurich user communities will be primarily composed of adults and students in their later stage of education.

Barcelona and Cologne Experimentation Sites

A lighter use of Barcelona and Cologne test sites will be employed to perform single application field tests, to broaden the evaluation of diverse user communities. In particular, we consider user communities of younger game developers or games enthusiasts, such as school children and teenagers.

The availability of multiple experimentation sites will also allow for running concurrent experiments in different location, by replicating isolated tests or by conducting connected experiments with interaction of users located in different cities.

1.4   Adaptation plans for phase 3

The platform is designed to provide the necessary support for the third phase of the Future Internet program. We envision the opening of the platform to new developers, providing the necessary instructions and tools to operate the platform, as well as sharing the experience of the use case tests.

The three tiers vertical slice development provides different levels of complexity that will attract different partners and SMEs both in the vicinity of Phase 2 Game Platform partners, such as Zurich, Saarland and Edinburgh and beyond via the open cloud platform deployments. The feedback from a larger base of developers and users will help improving the state of the platform further along with the results of extensive testing plans. We expect trials will raise new questions on platform use concerns.

The intended outcome is an ecosystem of usable platform components for SMEs to build new innovative applications. The work of phase 2 will aim to resolve system deployment and interoperation of relevant enablers to support rapid adoption of many SMEs across multiple sites. The business framework and impact of results for SMEs is also an area of importance we consider in preparations for a successful phase 3.

1.5   Business scenarios

Digitally augment consumer products

We aim to increase content consumption thanks to accessible tangible goods. This context focuses on the accessibility of tangible goods with wider appeal. The ARToy scenario supports a business model in which a toy is manufactured and sold through traditional retail channels. Purchasing the toy allows a child to unlock a collection of free AR games using the toy as the environment. The initial free collection can be supplemented with additional "game episodes" purchased via a self-contained micro transaction system, online proprietary portal/application store or retail token codes.
Procedure:
- Visual augmentation of toys
- Physical and audio augmentation
- Interactive characters and pets on and within toy's play space

Developing a tangible interaction medium engages developmental motor skills and unbroken presence in the real world. In-game items, abilities, animations, characters, clothing or other virtual effects can also be purchased. Thus, the original toy provides the seed for a consumer ecosystem centred around the game. Following transmedia concepts, the ARToy can connect to existing or future online worlds.

Creating these new experiences creates at the same time new business and monetization possibilities. For example, by bringing connected gaming experiences to traditional toys we open new markets for the sale of toys, trading cards, extension packs, and other physical objects that then have an impact on the connected gaming world.

Digitally augmented play space

We aim to increase content consumption thanks to enhancing spaces where people meet to play. This context includes controlled environment gameplay in a local shared space. Here, we target games developed in an installation, such as a museum, in which connected, cooperative game experiences are used to make the visit more compelling.

Procedure:
- Visual augmentation of room, chamber, store, rides, stage
- Physical and audio augmentation of play space
- Connected play spaces

Developing a tangible interaction medium engages inter-personal communication skills. The game can become 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.

Bringing gaming experiences to controlled spaces like museums or kiosk installations holds great potential as a middle ground between the restricted setting of ARToys and the more open-ended city-wide context presented next. Games in this location-based context have potential to offer unique experiences for players as well as for content producers and marketers.

City-wide gaming

We aim to increase content consumption thanks to accessible tangible goods. This context targets city-wide games in which larger numbers of players interact in unstructured environments. It is the most challenging as it requires a high degree of mobile connectivity as well as game dynamics implemented in a unstructured locations. Accessibility of orchestrated Internet content over a wide area is a key factor, together with accurate localization and environmental awareness.

Procedure:
- Visual augmentation over wide area
- Physical and audio augmentation
- Interactive game play

Developing a tangible interaction medium engages developmental navigation and exploration skills. Using real-world locations provides compelling settings for gaming experiences that can be both entertaining and educational. Connecting to familiar locations promotes tourism, business growth, and deeper connections to the cities in which we live.

Wide-area gaming has a tremendous potential but is also the most difficult scenario due to the unstructured nature and challenging set of technologies needed. Thus, the conclusion and recommendation in this context is to treat the gaming contexts in turn, first focusing on ARToys and then on location-based gaming before approaching wide-area gaming. This way, each step can be used as a foundation for the next, making the overall problem tractable.

2 - Social Connected TV

2.1 - Description

The partners involved in the TV platform of FI-CONTENT 2 plan to iteratively design, implement, test, and improve social connected TV services in the following areas:

User tracking and privacy

In a world where more and more professionally created content is streamed over IP networks and consumed on a variety of connected devices, broadcasters and other media services providers will be capturing increasing amounts of data about the content users are consuming. As IP-enabled TVs will gradually be present in every household, users will be able to access a wider range of services that gathers usage data. This means the same concerns over privacy, current on the web, will begin to emerge on TV. The ability to track users' behaviour around TV viewing will benefit:

- Broadcasters/media providers will be able to create personalised services and improve programme making
- End users will have visibility over the TV activity data and will be able to manage how it is used by the broadcaster and third party service providers

By putting in place tools that allow users to view their activity data, control it and such interaction to feed back broadcasters and service providers, specific research topics can be evaluated in the context of large-scale testing with end users.

The offering of personalised services on a TV such as tailored recommendations or the ability to view the attention data gathered by the broadcaster implies that the connected TV should be authenticated to an online account (individual or household).

The authentication process on a TV using a connected device addresses issues related to what stages would be most appropriate to be displayed on the TV (e.g. input feedback, confirmation, prompts), positioning of user interface overlay that need to be clearly visible at a minimum distance of 1 metre. It also addresses how to adapt current interaction models to improve the login process and ensure it is seamless, clear and simple with minimum learning curve ensuring users can quickly access the services available (i.e. personalised recommendations, activity dashboard etc..). The aim is to evaluate with end users the effectiveness of the authentication method to an online account that can be standardised across IP-enabled TV platforms and connected devices.

Once users access their online account they are going to be given visibility of the data that services hold about them and have control over their data:

- users can control how this data is used (e.g. service personalisation, including recommendations)
- users can export their data from a given service to allow transfer to other services
- users can delete data that services hold about them

Personalised TV experience

The challenge here is to design personalised services that will help users easily access and find their content of choice based on data inferred from the behaviour of individuals and groups of users, as well as explicit data provided by the users, e.g. through subscriptions and ratings.

- Content portals tailored to single and multiple users

- Social interaction between users (e.g. explicit recommendation)
- Search and discovery applications

Multi-screen interaction

Second screen services for connected devices such as Tablet PCs and smartphones will be developed. They will complement the TV experience and extend it towards novel usage scenarios. Intelligent inter-device and broadcast-broadband synchronisation will be used to present connected TV as one seamless platform to the user

- Intuitive interaction for advanced TV services
- More versatile content presentation across screens

2.2 - Field Trials

The use cases (as well as the related applications and the technology components in the backend) will be iteratively improved and upgraded during regular agile cycles based on the feedback gained from the lab and field trials of the experimentations.

In phase 2 of FI-CONTENT there will be two cycles of experiments, starting after the first 6 months of FI-CONTENT 2 and ending in the 22nd project month. These iterations will be preceded by a six month set-up period and followed by a two/three month wrap-up period. The Social Connected TV Platform will be tested at experimentation sites located in Great Britain, France and Germany (in both Berlin and Cologne).

Berlin Experiments
On the Berlin experimentation site Social Connected TV services will be tested that build on developments made in FI-CONTENT Phase 1. We will investigate the use of second screen applications in a synchronised hybrid TV environment. The services will be extended to address multi-screens and up-scaling concepts. We will also consider personalisation and issues regarding tracking of user data and its exploitation in terms of personalised content services. Following initial lab tests the services, based on RBB and ARD content, will be deployed to existing RBB HbbTV infrastructures. A representative panel of households will test and evaluate the services. As the services will be available on open networks they will also be accessible to a much larger group of users.

Brittany Experiments
The Brittany experimentation will focus on multi-screen (PC, tablet, smartphone) user experience versus various access (ADSL, FTTx, LTE) & networks (IPTV, DVB-T/T2). The user feedback should assess Social Connected TV service accuracy and relevance (search and discovery engines results) and usability and acceptability across various social environments (students on the move, family at home, etc). The experiment is not linked to a specific content provider and will rely on French Digital Terrestrial Television programmes (including regional/local contents) as well as French content aggregators or catch-up TV (like Myskreen for example).

Cologne Experiments
The Cologne experimentation site will perform cross-platform early trials testing the Social Connected TV, Smart City Guide and Gaming test applications. The connected TV part of the experiment will investigate social recommendations and content sharing as part of a collective media experience to create multiple, non-linear content discovery journeys around any chosen media subject. Designated test user panels will be cast in role of Active Explorers. Using any HTML5 or HbbTV

compliant device the test users will access existing AV professional content (from TV and VOD content providers such as RTL), as well as UGC, to create an individual truly personalized programme guide around a chosen media subject. Users will be able to share and interlink their individual programme guides to create a rich media community programme guide to recommend existing content to their friends and relatives.

Lancaster Experiments

The Lancaster (ULANC) experimentation site in Great Britain will manage or facilitate the deployment of testing tools. ULANC will host a number of iterations of user trials on personalised TV content consumption through user tracking and preference modelling. More specifically, it will investigate the strategy and methodology to track usage statistics and how such statistics can be visualised for each user and exploited for personalised content services (e.g. tailored content recommendation).

Social/interactive TV applications will be deployed onto an existing IPTV platform within the University of Lancaster student campus and their wider Living Lab infrastructure. Regarding the test content, the Lancaster site will continue to use a number of major UK TV and radio live channels and recordings (for on-demand service) within the UK under the ERA (Educational Recording Agency) licence as well as other content provided by the BBC. The first user trial will be designed to evaluate the test applications for better user perception and statistics modelling. Subsequent large-scale user trials will be hosted "in-the-wild" with thousands of users in the Lancaster Living Lab environment. It is also planned to measure the effectiveness of the personalised viewing experience through objective service metrics and user questionnaires.

The sites will implement scenarios with on-demand content offerings on connected devices. The use cases (as well as the related applications and the technology components in the backend) will be iteratively improved and upgraded during regular testing sites.

Tracking of user data and its exploitation in terms of personalised content services will also be tested in collaboration with RBB and IRT at the Berlin site. Following initial lab tests the services, based on RBB and ARD content, will be deployed to existing RBB HbbTV infrastructures. A representative panel of households will test and evaluate the services. As the services will be available on open networks they will also be accessible to a much larger group of users

2.2.1 - Definition of system

User tracking and interaction

The system to be tested is based upon a video-on-demand (VoD) service that allows users to view TV programmes streamed over the Internet. Users can sign in to receive a personalised interactive service on their connected TV or PC. This allows users to see details of all programmes viewed, bookmark their favourite programmes, and receive suggestions of recommended content to view. The service provides data privacy management features, so that users can tell the system to stop collecting data, or have a 'private viewing' mode where users can view programme content without the system recording details of which programmes have been viewed.

