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D2.4
Report on Technical Requirements (update)

Version 1.0

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1 Executive Summary

This report consolidates the results of the work on defining the technical requirements for the EPIC platform related to WP2 (“User Requirements Analysis”) of the EPIC Project. The technical requirements analysis defines the major functionalities that the EPIC platform and the pilot applications should provide to the users, while identifying the core technologies that the platform should address in order to meet the users' and applications’ needs.

The results of the technical requirements, as refined and updated in the second requirements analysis iteration, cover the technology spectrum that will be considered towards the realisation of the EPIC platform. The full sets of both functional and non-functional requirements are presented in generic and application specific level. This document will provide valuable input to the development of the EPIC platform (WP3), the integration and deployment of the three pilot applications (WP4, WP7) and the evaluation and validation of the platform (WP8).

2 Introduction

This report is an updated version of the D2.3 document, which already contains an initial set of user requirements that need to be addressed by the EPIC platform and pilot services. The key aim is to consolidate all the necessary user and application requirements that must be covered by the EPIC platform, to present the basic platform features and processes and to correlate the specified requirements with the platform's main components in order to highlight how those are actually addressed by EPIC. To this direction, the report updates the previous definition of the user requirements, accrued from the workshops that were organised by the pilot leads for the necessity of T2.2, taking also into account the feedback that was provided by the process of the platform's adaptation and the services' integration.

In this context, the document is structured in three main sections. The first section (Chapter 3) is devoted to the presentation of the definition of 'Smart Cities'. First of all, an overview of the existing services and paradigms offered by European cities right now is presented, while the current trends and challenges are described. Finally, we analyse our vision concerning what a 'Smart City' should become, and we describe how the EPIC platform will help the European cities to move towards this direction.

The second section (Chapters 4, 5) contains the analysis of the user requirements extracted from the pilot leads' workshops and all related discussions between the technical partners during the implementation of the platform. This analysis is necessary to derive the requirements towards the virtualized hardware platform (i.e. the sizing of the infrastructure provided by the IBM SmartCloud Enterprise and finally identify the necessary EPIC platform capabilities (i.e. the core enterprise services deployed in the underpinning SOA foundation). We firstly identify the common functional and non-functional requirements, and then we analyse the application-specific requirements in combination with a short description of the use cases, exploiting the D2.2. We then present the basic features that the platform must offer.

The third section (Chapter 6) is an extended analysis on how each requirement will be addressed by specific components of the EPIC, and correlates this document with the technical description of the platform. Finally, the conclusions on the outcomes of this document are presented in chapter 7.

3 The Concept of 'Smart Cities' in EPIC

Definitions of a Smart City vary but collectively tend to suggest the use of innovative ICT-based technologies such as the Internet of Services and Web 2.0 to deliver more effective and efficient public services that improve living and working conditions and create more sustainable urban environments. The EPIC Project Vision document [2] consolidates our view on "smart cities" and highlighted the challenges for providing and consuming "intelligent" public services in pan-European level. In addition, the following definitions present different understandings of what a "smart city" is and will be elaborated in the following sections:

- **IBM**: Smart Cities digitise and connect infrastructures (IOT) to infuse them with new intelligence. Smarter cities make their systems instrumented, interconnected and intelligent [4].
- **MIT**: Networked intelligence in fabrication and construction (IOT) [6].
- **Forrester**: The combined use of software systems, server infrastructure, network infrastructure, and client devices — which Forrester calls Smart Computing technologies — to better connect seven critical city infrastructure components and services: city administration, education, healthcare, public safety, real estate, transportation, and utilities. (IOT) [3].
- **Edinburgh City Council**: Smart City is all about people based public services (Web 2.0) [1].

Based on the extensive analysis of the aforementioned definitions, as presented in D2.1 and D2.3, EPIC believes that a truly 'Smart City' is one that is able to:

1. Benefit from the innovative developments of citizens, SMEs and other actors from across Europe rather than just within their own cities.
2. Leverage a service infrastructure that is capable of delivering 'one stop government' through the integration of services, interoperability of systems and use of actionable intelligence in service delivery.
3. Contribute to a multi-national service-oriented ecosystem by providing and sharing open business processes as services with other cities.

EPIC is predicated on the belief that a successful 'Smart City' approach needs to overcome the fragmentation and duplication that currently prevents innovative synergies between large technology and service providers, city administrators across Europe, small and medium-sized enterprises and end-users. EPIC provides a secure and trusted on-demand IT infrastructure, integrated web services and an implementation roadmap that will help deliver the necessary economies of scale and network effects to achieve high impact public service innovation in cost-efficient and effective manner.

EPIC will help stakeholders across the public service delivery chain to kick start innovation and work smarter:

1. **Cities:**
    a. Enhanced ability to provide more innovative, efficient and effective services at a reduced cost.
    b. New business models and working relationships with other cities and improved relationships with citizens and businesses.

2. **Citizens:**
    a. Access to more innovative, efficient and effective services.
    b. Enhanced ability to help improve public services.
3. **SMEs:**
    a. Greater access to local and international markets.
    b. Ability to work more cost-effectively via the EPIC cloud platform.

Therefore a summary of EPIC's Smart City vision statement can be condensed as follows:

"To be the first choice service innovation and delivery platform (with Roadmap) for medium sized (50.000–500.000 habitants) cities across Europe, where any city can cost-effectively share, access and adapt a range of services to work smarter to meet the needs of most, if not all, their citizens, visitors and a wide range of business/social relations".

4 Requirements Specification

The overarching goal of the EPIC Project - European Platform for Intelligent Cities - is to develop a scalable, openly accessible platform that enables cities, citizens and service providers (in Europe) to create and share innovative web service-based information and applications by offering different means of on-boarding and subscription.

4.1 Methodology

EPIC, as a CIP-Pilot Action, cannot be considered a typical RTD project. The key role of LLs and the various stakeholders in all processes of the project lifecycle as well as the fact the outcomes do not refer only to software but also to a roadmap, required adaptation of the management, analysis and implementation methodologies to the particular needs of the project. In that sense, the definition and analysis of the user requirements did not follow an off the shelve methodology. Instead, but based on partners expertise and taking into consideration well-established methodologies such the "Agile Development Methodology". The principles of this methodology are well defined in the 'Agile Manifesto' [5]. According to the latter, changes in the user requirements are welcome, even late in the development process, while updated versions of the software are being delivered frequently. Agile development process encourages close and daily cooperation between business people and developers. This means a numerous set of interactions between all partners, leading to the continuous definition of new requirements and the rapid delivery of useful working software. With this approach, it is more likely to meet the user's needs, as they are involved at the process of the development having working software instead of presentation documents and slides.

The requirements analysis outcomes presented in this document are very important for the successful completion of the EPIC project as they are key input to the forthcoming WPs for the implementation of the platform and the roadmap. As Figure 1 indicates, D2.4 consolidates the results of all WP2 processes, namely the state-of-the-art survey made by the technical partners (and it is included at the D2.3 document) along with the outcomes from the internal meetings that took place during this period, the three workshops at the pilot cities, the internal conference calls between all technical partners, and the experience gained from the development and integration process of the platform. Important contributors to the requirements acquisition and elicitation were the technology experts of the project, who in close collaboration with the pilot leads, identified and categorized the requirements for each platform element. This work is an updated version of the D2.3 document that has already provided value input for the WP3 ("Platform Adaptation") and WP4 ("Service Application Integration") as it identified the key guidelines to be taken into account during the implementation of the platform. During the process of those two work packages, additional requirements have been identified, and already existing ones have been adjusted to meet the real needs of the platform and the pilot labs' objectives. Considering also the fact that part of the outcomes of the workshops and internal meetings was closely related to the business view of the project, this document also affects WP6 for the development of the roadmap. With respect to the agile software development principals, the forthcoming packages have provided feedback to WP2 and requirements list which is now updated as the project has evolved enough. In

addition, the validation and evaluation of the platform both during the deployment phase for each scenario and the proof of concept for the Tirgu Mures City will provide valuable feedback through test cases being linked with the user requirements (degree of fulfilment).

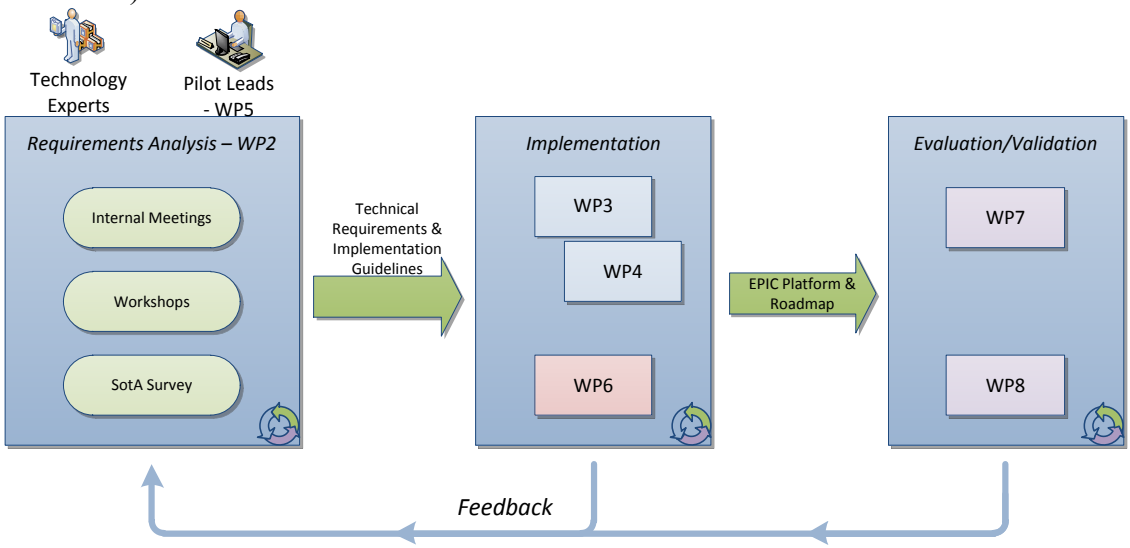


Figure 1: Relation between EPIC WPs

With respect to the Agile paradigm, the collection of the user requirements started with a face-to-face meeting between all WP2 partners. The participants were divided into three focus groups: the city administrators, the application developers and the technical experts that are contributing to the development of the platform. Each focus group had a brainstorming session, trying to identify key issues that need to be clarified. After this session, there was an extended discussion between all partners, trying to analyse every identified remark from different points of view. This leaded to the recording of the initial list of issues that needed to be studied and discussed in the pilot workshops.



