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This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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List of Terms and Abbreviations

21c	21c Consultancy Limited
ATC	Athens Technology Center SA
BCU	Birmingham City University
CIBG	Centre d'Informatique pour la Région Bruxelloise
DEL	Deloitte Consulting CVBA
EC	European Commission
ENOLL	European Network of Living Labs
EPIC	EU Platform for Intelligent Cities
FKIE	Fraunhofer-Gesellschaft zur Förderung der Angewandten Forschung E.V.
GA	General Assembly
HIL	Hildebrand Technology Limited
IBBT	Interdisciplinary Institute For Broadband Technology
IBM	IBM Deutschland GMBH
IM	Société d'économie mixte Issy-Média (SEM Issy Média)
IMMO	Immoweb
ISP	IS-practice
MCC	Manchester City Council
NAV	Navidis
NTUA	National Technical University of Athens
SME	Small and Medium Enterprise
TM	Municipal Tirgu-Mures

1. Executive Summary

This document contains a detailed specification of the overall scenario for the Pilot Applications of the EPIC project. The results of previous deliverables *D2.2 Stakeholder (User) Workshops' Results* and *D2.3 Online Service Delivery Baseline and Technical Requirements Report* are re-used and refined to enable an overall scenario that satisfies and matches the requirements of the citizen/business end-users. The scenario specification will provide important cornerstones for the upcoming deliverables *D5.2 Service Analysis & Documentation* as well as *D5.3 Adaptation Rules & Criteria for EPIC Scenario*. It defines the role of the users and what is expected from the pilots in order to support *WP5 Scenario Creation*. In combination with the other deliverables of *WP5* it will also clarify how WP5 partners will work together to implement the project and ensure the smooth start of *WP7 Pilot Deployment*.

The structure of the remaining document is as follows: Section 2 introduces the EPIC scenarios and innovation ecosystems and explains its relation to the end-user and to the principle of user-driven application development. An extensive elaboration of the platform and of the pilot scenarios that ensure a strong user-orientation in the remaining implementation of the EPIC project is presented in Section 3. Section 4 describes the constellation of EPIC innovation ecosystems and the roles of the various user groups therein.

2. Introduction

The overall aim of the EPIC project is to draw out and test the specifications of a Smart City Platform which supports a user-driven innovation process within an open innovation ecosystem. EPIC provides a roadmap for cities to use existing validated applications from Living Lab innovation ecosystems to deliver true value within the collaborative platform. The open innovation ecosystem supports the open innovation principle which presupposes the involvement of a wide range of potential end-users into the development of the application, and which turns them into real participants in the application development process. This methodology avoids an isolated development of applications (development silos) and establishes an early involvement of important user feedback in the application development.

The scenarios are meant to include and reflect all the stakeholders' needs and, furthermore, to specify the framework in which the development and testing of the pilot applications will take place. In this respect, the scenarios do not solely act as a vision of the applications use, but rather specify the real life conditions under which development and testing will be conducted. The real life conditions will then be established by each of the three Living Labs (see Section 4).

In the context of this project, scenarios will be created that consider the two EPIC target user groups: 1) city councils and their Living Lab Partners; and, 2) citizens and businesses either located in or visiting a city. The constructed scenarios are expected to define each of the stakeholders' roles as well as the interaction of stakeholders within the targeted innovation ecosystem. These actors will then systematically be involved in the development process, and furthermore construct the innovation ecosystem and enable and facilitate a user-driven development and innovation process. User roles named in the scenarios in Section 3 are to be picked up in the construction of the ecosystems in Section 4 and are expected to be mapped onto each of the Living Labs in WP7 so as to create a real life setting in which end-user-orientated development can be carried out.

In sum, this document intends to include a specification of the scenarios of use for all targeted innovation ecosystems. Scenarios outlined in previous deliverables, i.e. *D2.1 Project Vision* and *D2.2 Stakeholder (User) Workshops' Results*, will be refined and worked out to satisfy the pilot requirements and to support the upcoming development of the pilots. The scenarios need to match the stakeholders' requirements (see also *D2.3 Online Service Delivery Baseline and Technical Requirements Report)*. The specified scenarios and specified ecosystems will be used within the *D5.2 Service Analysis & Documentation* and *D5.3 Adaptation Rules & Criteria for EPIC Scenario* as well as in work packages *WP6 Roadmap Development* and *WP7 Pilot Deployment.*

3. EPIC Pilot Applications Scenarios

The following scenario specifications give a clear vision of the EPIC pilot applications in action. They are based on outlined scenarios of previous deliverables, namely *D2.2 Stakeholder (User) Workshops' Results* and *D2.3 Online Service Delivery Baseline and Technical Requirements Report*. The specification of scenarios will support a user-driven Pilot Deployment in *WP7*.

The chapter is structured as follows. The first section (Section 3.1) illustrates the scenario of use for the platform. The second section (Section 3.2) deals with the scenario used for the Relocation Service Application, the third section (Section 3.2.2.1) with the scenario for Urban Planning, and the fourth (Section 3.4) with the scenario for a smart environment. In a fifth section (Section 3.5), we will present how the three outlined scenarios are connected. Thus, Section 3.5 will provide a scenario with less details but a broader view on the EPIC service.

3.1 EPIC Platform scenario

The EPIC vision is to provide every city in Europe with the opportunity to use the EPIC platform to create and share innovative city services that deliver benefits to citizens and SMEs as well as efficiencies for city administrations.

EPIC has the target user groups "cities and their Living Lab partners" as well as "citizens and businesses" either located in or visiting a city. In that respect, the EPIC platform, as described technically in the deliverable *D3.2 Smart City Information Architecture and Functional Platform* and tactically in the roadmap for exploitation, evolved into a marketable product, has these two stakeholder groups as its potential customers.

This section explains how the strategic management platform for a smart city (a product being offered from the cloud on on-premises) can be used to provide governance for city departments, projects, processes and tasks. The following sections (3.2 to 3.5) then describe how this in particular is done for the common scenario along the relocation process.

3.1.1 City and Living Lab View

The City Council registers to use the platform (product) as the foundation of its smart and intelligent operations. The city becomes smart by understanding the context and creating a shared situational awareness about its operations – be it in the area of the management of public or private transportation, in providing good

citizen services or managing the energy consumption and carbon footprint of the city.

The city uses the platform to define relevant key performance indicators (e.g. neighbourhood energy consumption and carbon emission thresholds) and to specify events that might trigger corrective measures (e.g. evacuation of an arena in case of fire or threatening weather conditions).

For such applications, the platform provides services to integrate and correlate data from different sources and to present them in an intuitive fashion to the decision maker.

3.1.2 Citizen and Business View

Service providers (in particular SMEs) will be able to hook into the platform (register and licence) and offer their respective services, either process support or single application, with their service levels and commercial models (e.g. membership fees, pay-as-you-go or gain share) into the e-Government services offered by the smart city.

Citizens and businesses then can use the innovative services offered by cities and SMEs through the unified front-end of the platforms portal.

3.1.3 Platform Scenario

Platform adaptation to host a new application service is described in *D3.2 Smart City Information Architecture and Functional Platform* and consists of the following steps:

- development of application as a web service,
- definition of a new portal page,
- personalization of this portal page,
- implementation of a portlet to call the web service,
- definition of application user group,
- definition of users, and
- setting of permissions.

3.2 Relocation Service Application Scenario

The wish or the necessity to relocate constitutes a situation in which the EPIC platform will offer numerous forms of support and assistance for both, the citizens that wish to relocate and the city administrations that have to deal with the relocation. In the following, we will explain these forms of assistance and thus point out the advantages of the EPIC platform not only for the relocation service but also for other administrative operations triggered by and involving citizens. We will

begin by explaining the background and aim of the relocation service application as envisioned within the EPIC platform.