In addition to the back-end media streaming and delivery components, the system also comprises a connected TV or set-top box platform that delivers a simplified sign-in process with an intuitive user interface that guides the users through the authentication process. The system will be able to recognise several devices as authentication input device – from standard TV remote controls to smart devices (e.g., tablets, mobile phones).
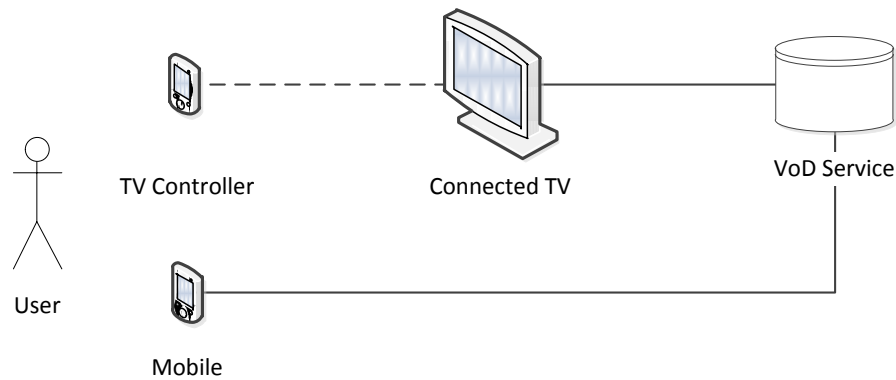
Figure 6 - User data & authorisation Service description

Refer to section 2.2.5 for details of the system architecture and infrastructure, and use of FI-WARE generic enablers and FI-CONTENT specific enablers. The first set of the system's core components comprises the *Media Streaming*, the *Secure Authorization* and the *User Profile* to allow sign-in to an online account via a Connected TV.

Personalised TV experience

The TV Experience should help the users finding their personalised programmes. The system is based on a TV Back-end platform that manages the access to the content catalogues such as TV guides, Catch-up TV catalogues, VOD catalogues, the users data and the integration with the Search & Discovery engines. The consumers watch and interact with the personalized services on connected TV or PC, 2nd screen devices, such as Tablets, Smartphones and through a broadband Internet connection (ADSL2+ or FTTH).

The applications available for the consumers take benefit of the Search engine capabilities and of the multi-screen interactions to facilitate the movie or TV event request. Furthermore, other applications invite the consumers to discover the large amount volume of content thanks to Discovery technologies with a link to the social networks. The collection of applications exploits the usage data to personalize the services.

Multi-screen interaction
The foreseen multi screen interaction enables TV viewers to browse enhanced digital teletext services, additional information, EPGs or catch-up TV services, access to Search and Discovery services on their personal devices while the regular programme is running on their HbbTV-capable TV set or on their connected TV or PC. The applications can act as smart remote controls for the main TV screen – e.g. for selecting content on the personal device to be watched on the main screen, as alternatives to or extensions of the main screen for presenting information or interaction devices with links to further information and social media.

2.2.2 - Description of test objectives

User tracking and privacy
We want to assess the level of control users want to have over their personal data in regards to TV activity.

Concrete research topics to be addressed include:

- What are user attitudes towards sharing data between different products and services within a single content publisher's offering?

- How do user attitudes to data tracking change over an extended period of time? Could it be used for measuring impact with viewers? Could it be used as a way of rating programmes?

- Under which conditions do users agree with and how can they profit from long-term tracking of their usage data?

- How can usage data be used as a way to evaluate and improve services or potentially to modify them in real-time?

Finally, we also want to understand if by simplifying the sign-in process users would be more likely to authenticate. The objective is to assess effectiveness of the system to ensure a seamless user experience during the authentication process. The aim is to implement an interaction model that is simple, effortless and intuitive.

Personalised TV experience
The aim is to test how users search and discover content through personalized services.
We will be especially attentive to the usability of services as well as how easy is the access to different applications.
To do this, the user must quickly find relevant content for himself and other people in front of the screen basing on innovative applications involving discovery technologies, search engine and the participation of the social network of user.
The improvement and optimization of the indicators (time, relevance, etc.) will be part of the iterative testing process that will be implemented.

Multi-screen interaction
We aim to measure the overall usability, stability and acceptance of the services developed. In particular we aim to investigate:
- The context in which second screen services are used and make the most sense for users and for editorial productions,
- What happens in multi-user situations
- What happens in multi-screen situations
- The most attractive types of services and features
- How can personalisation be introduced
- What role do second-screen applications play in social TV viewing?

2.2.3 - User communities

Brittany
Social Connected TV experimentation in Brittany will be held in a multi-device and multi-access network environment and evaluation must assess service usability and efficiency (perceived efficiency of search and discovery engines from the user perspective, especially the duration before selecting content). It will rely on Free-to-Air content for DTTV/IPTV and one French aggregator for VoD. There is no specific local content provider (local channels are parts of DTTV channels).

Berlin
In Berlin, a user panel of approx 20 representative households will be created to test multi-screen interaction on smart TV and connected devices. The households will be equipped with HbbTV-enabled TVs and Tablet PCs and given access to the services and applications to be tested.

As target audience for our use cases we want to include a represent sample of German TV households:
- Demographic range between 18-75 years old
- Mix of viewing habits

- Familiar with ARD and RBB programmes and services.
- Various levels of computer and Internet literacy

Cologne

An Expert Focus Group, established during FI-CONTENT has selected students from schools and universities (groups of 16 -18 year old pupils as well as a groups of 18 – 25 year old students) in Cologne to participate in the co-design of the user trials for phase 2 and also to participate as test users in the experiments. In addition, Pixelpark has a user panel of 20 households equipped with interactive TVs to test the Social Connected TV platform.

Lancaster

Targeted student communities with specific interests will be set up on LAN Bailrigg campus. A link to members of the public in rural villages will also be maintained to deploy experiments.

Lancaster University will work with Information Systems Services (ISS), a division within the University responsible for network management, local community users within the rural villages around Lancaster, and the management team of B4RN (Broadband for the Rural North) for a smooth deployment of the experimentation process. B4RN is one of the organisations listed in section B2.3.4 (Involvement of external parties) and will also be joining the User Advisory Board of FI-CONTENT 2.

As target audience for our use cases we want to include the widest range to truly represent typical European citizens:
- Demographic range between 18-75 years old
- An even spread of unconcerned and concerned in regards to users' attitude towards online privacy
- Various levels of computer and Internet literacy

2.2.4 - Test methodology

The test methodology for Social Connected TVs consists of various aspects: internal tests and validations from the responsible partner, evaluations at the experimentation sites, open calls in order to invite external parties and to analyse their feedback and competitions on the Connected TV platform.

It is planned use the experimentation sites from Brittany, Berlin, Cologne and Lancaster to get results on different experiments. Therefore two experimentation cycles will be organized (month 6-12 and month 15-22). Each cycle consists of one to two trials. Most experimentation sites have established local focus groups preparing the content user scenarios for the early trials in Phase 2. In FI-CONTENT 2 the partners will organise together with their local focus groups the early trials by activating the members for the user test panels, running the mobile and indoor trials and moderating a user advisory board at each experimentation site. The size of the focus groups varies between 10 to 40 active members, the test user panels vary between 20 and 50 participants and the user advisory board varies between 2 and 5 members.

Another way for testing and evaluating the Social Connected TV platform is to invite external parties by an open call in order to analyse the according experimentation feedback. Following the industry-driven approach of the FI-PPP programme to build and deploy harmonised European-scale technology platforms and their implementation in European industry, FI-CONTENT 2 will foster the validation, testing and experimentation of applications by developers, experts and especially European SMEs, which are active in the relevant areas. Thus, FI-CONTENT 2 strengthens SME innovations and prepares for phase 3 of FI-PPP through the concept of open calls.

User tracking and privacy

The system will have embedded capabilities to allow remote monitoring of users' behaviour through logs of interaction with the features that are automatically sent and stored onto a centralised, cloud-based database accessible only by authorised evaluators. This will allow us to view progress and monitor the correct functionality of the system during the course of the trial.

Access to the system and its features will automatically be disabled at the end of the trial and no further data will be tracked or stored on the centralised database.

Personalised TV experience

For conducting tests, a community of users equipped with connected TVs or PC and secondary screen should be registered. Information will be gathered through service platform logging functions that will log information related to user's action.

These logs will be:

- What action has been done (i.e. which application has been selected)?
- When did it start/end?
- Who performed the action (maybe several persons)?
- What content was accessed/ played?
- How long does a play take?
- Which additional information has been accessed?

In addition feedback will be asked to the users about their feeling in navigation, ergonomics and way of using the system. Is it easy, intuitive? Can the users find rapidly the content they want?

Multi-screen interaction

The test users' use of the services will be observed and investigated using a number of tools such as tracking user interaction, diary studies, on-screen questionnaires, depending on the services' level of maturity and consequently the objective of the individual tests.

Quantitative data collected will include the number of users of a service, frequency of use, clicks, pages visited, length of sessions, and measurements on the application response times, server capacity and traffic generated.

Lab tests will be conducted to collecting qualitative data on user interaction with the system through means of direct observation and interviewing.

User will be invited to the lab. Following a preliminary introduction to the test and service users will be assigned a set list of tasks. Through the tasks the users will be guided through the service and required to test the main functions and features. The users will be observed while they are completing the tasks. The observer will note the following:

- success/failure rate
- time taken to complete the task
- acceptance and understanding of functions

Following the tasks the users will be interviewed about the service.

All information gathered will be handled according RBB, ImaginLab, Lancaster University and Pixelpark's data protection guidelines, which are derived from local, national and EC law on data protection and privacy.

2.2.5 - Description of infrastructure

User tracking and privacy

It is planned to deploy the test applications onto existing (IP) and hybrid TV platforms and within experimental lab infrastructures provided by the project partners. Therefore the University of

Lancaster will provide an existing IPTV platform that is in operation at the student campus and their wider living lab infrastructure.

