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1 Executive Summary

This document is the *D8.2 – Evaluation Report* of EPIC Project and presents the evaluation results for the platform and pilot application elements that have been designed and implemented in the technical WPs of the project. The methodology that has been followed in WP8 for the evaluation and validation of the results was initially defined in report D8.1 - *Strategic Evaluation Methodology* based on the analysis of the requirements identified in WP2 and the pilot scenarios described in WP5.

EPIC project realizes the vision for a truly "smart" city by delivering a) a unique platform for services and applications allowing for ubiquitous access in pan-European level, b) a set of pilot applications as a reference for providing "intelligent" services and c) a roadmap that describes the exact processes that should be followed by the various stakeholders involved in the delivery of application for cities and citizens. D8.2 focuses on the platform features evaluation against the requirements identified in WP2 through the analysis of the experiences of the end-users interacting with the pilot services and the other internal processes focusing on specific platform aspects. In parallel, all the above have been adapted and tested in the proof of concept environment of a "virgin" city following the EPIC Roadmap and the results are presented in D8.3 report along with conclusions on the project achievements and lessons learned.

The approach that was implemented for the validation of the results includes an questionnaire based internal survey with the project's expert groups to capture their experiences with the platform elements, test case runs for validating specific features of the platform, performance tests and logs examination, as well as analysis of the end-user testing results from WP7. The outcomes of the aforementioned tasks have been used to produce the final version of the requirements traceability matrix that incorporates the EPIC strategy and the evaluation results on the fulfilment of each requirement.

2 Introduction

The primary objective of WP8 was to coordinate the processes for the evaluation and validation of the project outcomes to ensure that the EPIC services are consistent with the planned objectives, as set out by the real stakeholder' needs and summarised in the *D2.4 - Report on Technical Requirements* document.

The objectives of testing and evaluation approaches validate that the integrated EPIC service platform, the roadmap and the pilot applications is designed and implemented in a way as to satisfy the requirements and needs of the end-users and stakeholders (city administrators, application/data providers, etc.). This is accomplished through the verification and analysis of the results during closed and open test cycles with the participatory involvement of the end-users and some other stakeholders such as cities and SMEs, as well as through internal processes such expert interviews, test cases and performance and logging testing. Participants in this WP worked closely with WP7 for the enforcing the pilot evaluation methodology and acquiring input on the pilot end-user testing, while collaboration with WP5 and technical WPs (WP3 and WP4) ensured analysis of all aspects of the platform elements, pilot services and usage scenarios.

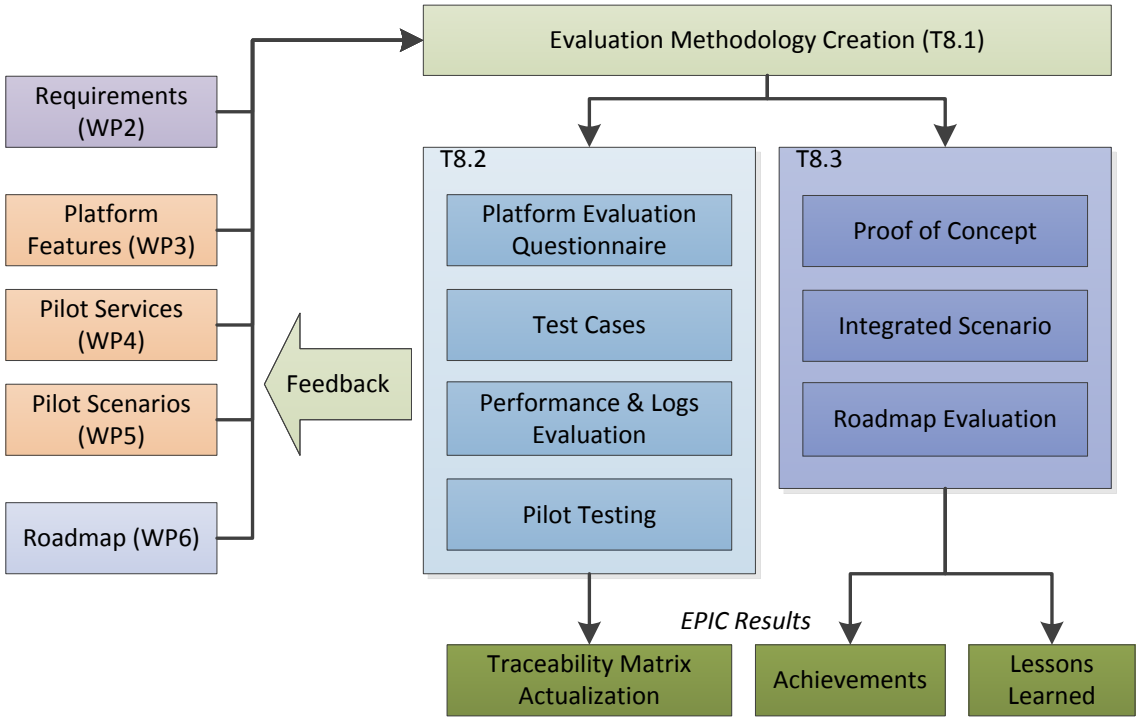


Figure 1: WP8 Evaluation Workflow

The main processes that were followed for the validation of the platform and the pilots include (Figure 1):

- Internal questionnaire to the project experts to identify the strengths and vulnerabilities of the platform (section 3).

- Detailed test cases and scenarios for evaluation of the platform and pilots functional and non-functional capabilities, identified in WP2 (section 4).
- Performance evaluation of the services deployed on the platform (section 5.1).
- Continuous analysis of system logs to identify operational issues and inform the component owners for addressing them (section 5.2).
- Analysis, in collaboration with WP5 and WP7, of the end-user testing results (both closed and open cycles) and provide feedback to the development teams to improve the components quality (section 6).

The results of the aforementioned activities have been examined both independently and combined, involving when required the respective task leaders, in order to ensure that the various developments are progressing as expected and meet the WP2 requirements.

Following the reviewers' recommendation a requirements traceability matrix was produced in WP2 which was also considered as a very important element for WP8 driving all testing and validation activities and summarizing the evaluation outcomes in a single reference point. Besides its use in WP8 and the respective evaluation activities, the requirements traceability matrix has been used contentiously as a guide for the development and integration activities of the EPIC components. The strategy that has been followed for addressing each requirement and the evaluation results are presented in the updated version of the requirements traceability matrix in section 7.

3 EPIC Platform Evaluation Questionnaires

3.1 Structure and Process

In parallel with the core testing activities of pilots and the various test cases, as part of the validation activities in WP8, processes for acquiring input from the project stakeholders on the platform elements took place. In a similar way that in WP2 the project requirements were identified through workshops, interviews and questionnaires, in WP8 we involved the members of the EPIC's consortium in an internal survey for capturing their impression on the project developments and outcomes focusing on the core platform functionality and the back-end services.

This task also addresses the *"Questionnaires will be distributed to the targeted user groups, as well as being placed upon the EPIC platform. Interviews will be conducted with administrators who used the Platform"* method proposed in DoW. The questionnaire survey was performed during the months March and April and followed the same structure as in WP2, an administrative and business section to examine whether EPIC fulfils its purpose as a platform for "smart" cities, and a technical section to study the perceived experiences of the developers and platform users on the technical aspects of the project.

3.2 Analysis

The EPIC Platform Evaluation Questionnaire included three parts: a) general questions, b) administrative & business questions, and c) technical questions. In the following sections we present the questionnaire results and an analysis in each of the questions. It should be noted that these results will be also examined together with the outcomes of the other tasks so as to effectively actualize the requirements traceability matrix.

3.2.1 General Questions

The general questions part had the following structure:

Table 1: Participant Profile

Personal Name	
Contact Email	
Organization	
Country of Origin	
Type of Organization	Company Research Center Academic Institution

	City Administrator
Involved in	Platform Development Application Development Pilot Lab City Administrator City Council Roadmap Development Other
Date of Completing the Questionnaire	

The following table summarizes the participant's profiles:

Table 2: Survey Overview

Organization Country of Origin	Greece	2
	Belgium	4
	France	3
	UK	2
	Romania	1
	Germany	2
Type of Organization (select more than one if applicable)	Company	7
	Research Center	2
	Academic Institution	2
	City Administrator	4
Involved in (select more than one if applicable)	Platform Development	3
	Application Development	3
	Pilot Lab	5
	City Administrator	3
	City Council	1

	Roadmap Development	2
	Other	1

One of the advantages of EPIC project is the strength of the EPIC consortium with expertise and background which cover a variety of countries, organization types and domains. This is also reflected in our survey with the various stakeholders providing valuable feedback on all project areas and outcomes as presented in the following sections.

3.2.2 Administrative & Business Aspects

The administrative and business questions focused on the level that the EPIC vision for a truly "smart" city exploiting the various EPIC elements was fulfilled as well as on the impact that EPIC has on users, citizens and service/data providers in a pan-European level. The list of questions is presented in the table below:

Table 3: Administrative & Business Questionnaire

Question	Answer	Comments
1.1 - Would you agree that the EPIC platform helps a city to become really "smarter"?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.2 - Can EPIC support the expected amount of end-users and all its different categories?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.3 - Would you say that platform attracts users to continue using it?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	

1.4 - Is it observed that the end-users provide feedback easily, in order to help to improve the platform?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.5 - Has EPIC reached all potential audience?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.6 - Is the EPIC's interface attractive enough?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.7 - Do you think the EPIC platform is easy to use?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.8 - Do you think the current implementation has a lot of limitations that are problematic for a new application provider to offer his solution via EPIC?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.9 - Do you believe that by using EPIC, a new application provider could easily reach a pan-European market?	Yes, I totally agree Yes, I fairly agree Neutral	

	No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
1.10 - Have you observed important legal constraints that could prevent EPIC to become truly pan-European?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	

All administrative & business questions of the survey revealed very interesting findings, which we present one by one in the rest of this section highlighting the feedback that was acquired.

1.1 - Would you agree that the EPIC platform helps a city to become really "smarter"?

Yes, I totally agree	6
Yes, I fairly agree	5
Neutral	2
No, I fairly disagree	1
No, I totally disagree	
Out of scope/Not applicable	

Important Comments

Based on the participants' comments a "Smart City" is a quite vague and term so the starting point in process of making as city smart is difficult to be defined. However, exploiting on the EPIC project outcomes, such as the platform and the roadmap, we can have a more clear view and orientation on what is required to provide "intelligent" services to cities and citizens. For instance, the guidelines in the roadmap, the reuse of services through the platform and the pilots as example applications and success stories, are elements that any city administrator or SME could apply to design or adapt "intelligent" services that will make the citizens life easier.

EPIC platform allows the involved stakeholder to bring together many different services that can be linked to a large set of relevant data provided by multiple service providers. Starting from the need of the citizen, the platform enables cities to offer smart and relevant services & information. However, platform itself cannot make the city smarter but provides to cities what is required for implementing

Smart Services. Technical environment in the Cloud, 3D Map for any kind of communication with geo-localized POI, services like "relocation" & "PME identification" at this stage and any kind of other services can be reused to increase the functionality of the applications offered to the citizens.

On the contrary some participants believed that there are currently flaws in the EPIC platform, especially technical ones and the content and variety of the services should be enriched so as to be effectively offered to cities/citizens/SMEs.

Of course EPIC in by no means sufficient to transform a city to a "smart" ecosystem. First, awareness should be created in the city to become "smart". The roadmap however, could kick-start cities thinking about "smartness" while the EPIC platform could provide certain solutions and help cities in achieving the identified objectives.

1.2 - Can EPIC support the expected amount of end-users and all its different categories?

Yes, I totally agree	1
Yes, I fairly agree	6
Neutral	4
No, I fairly disagree	1
No, I totally disagree	
Out of scope/Not applicable	2

Important Comments

In general, the pilot implementations and the proof of concept in Tirgu Mures prove that EPIC can reach a wide audience of end-users which is effectively supported by the respective platform services. However, this also depends on the services themselves and the number of cities where they are deployed.

The participants also highlighted, in technical level the need a robust and scalable platform and EPIC platform based on the IBM cloud services and J2EE is indicated to be flexible, and providing the possible elasticity to support different categories of end-users. One issue was though the login procedure which was considered as too complicated for citizens.

To summarize we could say that from the IT perspective the results are satisfying but since we target a pan-European audience additional features on "ease of use" are required and experimenting on the potential business models.

1.3 - Would you say that platform attracts users to continue using it?

Yes, I totally agree	

Yes, I fairly agree	4
Neutral	6
No, I fairly disagree	3
No, I totally disagree	1
Out of scope/Not applicable	

Important Comments

The feedback on this question was neutral as users would expect a more modern design for the EPIC applications as web applications. The EPIC platform and its current applications provide satisfying functionality but an effort could and should be made on the design and ergonomics to attract more users and encourage them to continue to use regularly the platform. The access and design of the platform seems not really suitable for citizen. Therefore in the production versions of the applications the various business services should be wrapped with modern GUI design and functionalities that follow the current trends.

1.4 - Is it observed that the end-users provide feedback easily, in order to help to improve the platform?

Yes, I totally agree	1
Yes, I fairly agree	1
Neutral	5
No, I fairly disagree	3
No, I totally disagree	
Out of scope/Not applicable	4

Important Comments

The end-users didn't interact directly with the platform during the testing cycles so useful feedback was acquired for pilot services, while the the platform related feedback was generic. In many cases, external tools were used for the surveys such as Survey Monkey and it was difficult to get feedback directly for the underlying infrastructure. Therefore, the feedback acquired referred mainly to the pilot services and was extremely useful for their improvement, and by analysing it in collaboration with the development teams, issues on the platform elements were identified and fixed in next releases.

1.5 - Has EPIC reached all potential audience?

Yes, I totally agree	1
Yes, I fairly agree	4
Neutral	5
No, I fairly disagree	4
No, I totally disagree	
Out of scope/Not applicable	

Important Comments

Some participants believe that EPIC can support all identified stakeholders (citizens, city administrators, SMEs, visitors) in the process of making a city "smart" even at this experimental status while others consider that EPIC has a large target audience group which is not easily exhausted. The messages on this question were contradictive and this is mainly due to the divergence of the participants. On one hand the participants with a business background believe that additional marketing effort should be done in order to increase the participation of SMEs, developers and cities. On the other hand, living labs and the technical teams highlight the increased interest of the users (cities and service providers) in EPIC. In some cases however, the nature of pilot application made it harder to reach the potential audience such as in the case of relocation service, where we could not find many real end-users with the intention to move to Brussels.