Background and Aims

A scenario involving a relocation service insofar is a relevant scenario as its aims at the mobility of European citizens. Our scenario even goes one step further. It is about relocating to a foreign city (within the European Union) and thus focuses on cross-border mobility. The scenario will highlight relevant advantages of EPIC's relocation service application including: a) smart e-government which means streamlining the often tiresome practical government-related duties in relation with relocation; b) overcoming the language barriers; c) making implicit knowledge visible; d) offering an augmented layer of government and non-government data concerning cities, including general information newcomers in a city need to know or strongly benefit from knowing (smart city guide); and, e) smart housing which means making finding a temporal or a more permanent place to stay much less cumbersome. Obviously, the listed advantages hold for situations other than relocating as well. For example, the solutions that we will develop and present for streamlining government-related duties in relation to relocation can easily be generalized to streamlining other government-related duties from renewing a passport to the registration of an enterprise. Thus, the scenario will not only highlight the advantages of the relocation service application, in particular, but will also underline the strength of the EPIC platform more generally.

The scenario of a relocation service has been chosen for three reasons. First, as has been outlined earlier, the solutions of the EPIC project with respect to relocation service application can easily be generalized. Thus, the scenario can be used as an example to explain service applications that are part of the EPIC platform. Second, the scenario can serve as an umbrella scenario, cf. section 4.4, to connect the EPIC pilot application scenarios. Third, the partners of the EPIC consortium have already partial solutions available that can serve as a robust basis for the development of smart solutions for the relocation service application. For example, IBBT in Brussels has already created a prototype hyper-local mobile web application to facilitate an easier housing search in the wider Brussels' area. The main goal of this application comes from the needs of citizens and local housing businesses to make it practical and easy to find real estate (to lend or for sale), based on the personal context of the user. Parameters that the application takes into account are geo-location, personal profile information, previous interests shown (i.e., interactive behaviour) and social attributes of the user. The mobile web application also provides a so-called 'augmented-reality' functionality, displaying a meta-information layer on top of the real world as seen through a realtime videofeed on a user's mobile device.

3.2.2 Scenario Description

The scenarios presented and discussed within this document refer to the EPIC platform. There are different kinds of people who will use that platform and who, thus, will benefit in different ways from it. Therefore, the scenarios will be presented and discussed with the different perspectives in mind. These perspectives are a) the citizens' perspective, b) the perspective of the respective city's employees, and c) the perspective of those who provide services on the platform for commercial reasons.

In this section, we will present and describe EPIC's relocation service application. The general scenario for relocation is the following. Mr. Fritz Meier works for the German company ABC which is an established supplier for the European Space Agency (ESA). His wife, the famous architect Christophera Troglodyte-Mignon, just got the permit to establish her business in Brussels, therefore the family (2 kids, 12 and 20) wants to move from Cologne to the area of Brussels Capital Region and settle in one of the nineteen communes (Anderlecht, Auderghem, Berchem-Sainte-Agathe, city of Brussels, Etterbeek, Evere, Forest, Ganshoren, Ixelles, Jette, Koekelberg, Molenbeek Saint-Jean, Saint-Gilles, Saint-Josse-ten-Node, Schaerbeek, Uccle, Watermael-Boitsfort, Woluwe-Saint-Lambert, Woluwe-Saint-Pierre) that are part of it. In this scenario, the citizens' perspective is the perspective of the family, the city perspective is the perspective of Brussels Capital Region and the nineteen communes, and the provider perspective is that of Immoweb who would like to improve its position as the leading online real estate advertisement platform in Belgium that brings Europeans relocating to Brussels and different stakeholders in the real estate business in Brussels closer together. We commence by exploring the scenario from the family's perspective.

3.2.2.1 The Citizen View

The family needs to access a) data that provides insight in the city they want to move to, b) government information and services that can be used to smooth and in parts automate the administrative relocation process, and c) high quality data about real estates available for rent or sale. Having decided to move to the Brussels Capital Region and to settle in one of its communes, the family starts to get more information about that area. As European citizens, the family is user of the EPIC platform and thus can log into the platform's information portal to start a service to receive and to examine information about Brussels Capital Region and to find data about interesting real estates. In the scenario, however, we will assume that the family has not yet registered to the platform in order to test and to evaluate possible registration procedures. We assume that Mr. Meier visits the information portal (hosted on the EPIC platform), registers and creates the family's user profile. The profile will contain the standard data like names and id numbers. In addition, other data might be relevant, such as:

- number of persons in household,

- educational needs,
- "green conscience factors",
- recreational interests,
- professional backgrounds.

This profile can be modified anytime whenever Mr. Meier logs into the portal. It is applied in any query he launches to return only a personally relevant result set from data in the European relocation knowledge base (hosted prototypically on the EPIC platform).

In the scenario, Mr. Meier needs information about the Brussels Capital Region and its nineteen communes in order to find on the one hand a district in the region that meets the needs of the family and on the other hand a real estate in that particular area in which he can settle. By means of filters regarding information about districts (environmental conditions, demographic composition, traffic congestion, housing conditions and population density) search queries about various points of interest in the area (transport, schools, banking, security, shopping, cultural, sport, recreation and health care facilities and infrastructure) and a search query about housing requirement (buy or rent, flat or house, price, surface, number of rooms) will be specified. After executing these filters and search queries the family will get an overview of all the points of interests and real estates that are located in the areas that match the query filters. The family can explored these points of interest and real estates in more detail (price, broker, rooms, contact etc…). By means of using a 2D map, the family gets a clear view of the immediate surroundings of the properties and the properties in question. Doing so, interesting offerings can be saved on a list of favourites. The family contacts one or more realtor companies whose links are published in the information boxes about the real estate in order to get more information about it that is not available in the service.

After that orientation, the family decides to visit Brussels to do some real-life exploration in a few of Brussels' districts taking a smart phone along. The districts they explore are the ones the family considers to live in based on the prior executed information process. The selected properties in these districts were saved in the list of favourites and can now also be viewed again on the mobile application. As the family visits the estates and homes in question, additional information about the objects can be called up by mobile from the platform. The same is true for additional information about other objects, e.g. public spots of interest, like metro stations or schools, in the surroundings.

As a next step of the scenario, it is assumed that the family has completed the discovery trip to Brussels and made up their mind regarding several factors:

- The family has selected an old mansion in a good neighbourhood spacious enough to provide comfortable living and adequate office space for Mrs. Troglodyte-Mignon's architect bureau.

- Mr. Meier will keep the status of a German employee in his company and will work on the basis of "send worker" in Belgium according to EU single market regulations.
- The energy profile of the house shows good potential for improving the rating through additional (exterior) insulation; a measure for which subsidies are granted from the city.
- As the house is even bigger than their home in Cologne, the family will do "a full move" and not store their possessions safely in Germany until they return. They will also sell their German home.
- The younger child will enter a High School and the elder one Brussels EU Law School.

With these decisions in mind, Mr. Meier starts the administrative operations through the EPIC platform as the platform hosts, among others, the following Business Process as a Service (BPaaS):

- self-served transfer of Mr. Meier's social security record to the Belgian Crossroads Bank, applying for child benefits and contracting supplementary healthcare insurance (services offered by the German Agency for Employment);
- application for a subsidised green-energy loan (a service offered by the Brussels environment agency);
- online contract closing (a service offered by his realtor);
- self-served residential registration (a service offered by the city of Brussels);
- professional registering (a service offered by the Brussels chamber of Commerce);
- enrolment in high-school (service by the city of Brussels);
- enrolment in Law School (service by the private university);
- emigration (service from the city of Cologne);
- registration at the tax systems in Germany and Belgium (service offered by the German Ministry of Finance);
- selection and contracting of moving company (value-add service of his realtor).

To run the scenario, it is assumed that Mr. Meier is the sole owner of all the documents needed as evidence for the consumed services. They are (simulated and) stored in the relocation service document safe and from there provisioned to the services. For example, the activity flow of the first business process includes:

- Mr. Meier logs on to the portal of the German Agency;
- he requests his social security record (as a standardized electronic document as defined in the EESSI[1] directive);

[1] *Electronic Exchange of Social Security Information (http://ec.europa.eu/social/main.jsp?catId=869)*

- after receipt, he "uploads" it into his personal document safe (provided as a core EU interoperability service);
- he authorizes Crossroads Bank to access this document;
- authorization triggers the transfer to Crossroads Bank.

These administrative functionalities will be implemented iteratively in the platform during development since it is hard for various practical reasons to implement them from the start. In the pilot application we will therefore use a list of useful urls that the family can consult in order to get more information to handle them. Based on the profile information when registering on the platform, these urls will be filtered accordingly to the profile of the family.