The following Figure 7 shows the major system components, in terms of technology enablers identified within the FI-Content project.
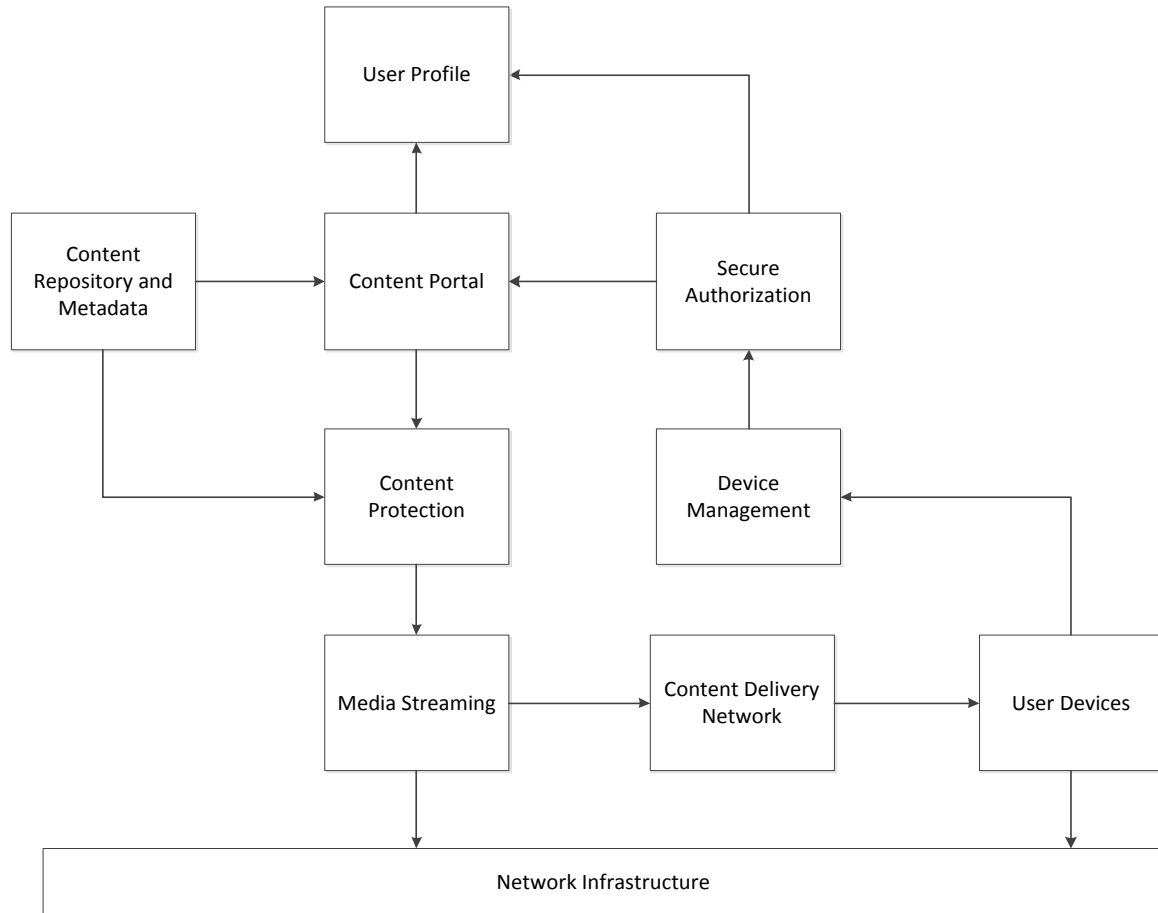

Figure 7 - User tracking and privacy system component description

The *Content Portal* allows the user to browse and search for programmes to view. Programme content is stored in the *Content Repository* together with metadata describing the content. Media content is streamed to users' devices by means of the *Media Streaming* component.

User preferences and viewing history are stored in the *User Profile*, which in addition to data storage provides privacy management functions. *Secure Authorization* allows the user to sign in using their connected TV, mobile, or PC device in order to access personalised content.

The *Device Management* component enables the smart controller to discover and establish communication with the connected TV.

The core infrastructure components make use of FI-WARE generic enablers (GEs), such as the *Data Centre Resource Manager (DCRM)*, *Cloud Edge Service Management (CE)*, and *Object Storage* FI-WARE cloud GEs. The *User Profile* is implemented in terms of the *Secure Storage Service Optional* and *Identity Management* FI-WARE security GEs. Other components shown are FI-CONTENT specific enablers.

There is going to be a common technical platform of the FI-CONTENT 2 ecosystem, that will be possible be used to build, host and operate the content applications to be tested with end users. This

platform will build as much as possible on top of existing FI-WARE Cloud hosting generic enablers and infrastructures provided by FI-PPP capacity building projects, complemented with dedicated solutions to address FI-CONTENT 2 specific requirements.

Furthermore, there is going to be the need to define the requirements on how XIFI can enhance the infrastructure configuration for the large-scale experiments in phase 3 of the FI-PPP.

Personalised TV experience
The service will be deployed in the identified testlabs:
- BBC R&D's Media Network Integration Laboratory
- BBC Rural Connect North West living lab
- Brittany ImaginLabs
- Cologne experimentation site

The Social and Discovery Video Service Platform will be deployed on network to be accessible from different experimentation sites. The platform would rely on several enablers to operate the personalized services such as the Content Portal, the Streaming, the Search engine, the Discovery applications, the Content Repository and metadata or the User Profile Broker.

Multi-screen interaction
The services, based on RBB and ARD content, will be deployed to existing RBB HbbTV infrastructures. These will link to the second screen framework provided by IRT. The services experimented in Brittany will based on French DTT TV channels and on a VOD provider such as MySkreen, the network infrastructure will be the ImaginLabs one. The services experimented in Cologne will be used local content for TV and VOD such as RTL.

User equipment: HbbTV-capable STBs, connected or not TVs, Tablet PCs (Android, iOS)
Backend: Simulated or local DVB playout, French DTT free TV channels and a French VOD provider. Second screen framework server and Social and Discovery Video Service Platform
Enablers: User Profile Broker and Device Management; if available/suitable: Streaming, CDI

2.2.6 - User feedback, analysis and evaluation

Data tracking and privacy
User interviews, focus groups, cultural probes and questionnaires will also be integrated to investigate the overall user experience of the content service as enhanced by the personalisation feature and user issues related to privacy, identity and trust. ULANC will design and implement necessary monitoring tools to collect user and service statistics.

Ethnographic and other qualitative methods will also be deployed for user-related experimentation tasks. ULANC will produce an ethical consent protocol that describes the experiments and their purpose; guarantees participants anonymity and confidentiality and the security of any data obtained from them; and set out how the data and participants will be protected after the end of the project.

Personalised TV experience
Users' feedback will be elicited through the use of questionnaires related to users observations and interviews. Privacy aspects will be guaranteed in accordance with relevant regulations and users' consent.

Findings coming from questionnaires will be matched against Service Provider Platform logging information.

Conclusion will be presented considering both sources: direct users' feedback and logged info.

Multi-screen interaction
Users' performance in the tests will be analysed to provide information on how they tried to complete a task, how long this took and how successful they were. Depending on the results, adjustment may need to be made to the service.

Users' general level of acceptance of the service will also be assessed. This will provide important information about how to position the service and market it to new users. This information will be obtained through observation and direct personal feedback including interviews and questionnaires, etc.

Before participating in any tests users will be requested to sign an agreement with RBB, ImaginLab, Lancaster University and Pixelpark governing their participation in the experiment. This agreement will be drawn up by RBB, ImaginLab, Lancaster University and Pixelpark's legal department under the guidance of our Data Protection and Privacy Officer. It will explain to users how their data will be handled and their rights and obligations as test participants.

2.3 - Adaptation plans for phase 3

Data tracking and privacy
Altogether there will be two cycles of experiments across all experimentation sites, starting in month 06 and ending in month 22. These iterations will be preceded by a six month set-up period and followed by a two/three month wrap-up period. ULANC will manage and facilitate the gradual increase in user communities reach for larger testing experiments.

Between each trial we will evaluate the results and user feedback. This information will be used to improve and refine the system in preparation for the next stage of trials. We will identify the major issues and research questions that would need more exploration with a relatively young target group, most likely more technical than the previous sample group.

The third tier of user trials aims to identify the improvements needed to the system in order to provide a richer user experience. This is made possible once technical issues and fundamental flaws in the interaction models are addressed and rectified through the previous round of testing with a smaller set of users

The objective is to define an implementation plan that includes gathering requirements, consolidate partnerships and reach out to WP2-4 and WP7 for an analysis of the services that will allow for the building of an ecosystem for the phase 3 of the PPP.

In preparation for phase three of the FI-CONTENT project, we would consider how to adapt the system to operate in multiple Test Bed locations across Europe. This will improve robustness of the system and encourage standardisation through utilisation by different organisations/service providers.

We would also open the technology to SMEs companies towards further definition of the exploitation plans. Improvements to the system will be assessed and prioritised according to their relevance to the next phase of the project and its objectives.

Personalised TV experience

From the feedback of the evaluations performed during the Phase 2, some improvement regarding Search & Discovery applications would be needed to answer to consumer expectations. Furthermore, some adaptations will be necessary to enlarge the robustness, the reliability and the scalability of the platform.

In order to open the Search and Discovery applications to SMEs companies during Phase 3, some API will be available to allow the use of existing proposed Search and Discovery applications, or to allow the development of new Search and Discovery applications based on the Social & Discovery Service Platform. The openness will also offer the capabilities to ingest new catalogues.

Multi-screen interaction

The multi-screen tests, depending on the level of stability and readiness of the individual services, will be either limited to the test households or open to a larger community. As the project progresses we except to roll out an increasing number of test services and features and attract an increased number of users. The eventual goal being the introduction of selected and proven FI-CONTENT use cases on regular DVB-T/S/C services.

To achieve this type of roll-out we will require the involvement of third party SMEs such as application developers and interface designers. As the standards being followed are open ensures there is a low entry barrier for SMEs interested in offering their services.

2.4 - Business scenarios

One of the major challenges for broadcasters in the future is to retain and increase their audience share in an environment where connected TV sets can equally access broadcast and Internet distribution channels.

The merging of TV and Internet means that the way people find and use TV content is changing. Viewers must remain informed of what TV programmes are available, this information must be easy navigated, programmes need to be easily accessed and viewers should be given the opportunity to engage with them. FI-CONTENT addresses these issues.

Furthermore, a simple and seamless login experience is key to ensuring it does not become a barrier to personalized services, such as recommendations or social discovery. The ability to monitor audiences' viewing activity in order to identify areas of particular interest or needing improvement so that it can provide a better service back to its audience.

It is important that public broadcasters take the lead in addressing users' concerns over gathering personal data and its uses. The deployment of this service will provide guidelines for best practice and encourage other commercial broadcasters, content and service providers to make viewing data transparent and accessible to end users.

It is also important to recognize that data portability across services can be beneficial to both end users and service providers, as the standardisation of attention data formats will allow for portability and interoperability between services, providing opportunities to create new services of a more commercial nature.