1.6 - Is the EPIC's interface attractive enough?

Yes, I totally agree	
Yes, I fairly agree	2
Neutral	3
No, I fairly disagree	6
No, I totally disagree	3
Out of scope/Not applicable	

Important Comments

The comments on the user interface were neutral to negative. At this stage, the EPIC interface is not clearly defined and additional efforts are required for the production version. The interface has "a look of 90s", some areas are a bit complicated and not nice-looking.

1.7 - Do you think the EPIC platform is easy to use?

Yes, I totally agree	
Yes, I fairly agree	9
Neutral	2
No, I fairly disagree	1
No, I totally disagree	1
Out of scope/Not applicable	1

Important Comments

Ease of use was one of the requirements considered of high priority, and the perceived experience working with the platform and the supporting services is quite positive. Again, more attractive GUIs are expected in production versions. Elements of the EPIC platform are very easy to use and some more complex. As with every new product, usability is an ongoing process that can be enhanced over time.

One feature that received negative feedback was the "login" which shouldn't be necessary for all end-user categories, especially in cases of predefined user id and password.

1.8 - Do you think the current implementation has a lot of limitations that are problematic for a new application provider to offer his solution via EPIC?

Yes, I totally agree	1
Yes, I fairly agree	5
Neutral	7
No, I fairly disagree	1
No, I totally disagree	
Out of scope/Not applicable	

Important Comments

As an experimental platform, EPIC is moving to the right direction. In addition, the fact that EPIC can act as an abstraction layer for accessing and reusing external data sources without the need to move the actual data is very accommodating for the developers. The comments from participants had mixed flavour. A new application provider who wants to implement in EPIC its applications need to be motivated and patient. EPIC is still too closed for an easy implementation of application, compared to the APIs and services available online, and potential software developers may need additional documentation and maybe a software development kit and customer service support. If the application is going to be developed from scratch

with the IBM tools, then it can be offered easily. But the developer has to learn the corresponding development tools that the platform requires first. However, the platform provided by IBM is a big step in improving services of e- Government.

EPIC provides many benefits to application providers. These features can only get better as the platform is taken up by new cities and the number of new service components available increases. Nevertheless, it is always a matter of convincing the regional ministers to make data available through an Open Data licence.

1.9 - Do you believe that by using EPIC, a new application provider could easily reach a pan-European market?

Yes, I totally agree	3
Yes, I fairly agree	6
Neutral	4
No, I fairly disagree	
No, I totally disagree	
Out of scope/Not applicable	1

Important Comments

The main message received from the participants in this question was that this is the challenge and the opportunity on which the EPIC consortium relies. EPIC is based on a set of open standards and built as a cloud platform that makes it possible to provide services in a pan-European context. For developers, a set of reusable components and services are provided on the platform to make these smart city services available. The reuse of services is very accommodating for the SMEs in order to adapt and migrate their applications to other cities or countries. Additional effort may be required though so as the adaptation process is more efficient. The hosting of service components in the EPIC Data Catalogue seems very useful for developers to create new services that they can offer across Europe. In addition, as more cities take-up the platform, the value of EPIC is increased along with the reach of new app providers to pan-European markets. Without new cities, market reach is limited.

1.10 - Have you observed important legal constraints that could prevent EPIC to become truly pan-European?

Yes, I totally agree	2
Yes, I fairly agree	4
Neutral	1

No, I fairly disagree	2
No, I totally disagree	3
Out of scope/Not applicable	2

Important Comments

In principle legal constraints may exist at application level and are mainly related with the data aspects, but it seems that at platform level they are covered. However, the final business plan has to take into account contracting issues that cities face for using the platform and the services, as well as the fact that cities have limited money to spend on new solutions. The EPIC product needs to clearly show a definitive cost/benefit analysis for take-up by cities. In addition, there may be unknown constraints in terms of legal procedures for aligning with the security and access management policies of public administrations.

3.2.3 Technical Aspects

The technical questions focused on the specific platform capabilities and whether these were advantages or barriers for a pan-European commercialization of EPIC. The list of questions is presented in the table below:

Table 4: Technical Questionnaire

Question	Answer	Comments
2.1 - Does EPIC have all required services for a new application provider to offer his solution through the platform?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.2 - Is it easy to integrate external sources of data to the EPIC platform?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.3 - Is it easy enough to register to the platform through the existing user interface?	Yes, I totally agree Yes, I fairly agree Neutral	

	No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.4 - Is it easy enough to deploy a new application to the platform through the existing user interface?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.5 - Does EPIC support all required technologies?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.6 - Does EPIC scales effectively in order to support different traffic loads?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.7 - Does EPIC provide the required security for your applications?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	
2.8 - Does EPIC provide cross-border customization through the multilanguage, different time zones/currencies support?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	

2.9 - Do you agree that it is easy enough for an application provider to re-use existing web services of another provider that are offered via EPIC?	Yes, I totally agree Yes, I fairly agree Neutral No, I fairly disagree No, I totally disagree Out of scope/Not applicable	

All technical questions of the survey revealed very interesting findings, which we present one by one in the rest of this section highlighting the feedback that was acquired.

2.1 - Does EPIC have all required services for a new application provider to offer his solution through the platform?

Yes, I totally agree	
Yes, I fairly agree	3
Neutral	5
No, I fairly disagree	2
No, I totally disagree	1
Out of scope/Not applicable	3

Important Comments

The feedback in this question was mixed. Some participants claimed that they were in a position to develop their own solution and provide additional web services for making easy this objective. The current platform has a number of specialized services (e.g. translation, semantic, identity, etc.) to facilitate the deployment of new applications. However, a better panel management system would be a necessity, and ways for users (be it providers or users of services) to profile, personalize the environment etc. In addition accounting services are required for the production version. The user management services and the functionality of wrapping/tunnelling data sources through the platform are a sufficient baseline for developing new applications.

An important remark is that the EPIC catalogue will be enriched in the future and additional service offerings will be available.

2.2 - Is it easy to integrate external sources of data to the EPIC platform?

Yes, I totally agree	2
Yes, I fairly agree	6

Neutral	1
No, I fairly disagree	
No, I totally disagree	
Out of scope/Not applicable	5

Important Comments

In EPIC the integration of external sources was implemented by using web services, and also the fact that these services are registered to the catalogue allows for wider use of the abstracted data sources. For example the housing and point-of-interest data of Tirgu Mures and the other pilot applications already indicate the 'easy' integration of data sources to the platform.

2.3 - Is it easy enough to register to the platform through the existing user interface?

Yes, I totally agree	1
Yes, I fairly agree	3
Neutral	2
No, I fairly disagree	3
No, I totally disagree	3
Out of scope/Not applicable	2

Important Comments

The feedback in this question was mixed. The participants weren't satisfied that the credentials were pre-allocated by the system and in general the access should be easier compared to other web based systems on the market.

2.4 - Is it easy enough to deploy a new application to the platform through the existing user interface?

Yes, I totally agree	2
Yes, I fairly agree	1
Neutral	3
No, I fairly disagree	2
No, I totally disagree	

Out of scope/Not applicable	6

Important Comments

The process was quite straight forward through the administration console. The EAR file is uploaded and the developer only hast to run through a couple of steps in which most options can be kept as default.

2.5 - Does EPIC support all required technologies?

Yes, I totally agree	
Yes, I fairly agree	1
Neutral	6
No, I fairly disagree	1
No, I totally disagree	
Out of scope/Not applicable	6

Important Comments

Participants mentioned that this depends on what are 'required' technologies, and the specific needs for application providers. The current platform however, supports a fair set of new (and older) internet technologies, including mobile etc. Even though from a first sight seems that the set of supported technologies is limited (mainly J2EE), the platform also supports web services that follow well established standards therefore through web services many technologies could be supported.

2.6 - Does EPIC scales effectively in order to support different traffic loads?

Yes, I totally agree	
Yes, I fairly agree	1
Neutral	6
No, I fairly disagree	
No, I totally disagree	
Out of scope/Not applicable	7

Important Comments

Definitely this is one of the aspects that the consortium didn't focus on during the implementation of the experimental applications but according to the participants, the performance of the applications was satisfying. One important remark was

though that the workload depends largely on the type of application and its use by end-users.

2.7 - Does EPIC provide the required security for your applications?

Yes, I totally agree	
Yes, I fairly agree	8
Neutral	
No, I fairly disagree	
No, I totally disagree	
Out of scope/Not applicable	6

Important Comments

This point has been taken very seriously since the beginning by all EPIC partners and the platform achieved a good level of security according to the participants. Specific security arrangements and policies are taken into account, both from the EPIC platform and the city administration level perspectives by using well established technologies and standards.

2.8 - Does EPIC provide cross-border customization through the multilanguage, different time zones/currencies support?

Yes, I totally agree	1
Yes, I fairly agree	5
Neutral	4
No, I fairly disagree	1
No, I totally disagree	
Out of scope/Not applicable	3

Important Comments

The proof of concept was a good example of cross-border customization (English/two different Romanian dialects). However, in the scope of this scenario only the multilanguage customization could be shown. Moreover, only in the 'Relocation case' the user has the ability to change the application's language automatically through the platform. In all other cases, this was not a crucial functionality, so different time zones and currencies support were never a pilot requirement.

2.9 - Do you agree that it is easy enough for an application provider to re-use existing web services of another provider that are offered via EPIC?

Yes, I totally agree	1
Yes, I fairly agree	4
Neutral	2
No, I fairly disagree	1
No, I totally disagree	
Out of scope/Not applicable	6

Important Comments

The participants believe that this is a typical case of the platform use and the developments for Tirgu Mures are a proof of that; things were (re)used relatively smoothly, and fast. There are though some concerns regarding the business aspects of that and whether commercial entities would use the EPIC platform and then see someone else (re-)use their web services, so accounting and billing features need to be implemented in the platform for that purpose. On technical level, an identified issue was that at the moment Web Services can only be accessed by the Portal Server due to firewall restrictions and future versions of the platform this should be fixed.

4 Test Cases

As part of EPIC platform evaluation plan, a number of test cases have been identified during the evaluation methodology definition process. These have been thoroughly described primarily in the D4.1 and then in more detail in the D8.1 document, which initialized the evaluation process of the EPIC project. As it has already been referred in D8.1, the evaluation of the technical aspects of the project, and mainly, the platform itself and the pilot application will be performed internally, involving all technical partners (technology providers, platform developers and pilot application providers). The main focus is the developers of the pilot applications, who have interacted directly with the platform's services and functionalities, as well as the technology providers, who have redesigned and extended the existing platform's capabilities, in order to adapt it to the EPIC's needs, as highlighted by the diversity of the pilot applications.

The test cases cover the complete set of user and platform requirements, as defined in the D2.4 document. In order to answer and to validate the test cases, different approaches will be followed. Some test cases can be answered by directly interviewing target user groups, others can be answered by just observing the behaviour of the platform, while others are based on jUnit tests regarding to the documentation of the services' functionalities. All test cases covers different aspects of the EPIC project, from a technical perspective: The Core Cloud Platform functionalities, the front-end user interface used for accessing the platform and the pilot applications themselves (either through a web browser or through a mobile device), and the development environment used by the application developers.

The rest of this section is constructed as follows: A subsection consolidating all test cases results and answers, and a subsection that describes the main outcomes of the test cases. This section will be a valuable input for the requirements traceability matrix section, which correlates the outcomes from the test cases with the initial user requirements that the EPIC platform should address.

4.1 Test Case Evaluation Process

In this subsection, the results of the predefined test cases are described. Those test cases were distributed among the most relevant technical partner of the consortium to be answered. The EPIC platform has diverse functionalities and covers a lot of technology aspects, which are not all needed for every application scenario. By distributing the test cases among the most relevant partners, it is ensured that only the ones that had directly access and deep knowledge with specific aspects of the platform will answer the relevant test cases.

In order to avoid re-writing things that have been already delivered, every table only contains the basic description of the test case and the corresponding user requirement that is closely related to. In the outcome row, the results and outputs of the test cases are being described. As has already been explained, those results will be validated either by using existing user surveys and experience gained by

interviewing specific user groups, thus exploiting the WP7's outcomes, either with the observation of the behaviour of the platform, accompanied by screenshots, either by doing some jUnits tests where the results are being referred. The documentation row describes where the outputs of the test cases are located or where the actual documentation of a specific component is being hosted.

What is more to mention is that some test cases were considered as outdated from the time they had been defined in D8.1. This is refers to the FR10 (time zone and multicurrency support) and FR17 (notifications) user requirements, as defined in the D2.4 document, which finally appeared to have no value for the pilot applications as core platform features and could be more effectively supported in pilot level. By then, the platform and application development was still an ongoing process and some requirements had to be redefined, according to the agile process of software development that the EPIC project follows, which has in detail explained in the D2.4 document and which involves the close interaction with the end-users according to the Living Labs' experience. This in fact led to the redefinition of some requirements, like RRS1 (Multi-Cultural Description of the Real Estate Properties), or to highlight different requirements as more severe than others. The justification for all changes and missing requirements can be found at the last section of the document as part of the requirements traceability results.

The rest of this subsection consolidates all results of the test cases:

Table 5: CC-1-1 Test Case - Service Deployment (Both REST and SOAP)

ID	**CC-1-1**
Name	**Service Deployment (Both REST and SOAP)**
Description	In this test case, the deployment of a new service must be validated.
Source	This test case will validate the FR1, FR2 and DE1 User Requirements, as defined at the D2.4 document.
Outputs/Results	For Web Services deployment there is no particular web interface for that purpose. You need to deploy your ear file by the administrational console. Websphere Process Server and Websphere Portal Server have an administrational console. You need to run through the following steps: 1. Log-in to the EPIC Platform with an administrator userid. 2. On the navigation panel click *Applications* and then *New Application.* Select the ear-file to be deployed and click *continue.* 3. A dialogue for deploying the new service ear file opens. Run through the dialogue and keep all options as default. 4. The service application has been deployed After deployment the service can be tested by any SOAP Web Service testing tool (for example with SOAP UI http://www.soapui.org).

	This test case is considered successful.
Related Material	The process is described under the keywords "Deploy an application with the administrational console" and can be found in IBMs Documentation Repository: http://publib.boulder.ibm.com E.g. http://publib.boulder.ibm.com/infocenter/iseries/v5r4/index.jsp?topic=%2Frzamy%2F50%2Fadmin%2Facappinst.htm Related screenshots are available in Annex A.