Finally, it is important to stress that the EPIC platform will also provide support for the family after the relocation to the real estate in the preferred area itself. Interviews we held with expats in August 2011 at IBBT pointed out that a substantial part of expats in the Brussels Capital Region tend to adopt a two staged residential strategy. First they search for a district and real estate for a short period in order to adapt to their new environment and get to know it better. In a second stage, when this adaptation phase to the area is over and the broad patterns of living and working in Brussels Capital Region are clear for them, they will look for new real estate that really fits their needs. Although the aim of the relocation application service is to have an impact on this current situation by increasing knowledge of Brussels before actually moving into a new district and new real estate, it is possible that the moment of really integrating in their new life environment will lead to a new search on the platform to explore points of interests in the district in more detail or consult other interesting real estate.

3.2.2.1 The City View

The relocation service application is especially useful for the citizen who wants to relocate. However, it also provides some advantages for the city and its administration. First, the forms that have to be filled out by citizens that relocate will be filled out online. Thus, the filled out forms can be directly processed. Otherwise, data provided by filled out paper forms would have to be copied to the respective files. In addition, the online forms can be tagged with checks so that only data of the correct type can be filled into its slots. This obviously helps to facilitate the processing of the filled out form in the city's administration and to make the whole administrative process less error-prone.

Furthermore, the city administration may requests statistical information about relocations in the past as well as planned relocations in future. This can be used to create responding statistics for making plans regarding structure and settlement of its city. Also, those statistics are the backbone of reports to other administrative levels up to national and EU level such as annual reports about immigration and emigration.

3.2.2.2 The Business View

A relocator is enabled to retrieve information about the degree of settlement in a particular area and thus might choose an appropriate location for his/her office and is furthermore able to present advertisement well-directed for customer acquisition purposes.

A company might place appropriate advertisements on the EPIC platform that are adjusted to the citizen interests provided by created statistical reports.

3.3 Urban Planning Scenario

3.3.2 Background and Aim

The Urban Planning Application allows users to manage, share and communicate information on the urban planning and development projects of the city. It is a virtual space of consultation and participation, designed for professionals and citizens alike, and complements the already existing "Urban Planning Centre" of the city, a public area for consultation and communication where interested stakeholders can meet and exchange information on urban development, projects and studies that are to be carried out in Issy-les-Moulineaux, France.

The application combines simplified view, 3D modelling, rich media and symbolic information. Users can simply fly over as well as move into the digital 3D model of the city and enter into major sites like in a video game. The 3D interactive navigation allows exploring the territory, navigating from one place to another, zooming in to view points of interest or any particular site and accessing additional information like statistics, geomatics, dynamic flows, media and so on.

The service will be extended and adapted by Issy Media and Navidis for use within the EPIC platform with the purpose to enable efficient real time networking between businesses and citizens but also provides an interconnection between Issy-les-Moulineaux's SMEs. The Urban Planning Application will propose new services enriched with important information on the local SMEs (who is who, who does what, what are the current offers, both in direction of other businesses and the citizens). This will enhance local activity in the long run under two aspects: on the one hand citizens will have a faster access to the local economic infrastructure (especially those seeking for job offers); on the other hand the local businesses will have an insight on the local economic tissue, the competitors, and the potential partners.

3.3.3 Scenario Description

The scenarios below are described according to the different kinds of people who will access the EPIC platform and use the Urban Planning application.

3.3.3.1 The Citizen View

A typical end-user connects to the EPIC platform and accesses the Urban Planning service, in which he/she can virtually fly over and move around the digital 3D model of the city, entering major sites. Registration is not required at this stage, but if the user wishes to interact with the service, accessing the content administration tool, the registration procedure will then be launched.

The user can opt for a general discovery of the city, or he/she can choose a specific topic of interest (Leisure and Culture, Sustainable Development, Urban Planning projects, Public Services, Enterprises).

After selecting the main topic, the points of interest in the city associated to it are highlighted on the 3D map. The user can simply fly over the city and choose the POI he/she would like to have information about. By clicking on the desired item, the user has access to a media centre providing general information, pictures and videos. He/she can also take a virtual tour of the place and access its web site, for more detailed information.

By selecting the topic "Enterprises", the user can view all the companies registered in Issy (in a 3D aerial view) and can access useful information provided by the company itself such as photos, presentation videos, latest job offers and their official website for further information.

If the user has an idea about the point of interest he/she is searching for, but is not sure where to find it (i.e. in which topic), he/she can use the search query for a fast finding and locating of the item.

The Urban Planning service will allow the citizen to discover the economical tissue of his/her city in a 3D view, to obtain information about a specific enterprise and to get in contact with that enterprise if he/she wishes.

3.3.3.2 The City View

The Urban Planning service is very useful for the city administration, allowing it to maintain up-to-date the information published on the platform (content and media) via a novel administration tool.

In the same time, the service offers the city administration the possibility to have a detailed view of the local economical fabric, follow its activity and stay up-to-date with the latest news and events in the sector. It will also allow the city admin to measure more easily the evolution of the occupancy rate of buildings by business district.

3.3.3.3 The Business View

The section "Enterprises" of the Urban Planning application offers an overview of the existing innovative businesses in the city. An SME wishing to make itself known and share information about its activity registers to the platform. Specific registration procedures will allow the SME to be geolocated on the 3D city map. And an editing tool will allow the SME to publish (and afterwards update) all data related to its activity, information about products and services offered, pictures and presentation videos as well as job opportunities.

A regular SME accesses the section "Enterprises", wanting to inquire about similar products and services in the city or simply just to have an idea about the companies located in the city. After selecting the topic, all the city's SMEs are highlighted on the 3D city map", and by clicking on one particular SME information such as photos, presentation video, or official website for further contact appear. The authentication procedure is launched if the user wishes to get in direct contact with a particular enterprise.

A private communication system (possibly in the form of a forum and accessible via the user's personal account credentials) will be put in place in order to allow a faster exchange of information and to enhance the communication flow between the SMEs.

The application has a double-oriented approach: a BtoC approach allowing businesses to inform the citizens on the services offered and job opportunities, and a BtoB approach enabling businesses to have a better knowledge of the economical tissue and identify competitors and potential partners.

3.4 Smart Environment Scenario

3.4.1 Background and Aim

Manchester City Council (MCC) along with its technology partner Hildebrand (HIL) will deploy an energy monitoring solution to provide information to assist citizens of Manchester reducing their energy consumption of electricity.

Manchester City Council (MCC) working with project partner Birmingham City University (BCU) will develop and deploy an energy usage visualisation tool for selected public buildings used and /or operated by MCC, to demonstrate how the city is reducing the energy consumed by the city building stock.

The domestic and public building solutions developed in this pilot will provide a complementary approaches to the larger problem of energy monitoring in both domestic and public buildings, which may require different technological solutions.

3.4.1.1 Domestic Energy Monitoring

Hildebrand will utilise its product, Energy Hive, opening up data sources and functionality to EPIC through application programming interfaces (APIs). Energy Hive utilises data collected from its Internet gateway and sensor management system, demonstrating a real Internet of Things (IOT) system. The sensors deployed within Manchester will measure the energy dynamics of residential properties, focusing on electricity consumption. Within EPIC, this will represent a specific scenario for a more generalised solution of using data and information to inform citizens with the potential to influence behaviour to reduce energy consumption. The intention is that the application will be added to the EPIC Platform to provide a service that could be used across Europe to help cities achieve their carbon reduction goals through reducing energy consumed by citizens in their homes. In the future, this technology could demonstrate to a city how they could support households in reducing their energy usage via access to a system that enables householders to better analyse and understand their energy consumption.

Once the Energy Hive APIs are available to the EPIC platform, other sensors such as heat meter readings from district heating can be used within the EPIC business process engine. Although heat metering will not be shown in the context of Manchester, it is a possible application that could be deployed by Tirgu-Mures and will be demonstrated as a capability by Hildebrand.