Personalized services will inevitably increase the interest of the user to the system, and thus increase the audience on these services. An easy, practical and ergonomic access to the content is a valuable asset and a important differentiator.

Relevant recommendations of all types (social or custom) improve the user's confidence in the system and leads to more consumption. The interest for the service provider is obvious in this context.

We know that viewers use personal devices while watching television. Multi-screen applications exploit this situation by offering services and content on second screens that are synchronised with the main TV content and can thus offer continuity of use across different media.

By offering EPG or catch-up services on a second screen, users can easily browse and navigate through the service on interfaces and devices designed for personal interaction and offering more flexibility than a remote control. They can also do this without interfering with main TV programme and as such are especially suitable for group viewing situations. Offering synchronised content on a second screen also means that viewers have more flexibility about when and where to consume this content.

Ultimately the technology enables broadcasters offering to their viewers attractive services and an enhanced TV viewing experience.

3 - Smart City Guide

3.1 - Description

Smart City Guide
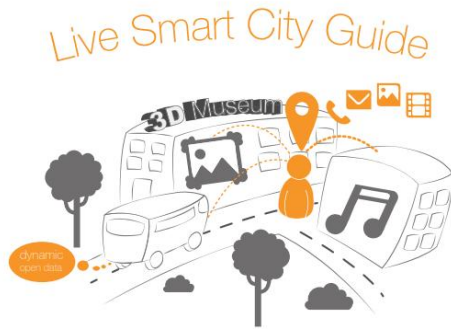
The Smart City Guide Service (SCG) allows users and communities to combine, organize and visualize for the first time **live Open Data, user generated content, user experience and feedback, and editorial content** for personalized and contextualized media services aiming at discovering, places, people, venues and live events.

Our target is to experiment with content, especially User Generated Content (UGC) and Open Data coming from cities, as a social activity driver, whether a group or a single person designs the content. The motivation is to spark off enthusiastic users' participation to interact over the Future Internet to co-create applications such as "live" Smart City Guides. The Smart City Guide connects, organises and visualizes all city-wide relevant real time information based on open data alongside user generated and professional content. It provides seamless access via navigable interfaces offering extreme ease-of-use for home based and mobile users.

By including contextualization, live information, live sharing, communication and social interactions, the Smart City Guide is an interesting concept to explore how Future Internet capacities could foster sociability and creativity.

The Smart City Guide will be a common interactive and informative platform dedicated both to tourists and to locals. People will combine to create a live Smart City Guide for themselves and fellow citizens. They contribute to the Smart City Guide by adding their own content or content that they have noted from their favourite site. They are automatically informed when some open data or some content is relevant in regard to their location. Live user generated video-streaming, open data, and cultural information will produce a new experience of live cultural events that people can share with local or remote friends and wider communities. We imagine that geo information, 3D content, open data, multimedia and cultural information will be combined to realize a "live" virtual city, which is living in the Future Internet each time a user uploads new content. The real and the virtual city will superimpose and enforce each other to open new ways of navigation and communication in urban environments.

The Smart City Guide will favour several kind of UGC: first, locals will be able to produce and post documents about an insufficiently known part of town or specific details on buildings or locations. They will complement official information given by institutions such as tourism offices by adding anecdotes and personal and relevant archives. Secondly, tourists will share their photos, their live video that they are shooting or media found on the city guide platform with relatives who have remained at home; UGC and public documents addressed to friends become conversational elements. UGC is thus a mixture of social relationships that enables the continuity between presence and absence, between individual and social activities. Different to today's commercial services such as Instagram/Picasa/Facebook/Youtube the Smart City Guide will enable dynamic trans-media storytelling where locals and tourists can interlink their live multi-perspective video streams, navigate through these non-linear stories and connect in real time with other users.

The SCG could evolve into a real community of users: members of a smart city social community can share live interlinked audiovisual tours of their city hotspots. Other members can experience these live video tours and change them to their taste. This way, a dynamic event and venue mesh is laid on top of the city map that is constantly getting denser and enriched with hundreds of little live stories related to venues and events. This scenario will be set up in several cities across Europe (Brest, Cologne, Barcelona, Berlin and also Milan as an option). The corresponding city guides can be connected and draw on each others' content, making it possible to compare venues between different cities or have a "similar tour in another city" recommendation feature. Any user can enjoy online different cities from the multi-perspective, emotional viewpoint of the local people presenting their own town.

Visitors and citizens can benefit from the federation of social networks they belong to in order to avoid to create yet another account on social networks and communities of their friends or of the other cities. The community platforms will provide the functionalities and support protocols to enable this federated scenario. Then visitors will continue to share their experience trough UGC and social activities in their own social networks and seamlessly other visitors in their own federated SNs can access and enjoy the others' experience.

In addition to the mentioned features, a new and entertaining paradigm for interaction with the service will be implemented: the usage of the Augmented Reality functionalities will help the user in finding relevant information of his interest directly on the live view camera of his mobile, allowing in this way his direct interaction with the real world surrounding the user. Both AR and image recognition features will give then to the user new search instruments to discover hidden treasures of visited cities. NFC- related functionalities will be also evaluated to be added to the platform in order to enable the user to interact with places and objects (e.g statues, TV screens, advertisements), to access easily information related to these places and objects and to allow to pay quickly tickets for public transportations or city events such as theatre shows.

Compared to existing services, the SCG offers the following service **innovations**:

The combination of:
- Open Data, UGC and streaming does not exist in terms of service yet;
- "Real Time", Personnalisation and Contextualization to favour community creation does not exist in terms of service also.

The usage of:
- Image recognition as natural search mechanism to find relevant information
- Augmented Reality as new paradigm to present contextual and enriched content

In addition, the SCG will investigate open data usage which is a promise market development sector. The enablers used for that purpose will be offered at phase 3 to any third parties interested to develop innovative services based on open data.

The Smart City Guide (SCG) is a service for tourists and locals. It covers 3 phases:

    Phase 1 - the Tour visit : the SCG provides contextual information in order to facilitate the actual visit (weather information, parking availability, etc.). The user can also upload additional information from its own (UGC) to enrich the SCG data base.

But also :

    Phase 2 - Tour preparation : the user prepares his tour by selecting locations and point of interests or a specific itinerary proposed by the guide; the SCG provides an access to information from coarse (main tourist sites information) to fine level (anecdotes or detail on a building) thanks to the mix between commercial or institutional sources and user generated contend. The platform also facilitates communication between people visiting.

    Phase 3 - Tour report: the user builds a report collecting information from the SCG data base and shares it with his/her relatives.

Five experimentation sites have been identified: Brest, Cologne, Barcelona, Berlin and Milan as an option.

3.2 - First stage testing

The use cases will be iteratively defined and upgraded during regular agile development methodology. In order to have quick end-user feed back about the ergonomics and design, we propose to use an agile development user centred method in order to enhance the service along its development. It means that end user tests should be achieved along the development in order to have quick user feedbacks and adapt the development to their recommendations.

To develop a harmonised infrastructure the Smart City Guide platform should orchestrate all essential services and make the link with all end user devices.

In order to insure interoperability, online support during experiment cycle the implementation will be centralized in Brest in the Imagin'lab platform as far as technical constraints allowed it. This platform is also a XiFi node that should facilitate phase 3 transfer.

There will be two cycles of experiments, the first one starting after 6 months and the second month 15. These iterations will be preceded by a six month set-up period and followed by a two/three month wrap-up period.

The objective is to develop and customise all the components and to integrate them together in order to provide an end-to-end functional service as far as they are available.

In the first stage testing plan we will focus on specific enablers (see smart city guide architecture plan). Generic enablers will be integrated in the second stage testing plan.

Brest (Brittany)

Brest experimentation site will be the main one in which we will produce the first release of the "Smart City Guide" in collaboration with Brest City.

Imagin'lab will provide the hosting infrastructure and platform access and connections. They are operating the 4G LTE network.

One of the main challenge of the "Smart City Guide" is to integrate different types of technologies and contents in a way that make sense for end users.

The Brest site will be the first site in which we set up integration taking into account the different technologies, mix of contents (especially dynamic contents and data).

Cologne

As mentioned earlier the Cologne experimentation site will perform cross-platform early trials testing the Social Connected TV, Smart City Guide and Gaming test applications.

The Smart City Guide part of the experiment builds around the first user scenario "Active Experience of live cultural event such as Carnival". Together with their teacher, the students of a school media class prepare the field trip by undertaking content research, explore the live cultural event such as Carnival in Cologne with their mobiles during field trips and create collaborative media presentations about their active user experiences.

Barcelona

Citilab, a living lab in Cornella, metropolitan Barcelona, have already developed a new tourist model call "knowledge tourism"[2]. This model is based on the hypothesis that a new generation of tourists will look for more creative places to engage themselves in creative experiences, not simply as

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[2] http://citilab.eu/en/projects/knowledgetourism

spectators, but fully as participants. A tourist living lab is an environment where native people and visitors (tourists) share a common experience. Citilab has just started testing the model at Colonia Guell, a community and at the same time a tourist destination because of Gaudi's monumental crypt, a UNESCO World Heritage Site[3]. Through different workshops community are training to present not only the Gaudi Cripta but also the community from where this artistic expression emerged.

The Barcelona Experimentation Site will deepen this user experience linking visitors and native citizens in sharing common creative experiences that could enrich the local community and also the tourist community. The Smart City Guide will be the place where both communities meet each other in a shared creative experience during the three phases of the tour, the preparation, the visit and the tour report. Each tour could be considered by communities, visitors and natives, as a unique moment of learning, discovery and innovation.

Defining the requirements of both groups in order to create the SCG as a sharing place of this new tourism model is what the Barcelona site will provide starting with this initial work in Citilab and Colonia Guell.

Berlin

The main focus will be on combined and integrated early trials of the utilisation of "Smart City Guide" applications on connected TV platforms.

Therefore, the objective is to use the location for services that target tourists and citizens providing information to live in and visit a city as e.g. Berlin.

- Tour preparation: the user prepares his tour alone or together with friends using a tablet, a smartphone or especially when preparing at home, the Smart TV. The SCG provides the access to information collected by the former SCG users who have already visited the city or collected by locals who live there.
- Tour visit: It is possible to run trials in various places in Berlin where the SCG provides various types of interesting information to the user. To run the experiments FOKUS will utilize the user communities built in conjunction with local universities.
- Tour report: FOKUS labs will be used to equip the user panels with infrastructure and access to SCG services using cross platform services and multi-device environments to build SCG reports, share and communicate with other users as well as to create a community between tourists and citizens.