Figure 2: Initial Requirements Collection

Having the first set of questions, the discussions continued internally between WP2 partners "fine-graining" and extending the questions that should be discussed in the workshops. After numerous iterations, we came up with two separate questionnaires to be

used as a basis for collection the user requirements, one containing the technical issues to be solved, and another to be answered by the end-users and the city administrators. Furthermore WP2 collaborated closely with WP6 lead – Deloitte in order to acquire additional input for the workshop discussions and ensure that the WP2 outcomes will be effectively exploited for the roadmap development.

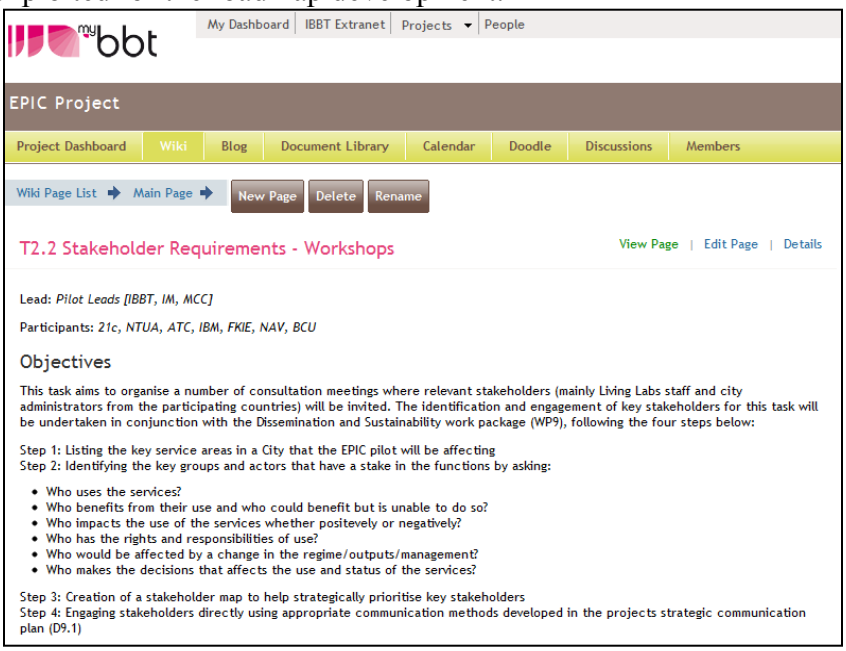


Figure 3: Requirements Analysis Workarea

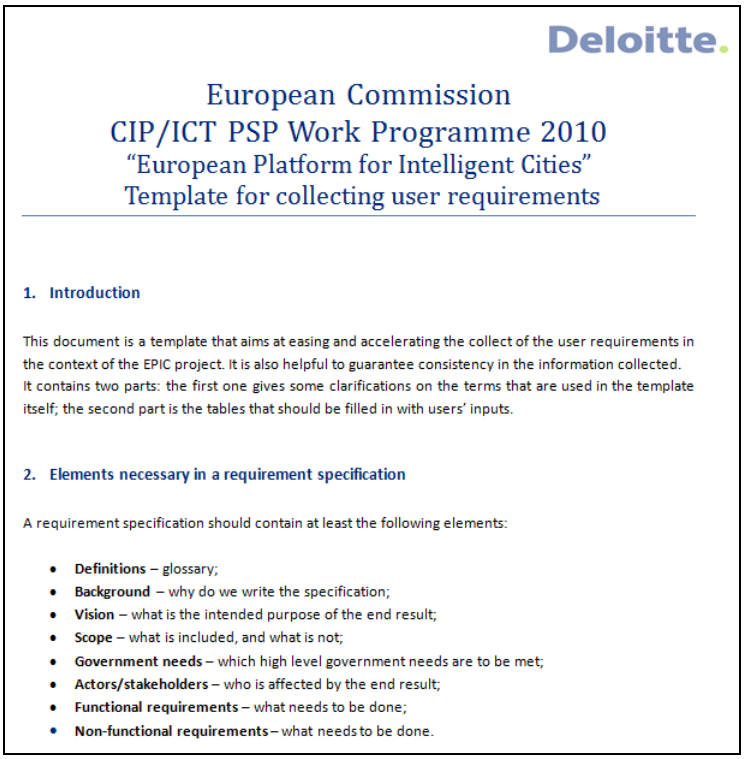


Figure 4: Template proposal for the collection of requirements

Afterwards, three workshops took place in each pilot city. Pilot leads had to identify the key target groups of stakeholders to attend these meetings and propose the agenda based on the guidelines and the initial discussions in WP2. The application developers as well as the relevant technical partners to each scenario participated to the workshops in order to enrich the process of those meetings with their technical expertise and to identify key technical issues. The outcomes were a list of answers to each question, addressing the different needs of every specific scenario. Those answers were circulated between all partners in numerous iterations, and produced the initial list of the technical requirements. Moreover, the partners' technical expertise produced additional requirements related with their platform elements covering all aspects of the project.

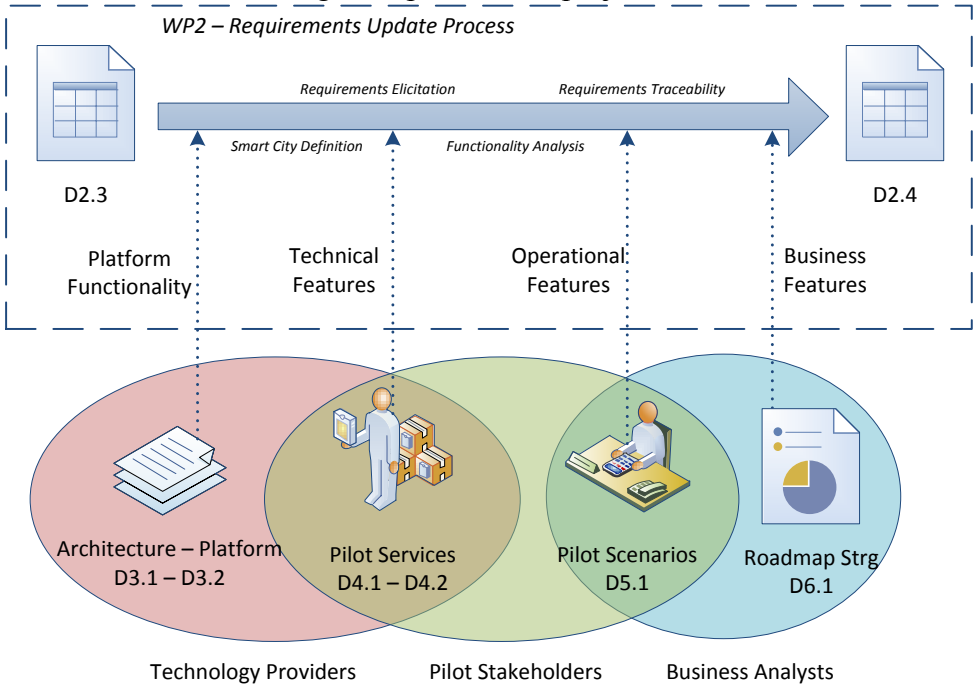


Figure 5: Requirements Update Process

After the completion of the initial set of requirements, included at the D2.3 document, the consortium was able to start the adaptation of the platform in order to meet the project's needs, while the pilot leads started to adjust their applications so as to integrate them to the EPIC. In this process, all technical partners were tightly involved, having weekly teleconferences where all raised issues were discussed thoroughly. From those meetings, a number of additional requirements were identified, while others had to be slightly updated. Those issues were also discussed at the regular meetings with the whole consortium, given the opportunity to be further clarified by the non technical partners (i.e. city administrators, pilot leads headers) who commented from the business and administrative point of view. Moreover, the experience gained from the migration of the pilot applications to the EPIC platform helped to identify a new set of functionalities that the EPIC must offer. Due to the pilot labs' expertise regarding the involvement of end-users in the development process, those functionalities were well defined and drove the enrichment of the D2.3 document with new requirements. D5.1 ("Specification of Scenarios of Use & Ecosystems"), D5.2 ("Service Analysis & Documentation"), as well

as D4.1 ("Platform delivery with testing Report & Service Catalogue") and D4.2 ("Delivery of the 3 Pilot applications"), which consolidate the outcomes of the related tasks, have been also a valuable input towards this direction. The final list of the EPIC's user requirements are presented at the following subsections.

4.2 General Requirements

Technical requirements arise towards the underpinning platform as well as towards the data and service providing parties. In addition, we have to distinguish between functional and non-functional requirements on both sides:

1. Functional Requirements –referring to specific set of capabilities and behaviour for a system or a component.
2. Non-functional Requirements – referring to restrictions on the types of solutions that will meet the functional requirements.

Collaboration, i.e. information and service sharing, in EPIC has both the human factors and the process management aspect to it, and requires the building of extensive and flexible knowledge bases.