A visually engaging dashboard on the Energy Hive platform will enable citizens to view their home energy consumption, in real-time, using an energy monitor that takes readings approximately every 6 seconds. This information provides a unique real-time insight into how exactly the energy is being used which will potentially enable users to adjust their energy consumption accordingly.

The City will have a public and private facing dashboard for creating interactions with citizens that will be provided by the EPIC platform and the APIs exposed via Energy Hive. The EPIC platform, in turn, may provide APIs back to Energy Hive for community views that are facilitated by EPIC developers and data sources.

The above will require the enablement of three key communication zones:

- Home Area Network (HAN): Data is transferred from a sensors to a secure Internet gateway, this will be provided by Hildebrand;
- Internet: The gateway then sends the collated data to the Internet;
- EPIC Platform (Cloud): Using a web service the data will be processed, stored and made available to applications for presentation.

This then creates commercial opportunities for data display using a web portal with application providers or the City using the data to power specific applications.

Likewise, a further scenario is being explored utilising data from public buildings via various Building Management Systems (BMS) at MCC. This integration work is being carried out by BCU to demonstrate a generalised approach to sensor data capture

and the Internet of Things (IoT) on the EPIC platform. Similar to household data, BMS data would be displayed for the building users and for the city administrators for insight into energy usage.

3.4.1.2 Public Building Energy Monitoring

Unlike residential premises, which will normally require installation of sensors and other equipment to allow monitoring of energy consumption, public and commercial buildings are generally already equipped with Building Management Systems (BMS) of varying complexity. BMS typically control heating, ventilation and air-conditioning (HVAC) systems and utilise and extensive network of sensors required for operation of the building systems. Such buildings commonly have fiscal smart-meters installed by the utility companies that supply electricity; gas and water. Many BMS also have quite extensive sub-metering, so that the total energy consumed can be broken down by zone or by usage type, for example electricity for lighting, air-conditioning, etc.

BCU will develop a generic monitoring framework (GMF) into which data-feeds from BMS systems can be stored, together with the associated meta-data for sensor readings and other usage context data. This will allow energy use data for public buildings to be displayed via a dashboard approach similar to that used for the domestic electricity consumption solution implemented by Hildebrand.

The public building data is, however, rather more complex than that from domestic premises, due to the size and scale of such systems. Collecting data will require access to, and aggregation and storage of, a variety of data-feeds including: utility smart-meter data (typically ; sub-meter data; access to historic reports held in the BMS; real-time access to sensors and actuators on the BMS and additional context-data feeds from wireless sensor networks, etc, utilising Internet of Things (IoT) approaches.

3.4.2 Scenario Description

3.4.2.1 The Citizen View

A user receives an Energy Hive sensor and gateway to be installed within their home. Physical setup is completed with a wireless, battery operated current transformer (CT) clamp installed near the electricity meter within the home along with the Energy Hive Internet gateway plugged into a standard broadband modem/router and mains power.

The user sets up an account at a given URL, by inputting their MAC address printed on the bottom of their Energy Hive Internet gateway and selecting a username and password for future login.

As a part of first use, a household profile is collected against a username such that analysis can be performed on dimensions such as number of occupants and size of property.

During subsequent normal use, a user authenticates to the system in order to access a dashboard, and is granted access to informational widgets according to the users preferences and entitlement.

One example of a widget is one that fulfils the use case of users examining their own household usage. A chart is shown in which both current usage and usage over a defined time period are shown. The data from these charts and interactivity would be provided to EPIC to trigger events in the event processing engine for community and City benefit. For example, a period of time use may be selected and be sent to EPIC for analysis regarding the benefit of community photovoltaic, electric vehicle charging point or neighbourhood storage investments.

The user will be able to edit their profile with this metadata being dynamic. Over time richer metadata can be added to individual profiles for example, insulation, number of rooms etc. or for community metadata for example, substation, ward or neighbourhood. The community metadata will be managed by EPIC with individual profile metadata controlled by Energy Hive. EPIC will also have the benefit of having public building data that can be combined with individual Energy Hive user data to give users a broader view of energy use and opportunities for savings.

Unstructured and semi structured data will also be supported and shared between Energy Hive and EPIC. This type of data takes the form of time keyed value pairs with an optional event classification. For example, the user records a free text note in the database whilst examining their usage. The note is time stamped, linked to the particular user and household in the database and may also be linked to a particular point in the usage history. Users may indicate an event category/type that could be acted upon by EPIC and make use of this facility for several purposes, for example:

- to record significant events, such as changes in circumstances, switching on - off equipment, etc., for later analysis,
- to record general observations for later reference,
- to record issues associated with the usage of the system such as bugs, defects, etc., and
- to record aspects of the system that they do not understand.

The user is able to specify which of these purposes through the event type system that the note was created for, in order to assist with later analysis.

3.4.2.2 The Public Buildings View

Many City Administrations already employ a centralised monitoring and control facility for their public building, generally via a BMS “head end” which allows remote interrogation of BMS sensors and alteration of controller set-points, etc.

The fiscal smart-meters typically send a meter reading at 30-minute intervals to the utility supplier (electricity, gas and often water) and these data are typically collected by the "head-end" and archived for later analysis. Some organisations outsource analysis of their smart-meter data to specialist energy analysts who help to ensure that they are receiving the best tariffs from the utility providers. Typically, BMS head-ends do not provide extensive data archiving, as they are designed primarily to provide a front-end for system visualisation and control.

In order to use the BCU developed GMF for archiving, a City would need to ensure that smart-meter data is send electronically to the GMF or that the GMF can gain access to the smart-meter data through a web-service running on the City BMS head-end.

Access to sub-meter data would need to be provided through remote access to the BMS head-end or direct access to the BMS networks, so that sensors or remote outstations can be queried directly. The majority of BMS now use TCP/IP which can be configured to allow remote access, but the data protocols used by many BMS are proprietary, although there now a move towards Open-Standards for BMS.

In addition to the BMS sensors and controllers, it may be useful to add additional sensors to provide context data for the BMS data, such as occupancy, external weather conditions, etc. The temportary or permanement deployment of wireless sensor networks (WSN) using ZigBee Pro enabled Arduino motes will provide additional data feeds to help contextualise the BMS data.

3.4.2.3 The Researcher and Technical Staff View

The researcher has access to statistical streams provided by the metadata dimensions from the individual and community profile. A design environment in the EPIC platform will enable the configuration of data streams for analysis and new functionality, specifically the creation of models. The EPIC platform will then enact these models when published, such that they become aware of data flows and system metadata.

Reporting functionality is supported by EPIC with real time web based reports powering the City and community views.

Operational views are both system generated and user generated. Users may issue tickets regarding bugs or other issues within the ticketing system, however support will be limited as the individual should be able to have self service through the Energy Hive portal.

For the purposes of the living lab study, assistance in the installation will be given by the City. When the household part of the system is installed at a house, a screen is accessed by the installer, which is used to register the household in the system, carry out communication tests between the household and the central database and carry out simple diagnostics to correct any anticipated problems. Creation of the user account will be carried out by the user as per normal with some face to face

assistance from the installer. The installer will confirm that the householder understands how to use the system.

Application of the Public-Building monitoring will be undertaken in collaboration with the City Administration and with the departments responsible for operating and monitoring public building stock.

3.4.2.4 The Business View

The business model is two fold for the Energy Hive system, first to provide enough value to end users so that they will purchase the necessary equipment (approximately GBP20) and secondly to receive revenue from applications that utilise the data supplied by the equipment.

Application revenue is shared between Energy Hive and the application provider. To illustrate, a utility switching company may offer its switching service to Energy Hive users resulting in a commission being paid to the switching company from the utility retailer or an academic organisation may have an enhanced CO2 calculator offered as a paid for application to users. In each of these scenarios, Energy Hive is paid a percentage for facilitation and empowerment of the application with data.

The City in the EPIC project is viewed as an application provider/partner. The EPIC platform is the system that runs the City's energy applications utilising the application developer APIs and systems provided by Energy Hive. The desired business outcome is a revenue stream from the City for applications that it creates. Therefore appropriate accounting and controls would need to be implemented within EPIC to realise this business model.