Table 6: CC1-2 Test Case - Service Registration to EPIC Catalogue

ID	**CC-1-2**
Name	**Service Registration to EPIC Catalogue**
Description	Verify that a service can be manually added to the service catalogue.
Source	This test case will validate the FR2, FR4, FR12 and FR14 User Requirements, as defined at the D2.4 document.
Outputs/Results	1. Log-in to the EPIC Service Catalog with an administrator userid. 2. In the Service Documents section, click on WSDL documents. 3. Click load documents on the command bar. 4. In the Path to the Document section, activate the Remote File Location button. 5. In the Specify URL box, enter the URL of the service. 6. When the Documents to be loaded screen appear, click Finish. 7. The Document Loaded Successfully screen will appear. **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 7: CC-1-3 Test Case - Service Listing in EPIC Catalogue

ID	**CC-1-3**
Name	**Service Listing in EPIC Catalogue**
Description	This test case will validate the search of the available web services offerings and will highlight the advances features provided by the EPIC's service catalogue.
Source	This test case will validate the FR3, FR6 FR16, and FR18 User Requirements, as defined at the D2.4 document.
Outputs/Result	1. Log-in to the EPIC Service Catalogue with an administrator userid.

s	2. In the Service Documents section, click on WSDL documents. 3. All the service documents will be listed. **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.. For the first two steps, screenshots are the same as CC1-2.

Table 8: CC-1-4 Test Case - Service deletion from the EPIC Catalogue

ID	**CC-1-4**
Name	**Service deletion from the EPIC Catalogue**
Description	In this test case we must validate the proper service deletion from the EPIC platform. The complete removal of all service's configuration data and application specific schemas must be highlighted.
Source	**The "deletion' of a service was not defined as a requirement in the initial process of the project, however it was highlighted as an important one later on, and have been included as a separate test case.**
Outputs/Results	1. Log-into the EPIC Service Catalogue with an administrator userid. 2. In the Service Documents section, click on WSDL documents. 3. All the service documents will be listed. 4. Check the box in front of the service to be deleted. 5. Click on Delete in the command bar. 6. The message The selected item was successfully deleted appear **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 9: CC-1-5 Test Case - Check all user management functions via web service

ID	**CC-1-5**
Name	**Check all user management functions via web service**
Description	This test case must validate all user management functionalities, as defined at the 4.2.5.4 subsection of the D4.1 document: • Check adding of new EPIC user • Check deleting of a EPIC user • Check selecting all EPIC users • Check adding of new application user

	• Check deleting of a application user • Check selecting all application users • Check adding of a new application • Check adding specific data type for a new application • Check deleting specific data type for a new application • Check adding a new user data pilot specific • Check deleting a new user data pilot specific • Check updating a new user data pilot specific • Check selecting all user data pilot specific • Check adding a new pilot role • Check deleting a new pilot role • Check selecting a new pilot role • Check assigning a pilot role to a user • Check deleting a pilot role from a user • Check adding a new usage history record • Check deleting a usage history record • Check selecting all usage history records • Check updating a usage history record • Check adding a new user interaction log • Check deleting a user interaction log • Check selecting all user interaction logs
Source	The User Management component of the EPIC platform is a key component that provides all requested functionalities to address the following User Requirements, as defined at the D2.4 document: FR1, FR3, FR5, FR7, FR11, FR12, FR13, FR15, FR17, FR20, FR22, FR23, FR24, FR25
Outputs/Results	For validating all above functionalities, a custom SOAP client was implemented. All CRUD functionalities were tested and all web methods returned valid response codes, as described in the relevant deliverables. 1. The web service was properly fetched for proper binding. An example URI of a WSDL file is here: https://vhost1825.site2.compute.ihost.com/EPIC_UserManagementWS_2_0/services/EPICUserManagementCourtesyTitle/EPICUserManagementCourtesyTitle.wsdl 2. All CRUD methods have been executed. 3. The response was valid according to the specifications of the component, as described in D4.1. **This test case is considered successful.**

Related Material	The full documentation of user management component can be found at the D4.1 deliverable. In addition this test case was used for the performance evaluation in section 5.1.

Table 10: CC-1-6 Test Case - Semantic Annotation

ID	**CC-1-6**
Name	**Semantic Annotation**
Description	In this test case will validate the platform support to annotate services with semantic information (metadata in Service Catalogue)
Source	This test case will validate the FR19 and FR21 User Requirements, as defined at the D2.4 document.
Outputs/Results	1. On the main page, in the Service Metadata box, select WSDL Services 2. Click on the service that has just been added 3. Click on edit properties. Enter a description, and click OK 4. The new metadata will be saved. **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 11: CC-1-7 Test Case - Performance test for a service

ID	**CC-1-7**
Name	**Performance test for a service deployed on the platform**
Description	The performance data from a Web Service will be collected and analysed. Performance data collection is configured and collected on the WebSphere Application Server using the WebSphere Performance Monitoring Interface (PMI) via the administration GUI. The performance data is then downloaded to a PC running the eclipse-based WebSphere Application Server Performance Tuning Toolkit.
Source	This test case will validate the FR23, NF6, and RUP2 User Requirements, as defined at the D2.4 document.
Outputs/Results	For the validation of the performance of a service deployed on the platform, stress tests took place on the 'User Management' web service core component that is being deployed on the platform's WebSphere server. Instead of performing performance tests in all web methods, 5 of the most popular functions have been tested, to prove the smooth performance behaviour of the platform. Apache's jMeter tool was used for the testing. The results are

	summarized as follows: **courtesyTitleSelectAll:** 500 simultaneous users have performed 3 invocations with a 500ms deviation on a 50ms delay offsets. The average response time is 2.5-3.0 seconds, as it is shown in the relevant screenshots. **pilotSpecificDataTypeSelectByPilot:** 250 simultaneous users have performed 3 invocations with a 500ms deviation on a 50ms delay offsets. The average response time converges at 15 seconds, as it is shown in the relevant screenshots. **pilotsSelectByID:** 500 simultaneous users have performed 3 invocations with a 200ms deviation on a 20ms delay offsets. The average response time converges at 2 seconds, as it is shown in the relevant screenshots. **userDataCommonAnnSelectByUserName:** 500 simultaneous users have performed 3 invocations with a 500ms deviation on a 50ms delay offsets. The average response time converges at 3 seconds, as it is shown in the relevant screenshots.
Related Material	The source code for the jmeter for the aforementioned test cases, is available in the internal project repository. The detailed analysis of the performance results including figures is presented in section 5.1.

Table 12: CC-1-8 Test Case - Platform usability

ID	**CC-1-8**
Name	**Platform usability and ability to reach as many mobile devices as possible**
Description	In this test case, the usability of the platform is validated. We include in the term 'usability' the ability of the EPIC platform to be reached by as many mobile devices as possible.
Source	This test case will validate the NF1, NF4, NF5, and RRS3 User Requirements, as defined at the D2.4 document.
Outputs/Results	A version of the EPIC relocation mobile application for iOS as well as most Android 2.3.x powered devices is available for download online. Due to the stringent procedures with regards to downloading applications through other means than the Apple App Store, the iOS version download requires an extra step of registration through a platform called 'TestFlight'. For every user session on a mobile device a trace log of the session is available. 1. App download landing page available at this link : https://iminds.qualtrics.com/SE/?SID=SV_3IvcgzXfgLDZrdW 2. User registered on Testflight and app successfully downloaded on iOS device 3. App successfully downloaded on compatible Android device 4. Mobile session log files successfully register use of both iOS as Android application. **This test case is considered successful.**

Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 13: CC-2-1 Test Case - Access and customize an internal data store

ID	**CC-2-1**
Name	**Access and customize an internal data store**
Description	In this test case the access an internal data store and the ability to define additional application specific data will be validated.
Source	This test case will validate the FR26 user requirement, as defined at the D2.4 document.
Outputs/Results	For the purposes of the EPIC platform, an internal datastore has been created. In order to be accessed, user must firstly set up a secure connection via public/private key. Then, all relevant actions can be performed via the IBM's DB2cc tool. 1. Secure connection was successfully established via PuTTy using a valid private key. 2. The proper DB schema was successfully retrieved, and additional application data could be defined. 3. The new application data was validated through the User Management component. Test Case CC-1-5 already described this procedure. **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 14: CC-2-2 Test Case - Access external data stores using services

ID	**CC-2-2**
Name	**Access external data stores using services via pilot applications (both REST and SOAP)**
Description	In this test case the access to the external data stores that provides data to the pilot applications must be validated, through the use of the appropriate web services.
Source	This test case will validate the FR9 User Requirements, as defined at the D2.4 document.
Outputs/Results	Within EPIC external data sources are provided by project partners (like e.g. Immoweb, Indecosoft, CIBG Brussels, Town of Tirgu Mures) by web services. Both SOAP/XML and HTTP/JSON web services are provided by partners.

	Mediating web services that run on the EPIC platform (on the Websphere Process Server) act as proxies for these Web Services. A transformation of the data pulled onto the platform is been performed as well. For instance, a transformation can be done from SOAP/XML web services to HTTP/JSON and vice versa. Websphere Process Server and Websphere Integration Developer are used in combination for Business Integration: http://www.ibm.com/developerworks/websphere/zones/businessintegration/wps/wps.html **This test case is considered successful.**
Related Material	Documentation can be found on the web under the keywords "Websphere Integration Developer mediation". E.g. http://www.ibm.com/developerworks/websphere/library/techarticles/0908_ferrier/0908_ferrier.html

Table 15: CC-3-1 Test Case - Use different time zones

ID	**CC-3-1**
Name	**Use different time zones**
Description	In this test case, the platform will be validated regarding its ability to manipulate data when users react with EPIC from different time zones.
Source	This requirement will validate the FR10 User Requirements, as defined at the D2.4 document.
Outputs/Results	**It was decided that this will be of lowest priority as the development process was proceeded so as to focus in more critical aspects.** EPIC platform did not provide any specific support for this test case and the local machine's time zone will be used instead. **This test case is not considered successful.** Additional information about the rationale of the rationale in the scope of the EPIC project can be found in section 7.
Related Material	N/A

Table 16: CC-3-2 Test Case - Use multiple currencies

ID	**CC-3-2**
Name	**Use multiple currencies**

Description	In this test case pilot applications will be validated regarding their ability to present finance data with multiple currencies.
Source	This requirement will validate the FR10 User Requirements, as defined at the D2.4 document.
Outputs/Results	**It was decided that this will be of lowest priority as the development process was proceeded so as to focus in more critical aspects.** EPIC platform did not provide any specific support for this test case and pilot services would address this if required by the specific application. **This test case is not considered successful.**
Related Material	Additional information about the rationale of the rationale in the scope of the EPIC project can be found at the 7 section.

Table 17: CC-3-3 Test Case - Use multiple languages

ID	**CC-3-3**
Name	**Use multiple languages**
Description	In this test case, the platform will be validated regarding its ability to present displays according to the user's favourite language
Source	This requirement will validate the FR21 User Requirements, as defined at the D2.4 document.
Outputs/Results	Test Process: 1. Log in as a Tirgu Mures test user 2. Visit the account settings in the top right corner of the screen and select the preferred language (Hungarian or Romanian) 3. Visit the Tirgu Mures 3D City application or Relocation application. The welcome page and most of the interface is shown in the preferred language.. The platform allows for multilinguality on 3 different levels: 1. Platform level via the user account settings – this impacts the main navigation 2. Application level via the same user account settings, which is in turn used in the webservice and portlet code to send or show the required language to the user. 3. Content level via the semantic web service, as employed in the relocation application to translate house descriptions from French to English. **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 18: CC-4-1 Test Case - Correctness of logging and statistics

ID	**CC-4-1**
Name	**Correctness of logging and statistics**
Description	This use case will validate the recording of the logging data, which are automatically generated by the EPIC's User Management functionalities.
Source	This requirement will validate the FR24 User Requirements, as defined at the D2.4 document.
Outputs/Results	1. User successfully logged in to the relocation application. 2. User explored some pages and proceeded to various actions 3. All actions were successfully logged in to the EPIC's database. **This test case is considered successful.**
Related Material	Details and figures on the logging analysis are available on section 5.2.

Table 19: CC-5-1 Test Case - Test the platform security mechanisms

ID	**CC-5-1**
Name	**Test the platform security mechanisms and identification of vulnerabilities**
Description	Verify that the data of all EPIC pages seen by the user is SSL encrypted to ensure security and privacy.
Source	This requirement will validate the NF2, NF3 User Requirements, as defined at the D2.4 document.
Outputs/Results	• Relocation Scenario: All pages were visited by the target users and no pop-up or other warning mechanism identified mixed SSL encryption vulnerabilities. • Urban Planning Scenario: All pages were visited by the target users and no pop-up or other warning mechanism identified mixed SSL encryption vulnerabilities. • Smart Environment Scenario: All pages were visited by the target users and no pop-up or other warning mechanism identified mixed SSL encryption vulnerabilities. SSL encryption works smoothly ensuring security and privacy. **This test case is considered successful.**
Related Material	This test case was based on the observation of the application providers in combination with the end user surveys and target group interviews.

Table 20: CC-5-2 Test Case - Test the user access and management

ID	**CC-5-2**
Name	**Test the user access and management mechanisms (role based, groups, etc.)**
Description	Verify that group and role based access permissions are enforced.
Source	This requirement will validate the FR1, FR3, FR7, FR11, FR12, FR13 and NF3 User Requirements, as defined at the D2.4 document.
Outputs/Results	1. Log in with a user configured to have access to the Brussels Pilot 2. Only the Brussels Pilot is shown 3. Log in with a user configured to have access to the Tirgu Mures Pilot 4. Only the Tirgu Mures applications are shown **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 21: CC-5-3 Test Case - Test the single sign-on mechanism

ID	**CC-5-3**
Name	**Test the single sign-on mechanism**
Description	Test that one user can be registered with two different pilots, and access each pilot with one userid.
Source	This requirement will validate the FR5 User Requirement, as defined at the D2.4 document.
Outputs/Results	A user that is registered in two different pilots was successfully logged in. The portal page the user was navigated after the log – in, had a navigation page menu with all the top level pages of both of the pilots. The user could successfully access all of these pages. **This test case is considered successful.**
Related Material	This test case was based on the observation of the application providers.