In order to get to knowledge-based centres of excellence, solutions need to be provided for:

- support of internal and external collaboration processes
- threat and operation control centres, integrated intelligence exploitation and enhanced decision making (policy maker, process managers, commanders)
- maintaining public safety and security
- federated identity management, incl. identification and verification capabilities
- integrated case management

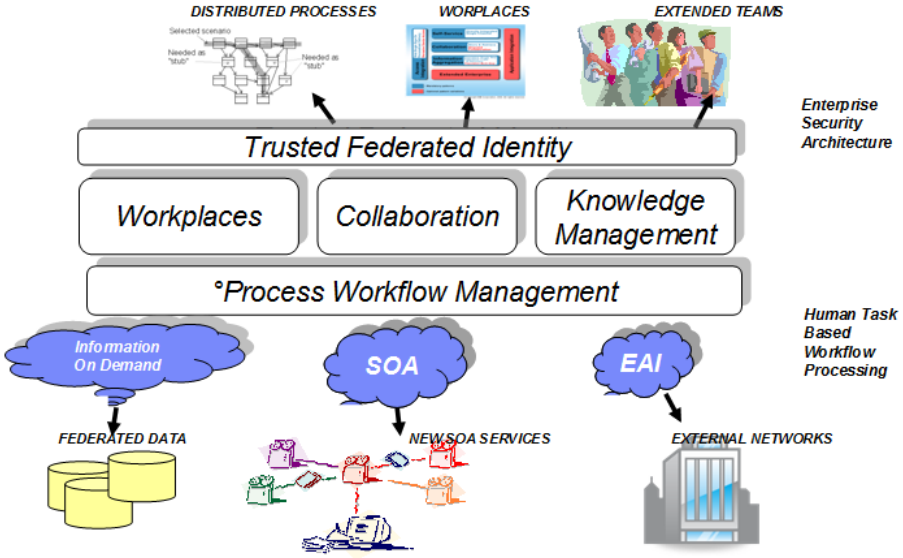


Figure 6: Components of an integrated collaborative information environment

A service-oriented architecture and infrastructure is the cornerstones that ensure the needed flexibility. In fact, without the dynamic discovery capability of SOA services, the collaboration environment would be based on the usual 'all or nothing' paradigm, where failure in the availability of one of the participants makes the entire process to stop. With

SOA instead, the presence of alternate providers is made transparent to the process, as well as the customization of capabilities to the different user roles. In addition, the federated identity standards, which are at the basis of distributed access and authorization, are better carried out on SOA infrastructures.

4.2.1 Functional Requirements

The EPIC platform needs to become a self-contained interoperability solution for pan-European information and service sharing between stakeholders. Therefore, it needs to deliver the following:

4.2.1.1 Platform Requirements

The requirements for the platform arise not so much from the needs of the ultimate stakeholders i.e. the cities and the citizens, but from the (pilots') service providers, who need to be able to offer their services from an industry-strength platform hosting a SOA reference architecture.

Those requirements ensure in particular the ability to sustain the EPIC platform beyond the project and to have it adopted as a preferred hosting platform for future commercial service providers.

These capabilities are in large part transparent to the end user of the Pilots.

Table 1: Requirement FR1

ID	**FR1**	**Severity**	High
Name	**Common role-based portal server**		
Description	All pilots will get access to the services solely via the EPIC platform portal, which needs to contain a portal server to manage: • Different user groups/roles, e.g. for the pilots • The different stakeholders, users of the platform • Presentation of portal pages on different mobile and non-mobile devices • Access control to services • Single sign-on to back-office applications and processes • Secure platform access from the internet via a DMZ (Demilitarized Zone)		
Source	• Administrative questions: A3 • Technical questions: T3, T16 • Even though the questions highlighted the multi-user aspects of the platform, this requirement is also driven by DoW as one of the key functionalities of the platform.		

Table 2: Requirement FR2

ID	**FR2**	**Severity**	High
Name	**Registration of a service**		
Description	The EPIC platform must provide services for any web service provider to register new services to be offered to city administrations, citizens/tourists and other service providers. This registration must include e.g. the web service description (WSDL); it can include also e.g. a service pricelist for different user groups.		
Source	• Administrative questions: A13 • Technical questions: T2, T4 • This requirement is also based on DoW as a need for allowing providers to register their web services to a common service catalogue in order to make them available to different cities/stakeholders.		

Table 3: Requirement FR3

ID	FR3	Severity	High
Name	**Registration of a stakeholder – providing credentials and trust evidences**		
Description	Likewise, the platform must enable the on-boarding of new stakeholders, in particular city and commercial service providers. This registration service should be implemented in a self-service portal to allow new stakeholders to register and upload necessary credentials and trust evidences e.g. licences and certificates as a trusted public supplier.		
Source	• Administrative questions: A3, A8		

Table 4: Requirement FR4

ID	FR4	Severity	Medium
Name	**Subscription to a web service**		
Description	In addition to the search of the repository, subscription to services should be facilitated by the platform e.g. subscribing to a service for usage statistics.		
Source	• Administrative questions: A13		

Table 5: Requirement FR5

ID	FR5	Severity	Medium
Name	**Federated single sign on using a single EPIC username**		
Description	All users authenticate themselves at the EPIC portal with their EPIC user id. The services they access from the portal might need different access credentials e.g. a social security number to apply for and receive state pensions. The access to the platform should be permitted based on this single EPIC username. However, every hosted application should be able to use additional user profile information that must be stored separately.		
Source	• Administrative questions: A2 • Technical questions: T2 • This requirement is also based on the scenario specific UC-SE1 use case		

Table 6: Requirement FR6

ID	FR6	Severity	Low
Name	**Search for a web service**		
Description	Visitors of the EPIC portal need to be able to search for and locate available web services related to a certain topic e.g. finding sports events. The EPIC platform therefore has to offer a search portlet for a keyword-based inquiry of the web-service repository (WSRR).		
Source	• This requirement is driven by the application specific UC-RS2 use case. The DoW cites generally the ability to search for a web service, but this context-aware search is application specific, and that's the reason why the technical experts indicate this requirement's severity as 'low'.		

Table 7: Requirement FR7

ID	FR7	Severity	Medium
Name	**Provide comfortable possibility to manage user access rights on specific contents of the EPIC's hosted applications**		
Description	The platform has to provide web content management functionality for web masters via the portal interface.		
Source	• Technical questions: T4, T5		

	• This requirement is driven by the application specific UC-UP1 and UC-UP2 use cases. • This requirement is also driven by the DoW, allowing the administrators to easily make use of existing APIs in order to modify and extend features and functionalities in a straightforward manner

Table 8: Requirement FR8

ID	**FR8**	**Severity**	Low
Name	**Possibility to negotiate SLAs when needed**		
Description	In cases where the application is offered via a specific fee, the use of SLAs will ensure the pre-agreed QoS and the data access to existing data resources.		
Source	• Administrative questions: A2, A8		

Table 9: Requirement FR9

ID	**FR9**	**Severity**	High
Name	**Web service enablers to ease the access to the platform DBMS (or external data sources) capable for manipulating significant amount of data**		
Description	Many pilot applications manipulate data relating to rich medias. Considering the fact that the end-users should be able to store rich medias, the EPIC platform should provide appropriate mechanisms to allow the ease access to external DBMS that are capable of manipulating a significant amount of data (up to a number of Petabytes), and to ensure high performance and best user experience.		
Source	• Technical questions: T2, T9, T10 • The requirement's severity is marked as 'High' by the technical experts as it is crucial for the success of the platform.		

Table 10: Requirement FR10

ID	**FR10**	**Severity**	Low
Name	**Time zone and multicurrency support**		
Description	The EPIC platform must be capable of supporting multicurrency and different time zones.		
Source	• Technical questions: T13, T14		

4.2.1.2 Front-end Requirements

Table 11: Requirement FR11

ID	**FR11**	**Severity**	High
Name	**Role-based user interface**		
Description	The Front-end must provide a different set of functionalities depending on the user that is currently logged on.		
Source	• Administrative questions: A2, A3		

Table 12: Requirement FR12

ID	**FR12**	**Severity**	High
Name	**Administration interface**		
Description	The administration interface will provide the elements needed to allow user management, role handling and access control – administrators being one defined user role in the central user directory.		

Source	• Technical question: T2 • This requirement is also a recommendation from the project technical experts so as to accomplish to allow cities to manage their services.

Table 13: Requirement FR13

ID	**FR13**	**Severity**	High
Name	**Registration Page**		
Description	The users of the EPIC Portal will have to register themselves using a registration form which will allow the provision of credentials and trust evidences if needed. The administrator will assign higher level rights to each user, appropriately.		
Source	• Technical questions: T2 • This requirement is tightly coupled with FR11		

Table 14: Requirement FR14

ID	**FR14**	**Severity**	High
Name	**Service registration screen**		
Description	This screen will ask the users to provide all the information that is required in order to register a service to the EPIC platform.		
Source	• This requirement is tightly coupled with FR2		

Table 15: Requirement FR15

ID	**FR15**	**Severity**	Medium
Name	**Personal Space**		
Description	The logged users will have to be presented with a personal page where they will be presented with the services which they have bought/registered/subscribed and also with the details of their EPIC account.		
Source	• This requirement is driven by UC-RS1 and UC-RS2 use cases.		

Table 16: Requirement FR16

ID	**FR16**	**Severity**	Low
Name	**Advanced search for services**		
Description	A search form allowing the users to search for services using multiple criteria (category, location, etc.).		
Source	• This requirement is driven by UC-RS2 and UC-UP3 use cases.		

Table 17: Requirement FR17

ID	**FR17**	**Severity**	Low
Name	**Notification List**		
Description	A list with the updates on services that the users have been subscribed to. The users should be able to view additional information regarding their selected services (price, rates)		
Source	• This requirement is a suggestion from the project application developers.		

Table 18: Requirement FR18

ID	**FR18**	**Severity**	Low
Name	**Promoted/Latest services area**		
Description	The EPIC Portal could provide an area where the latest available services can be		

	viewed by the users. The same or a similar area could be also used for promoted (if exist) services.
Source	• Administrative questions: A7

4.2.1.3 IOT Requirements

FR19 – Easy integration of IoT elements into cloud services is already covered by *FR20 – Interoperability.*

Table 19: Requirement FR20

ID	**FR20**	**Severity**	High
Name	**Interoperability**		
Description	Data feeds coming from a variety of domestic and industrial monitoring equipment and services will be published within the EPIC platform, consumed by other services and interoperable through a semantic layer within EPIC.		
Source	• Administrative questions: A10 • Technical questions: T7, T8, T10 • This requirement is also driven by the DoW in order to accomplish the Generic Public Services Conceptual Model (GPSCM) which provides an organising principle for interoperability and promotes the reuse of information, concepts, patterns, solutions and standards in the Member States and at the European level.		