The business model for the Public Building monitoring is slightly different, in that in many cases there will be no additional installation of hardware required, but access will be required to existing data feeds. For the City Administration the system will primarily allow the City to demonstrate through access to real-time and historic data on usage of electricity, gas and water (where monitored) how energy consumption is being reduced.

Many cities also operate buildings used by other organisations, and in this case energy monitoring could be made available to the building tenants as a paid-for service, or offered to commercial landlords who operate commercial premises.

3.4.2.5 The City View

City administrations would be able to collate the data from a number of different households for comparative analysis. Similarly, if a public building provided BMS data to the platform, this could be displayed for both city administrator and public use. This allows the city to gather data about the energy performance of different types of buildings and to contribute to a body of knowledge about energy usage. Another example might be where a landlord has installed photovoltaic (PVs) or

other thermal improvements; the city is able to compare these homes against similar properties without these facilities.

The City administrations will be able to collate energy usage data from different public buildings to demonstrate how their policies to encourage uptake of energy efficiency measures are resulting in reduce consumption of electricity, gas and water (where these utilities are smart-metered via BMS). The City will also be able to demonstrate how, through the provision of a commercial energy monitoring service delivered through the EPIC platform, they are assisting owners, operators, landlords and tenants of commercial properties to visualise their energy consumption so that appropriate energy reduction measures can be encouraged and implemented.

3.5 Pilot Applications Interoperability

Each of the pilot applications deal with properties of their corrosponding cities. Relocation Service deals with real estate properties of Brussels, Urban Planning Service contains 3D models for buildings in Issy-les-Moulineaux and Smart Environment Service provides data of energy consumption of Manchester's households.

In order to enable for an interoperation of the pilot applications we need to refer to a property that all three pilot applications have in common. Therefore we label an arbitrary House in Issy-les-Moulineaux's 3D model as "*Keith's House*". The databases of the other two pilot applications provide virtual data for that particular property. The Relocation Pilot will create a "dummy listing" in the Immoweb database for *"Keith's House"* located in Issy-les-Moulineaux. In this manner, the Energy Pilot will create a dummy entry and an energy data stream in the EnergyHive database for *"Keith's House"*.

The interoperation of the three pilots can then be demonstrated as follows.

Urban Planning Pilot

- The Urban Planning Pilot will allow the area around *"Keith's House"* to be explored.
- Navidis will access the Relocation Pilot web-service to retrieve details of *"Keith's House"*.
- Navidis will access the Energy Pilot web-service to retrieve energy usage of *"Keith's House"*.
- The city administration of Issy-les-Moulineaux can utilize statistic information from the relocation service application in urban planning to take into account the prereferences of future citizens for planning.

Relocation Pilot

- The Relocation Pilot will allow the property listing details of "*Keith's House"* to be retrieved.
- The Relocation Pilot will access the City Planning web-service to explore the 3D city region in which *"Keith's House"* is situated in the Issy 3D model.
- The Relocation Pilot will access the Energy web-service to view the energy usage data for *"Keith's House"*.

Energy Pilot

- The Energy Pilot will allow access to the simulated historic and real-time energy usage data for *"Keith's House"* in Issy.
- The Energy Pilot will access the Relocation Pilot web-service to allow the property listing details of *"Keith's House"* to be retrieved.
- The Energy Pilot will access the City Planning web-service to explore the 3D city region in which *"Keith's House"* is situated in the Issy 3D model.

Tirgu-Mures Use Case

Tirgu-Mures in Romania is EPICs final pilot partner and will use the EPIC roadmap to integrate and use new technologies to work smarter. In this sense, Tirgu-Mures will leverage its bed for the EPIC platform, high level applications and roadmap.

Tirgu-Mures will adapt the idea of "Keith's House" and/or pilot applications to meet public administration, local citizen and SME needs. In later Workshops to be held – based on the experience of the pilot developers, SMEs and the public administration in WP7 of the more advanced cities Brussels, Issy-les-Moulineaux and Manchester it will be discussed which of the Pilot Applications will be adapted for Tirgu-Mures in order to help them to work smarter.

The idea of "Keith's House" may be adapted to Tirgu-Mures in order to also demonstrate the interoperability of the pilot applications in a non-advanced city later on. Depending on which pilot application will be selected for a *Proof-Of-Concept* in Tirgu-Mures an appropriate scenario will be created in later Workshops that will act as developing scenario and testing scenario for the Tirgu-Mures innovation ecosystem.

Further use of Energy Hive may be possible in Tirgu-Mures utilising the heat metering solution Hildebrand has developed for district heating systems. District heating integration is not available in Manchester, but may be possible within Tirgu-Mures. The example of EPIC application that would then be possible is utility billing for heating services supplied by the city.

4. EPIC innovation Ecosystems & User Roles

This section describes the intended EPIC innovation ecosystems, especially Living Labs, for the three pilots Relocation Service Application, the Urban Planning Application and the Smart Environment Application. Each of EPIC's three Living Labs, namely IBBT iLab.o for the Brussels Capital Region, Issy-Media for Issy-les-Moulineaux and MCC for Manchester, will construct 'open innovation ecosystems' in later project stage WP7 and engage users from the local city ecosystem in the innovation process and facilitate 'public-private' partnership working. The Living Lab partners will help Tirgu-Mures to instantiate its own Living Lab in the end of WP7. Each ecosystem is expected to contain test users, Living Lab partners, SMEs and city councils. In WP7 Living Lab Partners will constitute an arrangement of users in such a manner all scenario user roles are represented. The user roles identified in the scenarios are to be listed below and will be distributed in WP7 within each Living Lab in order to create a real life representation of the scenarios.

In the following Section it is clarified how WP5 partners will work together to implement the project and insure the smooth start of *WP7 Pilot Deployment*.

4.1 Consortium interaction and collaboration

The following diagram depicts the initial interaction and collaboration of EPIC consortium partners. The particular pilot partners for the Relocation Service Application, the Urban Planning Application and the Smart Environment Application will provide Wireframes illustrating the functionality and the user interaction of the application for ATC. ATC receives the Wireframes and create portlets based on the Wireframes which provide then the graphical user interface for the EPIC platform and the pilot applications. In the initial phase of WP7 Deployment we focus on the Relocation Service Application. The Enterprise Service Bus (ESB) is a central component. It receives data from data suppliers Immoweb, CIBG and a geographical data service. The data is consumed, transformed and supplied to the portal server and the Smart Phone.

In the first stage of the deployment IBBT will recruit test users with support of CIBG and create a Living Lab for Brussels. The Living Lab interacts with the other consortium partners in two senses. First, it will provide real life user experience on the running pilot application to the pilot application developers that adjusts then the application for the end-users' needs. The real life user experience covers insights from the public administration, the civilian end-user and the small-medium-enterprise. Thus, the application will be optimized for all the involved stakeholders' needs.

Second, the living lab will provide real life user experience to Deloitte which develops the Road Map. The Road Map will provide important guidelines for less-advanced cities that plan to make their city smarter. The Road Map is an important input to Tirgu-Mures on which the Road Map will be finally validated. Tirgu-Mures will select one or more of the pilot applications dependent on the particular need of Tirgu-Mures that will be prototypically deployed in their city.