Table 22: FE-1-1 Test Case - Register a new user to the EPIC platform's database

ID	**FE-1-1**

Name	**Register a new user to the EPIC platform's database**
Description	The purpose of this test case is to verify that a user can be registered successfully to the EPIC platform
Source	This requirement will validate the FR5, FR12 and FR13 User Requirements, as defined at the D2.4 document.
Outputs/Results	OK - User creation has been done properly through the EPIC administration/Portal Users. Steps following: 1. Log-in to the EPIC platform as administrator 2. Navigate to the Database users page (EPIC Administration -> Database users) 3. Press the creat button in the database users list portlet 4. Fill in the Epic User Name of the user and optionally his email. The name of the user should be the same as the one he uses for logging into the portal. 5. Press the Submit button 6. If the list has more than one page, press the link of the last one **This test case is considered successful.**
Related Material	Screenshots resulting from the above steps and outlining the test result are available in the annex.

Table 23: FE-1-2 Test Case - Assign a pilot role to a user

ID	**FE-1-2**
Name	**Assign a pilot role to a user**
Description	The purpose of this test case is to verify that a pilot role can be assigned to an EPIC user successfully.
Source	This requirement will validate the FR12, FR13, FR14 and FR15 User Requirements, as defined at the D2.4 document.
Outputs/Results	OK - Was able to assign a pilot role and a group role with success through the EPIC administration / Pilots a Portal Users. 1. Log-in to the EPIC platform as administrator 2. Navigate to the Database users page (EPIC Administration -> Database users) 3. Click on the Link Users to Pilots link on the row of the user you want to register to a pilot. 4. Select a pilot from the pilots list in the User Pilot Assignments portlet. 5. Press the Add User Role button 6. Select a user group and a pilot role for the user selected. 7. Press the Submit button 8. If the list has more than one page, press the link of the last one **This test case is considered successful.**

Related Material	Related screenshots are available in Annex A.

Table 24: FE-1-3 Test Case - Initialize pilot specific data for a user

ID	**FE-1-3**
Name	**Initialize pilot specific data for a user**
Description	The purpose of this test case is to verify that a pilot specific data for a certain user can be registered to the EPIC platform successfully.
Source	This requirement will validate the FR4 User Requirement, as defined at the D2.4 document.
Outputs/Results	When initializing a pilot, there is the ability of specifying specific custom data related with the pilot application' internal functionalities. After logging into the EPIC platform, and by using the User Management Portlets, the administrator has successfully defined the Data Type 'MAC Address' and then, he entered the specific data values for every registered user. **This test case is considered successful.**
Related Material	The results can be found at the following screenshot (Smart Environment Scenario)

PILOT	USREPICUSERNAME	PSDTPILOTDATADESCRIPTION	UDPSPILOTDATAVALUE
Smart Environment S...	manchester004	MAC Address	6470027646F2
Smart Environment S...	manchester085	MAC Address	64700269FD7F
Smart Environment S...	manchester086	MAC Address	90F652F6B1EA
Smart Environment S...	manchester001	MAC Address	F8D111BD3B52
Smart Environment S...	Jan	MAC Address	F8D111BD3390-0
Smart Environment S...	manchester002	MAC Address	90F652D6D21B
Smart Environment S...	manchester003	MAC Address	90F652DC53DC
Smart Environment S...	manchester005	MAC Address	647002765238
Smart Environment S...	manchester012	MAC Address	F8D111BD3962
Smart Environment S...	manchester013	MAC Address	F8D111BD3390
Smart Environment S...	manchester087	MAC Address	64700269FD7D
Smart Environment S...	davewhile	MAC Address	F8D111BD3962
Smart Environment S...	manchester006	MAC Address	647002764EA3
Smart Environment S...	manchester007	MAC Address	647002765258
Smart Environment S...	manchester008	MAC Address	90F652D6DC91
Smart Environment S...	manchester009	MAC Address	647002765225
Smart Environment S...	manchester010	MAC Address	6470027651D9
Smart Environment S...	manchester011	MAC Address	647002764E24
Smart Environment S...	manchester088	MAC Address	64700269F37B
Smart Environment S...	manchester089	MAC Address	64700269FD55
Smart Environment S...	manchester091	MAC Address	90F652F6B0D2
Smart Environment S...	manchester034	MAC Address	90F652C527B3
Smart Environment S...	manchester035	MAC Address	90F652C50609
Smart Environment S...	manchester036	MAC Address	90F652C52134
Smart Environment S...	manchester037	MAC Address	90F652C5058C
Smart Environment S...	manchester038	MAC Address	90F652C5063B
Smart Environment S...	manchester039	MAC Address	90F652C52133
Smart Environment S...	manchester040	MAC Address	90F652C520A0

Table 25: FE-2-1 Test Case - Register a new pilot to the EPIC platform

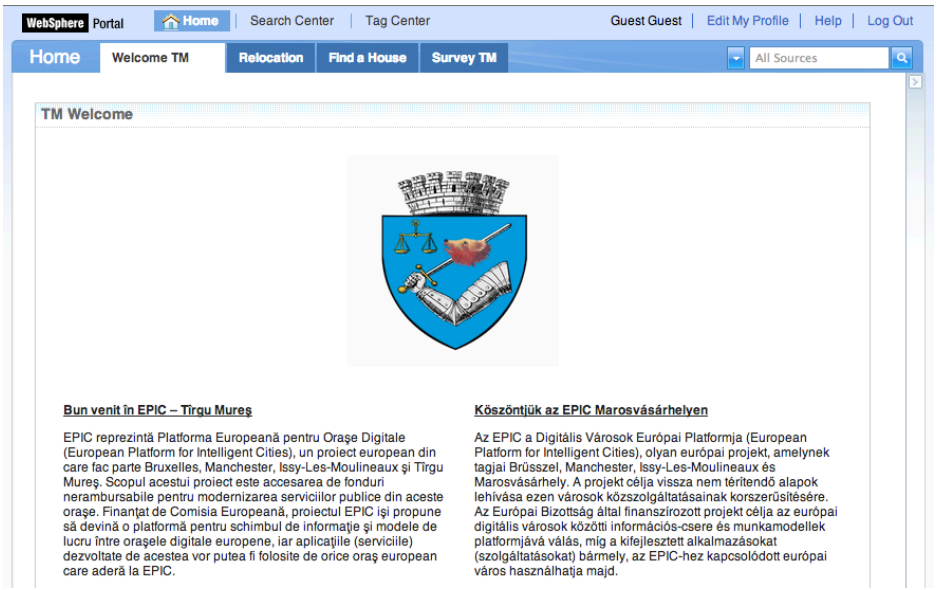
ID	**FE-2-1**
Name	**Register a new pilot to the EPIC platform**
Description	The purpose of this test case is to verify that a pilot can be registered successfully to the EPIC platform.
Source	This requirement will validate the FR2 User Requirement, as defined at the D2.4 document.
Outputs/Results	The EPIC's technical administrators successfully registered a new pilot to the platform. In the diagram below, it can be seen that a new pilot, the city of Tirgu Mores, is already registered with the Romanian's version of the Relocation application. This 'guest' end user has access both to the Romanian version and the Brussels' version of the Relocation scenario. **This test case is considered successful.**
Related Material	

Table 26: FE-2-2 Test Case - Add a user role for a pilot

ID	**FE-2-2**
Name	**Add a user role for a pilot**
Description	The purpose of this test case is to verify that a pilot role can be registered successfully to the EPIC platform
Source	This requirement will validate the FR1, FR7 and FR12 User Requirements, as defined at the D2.4 document.

Outputs/Results	Pilot roles can be created through the EPIC administration interface. A new portal user group is created which can then be assigned various rights. 1. Log in as valid EPIC admin user 2. Go to EPIC Administration in to right corner 3. Go to Portal Users tab 4. Click on Create User Group and create new user group 5. Give User Group rights **This test case is considered successful.**
Related Material	Related screenshots are available in Annex A.

Table 27: FE-2-3 Test Case - Add pilot specific data

ID	**FE-2-3**
Name	**Add pilot specific data**
Description	The purpose of this test case is to verify that pilot specific data can be registered successfully to the EPIC platform.
Source	This requirement will validate the FR26 User Requirements, as defined at the D2.4 document.
Outputs/Results	This test case is covered by FE1-3, so **it is considered successful**.
Related Material	N/A

Table 28: FE-3-1 Test Case - Reach at least two different types of mobile devices

ID	**FE-3-1**
Name	**Reach at least two different types of mobile devices**
Description	The purpose of this test case is to verify that access to the pilot applications hosted by the EPIC platform, can be easily achieved by at least two different types of mobile devices.
Source	This requirement will validate the RRS2, RRS3 and RUP1 User Requirements, as defined at the D2.4 document.
Outputs/Results	Test case is covered by CC-1-8, so **it is considered successful.**

Related Material	N/A

Table 29: FE-4-1 Test Case - View logging/feedback information

ID	**FE-4-1**
Name	**View logging/feedback information regarding a pilot application**
Description	The purpose of this test case is not focused on the valid recording of logging/feedback information, rather than the appropriate presentation of the already stored data.
Source	This requirement will validate the FR23 and FR24 User Requirements, as defined at the D2.4 document.
Outputs/Results	**It was decided that this will be of lowest priority and focus of other critical features.** Therefore, there is no portlet for viewing aggregated pilot log data however, this data are accessible through the DB2cc GUI tool, as described in CC-4-1. **This test case is considered partially successful.**
Related Material	N/A

Table 30: FE-4-2 Test Case - View the list of notifications of a target application

ID	**FE-4-2**
Name	**View the list of notifications of a target application**
Description	The purpose of this test case is focused on the validation on the notifications provided by pilot applications to the registered end users.
Source	This requirement will validate the FR17 and FR18 User Requirements, as defined at the D2.4 document.
Outputs/Results	**It was decided that this will be of lowest priority and focus of other critical features.** The outcomes in this test case are contradictive. Even though the platform was able to log the operational parameters of the pilot applications or the catalogue for new services or updated versions, in platform level there no notification mechanism was in place to inform administrators or end-users. In application level though, the Smart Environment Pilot services that are deployed on the platform monitored the heartbeat of the sensors and notified the administrators for failures.

	This test case is considered partially successful.
Related Material	N/A

Table 31: DE-1-1 Test Case - Usability and adequacy of the development tools

ID	**DE-1-1**
Name	**Usability and adequacy of the development tools**
Description	The purpose of this test case is to prove the usability and adequacy of the existing development tools, in order to validate that an application development has all required tools to develop his applications that will be hosted in the EPIC platform.
Source	This requirement will validate the DE1 User Requirement, as defined at the D2.4 document.
Outputs/Results	Regarding the development of portlets WebSphere Portlet Factory v7.0 provided by IBM was used. The tool has a number of build in components implementing different kind of functionalities like web services calls, Ajax web calls, integration with custom java and JavaScript etc. The tool has a lot of potential, offering a wide range of components for rapid development but it also has a long learning curve. **This test case is considered successful.**
Related Material	This test case was based on the observation of the application providers and the partners' internal questionnaire results.

Table 32: DE-1-2 Test Case - Easy integration, adaptation and deployment

ID	**DE-1-2**
Name	**Easy integration, adaptation and deployment of the pilot applications to the EPIC platform**
Description	The purpose of this test case is to prove the usability and adequacy of the migrating a pilot application to the EPIC platform.
Source	This requirement will validate the DE2 User Requirement, as defined at the D2.4 document.
Outputs/Results	The Relocation application developer has primarily implemented the application and then 1. Deployed the application to the EPIC platform, as described in previous test cases. 2. Easily set up service connections with external data stores for accessing POIs regarding the Brussels and Tirgu Mores city.

	3. The proper operation has already been validated by the online surveys of the open cycle test phases, involving end-users of the Pilot Labs. **This test case is considered successful.**
Related Material	Not applicable

4.2 Test Case Outcomes

According to the test cases, as referred in the above subsection, a couple of interesting outcomes can be identified. The test cases can be divided to three major categories: The ones that related with the core cloud platform of EPIC, the ones that are mostly related with the front-end user interface of the platform and of the pilot applications and the ones that are related with the developer's experience by using the EPIC tools in order to develop a pilot application that will be hosted to the platform. We'll analyse them separately.

4.2.1 Core Cloud Platform Test Cases

The majority of the test cases that reside in this category were succeeded, proving that the Core Cloud EPIC Platform is functioning according to its developments' expectation and what was defined and designed at the beginning of the project. All core functionalities are working as expected. The latter can be also divided into smaller groups that are being analysed below.

The platform can host new developed services and applications that can also be accessed through the service catalogue. All basic service catalogue's functionalities operate as expected. A user with administrative rights on the EPIC platform can register a new service to the catalogue, perform advanced search with the capabilities of the service annotation mechanisms, can access and register to existing services, while he can delete a service that is of no use.

The extended functionalities of the User Management back-end component work also as expected, after being performed a variety of JUnit tests aligned with the documentation of the services. These functionalities were also under tough testing mode, as they are being consumed by all hosted services and applications of the EPIC platform.

Platform's mechanisms for accessing external or internal data stores simplify the process of software development by the application providers. This has been validated by both the results of the relevant test cases and the experience gained by the testing pilot applications, as obtain by the internal questionnaires.

Security mechanisms for authenticating users have been widely developed and the EPIC's technical team put a significant amount of effort in doing so, as this had been identified as one of the major vulnerabilities during the beginning of the test phases. Authorization mechanisms also operate as expected, thus preventing a user from

accessing an application that has not been registered. At this point it must be highlighted that EPIC platform also check for proper authorization for accessing the pilot applications, and not authorizes users for accessing specific pages of an application, even if the platform is capable of handling this. That was decided to by managed by the application provider itself, rather than the EPIC, in order to facilitate the development of the core EPIC's backend component, based on the fact that the application providers have a deep knowledge of their applications, and can handle this by themselves.

EPIC platform also records a significant amount of logging data to be used internally by the application providers, so that the latter can have some detail insights regarding the use of their application. This has been proved to be of a high valuable input, as highlighted by the work that has already been done in the scope of the WP7 of this project. EPIC offers a generic way to record and make use of custom logging data according to each application needs.

Last but not least, EPIC didn't succeed to serve mechanisms for using different time zones and currencies in the scope of a pan European platform. During the ongoing process of software development, it was decided by the EPIC Project consortium that these functionalities are of lowest priority, and the technical partners should focus more on the most core and high important functionalities. These features were not highly related with the pilot application scenarios and no challenges related with the "smartness" of cities and services were identified. Applications that require should features could easily implement them though with considerably low effort.

On the contrary, EPIC platform treat the multilingual diversity inside the EU with much success, as it has been proved that a pilot application can presented in a different country with that country's specific lingual characteristics, test by the Relocation scenario in the Tirgu Mures' case.