4.2.1.4 Requirements for Semantics

Table 20: Requirement FR21

ID	**FR21**	**Severity**	Low
Name	**Multilanguage support**		
Description	The EPIC platform should support Multilanguage capabilities, exploiting the semantics technology.		
Source	• Technical questions: T12, T14 • This requirement is also driven by the DoW which cites explicitly the need to support for multinational communication		

Table 21: Requirement FR22

ID	**FR22**	**Severity**	Medium
Name	**Semantic annotation for web services**		
Description	Semantic annotation of web services enables other systems to interpret what meaning a particular web service and the provided information/functionality has. This feature belongs to the development of the semantic web in which it's aimed at achieving an "understanding" among it-systems and web services. The portal server should provide the possibility to employ *Semantic Annotations for WSDL and XML Schema (SAWSDL), Web Service Modelling Language (WSML)* and *Resource Description Framework schema (RDF schema)* of W3C which together provides a mechanism to supply XML schemas with semantic models. Semantic annotations and models have to be created at a later point for the web services.		
Source	• Technical questions: T13 • This requirement is also driven by the DoW which cites the exploitation of ontologies for easy cross-language adaptation and communication within the Cloud		

4.2.1.5 Other Requirements

Table 22: Requirement FR23

ID	FR23	Severity	Low
Name	**Feedback**		
Description	The EPIC platform should allow the end-users to provide feedback regarding the application experience, and report any bugs, malfunctions or suggestions that could be used for the improvement of the application.		
Source	• Administrative questions: A5, A13		

Table 23: Requirement FR24

ID	FR24	Severity	Low
Name	**Statistics & Analytics**		
Description	The EPIC platform should monitor the usage of the applications in order to provide statistical data. Moreover, the platform should allow the city administrators to extract intelligent information based on the end-users measures (i.e. identify which are the most popular functionalities that each service offer.).		
Source	• Administrative questions: A6, A13 • This requirement is driven by UC-SE7 use case • This requirement is also driven by the DoW which cites the need for collection and management of financial and statistical data		

Table 24: Requirement FR25

ID	FR25	Severity	High
Name	**Clean up all user history when the user unregisters**		
Description	The EPIC platform separates user data for the EPIC platform from user data for Pilots, including any pilot-specific data a user is required to supply at registration. The usage of the platform and of pilots is held in usage-log tables. If a user withdraws from a Pilot, all pilot-specific user data is removed and access rights to the pilot are removed for the user. The anonymised usage data for the pilot is maintained but can no longer be attributed to personal data about the pilot user because these details have been removed. IF a user withdraws from EPIC, all Pilot-specific user data and platform-account data is removed but the usage logs are maintained.		
Source	• This requirement is tightly coupled with FR24 and NF2 • This requirement is driven by the pilot labs' suggestions		

Table 25: Requirement FR26

ID	FR26	Severity	High
Name	**Database supporting different service provider application needs**		
Description	The EPIC platform must provide a database allowing storage of data the services providers choose to be hosted in the cloud.. However, each application has its own needs and special requirements to store different kind of information and it totally responsible for maintaining the data and in particular ensure legal compliancy and data privacy rights. This is in part addressed by the user-data management schema, where individual Pilots have the ability to assign access rights, user roles and elicit pilot-specific data from pilot users. This is done through the generic web-services.		
Source	• This required was defined by the technical partners during the development of the EPIC's applications		

4.2.2 Non Functional Requirements

Table 26: Requirement NF1

ID	NF1	Severity	High
Name	**Usability**		
Description	The EPIC platform should ensure its usability, especially for the elements where the actor is the end-user such as the front-ends.		
Source	• Administrative questions: A4, A10 • This requirement is also driven by the applications specific UC-SE6 use case.		

Table 27: Requirement NF2

ID	NF2	Severity	High
Name	**Privacy Protection**		
Description	The digital information society demands bridging between critical technical, business and legal issues in identity management. To enable safe and secure interaction while allowing users to keep control of their private spheres, the access control paradigm needs to change from a "one fits all" to a more granular approach: "what properties are really needed for accessing a specific resource?" This way the data release for authentication towards communication partners can be minimized.		
Source	• Administrative questions: A2, A15 • Technical questions: T4, T15 • This requirement's severity is marked as 'High' by all technical experts.		

Table 28: Requirement NF3

ID	NF3	Severity	Low
Name	**Security – rule-based authentication and authorization**		
Description	A minimal-disclosure credential system should enable strong authentication and privacy at the same time. It is to allow users to selectively reveal attributes contained in the credential without revealing any of their information whatsoever. It addresses all requirements of a privacy protecting public key infrastructure (PKI). It protects privacy via an efficient, minimal-disclosure credential system which builds on the principle of purpose-oriented and policy-driven federation of credentials (using an open privacy policy language called PPL).		
Source	• Administrative questions: A2 • Technical questions: T2, T11		

Table 29: Requirement NF4

ID	NF4	Severity	High
Name	**Support for mobile devices**		
Description	Mobile devices are supported in different, pilot-specific ways. Any mobile device with a standard browser can access the Pilots in the normal way, via the portlets delivered by the portal server inside EPIC, except for applications requiring a specific web player not supported by the mobile device – it is not expected having Urban 3D working on mobile. Some variations in screen layout may be implemented for smaller-screen devices. These can be selected automatically by querying the browser type from the client or selected manually by the user. At least one pilot plans to offer an app to mobile users, through which the web-services will be consumed, so that hardware specific features of the device, such as GPS and camera, can be used. The app itself will not be distributed to users via the EPIC platform but will be placed in the appropriate app store (Apple / Android or other) by the originators from where users can download and install the app.		

Source	• Technical questions: T1 • This requirement is driven by UC-RS7 use case. • This requirement is also driven by the DoW which cites the platform requirement to use the special features of mobile devices

Table 30: Requirement NF5

ID	**NF5**	**Severity**	Medium
Name	**Attractive design of EPIC web portal and pilot applications**		
Description	The EPIC web portal will be the entry point to the pilot applications. EPIC specific graphical elements and HTML templates should be well designed in order to ensure an attractive appearance as well as recognition value. Based on each pilots application workflow (yet to be created) a navigation concept through the web application should be developed.		
Source	• Administrative questions: A10		

Table 31: Requirement NF6

ID	**NF6**	**Severity**	Medium
Name	**High availability**		
Description	Some application scenarios require that the users provide row data to the EPIC platform in a per minute basis, and as a matter of fact, the EPIC platform must be able to receive them continuously.		
Source	• Administrative questions: A10		

4.3 Pilot Application Requirements

Existing applications can be consumed from the platform unchanged if and only if they are "wrapped" as a web service – via the usage of the web services. Each application/service will be invoked via the common EPIC portal server via portlets; according to the role and personal customization each user can be authorized for a different set of services all managed in the web service repository.

4.3.1 Relocation Service

The relocation service consists of non-mobile and mobile parts. For these parts different requirements are claimed because those parts run in completely different environments: A portal server with cloud computation power and smart phone operating system with less computation power and less memory. Also, the non-mobile application can make use of much more already available software and libraries than the mobile application.
This life-event scenario is based on a semantic layer allowing the end-user to:

- Create a relocation profile
- Create a search query
- Execute that query
- Save results of interest as 'favourites' for later reference
- Request government-related information
- View query and result both on pc and on a mobile device

Table 32: Requirement RRS1

ID	**RRS1**	**Severity**	Low
Name	**Multi-Cultural Description of the Real Estate Properties**		

Description	Citizens from different countries refer differently to properties. E.g. some citizens talk about size in terms of square feet or square metres and number of bathrooms, while other citizens might specify in terms of number of bedrooms and number of reception rooms. The semantic engine with the help of EPIC platform should map user needs onto the different descriptions provided by realtors and letting agents.
Source	• This requirement is based on a recommendation for project technical experts.

Table 33: Requirement RRS2

ID	**RRS2**	**Severity**	High
Name	**GIS/Map for showing points of interest, real estate properties, etc.**		
Description	For the user acceptance the visual appearance of the map plays an important role. Our solution has to compete against those which are commonly known nowadays. State of the art products could be also used taking into consideration any license restrictions.		
Source	• Technical questions: T1, T2, T9		

4.3.1.1 Mobile

Table 34: Requirement RRS3

ID	**RRS3**	**Severity**	Low
Name	**Reach as many smart phone platforms as possible and minimize software development effort**		
Description	Minimizing the effort of software development for the mobile part of the relocation part can be achieved by OS abstracting layers like Appcelerator Titanium. Hardware and operation system abstracting frameworks may decrease the performance of the application. Of course, at the same time they minimize programming effort by reaching several smartphones at once. Ideally, applications would be browser-based and would run on any mobile device. However, as this would limit the functionality of the applications, EPIC will aim to find a balance between native and browser-based applications.		
Source	• Administrative questions: A10 • Technical questions: T5 • This requirement is also driven by UC-RS7 use case.		

RRS4 – Realise augmented reality functionality (only mobile part) and *RRS5 – Ensure good performance of video flow in augmented reality view* are considered as application specific that do not affect the platform design and implementation.

RRS6 – Enable for communication between the mobile application and the portal server is already covered by *FR20 – Interoperability*.

4.3.2 Urban Planning Service

Navidis has developed a digital solution for managing, sharing and communicating the urban planning and development projects of the city. This digital consultation and participation solution provides innovative content and a considerable rich media data base, adapted to the needs and expectations of the City – a web based solution for professionals and citizens to meet and exchange information. Through the application, politicians, professionals and citizens can access, explore, better understand and work together on representation and information of different sites and major development projects of the city.