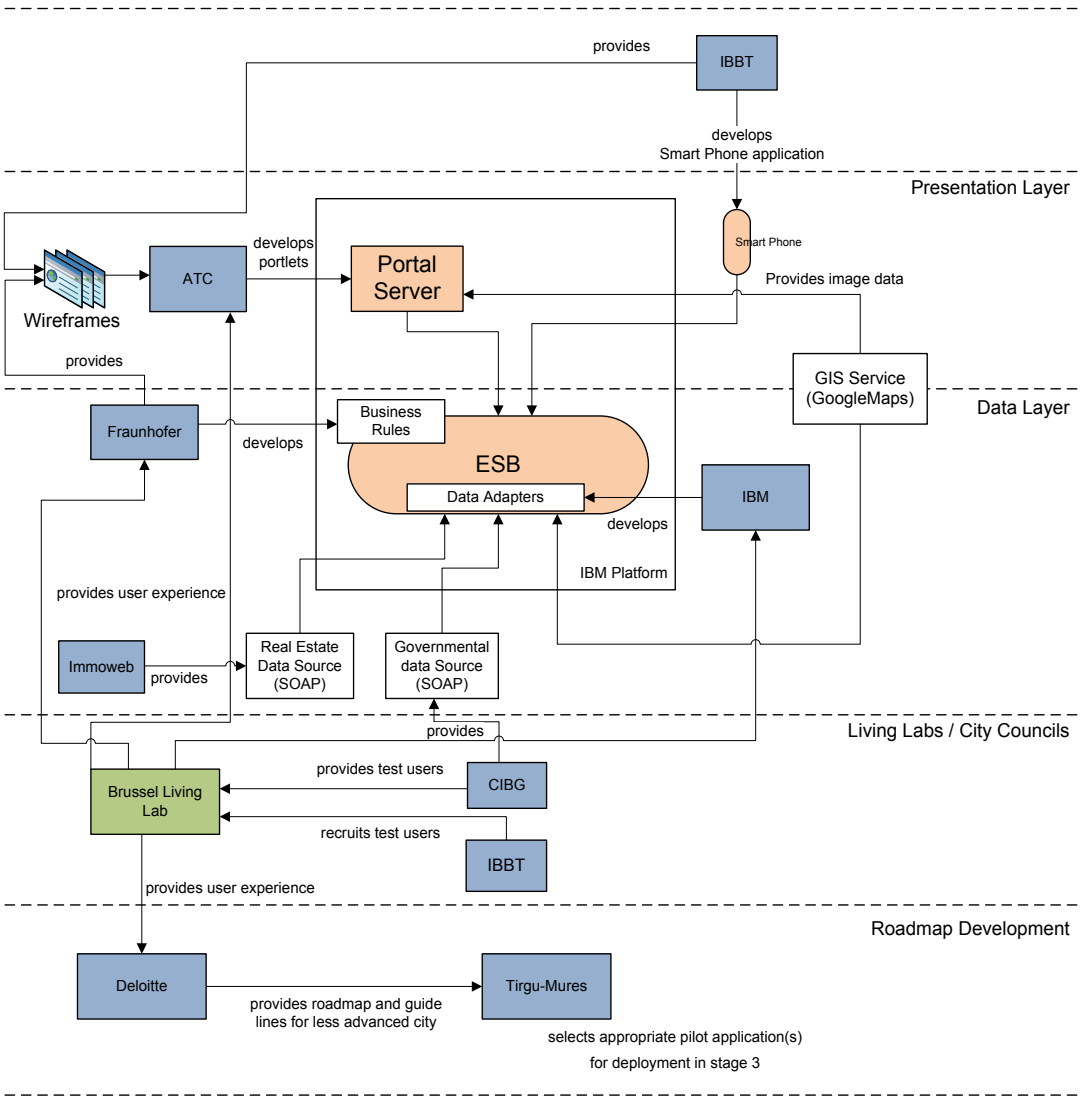

Figure 1: Initial interaction and collaboration diagram

4.2 Relocation Service Application

IBBT iLab.O works in close collaboration with Fraunhofer Institute, the Brussels Regional Informatics Centre and subject matter experts Immoweb (a leading SME in

the area of online property search and advertisement) to develop and test a semantic web relocation prototype in an extended Future of the Internet framework. The Brussels Regional Informatics Centre represents the public administrations of the Brussels Capital Region and the nineteen communes. It will provide relevant Brussels government data for the relocation application service and will contribute to the development and testing phase by providing professional test users that will evaluate the application. Immoweb will give access and allow the use of its web services with geo-located real estate information.

4.2.1 Constitution of the open innovation ecosystem of iLab.O Living Lab Brussels

As a part of IBBT, the independent research institute founded by the Flemish government to stimulate ICT innovation, iLab.O sets up test and experimentation platforms or living labs within the domain of ICT and facilitates all living lab research activities. iLab.O supports and coordinates today permanent test and experimentation platforms in Flanders, set up in collaboration with leading industrial players and public bodies. In addition to these permanent test and experimentation platforms, iLab.O designs, coaches and monitors temporary living labs that meets the needs of specific projects more accurately. It is possible that these temporary test and experimentation platforms, as a result of a positive output, are transformed after the projects in more permanent ones.

The latter option is the case for the relocation service application. The Living Lab that has been set up involves a public-private-people (citizen) partnership. It is a close collaboration between iLab.O, the public administrations of Brussels Capital Region and the nineteen communes, represented by CIBG/CIRB (the Brussels Regional Informatics Centre), the local SME Immoweb, Belgium's leading online real estate platform and the Fraunhofer Institute for Communication, Information Processing and Ergonomics, a German research institute in computer science and human-machine interfaces.

iLab.O will develop, with the aid of CIBG, Immoweb and Fraunhofer, its prototype hyper-local mobile web application to facilitate real estate search targeted at inhabitants of Brussels into a semantic web relocation service application prototype in an extended Future of the Internet framework targeted at people from different European countries who relocate to Brussels.

In order to test the relocation application service among the citizens, iLab.O will, in collaboration with researchers of SMIT based at the Vrije Universiteit Brussel and embedded within the Digital Society Department of IBBT, facilitate the living lab research activities for the Brussels test and experiment platform. iLab.O will do the selection, the recruitment and the coaching of a panel of end-users.

In line with the three stage approach for the deployment of the pilot in the city-ecosystem iLab.O will implement a gradual strategy to engage citizens in the living

lab and built the panel of end-users. In a first phase, iLab.O will set up a closed user group for the Brussels pilot during month in order to test if the service is working technically and is compliant with the scenario and initial user requirements. The closed user group for this pilot will be an active living lab panel of 150 people, consisting of civilian end-users, recruited by iLab.O, and of professional test-users provided by the CIBG/CIRB that will evaluate the application as a whole and the FKIE in particular. In a second phase, in line with the second stage of launching the relocation application service to the open, larger community, iLab.O will set up an open user group in order to test the application but also to evaluate the performance of the platform. For this open user group iLab.O will recruit a large panel of 500 civilian end-users. These civilian end-users are coming from different European Union countries and are about to relocate to Brussels, be it for a short time only or permanently, or have recently done so. In this second stage, Immoweb and CIBG/CIRB as users of the relocation application will also be involved, as well as the different stakeholders in Brussels Capital Region [Association of Belgium Relocation Agents, Brussels Business Flats, the Department of Demography and Organisation of the city of Brussels, Deloitte, ING (expatriates and non-residents) and Brussels Europe Liaison Office.]

4.2.2 User roles of scenario identified

The following section shows the identified user roles for the relocation scenario supporting user-driven application development and user testing, and picks up identified user roles from the scenario description in Section 3. The roles are assigned to Living Lab users and stakeholders from WP7 and will then be distributed among the Living Lab user crowd.

4.2.2.1 Public administrations of Brussels Capital Region and nineteen communes

The role of the public administrations of the Brussels Capital Region and the nineteen communes will be represented in the Living Lab by CIBG-CIRB. CIBG-CIRB is the public interest body in the Brussels Capital Region that aspires to be the technological neutral, competent, reliable and high-quality partner of all public institutions (regional government, local authorities, etc.) within the region to introduce innovative ICT for the benefit of public authorities, citizens, business and self-employed. Given this official role and it will insight into the different potentials of the application for public authorities: facilitating the administration process for relocating European citizens, retrieving statistical information about relocation people that benefits the urban planning on the level of the local commune or on the level of the whole region and finally assembling data for various reports to different administrative levels (regional, national and the European Union).

On the level of stakeholders, we aim, in order to represent the public administrations of the Brussels Capital Region and the nineteen communes, to involve in our living lab on the one hand the Brussels-Europe Liaison Office and on the other hand the Department of Demography and Organisation of the city of Brussels. The Brussels-Europe Liaison Office has the task to promote the image of Brussels as capital of Europe and seat of key European institutions and to inform residents of the important role played by Europe in the well-being and prosperity of the Region. The application will contribute to improve three of its main objectives: offering administrative and practical assistance to people relocating to Brussels, change attitudes and administrative procedures at all governmental levels in order to resolve practical and institutional problems for organisations and individuals moving to Brussels and encouraging European citizens and local citizens to meet one and another. For the Department of Demography and Organisation of the city of Brussels, which among other tasks is responsible for delivering residential permits, the application has the opportunity to smoothen the administration process for relocating European citizens to the commune.