Milan (option)

The Milan experimentation site, in collaboration with EXPO 2015, will be used to test Smart City Guide services during some satellite events in 2013 and 2014 and in preparation of the World Expo in 2015. In particular a Smart City Guide application for 4G smartphones will be used in order to provide the tester base with a service to access relevant and contextual information and content, aggregated from institutional sources and UGC. While people walk through the city, they are automatically informed when some content fits to their location, interest, context or new content is available, so they can have a richer experience on the move with the most fresh and updated information and content. They will be able also to interact with other visitors as well as to discover the city through the "augmented" map and live view (i.e. AR paradigm) of the city.

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[3] http://www.elbaixllobregat.net/coloniaguell/english/historia.asp

3.2.1 - Definition of system

The SCG Application can be used on different types of devices including mobile phones, tablets, computers, and TV sets.
For that matter, the SCG application provides different user interfaces (UI), depending on the type of equipment.
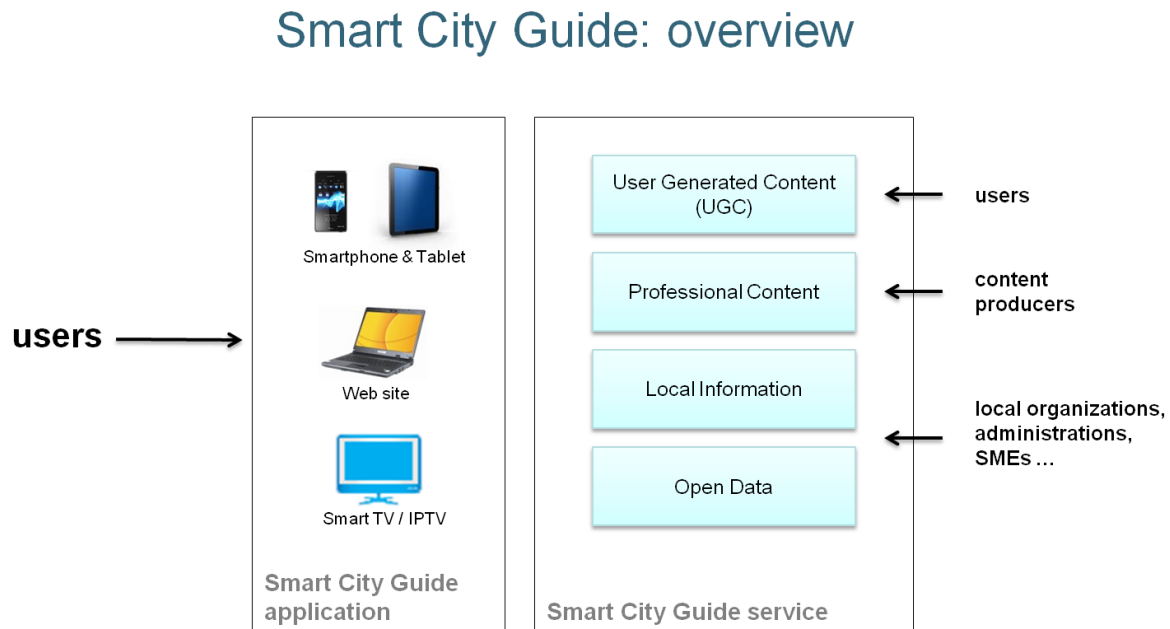

Figure 8 - Overview of Smart City Guide system

Brest

The experimentation will take place in Brest where Imagin'Lab is operating a 4G LTE network and a FTTH infrastucture. ImaginLab will also provide connections to the local authorities (Brest).
For Smart City Guide experiments, ImaginLab activities will encompass:
- Integration with local stakeholders of the Smart City Guide thin client, platform and access network provided by ImaginLab
- User panel management including incentives for users
- Loan of LTE devices - smartphone (mainly android), tablet or USB dongles (for a laptop), and SIM cards to access the ImaginLab LTE network in Brest

The experiment will cover the 3 phases of the service:
- We will experiment the tour preparation and tour report phases thanks to the ImaginLab FTTH infrastructure and the Brest user community (> 100 houses).
- We will deploy in Brest for the tour visit using ImaginLab LTE infrastructure

Cologne

The partners GAR and PIX of the Cologne Experimentation Site called >>Net-Innovation<< will co-create with its active user community the user scenario specifications for the experiments to test the Smart City Guide platform GAR will stage experiments for mobile and home users during live cultural events such as Carnival in Cologne. GAR will develop with PIX, the Cologne user advisory board including the City of Cologne, the University of Cologne, the University of Applied Science of Cologne, the Macromedia University of Design and Communication and public high schools and focus groups of students the scenarios for the early trials such as the active experience of live cultural

events, will co-design the user interfaces mock ups and prototypes to assess the feasibility of the test applications and will lead the user centric design approach to create novel user media experiences.

The testing capacity consists of cloud based server instances with monitoring and remote scaling capabilities, Next Generation Network, mobile devices as Smartphones and Tablets as well as lab/home devices such as PCs, Notebooks and TVs for multi-streaming and screening Services, state-of the-art flexible Software Streaming Server, Streaming clients or HTML5 solutions and Open Source Community platform with user and media management services. GAR is activating the focus groups and user community and PIX will deploy the tools for creation, sharing, collaboration for the open source community platform.

Barcelona

The Barcelona Experimentation Site will take place under the umbrella of the BL - Barcelona Laboratory initiative, founded by the i2CAT Foundation and the City council of Barcelona among others. For Smart City Guide Experiments BL will provide:

- 4G LTE Connections in specific points of the city,
- An open social network of different user organizations plus an open digital infrastructure,
- 7 Co-creation factories (physical locations in the city of Barcelona to deploy user lab activities),
- 2 Living Lab facilities in the metropolitan area (Neapolis and Citilab, physical locations in the metropolitan area of Barcelona to deploy user lab activities),
- FTTH connections in the 22@ neighbourhood,
- WIFI hotspots distributed along the whole city.

Berlin

The Berlin experimentation site plans to setup an open source community platform and build connections to the Smart City Guide concepts and planned phases. Furthermore the Berlin based showrooms belonging and driven by Fraunhofer FOKUS will be integrated into the tests by providing access to Berlin open data initiatives covering data from public transportation up to smart grids and more. FOKUS lab facilities also support a wide range of user centric end devices and experimentation installations as well as various service infrastructures such as mobile screens and applications, SmartTVs, IPTV and OTT infrastructures and multi-device environments to deal with novel distributed cross-platform applications and services. The existing infrastructure and services will be leveraged and integrated with the Smart City Guide to perform a broader range of tests and experiments. This main focus will be on combined and integrated early trials of the utilisation of smart city guide applications on connected TV platforms.

Therefore, the objective is to use the location for services that target tourists and citizens providing information to live in and visit a city as e.g. Berlin.

- Tour preparation: the user prepares his tour alone or together with friends using a tablet, a smartphone or especially when preparing at home, the Smart TV. The SCG provides the access to information collected by the former SCG users who have already visited the city or collected by locals who live there.
- Tour visit: It is possible to run trials in various places in Berlin where the SCG provides various types of interesting information to the user. To run the experiments FOKUS will utilize the user communities built in conjunction with local universities.
- Tour report: FOKUS labs will be used to equip the user panels with infrastructure and access to SCG services using cross platform services and multi-device environments to build SCG reports, share and communicate with other users as well as to create a community between tourists and citizens.

Milan (option)

The Italian test bed will host all the locally running enablers or access through APIs the remotely ones in order to enable as much as possible of the functionalities of the Smart City Guide platform.

The main specific enablers that will be available in the test bed will be:
- For the tour preparation function of the SCG platform:
  - A search instrument to access web resources but also cultural databases and social networks in order for the user to select and save in an easy way all the relevant information and content about the city is planning to visit.
- For the tour visit function of the SCG platform:
  - An Augmented Reality and image recognition platform that allows to deploy AR Content and visualize it superimposed to the reality as seen through the camera view of the mobile phone
  - A social network and its CMS that implements federated protocols in order to allow the federation features across several platforms that ensure cross exchange of content and social experience among user on different communities or cities.
- For the tour report function of the SCG platform:
  - A content enrichment platform that allows to annotate and enrich available content trough UGC (text, audio, pictures, video)
  - Publish/Subscribe Broker; Domain Compressed Video Analysis; Location Server; Semantic Annotation; Mash-up Factory; Security Monitoring GE; Identity Management; Data Handling

The Italian node of the XiFi project will support deployment and hosting of the platforms involved in the experiment.

3.2.2 - Description of test objectives

The key outcome of the testing is to understand the novel active user media experiences of the Smart City Guide Service and therefore assessment of the relationship between technology, performance (Quality of Service), user experience (Quality of Experience) and community behaviours (Quality of Community) is an essential element of this experiment.

The objectives of this FI-CONTENT Smart City Guide trials will be:

- To develop experiments, which engage the users actively in a live media event experience and to test novel paradigms for active (interactive and collaborative) user experiences shared over the Smart City Guide platform.
- To improve the social dimension of networking by supporting real-time interaction between users.
- To measure the Quality of the Experience of the users involved in the active experience of the live cultural event in a mix of real and online worlds, on particular to measure the quality of experience as it takes places in the real-world context as well as in social.
- To measure the acceptance and relevance of the technical means and new technologies provided to the community of students, of tourists or citizen in general. To measure the acceptance and usability of the GUI that supports the user in using the new services.
- All the findings from the first stage experimentation cycle in FI-CONTENT phase 2 will be evaluated and used as input for improving the usability, the quality of experience as well as the quality of the technology in the next experimentation cycle.

Questions/issues to be addressed by the testing:

Quality of service:

- How to mix Open Data, UGC (including Streaming) and professional contents in a way that make sense to end user ?
- How to combine Open Data, UGC and professional content in cross-border experiments?
- How to facilitate Open Data access to end user in a technical point of view? In a service point of view?

- How to design appealing user interfaces and formats for interlinked transmedia experiences?

- Which impact has pushing a "person centric" approach rather than "user centric" approach on services conceptualization, on business?

- Which "continuum" makes sense between presence and distance, collective and individual, multiple services, devices and technologies?

- How to technically enable the above mentioned continuum?

- Multi-screen: what is appropriate for which device? In presence and in distance? At home and on the move? Complementarity and similarity?

- Which adaptation is needed to existing technologies to achieve these types of services?

- Which tools (enablers/ functionalities) are necessary? Secondary but necessary? How different technologies coming from different providers can fit together?

Quality of experience:

- How to perform usability while different technologies and services has to be combined?

- What is the acceptability of profiling and contextualization in regards to the service?

- Do attractive experience can be perpetuated? And how?

Quality of community:

- How to foster community of interest?

- How real time information can foster sociability and sharing?

- How to recommend and support the connection between people based around a common media experiences?