The application is a real time 3D Model of the city (ISSY 3D) to provide an innovative augmented reality experience for professionals (urban planners, architects, etc.) and citizens (residents associations, community groups and individuals) who can access the Internet to virtually fly over and move around a digital 3D model of the city and access major sites like in a video game. This application helps users to understand the vision for the city and experience potential developments by accessing and experiencing relevant information like sounds, statistics, geometrics, dynamic flows and media etc.
The services will be redefined and adapted by Navidis for use within the EPIC platform. A specific layer, focus on SME, will be added to enhance the level of communication available at a global level and making them able to "chat" between and sharing information like with a "social network".
The Issy-Les-Moulineaux application allows the user to:

- Choose a topic of interest (thematic through a layer)
- Select the points of interest (for getting specific details)
- Query the points of interest (search any information)

Additionally, local government agents are also able enrich information available for the city, same as the local SMEs are able to inquire information regarding the local companies registered in Issy-Les-Moulineaux.

Table 35: Requirement RUP1

ID	**RUP1**	**Severity**	High
Name	**GIS**		
Description	Availability of GIS (like ESRI or openGIS) and 3D Data should be available in/through the Cloud for being able to provide visualization of the territory in 3D with Navidis design and features.		
Source	• Technical questions: T1. T4 • This requirement is also described in DoW which cites the need for access to the Geographic Information System of the city with an intuitive interface		

Table 36: Requirement RUP2

ID	**RUP2**	**Severity**	High
Name	**Performance of architecture**		
Description	In addition to 3D representation users will manipulate in real time, lot of rich media like photos, videos and sounds will be treated by the applications. That means availability and bandwidth of the system will be highly stressed. The architecture must be optimized to find the right balance between the execution on the client device and the server.		
Source	• Administrative questions: A13 • Technical questions: T10		

RUP3 – Middleware Interfaces is already covered by *FR20 – Interoperability*.

RUP4 – Middleware Administration is already covered by *FR12 – Administration Interface*.

RUP5 – IM/NAV Marketplace is considered as application specific and out of the scope of EPIC Project.

4.3.3 Smart Environment Service

The smart environment service (SES) focuses on monitoring of energy consumption in privately owned and social housing, public buildings and commercial premises. A personal energy monitoring portal, EnergyHive, developed by Hildebrand will be used to demonstrate how an end-to-end commercial service for domestic energy customers could be developed around energy monitoring web services.

The applications for domestic energy monitoring developed by Hildebrand will be broadened by a BCU-designed generic monitoring framework (GMF) focussing focus on energy-consumption data from public buildings and commercial premises. The data from fiscal smart-meters (electricity / gas / water) will be combined with data from wireless sensor networks (WSN) and data gained from access to the Building Management System head-end. Additionally the system will demonstrate how citizen provided data from Pachube can be integrated into the GMF. This will enable the EPIC platform to consume a diverse range of data feeds and accommodate existing and emerging hardware/software and data streams that will complement the Hildebrand domestic energy monitoring application.

This will demonstrate the potential applications for energy monitoring in the wider smart-city context, to complement the consumer focussed domestic energy monitoring application. SES web-services exposed within the generic framework will also allow energy usage data from domestic homes and public buildings to augment the Relocation and City Planning applications, encompassed under the BCU generic monitoring and control framework.

Table 37: Requirement RSE1

ID	**RSE1**	**Severity**	Medium
Name	**Domestic Energy Monitoring (Hildebrand / Manchester)**		
Description	Hildebrand has developed a commercial personal energy portal, EnergyHive. Users install a clamp meter onto their electricity meter which connects wireless to a small gateway module connected to their broadband connection. Within EPIC, Hildebrand and MDDA will develop a range of services that allow citizens to view energy consumption data from domestic housing. EnergyHive customers can access their individual data via the EPIC platform. Other users of the EPIC energy servicer who are not themselves EnergyHive customers will see only anonymised data which can be aggregated and viewed in different ways to provide smart-city relevant views of domestic energy usage. Tasks to be performed by Hildebrand / MCC and BCU. The Hildebrand solution fairly well developed but will need wrapping as a portlet for delivery through the EPIC portal server.		
Source	• Technical questions: T8 • This requirement is mainly driven by the technical partners' expertise		

RSE2 – Generic Energy Monitoring Framework is considered as application specific and out of the scope of EPIC Project.

Table 38: Requirement RSE3

ID	**RSE3**	**Severity**	High
Name	**Examine overall household energy usage**		

Description	System must record overall energy consumption of a household at regular intervals which provide 'real-time' data – minimum of 10 second intervals. This energy usage should be displayed on-screen in a manner which allows the end-user to review their data at resolutions of 1 hour, 1 day, 1 week, 1 month, 1 quarter.
Source	• This requirement is driven by UC-SE2 use case

RSE4 - Compare energy usage to local average, RSE5 - Installing a household system, RSE6 - Recording user notes, RSE7 - Raise issue ticket, RSE8 - Update household configuration and *RSE9 - User defined Alerts* are considered as application specific and do not affect the platform design and implementation.

4.4 Development Environment

Development in the EPIC project is performed at two levels. First, each individual pilot performs "local" application development in various extents. In a second step, the results need to be deployed on the EPIC platform. This section summarizes the requirements for the EPIC Deployment Environment.

Table 39: Requirement DE1

ID	**DE1**	**Severity**	Low
Name	**Application Development**		
Description	This task is performed individually by all project partners – ideally using an IDE environment as a common solution development platform integrating individual development tools.		
Source	• Technical questions: T6		

DE2 – Portal Configuration is already covered by *FR1 – Common role-based portal server.*

DE3 – Web Service Publication is already covered by *FR2 – Registration of a Service.*

Table 40: Requirement DE4

ID	**DE4**	**Severity**	Low
Name	**Application Adapters**		
Description	In addition to the provisioning of web services, it might become necessary to directly connect to applications (e.g. SAP) or information (e.g. databases) from the portal or from applications. In that case, the adapters inherent in the platform's enterprise service bus (ESB) need to be configured.		
Source	• Administrative questions: A10 • Technical questions: T7		

5 Platform Features

Following the extensive requirements analysis that took place in WP2, a set of key features for the platform have been identified. These features cover all main aspects of the EPIC Environment establishing the baseline for the implementation and adaptation of a pan-European platform for "intelligent" services. Those features are analysed in the following paragraphs.

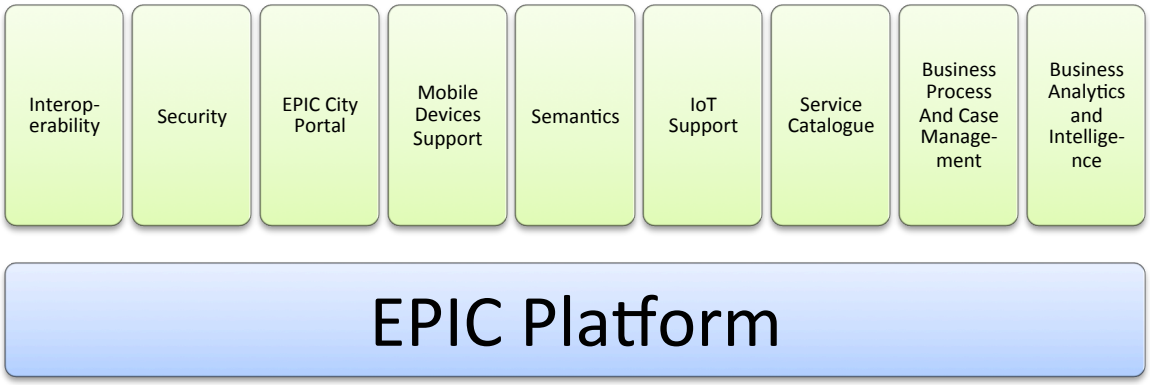


Figure 7: EPIC Platform Features

5.1 Interoperability

This feature of the EPIC platform is driven mainly by the need that the hosted applications should be able to consume data feeds that come from different of sources and to exchange and correlate these data among them. Regarding the 'Smart Environment Scenario', there is also a variety of industrial equipment that produces monitoring data that will be published within the platform. Moreover, there is the need for the 'Urban Planning Scenario' to enable the interconnection between different SMEs, that might make use of solutions that are consisted of different subcomponents, might be implemented in different programming languages, being deployed on different servers hosted in different operation systems and consume data feeds coming from a variety of sources. In order to ensure the smooth integration of all, the EPIC ensures that all related web services are interoperable within the platform.

5.2 Security

This feature of the EPIC platform is driven mainly by the necessity for the platform to be able to allow stakeholders to provide specific credential and trust evidences in order to register and consume the desired services. Different types of end-users are allowed to access different services depending on their roles (i.e. at the Relocation Scenario, a typical visitor in Brussels must only retrieve and read specific information of the city's points of interest (POI) while the city administrator should be able to use different services, allowing them to change accordingly this type of information). For this reason, secure based authentication and authorisation is provided by the platform. Additionally, the Urban Planning Scenario will implement a marketplace for SMEs to integrate their components and benefit from their usage, according to their specific policies. This business to business (B2B) model requires strict authentication techniques.

5.3 EPIC City Portal

EPIC City Portal aims to organise and display a comprehensive layer of existing city information, alongside access to chosen web service applications residing in the EPIC cloud. More specifically, the EPIC cloud platform provides a portal server managing the role-based look and feel of the EPIC portal for different stakeholders e.g. city civil servants, application providers, citizens. Based on different authentication means, these personalized portals provide either immediate access to services (single sign on) or allow the user to search for currently available services for a specific intent - e.g. finding an overview of available accommodation in another city ('relocation scenario'). The portal server also allows for the device specific presentation of "web pages" by either transforming the "screen" or via downloading device-specific application code during service consumption.

Different types of users will be able to log-in, search and/or make specific requests in order to get the required information, hints, and forms to support their needs. The portal will run on a SOA-BPM (Business Process Management) platform orchestrating the consumption of back office web services. It will be possible to access it with all the major Internet browsers and modern mobile devices giving a strong focus on smart phones. Additionally, the EPIC City Portal will enable the exposure of some of the available services as separate "widget-like" applications to be used anywhere on the Web. This will allow the cities to share some of the services deployed in their portal to another website or portal, and reach a wider audience.