4.2.2 Front-end/User Interaction Test Cases

Regarding the completion and the ease of use of the front-end user interaction, EPIC platform made a significant progress in providing portlets that would simplify the user experience of a user with administrative rights that will have to be able to make some more advanced actions in order to register an end-user to the platform and customize him according to each application's own specific requirements. In order to prove this, specific test cases had been defined that drives the administrative user to all the procedure he has to take to complete these tasks. An end user was able to be registered firstly to the platform as an EPIC user, then to be successfully assigned with a role to one of the existed pilot applications, while it was successfully tested that could be initialized with custom application data in the context of the Smart Environment scenario, where it was assigned with a relevant MAC address of the sensor he used to participate.

A minor limitation of the EPIC Platform that was identified from the test cases is the logging data front-end. As was already mentioned in the core cloud platform section,

the backed functionalities are validated, however currently there is no front-end portlet to present the data in a user friendly way and the development teams dedicated their effort to the pilot and platform service functionalities. This did not affect the operational aspects of the platform and during the development process the teams were granted direct access to the respective datastores.

4.2.3 Developer's Experience Test Cases

Two test cases are strongly related with the overall developer's experience for developing pilot applications using the EPIC tools and how easily can integrate services from different providers in order to enrich his own application. These test cases were answered by all pilot application providers who actually did the development of their application using these tools, and integrate different services. The outcomes are quite encouraging as it was identified that the richness of libraries and different technology offering by EPIC simplify the software lifecycle a lot, by decreasing the development time with the use of such tools. The automated process of integrated different web services from different service providers also was appreciated by all developers. This can also be observed by the outcomes of the internal questionnaires, as described in the previous section.

5 Performance and Logs Evaluation

In this chapter we present a more deep analysis regarding the performance evaluation of the EPIC platform in terms of responsiveness and functioning. This work goes beyond the CC-1-5 test case, described in the previous section, as we present analytical diagrams regarding the overall response time of some key functionalities of the EPIC's backend services. We also illustrate valuable information obtained from the logs files of the EPIC's Portal Server, so as to highlight the progress of the development of the platform and pilot application during the last phase of the project.

5.1 Performance Evaluation

The performance evaluation of the EPIC platform was based on stress tests that were performed on the EPIC's backend User Management functionalities to identify the overall response time of the most common method invocations on the platform. The tool that was used for the stress tests was the Apache's JMeter[1] traffic generator and the tested platform environment was deployed on a IBM's Smart Cloud Virtual Machine, with 4 core Silver 64bit CPUs, 8GB of RAM, 1060GB of storage, running on an Red Hat Enterprise Linux v5.5. The 'y' axis presents the response time (in miliseconds) of every request for invocation, while the 'x' axis presents the elapsed time. The black coloured traces describe each specific invocation's response time, while the blue curve shows the average response time in every instant. The red coloured curve shows the deviation and the green coloured curve the throughput.

The following indicative functionalities were tested:

- CourtesyTitleSelectAll
- PilotSpecificdataTypeSelectByPilot
- PilotsSelectByID
- UserDataCommonAnnSelectByUserName

5.1.1 CourtesyTitleSelectAll

This is a light functionality that was included to highlight the responsiveness of the Platform when invocating web methods with minor resource requirements. The stress test required 500 simultaneous users having performed 3 invocations with a 500ms deviation on a 50ms delay offsets.

[1] Apache JMETER: http://jmeter.apache.org/

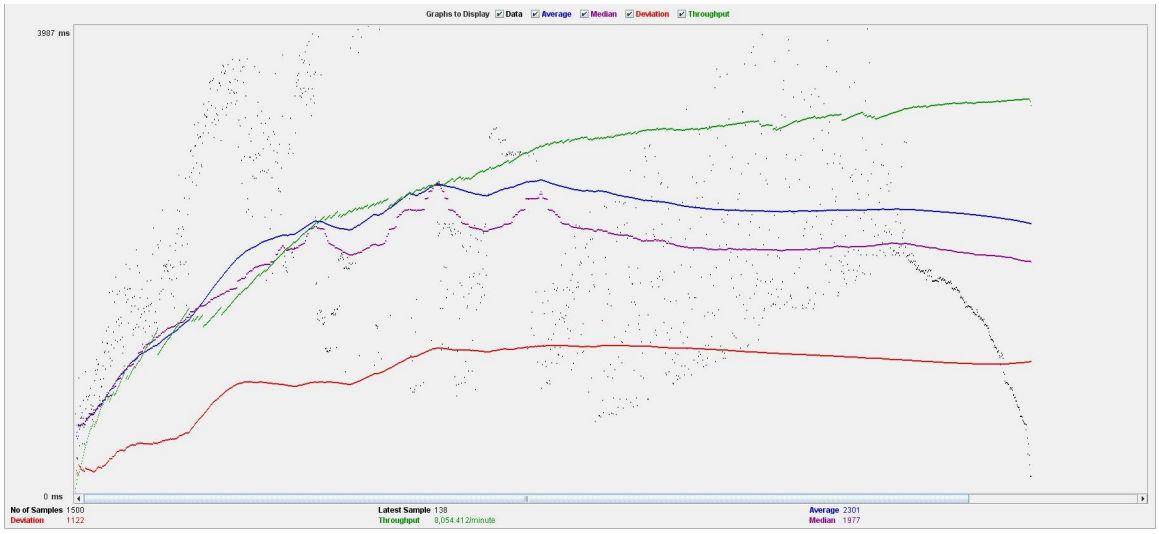


Figure 2: CourtesyTitleSelectAll Performance Test

The average response time under this heavy load is 2.5~5.0 seconds, as it is shown above.

5.1.2 PilotSpecificdataTypeSelectByPilot

In this stress test we had 250 simultaneous users performing 3 invocations with a 500ms deviation on a 50ms delay offsets.

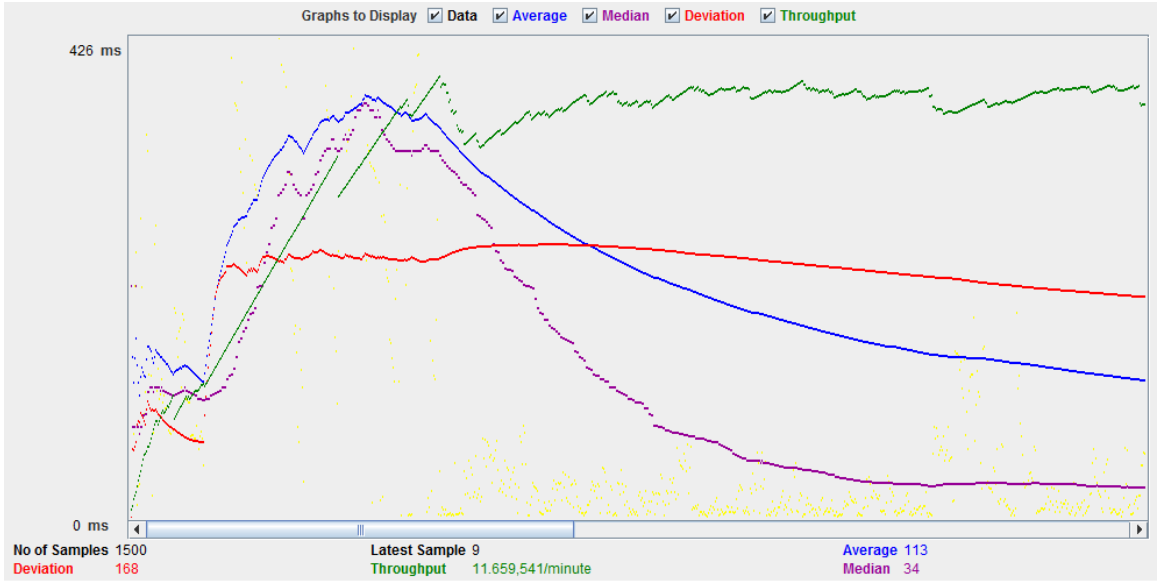


Figure 3: PilotSpecificdataTypeSelectByPilot Performance Test

The average response time converges at 110 milliseconds, as it is shown above.

5.1.3 PilotsSelectByID

This is one of the most common functionalities that is being invoked by every end-user whenever they visit a pilot application. In this stress test we had 500 simultaneous users performing 3 invocations with a 200ms deviation on a 20ms delay offsets.

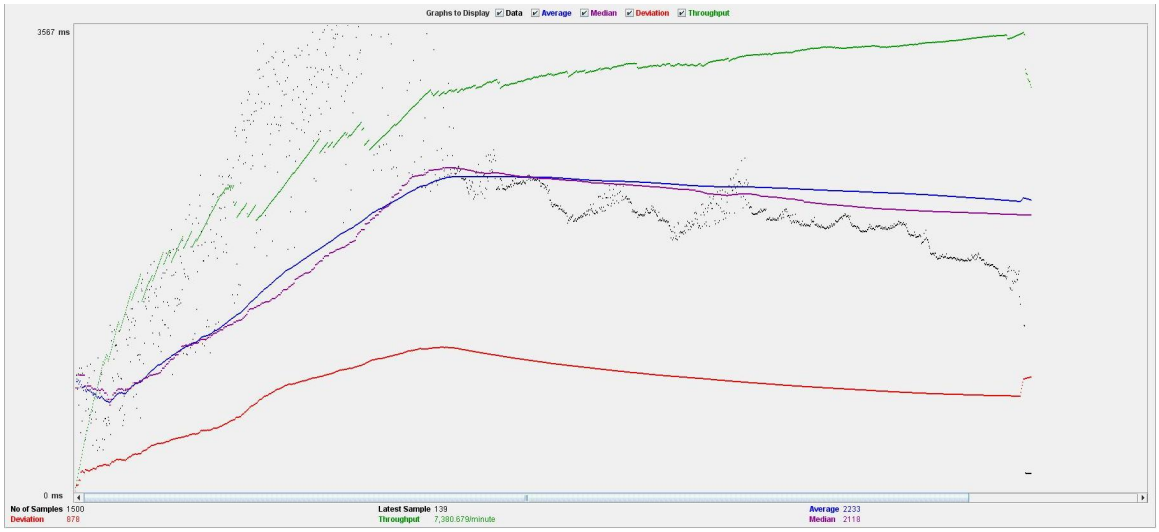


Figure 4: PilotsSelectByID Performance Test

The average response time converges at 2,2 seconds, as it is shown above.

5.1.4 UserDataCommonAnnSelectByUserName

This is one of the most common functionalities that is being invoked by every end-user, several times upon page navigation in a pilot application. In this stress test we had 500 simultaneous users performing 3 invocations with a 500ms deviation on a 50ms delay offsets.

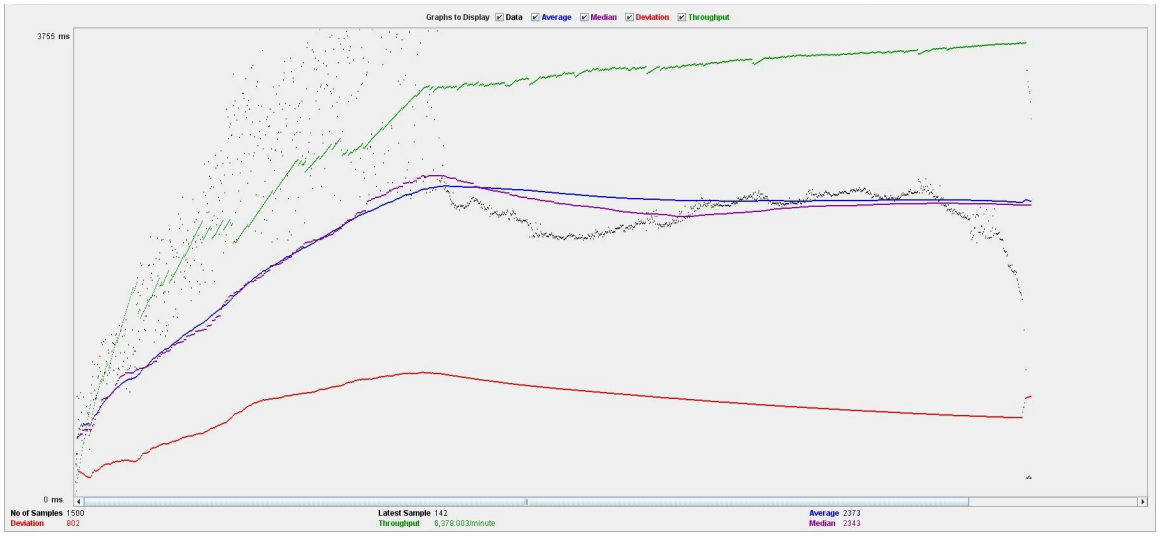


Figure 5: UserDataCommonAnnSelectByUserName Performance Test

The average response time converges at 2,4 seconds, as it shown above.

5.1.5 Performance Evaluation Results

What can we conclude from the above, is that although some stress tests had not a satisfactory performance, when it comes to the functionalities that are more crucial and are expected to deal with heavier load, the response time is acceptable. What is more, the EPIC Portal Server was configured to be deployed in a virtual machine that was tuned to address low traffic load. When the stress tests took place, the EPIC was in a testing phase of an open cycle and this means that no more than 4-5 simultaneous users were producing traffic to the server at the same time. The stress tests however, took into consideration more than 250 simultaneous users. When EPIC will come to production phase, it simply need to scale up the platform environment that is currently deployed, exploiting the elastic cloud capabilities of the IBM's Smart Cloud engine.

5.2 Logs Evaluation

Apart from the performance evaluation that was described above, an analysis of the EPIC's Portal Server log files has been done. The main objective was to identify the rate of unexpected errors (in terms of unhandled exceptions) that could seriously damage the user experience, and discover if this is constant or it was decreasing during the development process, as the valuable input that was receiving through the test cycles and the user interaction with the platform, helped the EPIC technical team to correct any bugs or relevant issues.

The logging data analysis took place mainly in the last phase of the testing cycles otherwise the results would not make much sense, (i.e. analysis results should not be affected by errors from the development process and the integration process. However, during the development process ad-hoc logging tests and analysis were conducted to identify implementation and operational issues of the services.

On the following diagrams, (A) represents normal notifications from the portal server, (E) represents unhanded exceptions, (I) represents logs that contain general information data upon user requests, (O) represents server internal errors, and (W) warnings that are recorded from the platform.

In the following diagram, the absolute values of the aforementioned logs are shown, in a 15 days period. In the 'y' axis the absolute value of notifications/errors/warnings is shown, while the 'x' axis represents the elapsed period of observation time.