4.2.2.2 Citizens

The role of the citizens will be represented in our Living Lab by the panel of end-users iLab.O will compose. In line with the aim of the EPIC scenario, these testers of our web and mobile relocation service application will all be citizens from different European countries who are in the process of relocating to Brussels capital region or have recently done so. They will thus be citizens looking for real estate before they leave their home country and upon arrival in Brussels coping with administrative and other daily life (healthcare, transport, schooling, banking etc.) issues when settling temporarily or permanently in Brussels.

4.2.2.3 SME

The user role of the SME will be represented by Immoweb. In addition to engage in the development of the application, it might benefit several advantages in using the generated data about people from other European countries that are relocating to the Brussels Capital Region. As the company behind the leading Belgian real estate portal website www.immoweb.be, Immoweb can use the information from the relocation service application as source for better highlighting certain properties that seem to be attractive for people from outside Belgium relocating to Brussels. As the company behind leading leisure periodicals in automotive and house decoration, the usage of the application by expats will give Immoweb more accurate information about their preferences and adapts these magazines according to the demands and needs of this social group. Finally, as Immoweb is also the Belgian leading portal in real estate advertisement business, information about expats that can be retrieved from the application is useful for better targeting the

advertisements from the various players involved in the real estate and relocating business in Brussels.

On the level of stakeholders participating in the Living Lab, these roles are represented by among others, for example, the Association of Belgium Relocation Agents, Brussels Business Flats, Deloitte and ING. For each of these players, the relocation application creates a unique opportunity to create more adapted services that respond better to the needs and demands of their expat-clients.

4.3 Urban Planning Service

Issy-Media works closely with the technology SME Navidis, a specialist in interactive geographical interfaces, to implement a multi-faceted urban planning suite which combines global information systems, rich content maps and 3D augmented reality applications. According to deliverable D2.2 [2] the application development is being carried out by Navidis (NAV).

4.3.1 Issy Medialand Living Lab

Officially labelled Living Lab by the European Commission in 2008,the bases of Issy Medialand Living Lab were set up as early as 1996, when the local administration adopted the Local Information Plan, a plan that served as a guide to the different initiatives launched by the city of Issy-les-Moulineaux. An essential part of the city's strategy was to bring multiple, diverse stakeholders together in stimulating environments in order to generate creative, innovative ideas. In Issy-les-Moulineaux the businesses (out of 57% are in the ICT and media sector, explaining thus the name "Issy Medialand"), the citizens and the government form an "innovative triangle", with businesses as technology facilitators, citizens as the users, and the government as the initiator and coordinator of the initiatives. The City of Issy-les-Moulineaux is therefore a Living Lab by definition.

The City is accompanied in the day-to-day management of the living lab by Issy Media, a public-private company in charge of the communication, the ICT development strategy of Issy-les-Moulineaux and the ICT implementation and innovation. Its aim is to help create a collaborative environment bringing together the public, the private and the research sector, in order to build a local Information Society which is innovative and open to all.

For the deployment of the Urban Planning Application a group of Living Lab users in Issy-les-Moulineaux will be recruited to provide end-user feedback in all stages of application development and to meet further particular needs of the project.

4.3.2 User roles of scenario identified

The following section shows the identified user roles for the Urban Planning Scenario supporting user-driven application development and user testing. The list picks up identified user roles from the scenario description in Section 3. These roles need to be assigned to the Living Lab users and possibly to the stakeholders in WP7 and will then distributed among the Living Lab User Crowd.

4.3.2.1 City administrators

Given that the entire city of Issy-les-Moulineaux is the Living Lab, the role of the city administrators will be represented by the local government that is currently in place. Its role is to support and encourage the adoption and use of innovative ICT tools for the benefit of the citizens, businesses and municipal civil servants. To this respect, the local administrators will get insight into the potential of the Urban Planning application for public authorities: offering an interactive multi-service portal to their citizens, the possibility to have a detailed view of the local economical fabric, follow its activity and stay up-to-date with the latest news in the sector, having a decision support tool for Urban Planning and implementation of local policies, fostering cooperation between different stakeholders within the city, and by so doing, encouraging the development of the economic fabric, and ultimately bringing citizens closer to their governments.

4.3.2.2 Civilian end-user

Issy Medialand Living Lab has a total population of 64,000 inhabitants, which all are considered to be potential users. Generally, the target groups of the e-services and applications experimented and implemented in Issy range from the very youngest to Issy's senior inhabitants. In line with the aim of the EPIC scenario, a group of volunteer users will be selected (based on a pre-defined methodology) to test the Urban Planning application. The Living Lab (the City, i.e. local administration, as previously described in Chapter 4.2.2), will involve users of all ages, from various backgrounds and from all economic and social groups. They will be citizens looking for general or for precise information about the city (cultural organizations, leisure centres, current urban projects, etc.) or they may be seeking for available jobs in the region.

4.3.2.3 SME

The user role of the SME will be represented by Navidis and a group of innovative SMEs from Issy-les-Moulineaux or the Urban Community of Grand Paris Seine Ouest. Through the Urban Planning Application the SMEs will be able to make themselves known, provide information about products and services offered as well as job opportunities. Personal login credentials will allow them to access the application's

back-office and post and update all relevant information related to their activity. The information shared through the interactive 3D application will allow not only a business-to-customer communication, but also a business-to-business interaction which will stimulate business development, partnerships and foster innovation.

4.4 Smart Environment Service

The Manchester City Council works alongside IOT specialists Birmingham City University and ICT SME Hildebrand to adapt its Smart Environment Application for use on the EPIC Platform.

MCC will help integrate and customise the application through its use on the EPIC platform. Volunteers will be engaged through the Living Lab network to deploy the sensors and use the EPIC platform to better understand their energy consumption. The feedback from these volunteers will enable the improvement of the application and platform to create a more user-friendly version that can be made available across Europe. Similarly, a public building scenario would engage with city building managers and city administrators,).

4.4.1 Manchester Living Lab

MCC is the "owner" of the Manchester Living Lab approach is fundamental to a smart city vision for the city. This includes developing opportunities for the developer community, including SMEs and user groups, to create new business opportunities through access to open data, the development of new apps and closer collaboration with community reporters and other "hacktivists", including the development of new social economy enterprises, e.g. digital cooperatives, to exploit these opportunities for the benefit of citizens and the wider community.

4.4.2 User roles and ecosystem constitution

MCC will help integrate and customise the application through its use on the EPIC platform. Fifty households will be engaged through the Living Lab network to deploy the sensors and use the EPIC platform to understand their energy consumption. The feedback from these volunteers will enable the improvement of the application and platform to create a more user-friendly version that can be made available across Europe. Opportunities to utilise data from public building systems will also be investigated for feasibility.

The following table picks up identified user roles from the D2.2 scenario description. These roles need to be assigned to the Living Lab users and possibly to the stakeholders.

Table 1: Constitution of the Smart Environment Innovation Ecosystem

Scenario role	Project role	Number of users	Project member
Small-Medium Enterprise	Development of technology-	n/a	Hildebrand (HIL)
City Council	Access to data	2	Manchester City Council (MCC)
Householder	Utilisation of monitoring equipment	50	MCC Living Lab
Home installer	Working with householder to install equipment	1	Manchester City Council (MCC)
Technical Staff	To support developmental and usage by citizens	1	Hildebrand (HiTe)
-	IOT Technology partner, Application development	-	Birmingham University (BCU)

4.5 Tirgu-Mures

Combining through this project the knowledge and expertise of IBM's cloud infrastructure with the knowledge and expertise of leading European Cities and LL's, Tirgu-Mures City intends also to become an European recognized LL, able to help and support the Commissions efforts, related to the Information Society, in the Eastern European and Mediterranean area.

Tirgu-Mures in Romania which is at the beginning of its digital development will create its own Living Lab for the deployment of one (or more) pilot applications. Living Lab partners IBBT, Issy Media, MCC and Enoll will help Tirgu-Mures with their expertise in Living Labs. Once the Living Lab partners for the main Pilot applications have finished building their innovation ecosystems they will use the gathered experience to initiate a Tirgu-Mures Living Lab.