5.4 Mobile Devices Support

The term 'mobile devices' is referred to the handheld computing devices (smartphones and tablets) which have a small display screen usually with touch input or miniature keyboard. Those devices make of the mobile web in order to access internet-connected applications. During the recent years, the capabilities of web mobile applications have been widely increased, as mobile browsers can get direct access to the devices' hardware (i.e. GPS chips). However, due to the diversity of those devices and their corresponding operating systems, in many cases every mobile application have to be re-developed to address each specific device's requirements. Due to this fact, interoperability is one of the major concerns when trying to implement a new user application.

EPIC will therefore take a two-pronged approach to supporting mobile devices:

a) Mobile devices with a standard browser can access the normal EPIC pilot services via the portlets delivered by the EPIC portal server, except services requiring a specific web player which doesn't work on the mobile device, e.g "flash" apps don't work on iphone and ipad.. Versions of the portlets more suitable for a smaller and / or lower resolution screen can be selected either by the user or automatically by the portal server, based on the browser type reported by the mobile device

b) Some Pilots will develop a device-specific app which will be executed on the mobile device through which it will consume the web-services provided by the EPIC platform. The allows access to device-specific hardware such as GPS and camera from the app; utilises the web-services running on the EPIC platform to deliver the necessary functionality yet frees the app / device from any restrictions imposed by the portal server.

This approach maximises leverage of the web-services delivered by the EPIC platform but allows Pilots to create a range of apps for different mobiles platforms if required, to embrace the very rapid increases in mobile device technology and capability..

5.5 Semantics

The current fragmentation and hyper local nature of the European Living Lab environment means that is often difficult to promote, let alone share, innovation across the European public sector. This problem is further complicated by the numerous languages spoken throughout Europe. To address this challenge, EPIC includes a Command and Control Lexical Grammar (C2LG) [7] to facilitate multi-lingual access to the service application and lay the foundations for easy cross-language adaptation and communication within the Cloud. To access and deliver innovation applications from across Europe via the cloud, all a 'Smart City' will need to do is to map information into C2LG, convert it into the target language and modify the ontology for local usage. The C2LG will address the need for multilanguage and multicurrency support, and the multicultural description of the real estate properties, a requirement that is mainly driven by the relocation scenario. This feature will also provide the semantic annotation needed in order to allow different subsystems to interpret the meaning and functionality of the defined web services.

5.6 IoT Support

One of the most innovative aspects of the EPIC platform is the use of the 'Internet of Things' (IoT) to provide common middleware for advance, future-oriented 'Smart City' services. IoT middleware will provide access to all kinds of geo-location and IoT technologies from 3D representations through to RFID sensors and Geo-tagging. The true value of the IoT is the combination of public services with sensor technology that enables connectivity between current and future devices. Under the EPIC 'Smart City' vision chosen objects will be able to "think", "feel" and "talk" with each other, making it possible for city administrators to monitor and control these objects everywhere and anytime and ultimately create an intelligent or 'smart' service. The platform will make it easier for third parties such as Living Labs and SMES to develop and provide IoT "plug-ins" that will allow any device within reason to be connected to the cloud. This type of advanced service model 'hides' the complexity of the underlying cloud infrastructure whilst at the same time meeting complex public sector requirements for cloud such as security, heterogeneity, interoperability, scalability, extensibility and configurability. The IoT Middleware will be a fundamental part of the Generic Energy Monitoring Framework, one of the key characteristics of the EPIC platform, driven by the Smart Environment Scenario. Also, the IoT middleware will help to easily integrate existing applications that make use of the future internet technologies, into cloud services hosted on the EPIC.

5.7 Service Catalogue

One of the key features that the platform provides is the Service Catalogue. Every new web service that will be accommodated by the EPIC must be registered to the common catalogue. The latter simplifies and enriches the discovery of the registered web services,

as the user can use multiple criteria to find the one that fit best their needs. Moreover, the platform can provide content-based search mechanisms that rely on the semantic annotation of the web services, as described above. The service catalogue also enables a numerous subscription facilities, as the platform can push to the end-user an event list of new promoted applications, or a list with the latest updates of the user's preferred applications. What is more, the application developers can benefit from this feature, as they are capable to navigate through the EPIC's portal, search and discover existing web services, and re-use them in order to compose even richer application solutions.

5.8 Business Process and Case Management

Business networks are changing as relationships become more dynamic between citizens, administrations, service providers, consumers, partners and suppliers, all of whom are constantly shifting and being re-evaluated. The same technologies that are creating a smarter planet are driving the need for a more dynamic business network. Citizens and enterprises demand lightning-fast responsiveness and increasing levels of personalization of service. Regulations and compliance demands shape and reshape the way business is conducted. More agile, interconnected business processes are required to enable organizations to establish dynamic business networks and fully take advantage of a smarter planet.

Business processes must be explicit, documented, understood and agreed upon. They must also be visible, making process performance data available, measurable and actionable in real-time. Increased personalization of service delivery needs agility combined with process information contextualized by role and current usage paradigm of each stakeholder, with robust governance to ensure compliance with business rules and regulatory requirements relevant to the stakeholder's location. This feature of the EPIC platform allows for fully personalized services, regarding each user's role and specific scenario. This is achieved by a common role based server which ensures role based user interfaces accordingly. Additional administration capabilities must be implemented and offered by the EPIC platform. Another important thing to mention is that the complexity of the marketplace extension of the Urban Planning scenario will be well benefited by the dynamically business networks that are supported by this platform's feature. Also, the basic actions related with the web services (register, search, subscribe) will be implemented using the business process management components.

5.9 Business Analytics and Intelligence

The SOA reference architecture underpinning the EPIC platform provides means to the business services hosted to log and monitor the service consumptions. Service providers can use this statistical data to analyse their clients behaviour in order to improve their respective offerings. In particular, they can inject surveys to be presented in the portal at certain workflow steps, getting online feedback. This feature is especially used and beneficial in the piloting phase of the EPIC project – to improve the applications in a most agile fashion.

6 Requirements Traceability

Besides the definition and elicitation of the requirements, a key process for their effective adoption is traceability. The traceability of the requirements refers to an internal project process that monitors the developments and outcomes of each WP against the list of requirements produced in WP2. This process is based on the production and maintenance of a living document which includes matrixes to associate each requirement with the strategy that was followed in the project to address the particular requirement.
In D3.1, we have identified the core components of the EPIC platform building on a SOA reference architecture – these are illustrated in Figure 8.

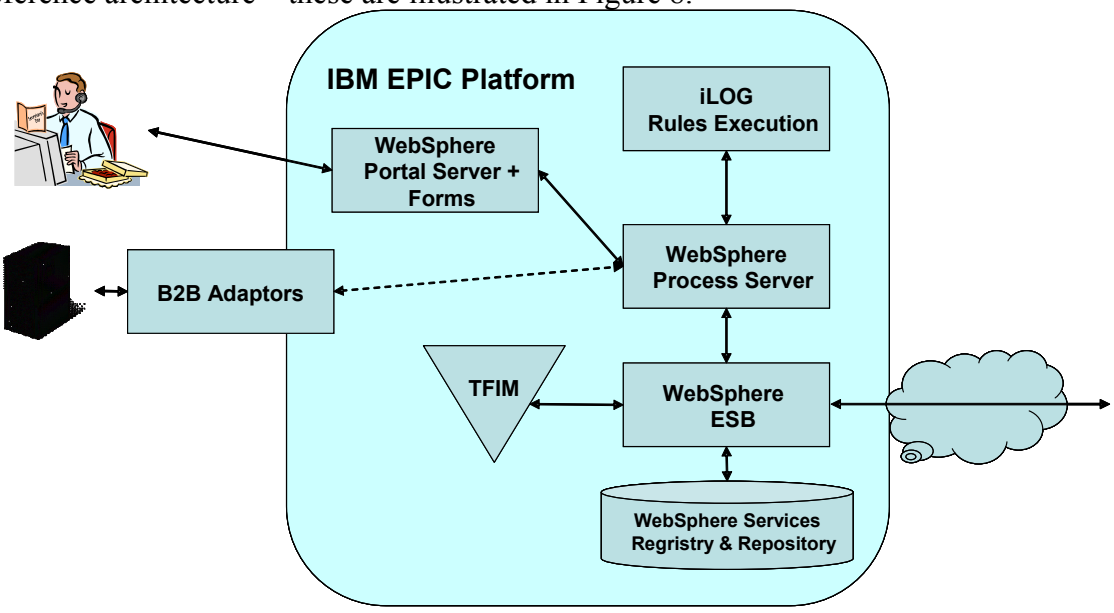


Figure 8: EPIC Platform - Component Overview

For traceability we have identified which component supports which requirement – both regarding the platform and the pilot applications. Table 41 gives an overview of the mapping of functional and non-functional requirements as identified in chapter 4 to the products chosen to implement the EPIC platform for the pilot applications.

Table 41: Requirements Traceability

Portal Server including Forms and Mobile Accelerator	FR1, FR2, FR3a, FR4a, FR5, FR6, FR7b, FR10, FR11, FR12, FR13a, FR14, FR15, FR16a, FR18a, FR21, NF1, NF2, NF3, NF4, NF5a, NF6d, RRS1, RRS2c, RRS3, RUP1c, RUP2, RSE1, RSE3
WebSphere Process Server	FR2, FR8, FR13
Jrules	FR8, FR21a
ESB	FR8, FR10, FR20c, NF7, RUP2
WSRR	FR2, FR5, FR6, FR16a, FR17a, FR22, RRS3, RUP2, RUP3
TFIM	FR1, FR3a, FR5, NF2, NF3, RSE3
DB2	FR3a, FR9, FR21, FR25, FR26

WID	DE1, DE3, DE4
	a: via application b: through additional web content management tools c: addressed by the Intelligent Operations Center ([8]) d: implemented in pilots

In the rest of this section, an independent table is produced for each requirement presenting: a) the high-level design element that is associated with the particular requirement, b) the strategy that was followed in the project to fulfil it, c) the related technologies and d) where possible testing guidelines as input to WP8 for the evaluation and validation of the platform.