3.2.3 - User communities

Most experimentation sites have already established in FI-CONTENT Phase 1 local focus groups preparing the user scenario for the early trials in Phase 2. For the Phase 2 the partners will prepare the early trials with their local focus groups and activate together the members for the test panels, run the mobile and indoor trials with test user panels and activate an user advisory board at each experimentation site. The size of the focus groups varies between 10 to 50 active members, the size of the test user test panels varies between 20 and 1000 participants and the size of the user advisory board varies between 2 and 8 members.

An example for such bootstrapping activity of a local user driven open innovation Ecosystem is shown in Figure 9 below.
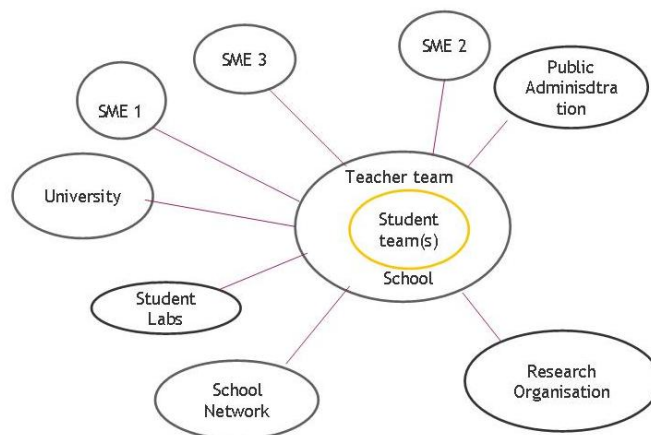

Figure 9- Model of Local User Driven Open Innovation Ecosystem for Phase 1

Right after the start of FI-CONTENT Grassroots kicked-off a first Focus Group meeting in Cologne to co-create use case scenarios for small, early trials in a regional experimentation environment. In July 2011 Grassroots Arts and Research organised the first regional Expert Panel meeting with the title "The sensible use of the Future Internet in Education and Culture" with about 25 participants. These focus groups are involving educational practitioners such as teachers, professors, school directors, student research lab staff, entrepreneurs and school networker and research organisations such as Fraunhofer IAIS.

For the Phase 2 large-scale experiments Grassroots will connect with their Cologne Testbed user community with the user community of the other FI-CONTENT 2 experimentation sites such as Brest, Berlin and Barcelona to create a model for an "user-driven open innovation ecosystems across borders" as shown in Figure 10 below.
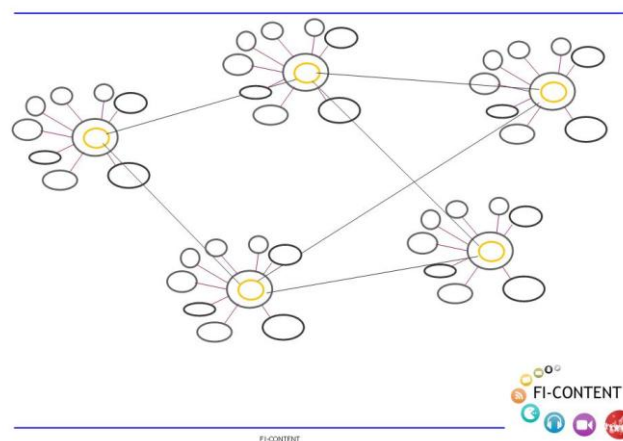

Figure 10 - Model for User-driven Open Innovation Ecosystems across borders for Phase 2 towards phase 3.

In order to build up and manage a large scale, cross-border user community for the large scale experiments in phase 3 the partners will deploy in phase 2 an open source community platform to connect the different local focus groups at the European sites to create a cross-border user community with a controlled number of test users for the early trials.

In phase 3 for the large scale experiments the partners plan to activate a large scale user community via their open source community platform by connecting with existing international user communities such as eTwinning (more than 153.000 networking schools across Europe), other international Living Labs provided by ENOLL (European Network of Living Labs), the FI-PPP user communities of the other use case trail projects as well as connect to any other existing social network such as Facebook to create a federated social network.

Our open source community platform will serve as an experimental Net-Innovation framework to enable citizens, and web entrepreneurs and SMEs in phase 3 to test the novel test applications implemented on these experimentations sites.

Brest
The experimentation is based on the ImaginLab testbed, which will provide 25 to 50 people using 4G daily on mobile or tablet, 25 people using their IPTVs, users visiting Brest, granted with LTE devices, and 25 to 50 people living in the city of Brest.

Cologne
In Cologne GAR is activating the focus groups and user community and PIX will deploy the tools for creation, sharing, collaboration for the open source community platform. Right after the start of FI-

CONTENT Phase 1 GAR has kicked-off a first Expert Focus Group meeting in Cologne to co-create use case scenarios for small, early trials in the Cologne experimentation environment.

For the Phase 2 this focus group has decided to carry out experiments around the Cologne Carnival and they created a model course for improved media skills for pupils from 16 – 18 years old at a model high school, who will carry out these experiments mentored, guided, graded towards their final exam as well as insured by their school, head master, teachers, and professors evaluating this model media course. As this focus group has high interest to carry out this model course they do it free of charge. This example shows that you need to establish right at the start of the project a trust relationship with the local citizens and organisations to have real interest in the experiments.

Secondly PIX activated already a user panel of 20 households equipped with interactive TVs to test the Social Connected TV platform. DFKI will support the activities on the technical/tool side, in particular with respect to the 3D-Web and Advanced User Interface technology.

Barcelona

I2CAT is a ready-to-use and permanent community of grassroots innovation network of freelancers, entrepreneurs, educators, artists, researchers and civil servants, organised in an open platform. i2CAT is one of the founding members of such a community. I2CAT creating the social network services for sharing projects and services between such a community.

Through the Dep. of Culture of City of Barcelona I2CAT will give access to tourist users for Smart City Guide tests.

Berlin

FOKUS maintains relationships to four Berlin based universities, teaching around 300 students per year. Those students usually participate to projects within FOKUS and will be activated during the project to be early adopters and parts of the experimentation panel. Experiments will be executed using those user groups either mobile, at home or in a showroom/lab environment. Tools and communication for community activation will be provided by FOKUS as well as means to setup and execute particular experiments, including training and education of panellists.

There are three different kind of partnering with local institutions: media content, user base, open data

- Content to be used in Berlin will come from users as well as from professional providers such as RBB for TV content, Netrange for SmartTV apps and OTT video content.
- For user community activation we will partner with different universities (TU Berlin, Beuth, UdK)
- For open data we partner with local government (daten.berlin.de) and infrastructure provider (e.g. public transport agency VBB) to provide Smart City Guide and Pervasive apps

A panel of representative households will be created and (if necessary) equipped with hardware and software required to test the services. Their use of the services will be observed and investigated using a number of tools such as tracking user interaction, diary studies, on-screen questionnaires, depending on the services' level of maturity and consequently the objective of the individual tests. Quantitative data collected will include the number of users of a service, frequency of use, clicks, pages visited, length of sessions, and measurements on the application response times, server capacity and traffic generated.

Milan (option)

In Milan experimentation site, Telecom Italia is activating a community of users (from 20 to 50 people), both for focus group sessions and user panels with the support of Leonardo Campus within the Polytechnic of Milan facilities and User Experience Lab within the Telecom Italia facilities.

3.2.4 - Test methodology

Based on the use case requirements for the Smart City Guide in terms of user communities and equipment, the following test methodology should be used. The objective is to ensure that selected test beds support the requirements of the Smart City Guide use case and that the use case itself is sufficiently validated: quality of service, quality of experience and quality of community.

Furthermore, possible interconnections between the sites are investigated.

Since the target audience of the Smart City Guide is the end-user, they should be actively involved in the design and testing process in addition to scientists and technicians. It is also the objective to build up a user community around the use case.

We will define and execute three types of user testing and evaluation activities regarding usability and user experience issues:
- expert based testing and evaluations to deliver initial feedback on the interface designs of prototypes and user-centeredness of the applications,
- lab based user experience tests of partial prototypes,
- and field trip experiments at the different experimentation sites (Brest, Cologne, Barcelona, Berlin, Milan as an option).

All three activities are carried out for the different Smart City Guide experimentation sites.

Beside traditional user-centred testing and evaluation methods (e.g. heuristic evaluation, usability and user experience testing) new methods will be considered, e.g. end users as evaluators. An important challenge for usability and user experience inspection of media services is to make sure that the applications' context of use is adequately understood and taken into consideration during the testing and evaluation. Thorough understanding of the context of use is usually not held by usability experts, applications engineers and user interface designers. Such understanding is typically held by domain experts and in our case by end users ("tourists and citizens"). Therefore we will combine expert testing and evaluation methods with new user evaluation methods. The involvement of end users in usability and user experience inspection allows a direct user feedback and supports the user driven innovation approach within the FI-CONTENT 2 project. The overall challenge is to produce testing strategies and evaluation results "together with users" and provide them that feedback to the application developers.

To complete these feedbacks, community of users equipped with smartphones should be registered. Information will be gathered through service platform logging functions that will log information related to user's action and usage.

Planned early Smart City Guide trials at the different experimentation sites:

Cologne

In FI-CONTENT Phase 1 several brainstorms with expert panels and focus groups were conducted involving end users such as students and educational experts, researchers and technical people. Subsequently, the educational experts gave their commitment to mentor the students to prepare and perform the first experiment around the Carnival of Cologne in Feb 2014.

GAR will run the test experiment "Active Experience live cultural events" by initiating and preparing the field trip of the students during a live cultural event such as Carnival in Cologne, monitoring the social activities (real and online) performed by individuals and communities during the experiment as well as collecting all the associated data. GAR analyses the data produced in the "Run" stage and also collects additional data from users. GAR determines if the experiment is complete or whether additional "Run" steps are required. Following the Carnival Experiment we will stage more experiments according to the recommendations of our local expert and focus group meetings.

Brest

An experimentation of the Smart City Guide is planned on the Brest site targeting both tourists and locals.

That site is specialized in creating and running panels of between 10 and 100 people, with a strong emphasis on qualitative user feedback.

Barcelona

The i2CAT Foundation has a group of software developers, sociologist and anthropologist that jointly perform user requirement analysis, design, implementation, prototyping and testing tasks. In addition, through the BL an open social network will be aware and will participate in the different stages of project development.

The Barcelona Experimentation Site will deepen the user experience linking visitors and native citizens in sharing common creative experiences that will enrich the local community and also the tourist community. The Smart City Guide will be the place where both communities meet each other in a shared creative experience during the three phases of the tour: the preparation, the visit and the tour report. Each tour could be considered by communities, visitor and native, as a unique moment of learning, discovery and innovation.

Berlin

The Berlin experimentation site plans to setup an open source community platform and build connections to the Smart City Guide concepts and planned phases.