The Living Lab partners of EPIC will support Tirgu-Mures in recruiting test-users and help them to create their own innovation ecosystem. In stage 3 of WP7 for the

non-advanced pilot city Tirgu-Mures an open user group of minimum of 500 users is considered.

Depending on the possibilities, the ecosystem will contain also small-medium-enterprises and demonstrate a public-private partnership between the Tirgu-Mures City Council and the businesses of Tirgu-Mures.

5. Conclusion

In this Deliverable the scenarios and ecosystems have been outlined and specified. Section 3 specified the scenario of use for the EPIC platform, for the Relocation Service Application, for the Urban Planning Service Application and for the Smart Environment Application. These scenarios do not act as a mere vision, but rather reflect the functionality that will be provided to the different users or stakeholders. This chapter described for each of the pilot applications different user views, namely, the city councils perspective, the civilian user's perspective and the small-medium enterprise's perspective, how they use the platform and how they can benefit from it. The specification of scenarios also described the overall functionality of the platform and of the pilot applications to be implemented.

Section 4 elaborated upon the user roles underpinning the scenarios (Section 3) and sketched how these user roles can be represented by each of the Living Labs iLab.O Living Lab Brussels, Manchester City Council and Issy Media-Living Lab. This information will be utilized for the actual setting up of the ecosystems in WP7 and thus be deployed to create real life representations of the scenarios developed and outlined here.

In WP7 it is expected to receive feedback from Living Lab users and to adjust the pilot applications to users' needs and, thus, the scenarios presented here are not meant to be understood as predeterminations rather they are open for refinement based on Living Lab findings for the duration of the EPIC project.

References

[1] EPIC Deliverable D2.1 “Project Vision”, http://www.epic-cities.eu, 2011

[2] EPIC Deliverable D2.2 “Stakeholder (User) Workshops’ Results”, http://www.epic-cities.eu, 2011

[3] EPIC Deliverable D2.3 “Online Service Delivery Baseline and Technical Requirements Report”, http://www.epic-cities.eu, 2011

Appendix A – Living Lab Concept for Innovation

Innovation policies that support and foster innovation processes have been perceived as crucial to increase competitive advantage. Next to an R&D focus these innovation policies also incorporate an implementation and piloting perspective. This is embodied in the current i2010 policy framework in which one of the main themes is constituted by the "Strengthening innovation and investment in ICT research". For ICT innovations in particular, more open and networked forms of collaboration between industrial, governmental, academic and user stakeholders in the innovation process have been identified as a crucial policy challenge. Recent experiences prove that such open or networked innovation should not be interpreted in terms of a naive or ideology-driven concept, but rather in terms of a concrete solution for dealing with complex and systemic innovation of ICT products and services that are composed of many complementary components, as well as for dealing with the fundamental unpredictability of ICT usage. This approach also fits within the Europe 2020 strategy and tin addressing the different issues mentioned in the digital agenda to boost Europe's prosperity and well-being.

Living Labs are platforms that implement this open innovation model and to pilot different initiatives towards the Europe 2020 perspective. Living labs are defined as user-driven open innovation ecosystems based on a business-citizens-government partnership which enable users to take an active part in the research, development and innovation process.[2] Benchmark examples of Living Labs are environments in which technology is given shape in real life contexts and in which (end) users are considered 'co-producers'[3]. They bring together stakeholders from the various parts of Research, Development and Innovation (RDI) process: cities and municipalities, innovation agencies, Living Labs and universities, large industrial partners, SMEs, citizens and so on. An ecosystem is established in which new products and services in real-life environments are created, prototyped and used. Users are not treated as object in the innovation process or as mere customers, but as early stage contributors and innovators[4].

The Living Lab is therefore an important mechanism for RDI activities as it:

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[2] *Directorate General for the Information Society and Media (2009) Living Labs for user-driven open innovation. European Commission*

[3] *Ballon, P., Pierson, J. & Delaere, S (2007) Fostering Innovation in Networked Communications: Test and Experimentation Platforms for Broadband Systems. In: Heilesen, S.B. & Siggaard Jensen, S. (eds.) Designing for Networked Communications – Strategies and development. Hershey (PA)/London, IDEA, 2007, pp.137-166*

[4] *See also Wise, Emily & Høgenhaven, Casper (2008) User-Driven Innovation. Oslo: Research Policy Institute - Nordic Innovation Centre, 136.*

1. enable industrial research, pre-competitive development and other types of innovation activities
2. can facilitate innovation within a specific (controlled) environment
3. can spread and limit the cost and risks.

Over the past decade, Living Labs have become an established part of local and regional innovation systems, using a variety of methods and tools, and focusing on a wide array of domains and themes. They are an important instrument in bridging the pre-commercial gap between research and the market by building public-private partnerships involving people (PPPP-model).

One of the main strengths of the Living Lab approach is its ability to merge research and innovation processes with the daily, local, real-life context, close to people in their role as both citizen and consumer. This makes this approach particularly suited to improve the R&D process by involving the user and by tackling issues of behavioural change and innovation, impact on business models, organisational processes and structures, multi-stakeholder participation, and taking into account (multi-)cultural specificities.

However, the experimental, learning-by-doing set up of Living Labs within various application domains and the disconnection between individual Living Labs, has lead to a wide variation of approaches, results and impacts of Living Lab activities. Therefore, as this innovation instrument matures, it is paramount to ensure that its main strength in terms of local embeddedness does not turn into a significant weakness in terms of the general applicability, validity and robustness of Living Lab test results. Also, there is a need of providing SMEs that partner and interact with local Living Labs with access to other European national markets and of scaling up lead markets to enable pan-European product and service innovation. It follows that there is a clear need for hands-on experiences with intensive networking, collaboration, cross-comparison and scaling up of local LL initiatives.

Networking Living Labs

In the last years there has been an increasing number of Living Labs throughout Europe, which are gradually forming a vibrant and still growing community. As mentioned above, these Living Labs do not only differ in the composition and approach but also in the domains they address and their approach. As a first step in networking these initiatives, the exchange of high-level principles and best practices for individual Living Lab set-up and implementation has been addressed in a number of national and European projects (like laboranova, ecospace, C@R, …). These past and current projects have mainly focused on the following elements: creating awareness related to the concept of a Living Lab, development of tools and methods to be used in individual Living Labs and the exchange of best practices

Currently we do see that these individual Livings labs are going beyond the local level. They start to collaborate in a more networked way. The main motivation to cooperate in such networked environment is on the one hand to further exchange

lessons learned and to facilitate cross-local and cross-border research. The latter is important in terms of scalability, comparative analysis and accessing new markets for companies (and SMEs in particular). At the moment various emerging Living Lab networks have been set up on the European, the regional, and the national levels. In 2006 the European Network of Living Labs (EnoLL) was established. This network creates a platform where companies, public authorities and citizens can work together on developing and testing new technologies, business models and services in real-life contexts. Currently it embraces over 200 Living Labs. But also on both the interregional level (e.g. Nordic-Baltic Network of Living Labs) as well on the national level (Italian network of Living Labs, Finnish Network of Living Labs)[5].

[5] *In this regard, the current CIP project APOLLON project (see http://www.apollon-pilot.eu) is focussing on the analysis of Europe-wide user, market and technology characteristics and an economically more valuable mode of experimentation, by networking, comparing and scaling up cross-border Living lab networks. This is of particular importance to facilitate the participation of SMEs including micro-entrepreneurs both as users and suppliers in this process. But within this type of cross-border collaboration stakeholders are confronted with a number of specific challenges related to combining ecosystems, measuring and benchmarking, interoperability of platforms, and the integration of solutions. The APOLLON project focuses on new methods, tools and interaction structures in order to leverage the current expertise and to enable the different Living Labs to initiate cross-border innovation activities.*

A next step in this Living Lab collaboration model is to build on the experience and results of those cross-border collaborations can be used to connect smart cities. How can interlinked, thematically networks of Living Labs be an instrument for facilitating the development and implementation of various future Internet services (in a smart-city context). The main challenges in doing so are the design and use of common platform on which smart services can be created, deployed and easily transferred through different cities.