Table 42: FR1 Traceability

FR1	**Common role-based portal server**
Matching on high-level design	Portal and Forms Server Federated Identity Manager
Strategy	A single centrally managed platform will be implemented that will host all the functionalities the end users and the stakeholders may want. Will provide self-service and delegated administration and will proactively govern the service life cycle enabling fast and flexible application integration. Will be implemented in SOA in order to increase the interoperability and service re-usage by using service federation.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM Tivoli Federated Identity Manager Business Gateway V6.2.1 Lightweight Directory Access Protocol (LDAP) Security Assertion Markup Language (SAML)
Testing Guidelines	The platform should be tested by the stakeholders. The stakeholders, for that requirement, are the end users, the system administrators, and the city council officers. The GUI (Portal) of the platform should comply with the latest HCI (Human Computer Interaction) standards as that will increase the efficiency of the platform.

Table 43: FR2 Traceability

FR2	**Registration of a service**
Matching on high-level design	Portal and Forms Server Process Server and Business Rules Web Service Registry and Repository
Strategy	The registration will be facilitated by the platform's extended backend, that makes use of the underlying ESB and Service Registry, all parts of the Service Catalogue.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM WebSphere Process Server

	iLOG Rules Execution IBM WebSphere Service Registry and Repository (WSRR)
Testing Guidelines	Register multiple services to the portal and check the failure rate. Discovery delay.

Table 44: FR3 Traceability

FR3	**Registration of a stakeholder – providing credentials and trust evidences**
Matching on high-level design	Portal and Forms Server Database Management System
Strategy	The Data Access Layer and corresponding front-ends are implemented at the platform layer. The EPIC platform will provide the capability to define global, group and individual password policies. Also will set and enforce password policies for logins used by directory server administrators. All that constrains are addressed to the high-performance Lightweight Directory Access Protocol (LDAP) identity infrastructure that the EPIC Platform has.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM DB2
Testing Guidelines	A system or a reminder should inform the user for the straightness of the password that uses. As the system has one password for all the services that provides it is crucial to reject weak passwords and force the user to renew it after a specific time frame.

Table 45: FR4 Traceability

FR4	**Subscription to a web service**
Matching on high-level design	Portal and Forms Server
Strategy	The EPIC's extended backed components will provide appropriate services to facilitate the service subscription.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	The system response to multiple subscriptions should be checked. Also should analyze the network utilization using different time intervals for the subscription requests. Additional tests should be performed in order to validate that the user can access their subscribed services, and are granted access to them.

Table 46: FR5 Traceability

FR5	**Federated single sign on using a single EPIC username**
Matching on high-	Portal and Forms Server

level design	Web Service Registry and Repository Federated Identity Manager
Strategy	The access to the platform should be permitted based on this single EPIC username. Using that all the data will need the same identification key.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM WebSphere Service Registry and Repository (WSRR) IBM Tivoli Federated Identity Manager Business Gateway V6.2.1 Lightweight Directory Access Protocol (LDAP) Security Assertion Markup Language (SAML)
Testing Guidelines	A user should register to all deployed applications and tests have to validate that he can access them all by logging in once, and access all pilot applications with his unique username.

Table 47: FR6 Traceability

FR6	**Search for a web service**
Matching on high-level design	Portal and Forms Server Web Service Registry and Repository
Strategy	The search for a web service will be facilitated by the platform's extended backend, that makes use of the underlying ESB and Service Registry, all parts of the Service Catalogue.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM WebSphere Service Registry and Repository (WSRR)
Testing Guidelines	The user should be allowed to search for available applications by using different search criteria.

Table 48: FR7 Traceability

FR7	**Provide comfortable possibility to manage user access rights on specific contents of the EPIC's hosted applications**
Matching on high-level design	Portal and Forms Server
Strategy	The EPIC's front end will have to consume relevant web services, that are layers at the platform's backend and make use of the Content Accelerator.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	All different user groups should be tested to validate their access to the contents, as defined by their different access rights.

Table 49: FR8 Traceability

FR8	**Possibility to negotiate SLAs when needed**

Matching on high-level design	Process Server and Business Rules Enterprise Service Bus and Service Registry
Strategy	Even though this is supported natively by the platform it was not considered as a primary objective of the project.
Technologies	IBM WebSphere Process Server iLOG Rules Execution IBM® WebSphere® Enterprise Service Bus (WESB)
Testing Guidelines	-

Table 50: FR9 Traceability

FR9	**Web service enablers to ease the access to the platform DBMS (or external data sources) capable for manipulating significant amount of data**
Matching on high-level design	Database Management System
Strategy	Each external data provider will have to implement appropriate web service enablers, in order to allow access to its data. Those services will be published at the platform's catalogue, in order to be available through the EPIC and to be accessed by third parties providers.
Technologies	IBM DB2
Testing Guidelines	The platform must be tested that it ensures smooth communication between the external database source and the user's client device. The user should try to fetch a significant amount of data, to validate that the platform is capable of manipulating large data feeds and ensures best user experience.

Table 51: FR10 Traceability

FR10	**Time zone and multicurrency support**
Matching on high-level design	Portal and Forms Server Enterprise Service Bus and Service Registry
Strategy	Supported natively by the platform. The pilot services will be parameterized accordingly.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM® WebSphere® Enterprise Service Bus (WESB)
Testing Guidelines	To be defined.

Table 52: FR11 Traceability

FR11	**Role-based user interface**
Matching on high-level design	Portal and Forms Server
Strategy	The EPIC's front end will have to consume the underlying relevant web services which provide different functionalities regarding each user's group.
Technologies	Business Process Accelerator Collaboration Accelerator

	Content Accelerator Mobile Device Accelerator
Testing Guidelines	Different user roles should be tested in conjunction to what they are allowed to be view and what they are allowed to do.

Table 53: FR12 Traceability

FR12	**Administration interface**
Matching on high-level design	Portal and Forms Server
Strategy	The EPIC front end will have to provide appropriate administration functionalities. The platform's extended backend, that makes use of the Directory Server, will ensure that appropriate access rights.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	All different user groups should be tested to validate that only administrators have access to specific contents. Administrators should define new user groups accordingly and assign end users to the latter. Also, the users should try to make various actions on the applications, in order to validate that they have the appropriate rights (i.e. an application admin can define 'admin', 'manager', 'user' rights. Then he should assign those rights to different end users. At the latest stage, a user that belongs to the 'user' group should not be allowed to user 'management' functionalities of the applications).

Table 54: FR13 Traceability

FR13	**Registration Page**
Matching on high-level design	Portal and Forms Server Process Server and Business Rules
Strategy	EPIC will provide through the integrated front end a registration page, that relies on the platform's extended backend, that makes use of the Directory Server.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM WebSphere Process Server iLOG Rules Execution
Testing Guidelines	The user must be allowed to register once in the EPIC platform, and choose to register to a variety of available applications. Then they have to be assigned the corresponding user group. This testing will have to be in conjunction with the FR12 requirement.

Table 55: FR14 Traceability

FR14	**Service registration screen**
Matching on high-level design	Portal and Forms Server

Strategy	EPIC will provide through the integrated front end a service registration screen, which relies on the platform's extended backend that makes use of the Directory Server. The backend functionality ensures that all required data are provided by the user.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	A generic screen will have to be presented to the users each time they want to register, either to the platform or to a specific application. The screen should be validated that it presents the corresponding information (i.e. input parameters) according to each application's specific needs.

Table 56: FR15 Traceability

FR15	**Personal Space**
Matching on high-level design	Portal and Forms Server
Strategy	EPIC's extended backend will gather all users' registered services, and provide related information. To be able to do so, it relies on the Directory Server and ESB and Service Registry.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	The end user must subscribe to various hosted applications firstly. Then, he should be allows to see specific information that is relevant with the previously selected applications.

Table 57: FR16 Traceability

FR16	**Advanced search for services**
Matching on high-level design	Portal and Forms Server Web Service Registry and Repository
Strategy	The search for a web service will be facilitated by the platform's extended backend, that makes use of the underlying ESB and Service Registry, all parts of the Service Catalogue.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM WebSphere Service Registry and Repository (WSRR)
Testing Guidelines	Different search criteria should be tested validated that returns the appropriate results.

Table 58: FR17 Traceability

FR17	**Notification List**
Matching on high-level design	Web Service Registry and Repository

Strategy	The platform's extended backend will provide the described functionality, based on the ESB and Service Registry, all parts of the EPIC's Catalogue.
Technologies	Web Service Registry and Repository
Testing Guidelines	The user should be able to see a list of notifications related with his subscribed services. As a matter of fact, random notifications must be generated, and the platform must ensure that they are presented to the end users appropriately.

Table 59: FR18 Traceability

FR18	**Promoted/Latest services area**
Matching on high-level design	Portal and Forms Server
Strategy	The platform's extended backend will provide the described functionality, based on the ESB and Service Registry, all parts of the EPIC's Catalogue.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	The user should be notified with the latest provided services, and any corresponding updated to the already subscribed ones. This can be tested in conjunction with the FR17 requirement.

Table 60: FR20 Traceability

FR20	**Interoperability**
Matching on high-level design	Enterprise Service Bus and Service Registry
Strategy	Standard formats will have to be used, in order to ensure the smooth communication between all components, in order to facilitate integration issues.
Technologies	IBM® WebSphere® Enterprise Service Bus (WESB)
Testing Guidelines	The success of the 'Keith's House' use case will validate this requirement.

Table 61: FR21 Traceability

FR21	**Multilanguage support**
Matching on high-level design	Portal and Forms Server Database Management System
Strategy	The platform should exploit semantic annotation capabilities, but the strategy to address this requirement has not be defined yet.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM DB2
Testing Guidelines	Each application must be tested in at least two different languages.