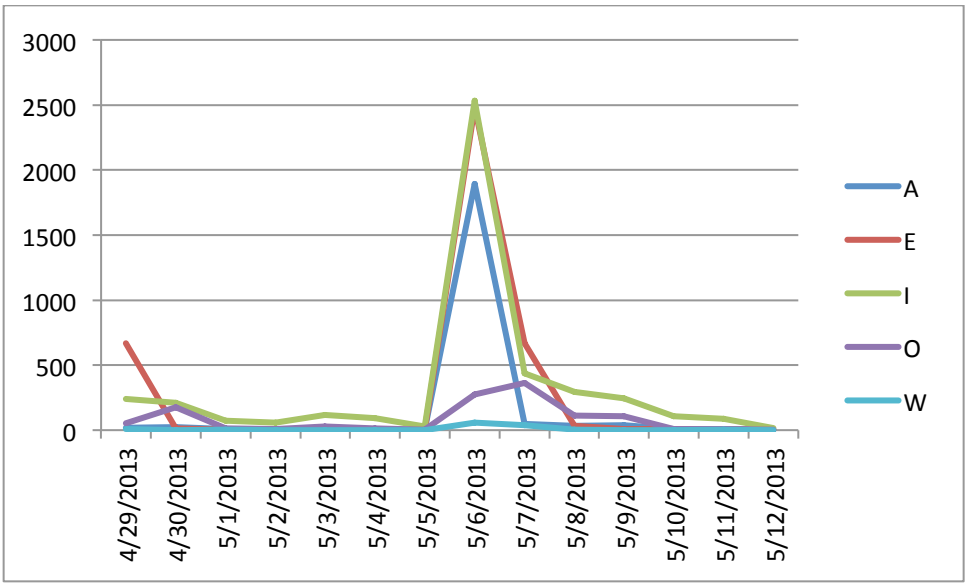


Figure 6: EPIC Platform log entries (numbers)

From this diagram, there is a pick of log data during the days that EPIC served a high traffic (i.e. on the labour-day there is almost no traffic) while the following diagram presents in the 'y' axis the relative value of notifications/errors/warnings in percentage:

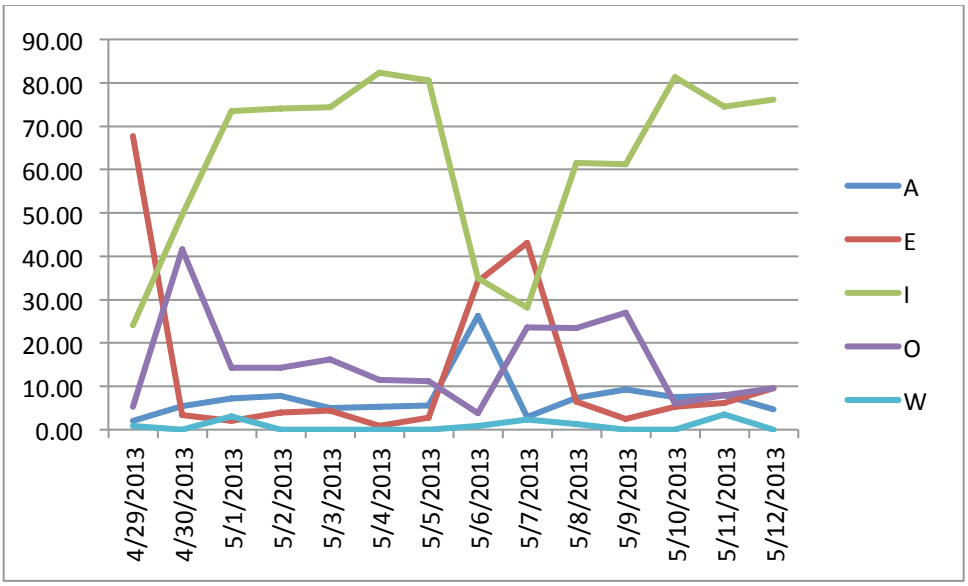


Figure 7: EPIC Platform log entries (%)

In most cases, the platform experience normal behaviour however, a significant amount of errors occurred between the 6 and 7 of May. This was caused due to an abnormal behaviour of an external data provider, in the integrated scenario. The instant increase of errors during this phase was monitored, so the technical team

could react as soon as possible in order to solve this issue. The error stack was the following:

[5/6/13 20:50:03:438 GMT] 0000002c WSClassFinder E WSWS7058E: A JAXBContext could not be created correctly because of the following error: …

This means that the external data provider suddenly stopped providing data upon the pilot application's request, which lead to a crash, as the relevant JAXB objects couldn't be initialized. This was monitored by the EPIC platform, so the technical team could inform the data provider about the cause of problem, who responded quickly. Moreover, this bug with unhandled exceptions which caused the application to crash was also fixed, so in the future, a user friendly message will be shown to the end user.

6 Pilots Testing Results Analysis

This section focuses on the evaluation of the pilot applications and summarizes the results and outcomes following the progress of this project. The evaluation takes input from the very beginning work packages (WP2, WP3) which were presenting the requirements for every specific pilot application and the initial capabilities of IBM's Smart Cloud Platform, which was used as the basis for the EPIC environment. WP4 and WP5 also provided valuable input, as they consolidate the pilot applications and scenarios definitions, which are later used for highlighting the basic advantages of the platform, while WP7 collects all end-user results and analyse them from a pilot lab's view perspective. It should be mentioned here that the D8.2 document focuses on the evaluation of the pilot applications from a technical perspective. The living lab processed sociological aspects of how each application will help a city to become "smarter". How this will take place was not within the scope of the technical evaluation, but they are examined in D8.3.

The remaining sections give a brief explanation for every pilot application and then the analysis of the evaluation process is described.

6.1 Relocation Scenario

6.1.1 Overview

The relocation scenario consists of two main cases: The web and the mobile application. Those two sub-scenarios implement different functionalities. The web perspective of the application mainly focus on the 'where to live' functionality, which assists the incoming citizen in getting to know the different areas of the city. The 'Finding a Place' section of the Relocation application allows the user to search and browse through available houses and apartments for sale or rent. The application also allows to limit a search result to a property's proximity to specific points of interest in the area of the property, which extends the features of most house searching sites today. The "Making Favourites" functionality allows user to personalize a list of favourites apartments/houses for easy retrieval. Lastly, the 'living in the city' functionality integrates administrative data from the Brussels city administration into the relocation application.

The mobile application allows the user to use the mobile application and visit the places that were pre-selected as favourites while using the web application, find new places from within the application itself and discover the neighbourhood and its points of interest. The 'finding a place' functionality is similar to the web perspective. Additionally, the ''what's around me' shows all POIs in a user-centric way, rather than just showing them deployed in a map around the desired house.

The Relocation Service application is not only useful for those moving into a new city but to the city's administration and different other stakeholders as well. It can give valuable aggregated data and statistics regarding the user's different preferences, as defined in the FR24 user requirements.

This scenario has been firstly tested in the city of Brussels, and later, it was transferred to the Romania city of Tirgu Mures, using different language accordingly. Extensive user and stakeholder interviews and research at the start of the pilot resulted in a set of requirements more specific to the selected target group as well as a priority list of which features were most important to be integrated first and which could be integrated at a later stage. This gave a valuable input to the D2.4 document, in order to identify additional user requirements needed by the EPIC platform to host this pilot application and also confirm the existing ones. One of the major requirements was the ability to consume data coming from external resources, as included in the FR9 requirement. The Relocation Scenario in Brussels exploits data from two different external data providers: CIBG for providing POIs and Immoweb for providing real estates' offering. Moreover, when deployed in a new city, like Tirgu Mures, the application must facilitate the integration of the new city's local data provider. This proves the reusability and transportability of the Relocation Application and its underlying EPIC platform, and also validates the FR6 and FR20 user requirements.

6.1.2 Pilot Adaptation

In order to access the application, it is necessary to have a username and password. Regarding the permissions that a user might have, he will be then directed to the Brussels or Tirgu Mures version of the application. This evaluates the FR1, FR3, FR5, FR7 and FR11 user requirements, as defined in the D2.4 document. In case of the Tirgu Mures version, the pilot application will be translated to either Romanian or Hungarian, based on the user preferences and the ability of multilingual support provided by the EPIC platform, as defined in the FR21 requirement.

6.1.2.1 Closed Cycle Testing

The first test phase ended with the most critical features of the application, namely the ability to search for properties based on basic, to display search results in a list and on a map integrated with a first set of POIs, display property's basic details, to select and retrieve favorite properties, and to log key user activities into the EPIC platform, for statistic elaboration. The major technical achievements during this phase were the ability to connect and retrieve data from external data providers (requirement FR9), customize the EPIC's internal database for the application specific needs (requirement FR26), create basic portlets for the relevant pages, basic roles and permissions (requirements FN1 and NF2) and integrate with the EPIC's backend logging component. The most significant technology outcome was the integration of the relocation application with the external data providers, where the EPIC platform's underbelly, through a role based permissions system, takes care of making sure that only portlets and users with the proper clearance have access to the data fed through these web services, mainly evaluating the FR1, FR2 and FR4 requirements.

The short timespan between the first two test phases only enabled a number of identified bugs to be solved and a minor set of new functionalities to be implemented, mainly the display of city administrative data into the 'living in Brussels' component. The GUI also was improved according the end-users' feedback, which tried to evaluate the NF5 requirement.

Following the two test phase related with the closed cycle of end users, an additional phase was defined strictly related with the mobile version of the relocation application. The main problem was the inability of the EPIC platform to ensure privacy and authentication to mobile, which was not predicted in the very beginning of the project. In order to address this and be aligned with the relevant user requirements, as defined in the D2.4 document, an additional layer for security was implemented outside of the platform's boundaries, and thus extended the capabilities of EPIC. This addressed the requirement for addressing mobile devices (NF4 requirement). Moreover, the critical functionalities that already existed in the web version of the relocation application were also offered in its mobile version. The main difference was that the web services endpoints had to be transferred from SOAP based to REST based, in order to ensure high performance when consuming live streaming data (RUP2 requirement), thus exploiting the lightweight communication with RESTful web services in a JSON format. The mobile application was also developed using cross platform development frameworks that allowed applications to be built for iOS, Android and Blackberry devices (Windows Phone in the future), reaching as many as mobile devices as possible (RRS3 requirement).

6.1.2.2 Open Cycle Testing

In the following two phases for the open cycle test, a lot of work was done regarding performance issues and the insurance of high availability (NF6 requirement) and stability of the application, as this test cycle involves a large amount of end users coming from different sources. As mentioned in the D7.3, the main concerns of the end-user were the slow performance in specific actions, the significant amount of bugs when navigating through the different functionalities of the applications, and the poorness when displaying POIs into the map. According to the end users' suggestion, the number of logged results is reduced to the most critical log events, instead of various types of minor bugs, while the overall user experience was improved by adding different POI categories and displaying the information with different stylesheets, to make it clearer to the end users. The summary of the additional features that were implemented during these two phases can be found at the D5.3 document.

The last phases for the open cycle introduced a number of advanced features that evaluate the initial vision of the EPIC's consortium regarding the capabilities of the EPIC platform for reusing existing services in order to build up advanced functionalities, in an interoperable way that can be reused into different cities in order to become 'smarter'. This was also a major requirement which was identified by the feedback that the end users gave to us during the last test phases, as it is

described at the relevant D7.3 document. At this phase, the ability to search for houses based on their proximity to a subset of POI categories was introduced, while the addition of community indicators or geolocative, demographic data about the different communes of Brussels was also presented. This validates the chance to finally combine two external web services into one internal service and really show the potential of the EPIC platform as a smart city tool. This service was built with reusability in mind. Upon moving the application to a new city, a minimal number of changes need to be made to bring this service up and running.

Apart from that, a semantic engine was also implemented validating that also external services could be made available for use on the EPIC platform using semantic annotation, major user requirement (FR22) as defined in the D2.4 document. The semantic engine was used as a proof of concept in the scope of the Relocation scenario, mainly used for translating the description of a property into the user's native language. This was in contrast with the defined RRS1 user requirement, which was initially intended to translate specific property's types according to each European city's preferences (number of space in Brussels to corresponding number of bedrooms that mainly describe a property in the UK). However, during the process of the development process, the translation of the text description of the property to a different language seemed more useful. By all means, the semantic annotation and for multi-cultural description of the properties is considered evaluated.

Finally, caching mechanisms were introduced in the mobile devices in order to limit the amount of times the app needs to communicate with the server, providing a fierce speed (and battery) increase and to increase the overall performance. The display of the POIs was also enhanced by showing additional information, thus increasing the overall user experience even more.

6.2 Urban Planning Scenario

6.2.1 Overview

The application for this scenario is supposed to be used by different types of users with each one of those to have specific needs.

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.

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.

The Business View: An SME wishing to make itself known and share information about its activity registers to the platform. 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 Urban Planning application is using external sources of data that offer them within EPIC on a 3D mapping, which validates the FR9 user requirement, as defined in the D2.4 document. In addition it allows for an interactive and multimedia modeling of the city so that the application can display geo information enriched with media in space and time, different levels of representation, from symbolic to realistic using thematic display through layers or categories or by the introduction of consultation filter, which validates the RUP1 application specific user requirement. The pilot can also interpret data and transform it into information to give them meaning and so as to be understood by different public without technician, specialist or expert support while it also manages dynamic data in real-time such as mobile phone, energy, transportation flows etc.

The 'Navidis' 3D Framework that was also developed, is scalable and can act as a middleware within EPIC and the core functionalities of this scenario, which means that this pilot application can be transferred to any type of underlying infrastructure. This framework has its own set of program interface, thus allowing for the implementation of customer interfaces, model and representations of static or dynamic data, for adding enrich features and aggregations of services developed elsewhere. This framework supports various devices like PC, MACs, touchscreens, tablets and smartphones, which is a major requirement in EPIC. This is also aligned with the NF4 and RRS3 user requirement.

6.2.2 Pilot Adaptation

In order to access the application, it is necessary to have a username and password, and in order to access features available within EPIC it is necessary to have a profile set defining access rights of an EPIC, City or SME administrator. This validates the FR1, FR3, FR5, FR7, and FR11 user requirements. Then the application gives you access to different information: the main page, the questionnaire, the 3D application, the city administrative tool and the SME administrative tool.