Furthermore the Berlin based showrooms driven by Fraunhofer FOKUS will be integrated into the tests by providing access to Berlin open data initiatives covering data from public transportation up to smart grids and more. FOKUS lab facilities also support a wide range of user centric end devices and experimentation installations as well as various service infrastructures such as mobile screens and applications, SmartTVs, IPTV and OTT infrastructures and multi-device environments to deal with novel distributed cross-platform applications and services. The existing infrastructure and services will be leveraged and integrated with the Smart City Guide to perform a broader range of tests and experiments.

Milan (option)

In Milan, the methodology presented earlier in this paragraph will be followed, involving iteratively different type of users (experts and technical people, students, real end-users) to further refine the basic service scenario and step by step functionalities implemented in the SGC platform and GUI.

3.2.5 - Description of infrastructure

The technical challenge will be the integration of a large set of technologies including Generic Enablers from FI-Ware as well as Specific Enablers from the FI-CONTENT partners into a comprehensive system and user interface such as geo-localization, event detection, content recommendation and discovery as well as social networks.

The infrastructure will be built to ensure the overall development and integration of all major components to prepare the Smart City Guide platform. This includes application development and service implementation for field-tests in Brest, Barcelona, Berlin,Cologne and Milan (as an option).
The Smart City Guide service will be based on several components and building blocks derived from FI-CONTENT phase 1 and FI-WARE as far as they are available and suitable for that purpose.
To develop a mostly harmonized and comparable infrastructure a Smart City Guide service enabler will be implemented that should orchestrate all essential services and make the link with all end user devices.
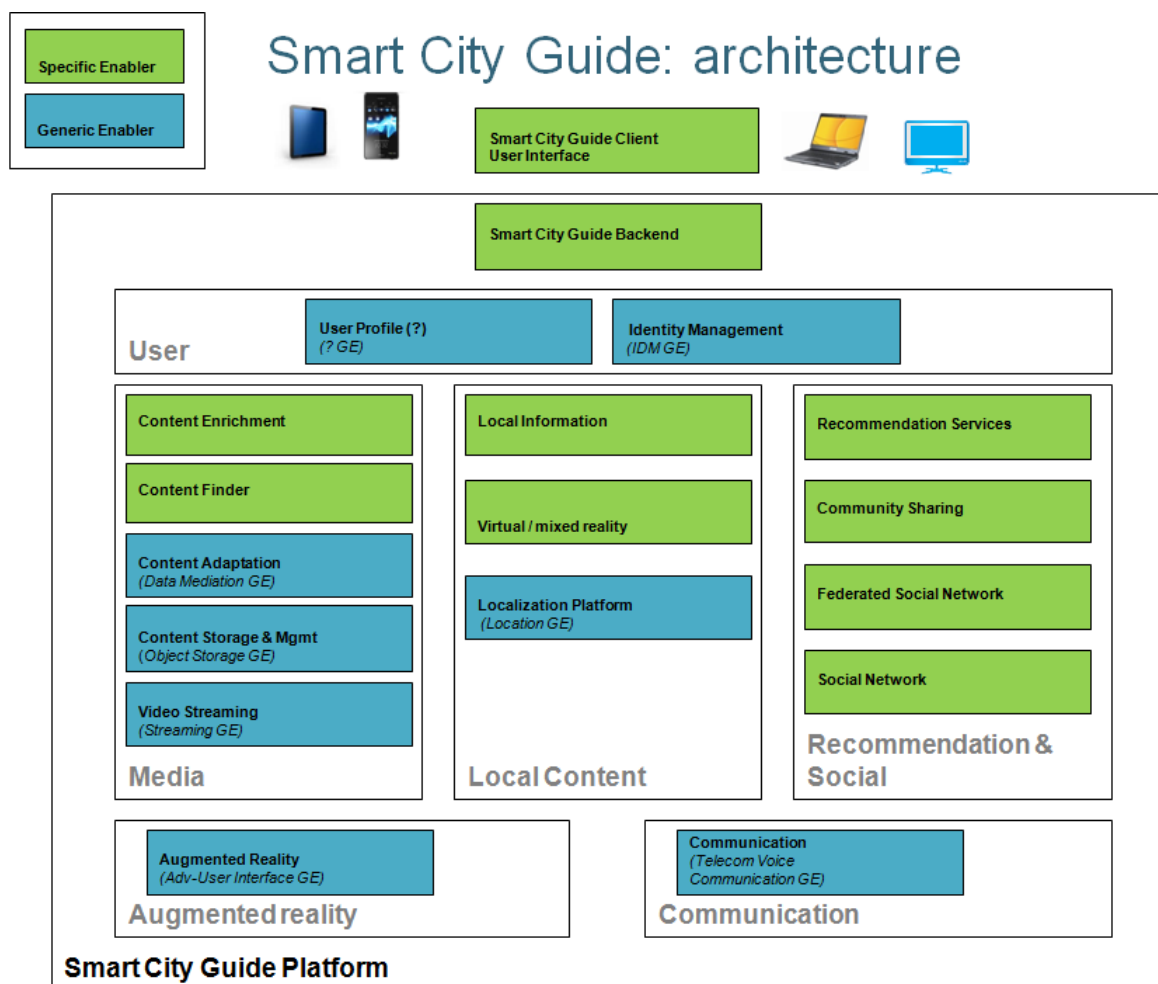

Figure 11 - Smart City Guide system architecture

The Figure 11 above shows the Smart City Guide Architecture including Generic Enablers coming from FI-Ware (blue boxes) as well as Specific Enablers coming from the involved partners (green boxes).

This architecture contains 6 groups of Enablers:

1. **User**
   - **User Profile** (user preferences management, including consumption pattern, connections to social graphs, navigation habits, previously consumed content, etc.)
   - **Identity Management** (authentication/access control and identity/attribute assertions as a service to relying parties)
2. **Media**
   - **Content Finder** (provides the ability to search for content based on different criteria, including the user's profile and context).
   - **Content Enrichment** (allows any content and media to be enriched with supplemental information)
   - **Content Adaptation** (content adaptation regarding devices capabilities)
   - **Content Storage** (provides people with a Personal Cloud infrastructure enabling persistence and integrity of their content and an ubiquitous access of their content)
   - **Video Streaming** (real time, timeliness and synchronicity with multi streams processing capabilities)
3. **Local Content**
   - **Local Information** (in charge of aggregating multiple external resources)
   - **Virtual/Mixed Reality** (Virtual/Mixed reality and location based services)
   - **Localization Platform** (user's localization information)
4. **Recommendation & Social**
   - **Recommendation Service** (content recommendations based on the user group constellation, context, user profiles, etc.)
   - **Community Sharing** (content sharing between a community of users, geographically close to each other, when no access to the communication infrastructure is available)
   - **Social Network** (link with Social Networks)
   - **Federated Social Network** (provides capabilities for federation scenario where users from different social networks can follow and interact each other avoiding to create yet another account on social networks and communities of their friends)
5. **Augmented Reality** (presents content on the mobile environment)
6. **Communication** (set of communication services)

Further developments will include combined use cases for Social Connected TV and envisaged Smart City Guide services to enhance the 3 SCG phases by planning a trip using the connected TV, and create and share tour reports. The objective is to develop and customize all the components and to integrate them together in order to provide an end-to-end functional service as far as they are available.

The objective is to install the overall technical environment in order to provide access to the service to each test location (Brest, Cologne, Berlin, Barcelona, Milan as an option). This includes enablers access as well as technical maintenance.

The information should be updated on a regular basis to consider changed requirements in the use case and to consider updates in the testbed itself.

3.2.6 - User feedback, analysis and evaluation

In order to provide helpful services for European citizens it is important to understand the needs and demands from today's visitors (children up to family grandmother). Firstly three types of user testing and evaluation activities will address open usability and or user experience tasks. It is planed to establish expert based testing and evaluation for interface designs and prototype development, lab based user experience tests and field trip experiments at mentioned experimentation sites. User feedback needs to influence the development as well as the everyday experience with the proposed services. Trend analysis based on live data analysis (e.g. movement data) will help to foster service availability and prevent infrastructure bottlenecks.

Continuous feedback:
- User centred testing, evaluation and development
- User evaluation of provided and/or created content (e.g. usefulness)
- Face to face interviews with student usage groups
- Flexible reporting of user satisfaction (used devices, service reliability)
- User awareness concepts

Live evaluation:
- Statistic analysis on application data (anonymous data)
- Trend and interaction data analysis (anonymous movement profiles)

All the collected feedback, a part of the anonymization, will be studied and statistically evaluated to provide an input for further refinement and improvement of the service itself.
The concepts and technology for live data analysis will improve services for upcoming project phases.

3.3 - Wider testing plans

The wider testing plan includes additional testing and experiments for the second release: month 15 to 22.
In this second release we should include generic enablers provided by XiFi project.
Feedbacks and recommendations from first stage testing will be taken into account in order to refine the second release.

3.4 - Adaptation plans for phase 3

For phase 3, we will open the service in other cities and the enablers to third parties able to extend the initial service or to develop complementary services.

Regarding extension of the Smart City Guide service in other cities the idea is to work with Telco business units in order to define a roadmap of expansion on their footprint. For instance for Orange it should be France, UK, Belgium, Poland, Spain and then outside Europe.

Regarding openness to third parties developers, the idea is to open the enabler APIs (both device and network APIs) to external organisations and to provide a support to help developing new applications. The idea is then to engage developers communities and SMEs to leverage the Future Internet platforms for their services. In this way new services will be soon available to a wider community of end-users around Europe. Opening up the FI-Content platforms to third parties it will be promoted its experimentation and validation in real context and scenario.
For that part, there is a need to establish a business model which cover costs (support, exploitation, maintenance, ...). From a practical point of view, ImaginLab, which will be the platform hosting the Smart City Guide enablers but also the generic enabler (it will also be the French XiFi node), is part of the Pôle Images & Réseaux (Networked media cluster) which group more than 230 organisations

and more or less 150 SMEs. So it will be easy to use this support to encourage SMEs to develop innovative services.

There will be the similar initiative in the 4 others sites using local organisations and communities to facilitate development of the services around the Smart City Guide concept. It is obvious that users will be interested to get more and more information from their city such as environment, transport, logistics, food, safety, education, culture, entertainment as well as health, e-government and tourism. So there are many possibilities for new businesses for SMEs and start up.

3.5 - Business scenarios

The following business scenarios are intended to complement the described user scenarios with business-related aspects as well as to establish a starting point for the business models in FI-PPP Phase 2. Therefore, these scenarios consist of a) consumers, b) service providers (thinking about that behind this actor there are also content providers and platform providers) and c) their relationships as well as d) an analysis of the value created by the service providers from the customer's view.