Table 62: FR22 Traceability

FR22	Semantic annotation for web services
Matching on high-level design	Web Service Registry and Repository
Strategy	This is supported during the design of the various web services.
Technologies	IBM WebSphere Service Registry and Repository (WSRR)
Testing Guidelines	To be defined.

Table 63: FR23 Traceability

FR23	Feedback
Matching on high-level design	Platform's extended backend
Strategy	EPIC's backend will provide the functionality that allows users to record notes regarding their experience with the subscribed services, and report any problems/bugs. All user notes will be stored at the internal platform's database.
Technologies	
Testing Guidelines	A user should be able to record some notes, and different users must be able to see them.

Table 64: FR24 Traceability

FR24	Statistics & Analytics
Matching on high-level design	Platform's extended backend
Strategy	This platform component will collect all service related statistics, in order to provide useful information, regarding the user platform interaction, given that it is supported by the pilot application. The EPIC platform will provide generic web-services which each Pilot can call to record a user-interaction within the DB2 datastore held on the EPIC platform. This will allow recording of events such as page-load, record user initiated events such as button clicks and provide a facility to display a dialogue box and capture the prompt plus user response. This is covered within the user-data management.
Technologies	-
Testing Guidelines	Different user access to the hosted application should provide different statistics.

Table 65: FR25 Traceability

FR25	Clean up all user history when the user unregisters
Matching on high-level design	Database Management System
Strategy	EPIC's database will ensure that the user personal information will be decoupled from the user's history and logs that will be accessible

	through the extended backend. This will use the user-data structures defined in WP4.2.
Technologies	IBM DB2
Testing Guidelines	When a user de-registers from a Pilot or as an EPIC platform user, all personal data will be removed. However, the Pilot and Platform interactions logs will remain, but be anonymousness as all personal data has been deleted in the corresponding tables.

Table 66: FR26 Traceability

FR26	**Database supporting different pilot application needs**
Matching on high-level design	Database Management System
Strategy	The user-data management structure which will be implemented in DB2 will allow each Pilot to define pilot-specific data types and to hold pilot-specific information about users. The data structures will also permit pilot-specific roles to be created for users. These will be accessed by Pilots using generic web-services. Each Pilot will be responsible for creating pilot-user accounts and adding eliciting required data from users as part of the sign-up process. User –interaction with pilots will require calls to the generic web-services to be placed at appropriate points in the portlet or app. The delivery of extended user feedback surveys may be difficult using this approach and alternatives may be required, probably outside of the EPIC platform.
Technologies	IBM DB2
Testing Guidelines	The database will be initially empty. In order to deploy the three pilot applications, all application specific data should be tested.

Table 67: NF1 Traceability

NF1	**Usability**
Matching on high-level design	Portal and Forms Server
Strategy	The developers should be in collaboration with the end-users to ensure the usability of the platform.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	The GUI (Portal) of the platform should comply with the latest HCI (Human Computer Interaction) standards as that will increase the efficiency of the platform.

Table 68: NF2 Traceability

NF2	**Privacy Protection**
Matching on high-level design	Portal and Forms Server Federated Identity Manager
Strategy	The platform will be developed considering the latest security standards. The algorithms that will be used should be certified.

	The first approach is to minimize the amount of personal data held on the platform through careful design. At minimum a user must provide only an email address when registering to be an EPIC platform user, although pilots can request additional data where this is required to ensure functionality of the pilot.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM Tivoli Federated Identity Manager Business Gateway V6.2.1 Lightweight Directory Access Protocol (LDAP) Security Assertion Markup Language (SAML)
Testing Guidelines	Check the system against brute force attacks (for the passwords), and denial of service for the services of the platform.

Table 69: NF3 Traceability

NF3	**Security – rule-based authentication and authorization**
Matching on high-level design	Portal and Forms Server Federated Identity Manager
Strategy	This is supported natively by the platform.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM Tivoli Federated Identity Manager Business Gateway V6.2.1 Lightweight Directory Access Protocol (LDAP) Security Assertion Markup Language (SAML)
Testing Guidelines	The platform should be tested against various types of networks attacks (i.e. 'Data Modification', 'Man-in-the-Middle' etc.).

Table 70: NF4 Traceability

NF4	**Support for mobile devices**
Matching on high-level design	Portal and Forms Server
Strategy	A mobile application will be built to support the relocation service scenario. The application will be available on iOS as well as Android smartphones and interface with the EPIC front-end via web services.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	At least one mobile platform should be compatible with the EPIC Front-End.

Table 71: NF5 Traceability

NF5	**Attractive design of EPIC web portal and pilot applications**
Matching on high-level design	Portal and Forms Server

Strategy	Some interactions between the web portal development team and a target group of end users will ensure the attractive design of the EPIC web portal.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	The end users should validate this requirement by answering specific requirements.

Table 72: NF6 Traceability

NF6	**High availability**
Matching on high-level design	Portal and Forms Server
Strategy	The developers should implement the platform in order to serve more than 500 users.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	Check the platform against DoS attacks.

Table 73: RSS1 Traceability

RRS1	**Multi-Cultural Description of the Real Estate Properties**
Matching on high-level design	Portal and Forms Server
Strategy	Metadata with regards to properties and points-of-interest will be offered in multiple languages. Dimensions will be adjusted according to user's preferences However, technical difficulties arise due to the fact that some property metadata is full-text provided by property owner or real-estate agent and may be hard to translate without error.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	Have Living Labs users evaluate the quality of translations and unit conversions.

Table 74: RSS2 Traceability

RRS2	**GIS/Map for showing points of interest, real estate properties, etc.**
Matching on high-level design	Portal and Forms Server
Strategy	Properties and surrounding points-of-interest are shown on a Google Maps plugin, interchangeable for another map plugin should the need arise.
Technologies	Business Process Accelerator Collaboration Accelerator

	Content Accelerator Mobile Device Accelerator
Testing Guidelines	Evaluate quality of local maps. Evaluate cross-browser performance and availability.

Table 75: RSS3 Traceability

RRS3	**Reach as many smart phone platforms as possible and minimize software development effort**
Matching on high-level design	Portal and Forms Server Web Service Registry and Repository
Strategy	A cross-platform development framework is used. This allows for a single codebase to be compiled for multiple mobile platforms (Android and iOS) with minimum effort.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM WebSphere Service Registry and Repository (WSRR)
Testing Guidelines	Test mobile application on Android and iOS smartphones.

Table 76: RUP1 Traceability

RUP1	**GIS**
Matching on high-level design	Portal and Forms Server
Strategy	The platform should make use of common standards.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	Evaluate quality of local maps. Evaluate cross-browser performance and availability.

Table 77: RUP2 Traceability

RUP2	**Performance of architecture**
Matching on high-level design	Portal and Forms Server Enterprise Service Bus and Service Registry Web Service Registry and Repository
Strategy	The platform should provide small size objects in order to ensure high performance when comes to mobile devices that need to consume real time data feeds.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM® WebSphere® Enterprise Service Bus (WESB) IBM WebSphere Service Registry and Repository (WSRR)
Testing Guidelines	Have Living Labs users evaluate the performance of the application.

Table 78: RSE1 Traceability

RSE1	Domestic Energy Monitoring (Hildebrand / Manchester)
Matching on high-level design	Portal and Forms Server
Strategy	The pilot will provide that respective services that will be deployed on the platform.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator
Testing Guidelines	To be defined.

Table 79: RSE3 Traceability

RSE3	Examine overall household energy usage
Matching on high-level design	Portal and Forms Server Federated Identity Manager
Strategy	The pilot will provide that respective services that will be deployed on the platform.
Technologies	Business Process Accelerator Collaboration Accelerator Content Accelerator Mobile Device Accelerator IBM Tivoli Federated Identity Manager Business Gateway V6.2.1 Lightweight Directory Access Protocol (LDAP) Security Assertion Markup Language (SAML)
Testing Guidelines	To be defined.

Table 80: DE1 Traceability

DE1	Application Development
Matching on high-level design	-
Strategy	General scope IDE that relies on well-known programming languages and make use of commonly accepted formats and specifications must be used in order to facilitate the development of a new application using EPIC's provided tools.
Technologies	Eclipse IBM Integration Designer V7.5
Testing Guidelines	The pilot application developers will have to evaluate the ease of use of this component.

Table 81: DE4 Traceability

DE4	Application Adapters
Matching on high-level design	-
Strategy	External adapters must cover the majority of external applications that are needed in average application (i.e. databases).

Technologies	-
Testing Guidelines	The pilot application developers will have to evaluate the adequacy of the provided adapters, and their proper functioning.

In these matrixes, each requirement is associated with its ID number, as defined at the previous section. Additionally, the strategy to address each requirement in project level is described, along with the corresponding building blocks and components of the high-level design of the platform that fulfil it. The technologies used to implement those functionalities are also referred. Finally, guidelines for testing the requirements will be proposed for each one of them which will be used by WP8 ("Results and Validation") to produce the final test cases and validate the EPIC platform.

7 Conclusions

This report presents the results of the work carried out in the scope of T2.4 (”Technical Requirements Creation") of EPIC project. It is an updated version of the D2.3 document. Initially, in this report we provided a short description regarding our vision about the 'Smart Cities’. As a result, we briefly presented the major user requirements of the EPIC platform explaining how the platform will solve all issues identified by this process and how the EPIC platform will take the European cities a step forward in order to provide smarter services to their citizens.

We’ve consolidated all user requirements that the EPIC platform should cover. Each one of them has a unique identification number, its severity measure, followed by a small description. They are categorized in three types: general, application specific and those related to the development environment. The user requirements that are reported in this section were defined from one part by the D2.2 of the project and from the other part by the technical partners' experience. It should be noted that the requirements analysis was an iterative process and in that sense this documents also is an updated and extended version of the D2.3, and exploits that feedback from the technical WPs as the project progresses.

It is expected that this report will provide useful input for the whole project, as it will be used as the basis for the design and implementation of the EPIC platform and will be taken into consideration for the evaluation and validation processes.

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