6.2.2.1 Closed Cycle Testing

During the first test phase there were three essential features available: the navigation in the 3D model while accessing first level information, the display of POIs into the model and time evolution of the city on a yearly basis. This is also aligned with the RRS2 user requirement. Although the majority of the feedback from the end-users was positive enough, concrete requirements for the second phase were identified that had to do with the improvement of the performance of the application as the time of loading the 3D model was inacceptable, the enhancement of the design where required thus enriching the solution by adding contents like rich media, the extension of the administrative tools and the addition of more SME network functionalities.

6.2.2.2 Open Cycle Testing

During the second phase of tests, the loading time of the application was improved, the overall design of the application was revised, with respect to the NF5 user requirement, and a new interface to access information was also provided, while the additional information layer was further improved in order to enable the City to understand its economy and individual SMEs that are on its territory. Recorded SMEs are now allowed to communicate via the EPIC platform. The 3D model and selection interfaces have been improved. Companies are now categorized for an easy searching and a better understanding of the mapping. Due to this, the “Issy Spot” service was used that is based on ‘open data’. Media centers are used to provide additional information to the POIs and projects with description and photos. The contents of these media centers are managed by using the "City admin" tool that allows adding, deleting or changing the contents. According to the results of the surveys, the review of the design, the interfaces and interactions, and the improvement of some features like “categories”, “layers” and administrative tool have been appreciated by users and made the difference with the phase 1. This is clearly mentioned at the D7.3 document where the overall usefulness and attitudes towards the new features is well appreciated by the test users, increasing the rates at the various positions that were asked. The usefulness of the Urban Planning application also evaluates the NF1 user requirement. However, there are still some improvements and additional functional features that need to be implemented. The application should be offered by touch tablets or smartphones in order to be accessed by the maximum amount of people, the ability to navigate at street level, a ‘search’ feature that is totally missing, the readability of text and photos could be improved while the use of more ‘open data’ would be desirable.

During the third phase, an integrated scenario was developed for repeating the experience of all three pilot applications in a new city in Romania, Tirgu Mores. A new 3D model was developed by providing GIS data and heights of buildings, which was further enriched by adding some information of famous places, modeled in a different layer. With the assistant of the city administration, the interface was decided to be in line with thematic and categorized POI they would like to highlight

within the Urban Plan Solution. The database of POIs, built by the city, was accessed via the adhoc web service. These POIs were geo-tagged on the 3D map by categories. In the same way the Energy web service was integrated in order to show energy consumption of some public buildings in real time. Moreover, by using the TM Properties Web Service, the end-users can see the information of real estates into the same city model. All these features and functionalities tried to also mainly address the FR6, FR20 user requirement. Some improvements are still missing, the loading time, the search engine and the easiness of navigation being the most important of those. Some improvements were suggested like a button to return to a 'starting point', the integration of the sun, and some additional assistance would be useful. All those enhancements and additions have been solved at the latest version of the application that was not available however at the third testing cycle.

6.2.3 Conclusions

The most important strength of the Urban Planning scenario is its unique "3D immersive" visualization concept to discover a territory and its projects, to develop strengths in a form at once intuitive, spectacular, fun and informative. This approach is differentiating compared to Google map, as it respects the identity of the city. The 3D model is considered fin and easy to navigate, according to the end users results, with a richness of features. The application can use multiple sources of information, like GIS data, Open Data, Big Data. Also, it uses the Navidis' evolutionary framework as a middleware that can be transferred to different technology providers. The application can be used by all different devices like PCs, smartphones, tablets etc.

Some major weaknesses have been identified, some due to EPIC architecture and other due to features missing in Urban Plan solution that were expected by few users. The most important of those issues are the impossibility for a self-registration. Citizens must be registered by the city administration authority in order to have controlled user access to the platform and services to avoid malicious behavior that could affect the operational status of the EPIC environment or disturb the development process. The integration of new services or applications provided by third partners is difficult due to security issues required by the platform. The search capability is still missing, but this is an application specific issue, not related with the EPIC platform. The pure application's administration tool is also an issue not related with the EPIC platform. There also some design issues, when an important number of POIs, the 3D Map is imprecise and POIs covered themselves making some not visible or non-understandable. All the aforementioned statements are also indicated at the negative aspects of the lasting impressions of the testing cycles, as it is clearly mentioned at the D7.3 document.

6.3 Smart Environment Scenario

6.3.1 Overview

The smart environment pilot has two discrete elements each presented by a separate dashboard within the Smart Environment Pilot. The domestic energy

dashboard helps citizens who have the necessary monitoring equipment installed in their homes, to visualise and understand their electricity consumption and to compare this with the usage of similar type properties. The public buildings dashboard helps citizens to view and compare the energy used by different public buildings in the city, where these are providing energy data to the EPIC platform from the Building Management systems and /or smart-meters. From the high level description of the pilot and the scenario we can recognize its relevance with many of the platform requirements which validates, as will analyse in section 6.3.3. Some key requirements refer to the communication with external data sources, including specialized hardware, the ability to store application specific data in the platform database, user management and others.

6.3.1.1 Citizen View

Personal Energy Dashboard: A citizen who has installed the energy monitoring hardware and connected it to their home broadband will see a personalised view of their energy use when they have logged in to the EPIC platform. All citizens who have monitoring equipment must have a unique EPIC userID and the MAC address of their energy monitor must be registered with the off-platform Generic Monitoring Framework (GMF) which handles all energy data feeds.

Public Buildings Dashboard: The public buildings dashboard provides the same view to all smart environment pilot users, irrespective of whether they have domestic energy monitoring installed. The final version of the dashboard allows the user to select from a number of monitored buildings and to overlay traces of energy consumed, again on user selected time scales.

6.3.1.2 The City View

Domestic Energy: We envisage a scenario where a city administration has been encouraging users to invest in energy saving retrofit measures such as improved insulation and to uptake renewable energy such as photovoltaic (PV), solar water-heating and micro-generation. In such cases one of the property parameters could be the energy efficiency measures in place. This would enable the city and citizens to compare the average energy use of the retrofitted properties with that of the unmodified properties.

Public Buildings: Modern public and commercial buildings typically have a building management system (BMS), responsible for all HVAC (heating, ventilation and air-condition) and for the monitoring of energy use, through fiscal smart-meters, sub-metering and other sensors. The data is typically accessed from the BMS "head-end" which allows detailed drill-down into the building controls network. The public building dashboard in smart environment is not designed to replicate the BMS functionality, but to provide a live extension to the energy certificates commonly found in public buildings. This helps a city to demonstrate to its citizens how they are achieving energy reduction, particularly by comparing between buildings or between different operating years of the same building.

6.3.1.3 The Business View

Domestic Energy: Many utility companies provide their customers with an energy monitor on request, commonly the CurrentCost EnviR as used in EPIC. This is normally used as a standalone monitor and is not connected to the outside world. Some utility companies are now providing a web-based stored for energy data, but this is normally personalised. The potential to compare energy use by different aggregation of property type / household type / location and other parameters may be of use to energy suppliers, particularly where they are required to offer energy saving measures to their customers.

Public Buildings: Many building owners have access to their BMS head-end, often as part of a wider building control network within the city. However, whilst they may be able to access the data for their buildings; they may be unable to compare this with other similar buildings. Through comparisons with similar buildings they may be able to identify changes in configuration of their BMS or modifications to operating practices that can lead to significant savings in energy.

6.3.2 Pilot Adaptation

To access the smart environment pilot it is necessary to have an EPIC username and password and to have rights assigned for access to the smart-environment pilot. This validates the FR1, FR3, FR5, FR7 and FR11 user requirements and allows to access the smart environment pilot. As a citizen with energy monitoring hardware installed it is also for the MAC address of the hardware to be recorded against the username in the EPIC user management database, as this identified that a personalised energy feed should be available. The GMF also requires registration of the MAC address which represents the sensorID, to ensure that MQTT messages published by this sensor to the MQTT broker and subscribed to by the GMF are processed and that valid data is added to the GMF. Without registration of the sensorID with the GMF, MQTT messages will be ignored.

The smart environment pilot followed a different test plan due to delays in implementing all aspects of the pilot following the withdrawal of Hildebrand from the project in M21. In essence test cycles in Manchester were truncated and the pilot implementation phase in Tirgu Mures was integrated into the closed-group testing with Manchester users.

For domestic users in Tirgu Mures the only difference was around language options on the portlet, but the same hardware as used in Manchester was supplied to Tirgu Mures for two domestic installations. The implementation of this feature validates the approach that we explained in test cases section for the FR21 requirement and the respective test case, which were fulfilled in pilot and not in platform level.

For public buildings however things were rather different, as no smart-meter feeds were available from public building in Tirgu Mures. To overcome this problem, a hybrid solution was created where a 3-phase version of the domestic energy monitors was used to measure electricity use in several Kindergartens. However,

whilst the data was delivered using MQTT as per the domestic data, it could not be aggregated with or visualised by the domestic energy dashboard, as it was to be comparable with the Manchester building data visualised by the public building dashboard.

The BCU technical team therefore created a smart web-service, that queried the 6-second power measurement data from the public buildings in Tirgu Mures and returned this as energy consumed in 30-minute periods, the same format as that supplied by the Manchester building smart meters. In this way the domestic energy hardware provided the public building data for Tirgu Mures, which could still be visualised as if it had been supplied by a smart-meter, due to the data-processing functions of the smart web-service. This approach validates that the platform supports several types of (external) data resources and allows effectively for the transformation and visualization of the data to the pilot front end.

6.3.2.1 Closed Cycle Testing: Domestic Energy

The first phases of testing utilised a closed group of around 15 users from Manchester and Birmingham. A key aim of the first test phases was to ensure that the custom firmware developed by BCU for the TP-Link to connect the energy monitor to the MQTT broker functioned properly and could recover from loss of internet connectivity when the user's broadband dropped out, as it common for most domestic installations. These testing processes are highly related to the FR20 for interoperability of services and devices as well as with the non-functional requirement NF6 for high availability. Iterations of firmware were tested to improve the re-establishing of the connection to the MQTT broker when internet connectivity was restores, to remove the need to power-cycle the TP-Link. Feedback on the domestic energy dashboard also led to some layout changes to improve clarity. The latter is rated with the requirements of providing feedback (FR23) and NF1 for usability.

6.3.2.2 Closed Cycle Testing: Public Buildings

The very first phases of public building testing utilised energy feeds from buildings at Birmingham City University to test the dashboard. Initially this was constructed with two sets of portlets, so that data from different buildings could be displayed in different windows. Once the Manchester building data came on stream, from two city buildings and two academies, Manchester City Council energy team staff formed the closed-group for user testing. Closed group testing identified that the multiple-window approach was rather confusing for users and the decision was taken to rework the portlets using single windows with overlaid plots for Open Testing. This satisfied the requirement NF5 for attractive design of the portal and the pilots. However, in this topic there is much space for improvements in a production version of the scenario to meet the end-user expectations.

6.3.2.3 Open Cycle Testing: Domestic Energy and Public Buildings

Open cycle testing was conducted by the Manchester team, involving more than 60 users and using the updated dashboard. Not all open-group users had energy monitoring hardware installed, so those users could see only the averaged energy use of the domestic dashboard, but had the same view of the public dashboard. Open-group users were issued with the latest firmware variants of the TP-Link when installations were carried out by the Manchester installers. A sensor status tab was added to the Admin view of the dashboard to enable Manchester staff to identify sensors that had been offline for some time, so that remedial actions could be taken, depending on the reasons.

6.3.3 Conclusions

The domestic energy solution was created in its entirety by the BCU and IBM technical teams, following the withdrawal of Hildebrand in M21. This led to considerable delays in testing and required the compression of user test cycles, with Tirgu Mures users combined with Manchester users for open-group testing.

The use of MQTT, an IoT protocol for distributed sensors proved extremely effective, and delivered reliably the energy message sent by each domestic sensor once every six seconds, corresponding to 14,400 messages per day per home, which is proof for the high performance capabilities of the application (RUP2), even though this was initial identified for the Urban Planning pilot.

The ability to visualise instantaneous power-usage and cumulative energy consumption helps households to understand their consumption, and particularly the quiescent consumption of the house when unoccupied and the effect of high-load appliances such as electric showers, kettles, electric ovens, water heaters and dishwashers. It should be emphasised that the aim of the domestic energy pilot was to help users understand energy use, not to offer a billing function however, the pilot related requirements RSE1 and RSE3 are considered as well addressed.

In addition to the initial requirements, the Public Buildings dashboard was a new deliverable not contained in the original DoW, and created by the BCU Team to broaden the applicability of smart environment to cities and businesses. The architecture of the GMF which sits behind the smart environment pilot has worked 100% reliably and now contains almost 30 million energy readings, mainly domestic data.

One on-going issue was the stability of domestic broadband connections which could lead to periods of connectivity loss and consequent data loss. In extreme cases this needs rebooting of the domestic router to remedy, but the users need to be alerted to the problem, which was identified as a requirement, FR17, which again was addressed in application and not in pilot level.

7 Requirements Traceability

According to the DoW description and the workshop outcomes in WP2, a concrete list of user requirements had been defined in the beginning of the project, in order to guide the EPIC Project consortium on the various aspects and functionalities that the platform should offer. After an extended discussion between all project's partners (both administrative and technical) an initial list of user requirement was initially defined while in project Y2 and Y3 the requirements list was updated according to the end-user needs, as defined by the Living Labs approach, with respect to the agile development process that was chosen by the consortium. The full list of the user requirements is in detail described in the relevant D2.4 document.

The following list of tables summarizes the traceability matrix, as defined at the D2.4 deliverable, with additional information regarding the test cases that validates each user requirement. The purpose of this matrix is to correlate the outcomes from WP2 which describes "*what the EPIC platform should provide?"* with the outcomes of this documents which answers the question "*what the EPIC platform actually provides?*". Every user requirement is also correlated with the specific test cases which evaluates its purposes as well as with the questionnaire results and the pilot application testing outcomes.

7.1 Requirements Analysis

Table 33: FR1 - Common role-based portal server

FR1	**Common role-based portal server**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-1-1, CC-1-5, CC-5-2, FE-2-2 test cases. All aforementioned test cases were successful.

Result	Based on the test cases, this user requirement is considered addressed. In addition, the feedback received from the questionnaires showed that the portal server related processes were straightforward and the offered functionality satisfying. The core services are in place for now but the capabilities should be enhanced for commercial offerings such as a better pale management system (1.7, 2.1, 2.4)

Table 34: FR2 - Registration of a service

FR2	**Registration of a service**
Severity	**High**
Matching on high-level design	Portal and Forms Server Process Server and Business Rules Service Registry EPIC Service Catalogue
Strategy	The registration will be facilitated by the platform's extended backend, which makes use of the underlying ESB and Service Registry, all parts of the Service Catalogue.
Test Cases	This requirement was tested by the CC-1-1, CC-1-2, FE-2-1 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed which is also confirmed by the questionnaire responses in 2.4. Regarding the pilot scenarios testing, the Relocation application had to register for the Romanian services in order to be provided in the proof of concept city.