During WP5.5 in Phase 2 we will develop, discuss and refine business models based on the Business Model Ontology proposed by Osterwalder/Pigneur. These models will take the following business scenarios into account and will distend them to the full range of the nine building blocks according to Osterwalder/Pigneur. So, the business models will be more detailed in terms of value proposition, customer segments and relationships, channels, revenue streams, partners, activities, resources and structure. They will also receive an update in terms of technical feasibility according to the given software development and deployment status. Furthermore, one might consider aggregating two or more business scenarios into one business model as well as integrating two or more business models into one or more value networks.

That said, different business scenario can be evaluated in this ecosystem:
- o B2C: it can be made available to end-user different level of services from "Basic", to "Plus" and "Premium" to reflect progressive interest for the market development envisioning different price policies.
- o B2B: service provider can sell their platforms (or the access to it through APIs) to Content providers and 3rd parties in order for them to build application and service on it and offer their content.

In particular in the following sections, three business scenario declinations are described:
- Smart City Guide as ad-supported application
- Smart City Guide as paid (content) application
- Specific Enablers via APIs (pay per use)

Smart City Guide as ad-supported application

If one aims to develop and position the Smart City Guide (SCG) as an ad-supported application, one has to address a two-sided market. Therefore one has to build a consumer-oriented product with a high range in specific and targetable user groups as well as one has to sell access to these segmented user groups to ad-networks or advertising companies.

Given this context, one can focus on the **Value Proposition** in terms of end-users: The Smart City Guide Service allows users to a) combine, b) organize and c) visualize three types of content: 1) Open Data, 2) user generated content, and 3) editorial content. Using the SCG, one can create personalized and contextualized media experiences as well as creatively discover places, people, venues and events. A central aspect of the SCG is its immanent live character: The three functions as well as the three types of content can be used live and in real time. Along with this comes a very direct experience of mediatized events. In terms of advertising customers it's core of the SCG that they are able to benefit from technologies in the fields of targeted advertising. For example, advertisements can be placed a) in (near) real time and b) based on user profiles as well as c) based on specific content.

The service provider of the SCG correspondently addresses different **Customer Segments**: At first stage one can focus on tourists and deliver a minimum viable product (MVP) to them. This MVP might base on the given functions and focus on content types especially relevant to tourists. In a second phase one might broaden the context and address locals as well. In both cases it is very important a) to focus on a limited set of cities with a "critical mass" of potential users to quickly scale

adoption as well as b) to take the feedback from first stage testing into account (see above). After building the products as well as a valuable range, the provider has to analyse potential customer segments in the advertising market.

Different **Customer Relationships** have to be build and maintained in this scenario. First, it is important to establish close relationships with early adopters which are able and disposed to test and support the SCG. Second, the provider has to create a community around the products and its brand based on self-service as well as personal support. Third, one has to develop relationships to advertising companies as well as ad-networks on personal basis or by self-service platforms.

The service provider should develop native applications of the SCG for iPhone and iPad (iOS) and for Android-based Smartphones as a minimum. So, the established marketplaces and interfaces of the respective operating systems (Apple's AppStore and Google Play) will function as **Channels** for delivering the SCG to the end users. Beside that one has to develop channels to interact with customers in the fields of advertisements; therefore one might evaluate the corresponding offerings by Apple and Google.

Smart City Guide as paid (content) application

If one aims to develop and position the Smart City Guide (SCG) as a paid (content) application, one only has to address a single-sided market. Therefore one only has to build a consumer-oriented product with a high range in a specific user groups.

The **Value Proposition** of this approach is closely related to the one described above: The Smart City Guide Service allows users to a) combine, b) organize and c) visualize three types of content: 1) Open Data, 2) user generated content, and 3) editorial content. Using the SCG, one can create personalized and contextualized media experiences as well as creatively discover places, people, venues and events. A central aspect of the SCG is its immanent live character: The three functions as well as the three types of content can be used live and in real time. Along with this comes a very direct experience of mediatized events.

In the same manner the **Customer Segments** correspond to the first business scenario: At first stage one can focus on tourists and deliver a minimum viable product (MVP) to them. This MVP might base on the described functions and focus on content types especially relevant to tourists. In the second phase one might broaden the context and address locals as well. In both cases it is very important a) to focus on a limited set of cities with a "critical mass" of potential users to quickly scale adoption as well as b) to take the feedback from first stage testing into account (see above).

In terms of the **Customer Relationship** it is important to support users in fostering their creativity through the application. The SCG should empower them to dynamically create and tell trans media stories. In the same way, the relationships have to be build. The applications resp. companies Animoto and RobotMedia might be evaluated as benchmarks.

As in the first scenario, the service provider should develop native applications of the SCG for iPhone and iPad (iOS) and for Android-based Smartphones as a minimum. So, the established marketplaces and interfaces of the respective operating systems (Apple's AppStore and Google Play) will function as **Channels** for delivering the SCG to the end users. In addition one might evaluate the risks and opportunities of in-app sales / purchases – e. g. the service provider could sell additional features this way. A very important aspect is the ease of use.

Specific Enablers via APIs

The following business scenario derives from the development of specific enablers as individual usable and distributable services. Its goal is not to provide a standalone application for end users but

to empower developers and SMEs to reuse different technologies and to build their own applications on top of that.

The **Value Proposition** of this approach consists of a) the specific function of the enabler as well as b) scalability, ease of integration and pay per use as the core modalities of the API. Concerning a), the service provider offers different technologies to mash up and integrate Open Data, user generated and editorial content as well as their (near) real time processing. In terms of b), the provider offers different price plans with a set of different parameters and quotas as well as documentations and examples of successful applications.

The provider might mainly address three **Customer Segments** with the described value proposition: First, the enablers could be useful for developers and start-up companies for rapidly prototyping and iterating on new products. Second, the provider might address small and medium media companies helping them to optimize existing products and to build new ones. Third, one might also target cultural institutions like public libraries and archives. In all three cases the API-based enablers would empower customers to use latest technologies without upfront investments but at proportional costs.

The **Customer Relationship** might be characterized by self-service as well as personal and community-based support. To offer a strong and valuable self-service, it is important to come up with helpful and extensive documentation.

Two **Channels** might be used in the first place: Through developer events one is able to establish direct content to key players in a specific community as well as to early adopters. Beside that the website of the API platform is a strong and important channel to communicate and deliver the given value proposition.

4 - Regulatory issues

This chapter lays out certain key policy and regulation issues and gaps in the FI PPP content usage domain. The issues, still in an initial phase of analysis, were discussed between the CONCORD project and the FI-CONTENT that is the core project in the domain, during an interview that took place between representatives of the two projects on November 28, 2012.

The emphasis of the case at this stage is on identifying and analyzing the policy and regulatory issues emerging at project level. In other words, the main objective is to gather evidence and prepare the analytical framework to be applied. At a later stage, and once the policy and regulation issues affecting all use case projects have been documented in project-specific cases CONCORD will undertake a cross-case analysis in order to prepare the ground for domain-level and FI PPP Program-level policy and regulation recommendations.

For FI-CONTENT there are six key issue/gap areas to be addressed through policy and regulatory action. They are as follows:

1. *Access to open data*. Current policy and regulatory regimes do not have clear rules on how to access open data. In addition, access to data in public administrations are not clearly regulated today, which makes it difficult to know what needs to be done doe Phases 2 and 3 of FI PPP.

2. *Content protection*. There is no effective regulation on content protection in areas such as professional content and games. There is a patchwork of national regulatory regimes but no EU regulatory framework.

3. *Personal information*. Content services are more and more personalized according to user situation. This personalization is based on personal information that is spread across many service providers without any consistency. There is a need to regulate this information storage and flow in order to get a single profile managed by the user himself and accessible by any service provider. There are still silos on which personal information is accumulated and these are owned by companies like Google etc. and not managed by the users themselves. Policy and regulatory change is required in order to allow users control their information].

4. *Authentication*. Most of the content services need authentication by the providers as well as the users. Technical solutions exist but there is a need to make a choice. There is a need for a single EU-level authentication mechanism.

5. *Privacy*. User generated content is more and more used by people with the cloud storage services but no security/privacy service exists. There is a need to have a standardized mandatory security/privacy function.

6. *Micropayment.* In order to access to content, it could be necessary to pay for it and that could be done between users and not only between users and professional content providers. This means that we need to provide a service which allows people to exchange money in a secure and regulatory mode

Along this dimension the case addresses the following issues:
- Why are these issues requiring policy or regulatory action ?
- What are the concrete implications for the domain the project focuses on ?
- What happens if no action is taken ? (e.g. hindering innovation, increasing the market dominance of actors, loss of competitive position, loss of customer value etc.)
- Will the success of the F-PPP be affected if the issues are not resolved ?
- What are the "market failures". Should EU or governments intervene? Cannot this be done by market actors themselves

- What is the value and importance (societal, business) of removing (policy, regulatory) bottlenecks or creating better (policy, regulatory) conditions.

To solve these issues, several proposals have been pushed :
- What are the regulatory measures, policy initiatives needed to create favorable conditions ?
- Who is/are the central actor(s) responsible (e.g., EC, national, regional, cities, EP etc.) ?
- Who could elaborate the identified issues and prepare actions and their impacts (OECD etc.) ?
- What can be the role of CONCORD to support the finding of solutions. What direction to take for recommendations ?

This work is still pending, a Policy working paper is under preparation by CONCORD IAD group which covers the issues coming from all the 8 FI-PPP use cases. It will be finalised after the end of FI-CONTENT project.

Conclusions

This document is the second release of the main deliverable of WP5 which has been widely used to set up the FI-CONTENT-2 project proposal as well as the XiFi proposal. This means that FI-CONTENT-2 experiments will be really integrated in the Future Internet Phase 2 program.

FI-CONTENT-2 will experiment 3 use cases in 5 locations:

- Social Connected TV in Brittany, Cologne, Berlin and Lancaster

- Smart City Guide in Brittany, Berlin, Cologne, Barcelona and Milan as an option

- Gaming in Zurich, Cologne and Barcelona

XiFi nodes will be set up in several locations and will offer access to generic enablers:

- Brittany (ImaginLab) which will cover experiments located in Brittany and in Zurich (the 3 use cases)

- Sevilla which will cover experiments located in Barcelona (2 use cases)

- Dublin which will cover experiments located in Lancaster (1 use case)

- Berlin which will cover experiments located in Berlin and in Cologne (3 use cases)

- Trento which will cover experiments located in Milano (1 use case)

The document describes also some proposal about the phase 3 of the Future Internet PPP for each of the use cases and also provide potential business scenarios that will be elaborated during the FI-CONTENT 2 project.

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D2.1 : Concept design, illustration of use cases and scenarios – document creation

D2.2 : Functional definition of use cases and scenarios created – 5 content areas included

[end of document]