Table 35: FR3 - Registration of a stakeholder

FR3	**Registration of a stakeholder – providing credentials and trust evidences**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-1-3, CC-1-5, All aforementioned test cases were successful.
Result	Even though this user requirement is considered addressed, the feedback in the questionnaire (2.3), as well as the pilot testing results highlighted that the registration process need improvements both as a process and the respective GUI, while for some scenarios should be optional. In all scenarios, there was the need to provide some credentials in order to be authenticated by the platform.

Table 36: FR4 - Subscription to a web service

FR4	**Subscription to a web service**
Severity	**Medium**
Matching on high-level design	Portal and Forms Server
Strategy	The EPIC's extended backend components will provide appropriate services to facilitate the service subscription.
Test Cases	This requirement was tested by the CC-1-2, FE-1-3 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. In addition, the fact that the services could be reused through the platform, as proved in the scenarios and also in the questionnaire (2.9), indicates that this requirement was fulfilled.

Table 37: FR5 - Federated single sign on using a single EPIC username

FR5	**Federated single sign on using a single EPIC username**
Severity	**Medium**
Matching on high-level design	Portal and Forms Server 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.
Test Cases	This requirement was tested by the CC-1-5, CC-5-3, FE-1-1 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. However, as already mentioned in FR3, the questionnaire feedback on the user managements highlights the need for accessing the platform without requiring registration, especially for citizens to improve usability (1.3, 1.7, 2.3). The pilot scenarios proved that an end user can successfully login in to the platform by providing only the EPIC username and password, and then have access to all pilot applications that has been registered.

Table 38: FR6 - Search for a web service

FR6	**Search for a web service**
Severity	**Low**
Matching on high-level design	Enterprise Service Bus Service Registry Service Catalogue
Strategy	The search for a web service will be facilitated by the platform's extended backend, which makes use of the underlying ESB and Service Registry, all parts of the Service Catalogue.
Test Cases	This requirement was tested by the CC-1-3 test case. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. There are no negative remarks for this requirement from the questionnaire participants.

Table 39: FR7 - Manage user access rights

FR7	**Provide comfortable possibility to manage user access rights on specific contents of the EPIC's hosted applications**
Severity	**Medium**

Matching on high-level design	Portal and Forms Server Content Accelerator
Strategy	The EPIC's front end will have to consume relevant web services, which are layers at the platform's backend and make use of the Content Accelerator.
Test Cases	This requirement was tested by the CC-1-5, CC-5-2, FE-2-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. The best usage example is in the Urban Planning scenario, where an end user has access to different views of the application (city view, admin view, SME view) according to her/his user rights. In the questionnaire the feedback on platforms security and authorization aspects (2.7) was very positive.

Table 40: FR8 - Possibility to negotiate SLAs when needed

FR8	**Possibility to negotiate SLAs when needed**
Severity	**Low**
Matching on high-level design	EPIC Service Catalogue
Strategy	Even though this is supported natively by the platform it was not considered as a primary objective of the project.
Test Cases	This requirement couldn't be tested in a real life scenario by the EPIC platform, as none of the existed scenarios had taken it into account. However, it was tested offline with the experimentation of the User Catalogue, and it was proved that there is the possibility to define Service Level Definitions, and to negotiate for specific SLAs, using different policies and rules.
Result	Even though specific test cases couldn't validate this requirement as we are in a testing environment, the EPIC Catalogue related implementations prove that the progress on this requirement is satisfying. In a production version of EPIC though, the related features should be even further extended, as indicated by the questionnaire results, in order to attract providers to offer their products in a pan-European level though EPIC (1.8, 1.9).

Table 41: FR9 - Web service enablers

FR9	**Web service enablers to ease the access to the platform DBMS (or external data sources) capable for manipulating significant amount of data**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-2-2 test case. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It is mainly implemented in the Relocation scenario, where the application consumes data from two different external providers with different data format. Also confirmed by 2.2 question.

Table 42: FR10 - Time zone and multicurrency support

FR10	**Time zone and multicurrency support**
Severity	**Low**
Matching on high-level design	Pilot Services
Strategy	Supported natively by the platform. The pilot services will be parameterized accordingly.
Test Cases	This requirement was tested *by the CC-3-1, CC-3-2 test cases which were not fulfilled directly* since the related features will be implemented by the pilot applications that need it.
Result	This requirement has a low level of severity and was not directly related with the EPIC Pilot applications (see also question 2.8). Therefore it was decided by the EPIC's consortium to concentrate to other requirements of higher priority.

Table 43: FR11 - Role-based user interface

FR11	**Role-based user interface**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-1-5, CC-5-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. As already mentioned in previous requirements the received feedback on the interfaces highlighted the need for improvements in a production version with a more modern design (1.3, 1.6, 1.7).

Table 44: FR12 - Administration interface

FR12	**Administration interface**
Severity	**High**
Matching on high-level design	Portal and Forms Server Directory 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.
Test Cases	This requirement was tested by the CC1-2, CC-1-5, CC-5-2, FE-1-1, FE1-2, FE-2-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. From the questionnaire besides the negative feedback for the look 'n feel, the provided functionality through the administration interface is satisfying (question 2.1).

Table 45: FR13 - Registration Page

FR13	**Registration Page**

Severity	**High**
Matching on high-level design	Portal and Forms Server Process Server and Business Rules Directory Server
Strategy	EPIC will provide through the integrated front end a registration page, which relies on the platform's extended backend, which makes use of the Directory Server.
Test Cases	This requirement was tested by the CC-1-5, CC-5-2, FE-1-1, FE-1-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered as addressed. Even though the required functionality is provided the questionnaire feedback highlighted problematic registration processes that should be improved and in some cases skipped allowing open access to citizens (questions 1.2, 1.7, 2.3)

Table 46: FR14 - Service registration screen

FR14	**Service registration screen**
Severity	**High**
Matching on high-level design	Portal and Forms Server Directory 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.
Test Cases	This requirement was tested by the CC-1-2, FE-1-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. Also positive feedback was received through the questionnaire (questions 2.1, 2.4)

Table 47: FR15 - Personal Space

FR15	**Personal Space**
Severity	**Medium**

Matching on high-level design	Portal and Forms Server Directory Server Enterprise Service Buss
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.
Test Cases	This requirement was tested by the CC-1-5, FE-1-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It is mainly tested in the Smart Environment scenario, where citizens can experience a personalized view of their energy consumption.

Table 48: FR16 - Advanced search for services

FR16	**Advanced search for services**
Severity	**Low**
Matching on high-level design	Portal and Forms Server Service Registry Enterprise Service Bus EPIC Service Catalogue
Strategy	The search for a web service will be facilitated by the platform's extended backend, which makes use of the underlying ESB and Service Registry, all parts of the Service Catalogue.
Test Cases	This requirement was tested by the CC-1-3 test case. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. No feedback from the questionnaire on this requirement.

Table 49: FR17 - Notification List

FR17	**Notification List (for new services)**
Severity	**Low**
Matching on high-level design	EPIC Catalogue

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.
Test Cases	This requirement was tested by the CC-1-5, FE-4-2 test cases. Although the CC-1-5 test case was succeeded and the platform allows to record custom notification messages so as to be used by the application providers, the FE-4-2 results were contradictive. Even though the platform was able to log the operational parameters of the pilot applications, in platform level there no notification mechanism was in place to inform administrators or end-users for new services. A notification mechanism was also implemented by the Smart Environment pilot services that are deployed on the platform, which monitored the heartbeat of the sensors and notified the administrators for failures.
Result	This requirement is considered as partially addressed.

Table 50: FR18 - Promoted/Latest services area

FR18	**Promoted/Latest services area**
Severity	**Low**
Matching on high-level design	EPIC Catalogue
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.
Test Cases	This requirement was tested by the CC-1-3 test case. Although the CC-1-3 test case was succeeded and the new services are listed, no particular capabilities were implemented in EPIC Catalogue to promote or advertise them since this is clearly a business issue that should be architected according to the business aspects of the production version of EPIC platform.
Result	This requirement is considered as partially addressed.

Table 51: FR20 - Interoperability

FR20	**Interoperability**
Severity	**High**
Matching on high-	Enterprise Service Bus and Service Registry

level design	
Strategy	Standard formats will have to be used, in order to ensure the smooth communication between all components, in order to facilitate integration issues.
Test Cases	This requirement was tested by the CC-1-5, CC-1-6 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It is mainly proved on the Tirgu Mures proof of concept related implementations, when the same application had to be configured differently in order to consume data from different providers. The EPIC platform facilitates the transportation of the application from Brussels to Romania and the easiness of reconfiguration, proving the interoperability capabilities of the platform. Moreover, the Smart Environment introduced a new firmware so that the EPIC can connect to different technology providers of sensors. Also in the questionnaire results (questions 1.9, 2.2, 2.9) we identified the interoperability and reuse of services are very important and allow for pan-European delivery of the various "smart" applications.

Table 52: FR21 - Multilanguage support

FR21	**Multilanguage support**
Severity	**Low**
Matching on high-level design	Portal and Forms Server Database Management System Pilot Services
Strategy	The platform should exploit semantic annotation capabilities, but the strategy to address this requirement has not been defined yet.
Test Cases	This requirement was tested by the CC-1-6, C-3-3 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It is mainly addressed in the Tirgu Mores scenario, where the same relocation application can be offered in two different languages (Romanian and Hungarian) at the same pilot city. Also, the Smart Environment had the option to be translated to the Romanian language, if there was an end user from this country. Even though this is not a fundamental requirement, questionnaire participants agreed that the proof of concept is a good example of cross-border customization (question 2.8).

Table 53: FR22 - Semantic annotation for web services

FR22	**Semantic annotation for web services**
Severity	**Medium**
Matching on high-level design	Web Service Registry and Repository
Strategy	This is supported during the design of the various web services.
Test Cases	This requirement was tested by the CC-1-5 test case. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It is mainly proved in the relocation scenario, where the description of the real estate properties were semantically annotated so as to be easily translated to the end user's native language. No specific comments related with this requirement in the questionnaires.

Table 54: FR23 - Feedback

FR23	**Feedback**
Severity	**Low**
Matching on high-level design	Database Management System Pilot Services
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.
Test Cases	This requirement was tested by the CC-4-1, FE-4-1 test cases. Although the test cases CC-4-1 succeeded and the platform do allow to log feedback about the existing services, the FE-4-1 did not succeed, and there is no specific mechanism for the user interaction for providing or accessing this kind of information.
Result	This requirement is considered partially addressed**.** The feedback in the related questionnaire response (question 1.4) was that it was preferable for the pilots to use their specific or external tools, following the familiar for them Living Lab processes. This requirement had minor impact for the pilot operations.

Table 55: FR24 - Statistics & Analytics

FR24	**Statistics & Analytics**
Severity	**Low**
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.
Test Cases	This requirement was tested by the CC-1-5, FE-4-1 test cases. Although the EPIC platform offers a sophisticated mechanism for collecting statistics and analytics, based mainly on the strength of IBM's Smart Cloud environment and the extended capabilities of the User Management backend component, there is no specific portlet for accessing this information.
Result	This requirement was well exploited by the city administrators of Brussels, who can produce meaningful conclusions regarding the citizens habits and preferences. Also, it was one of the core functionalities of the Smart Environment scenario.

Table 56: FR25 - Clean up all user history

FR25	**Clean up all user history when the user unregisters**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-1-5 test case which was successful.

Result	This user requirement is considered addressed.

Table 57: FR26 - Database supporting different pilot application needs

FR26	**Database supporting different pilot application needs**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-2-1, FE-2-3 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It is mainly covered by the Smart Environment scenario, where the MAC address of the end users' sensors had to be stored. Also based on the questionnaire results (questions 2.2, 2.4, 2.8, 2.9) the data management and aspects were also considered of major importance and the feedback for the platform capabilities on this was positive.

Table 58: NF1 - Usability

NF1	**Usability**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-1-8 test case. All aforementioned test cases were successful.
Result	This user requirement is considered addressed however; the feedback from the questionnaires (questions 1.3, 1.6, 2.3, 2.4) indicates that while the administrative GUIs are satisfying, there is space for improvements, mainly modernization, for the end users interface.

Table 59: NF2 - Privacy Protection

NF2	**Privacy Protection**
Severity	**High**
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.
Test Cases	This requirement was tested by the CC-5-1 test case and was successful.
Result	This user requirement is considered addressed. A usage example was in the Smart Environment scenario where the building identification and location had to be anonymous in order to ensure the privacy of this sensitive data. Finally, in the questionnaires not privacy issues have been reported from the participants.

Table 60: NF3 - Security

NF3	**Security – rule-based authentication and authorization**
Severity	**Low**
Matching on high-level design	Portal and Forms Server

	Federated Identity Manager
Strategy	This is supported natively by the platform.
Test Cases	This requirement was tested by the CC-5-1, CC-5-2 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. It should be noted that security is very important for all web applications, as also highlighted in the questionnaires (question 2.7). However, the low severity here indicates that it was within the project's development processes the primary focus of the platform and off the shelve solutions have been implemented.

Table 61: NF4 - Support for mobile devices

NF4	**Support for mobile devices**
Severity	**High**
Matching on high-level design	Portal and Forms Server Pilot Services
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.
Test Cases	This requirement was tested by the CC-1-8 test case which was successful.
Result	This user requirement is considered addressed.

Table 62: NF5 - Attractive design of EPIC web portal and pilot applications

NF5	**Attractive design of EPIC web portal and pilot applications**
Severity	**Medium**
Matching on high-level design	Portal and Forms Server Pilot Services
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.

Test Cases	This requirement was tested by the CC-1-8 test case which was successful.
Result	This user requirement is considered addressed. However in the questionnaire results (questions 1.3, 1.6) we see that a more modern design was expected, something that should be addressed in future versions of the application and pilot elements in order to reach a broader audience and increase the user engagement.

Table 63: NF6 - High availability

NF6	**High availability**
Severity	**Medium**
Matching on high-level design	EPIC Platform
Strategy	The developers should implement the platform in order to serve more than 500 users.
Test Cases	This requirement was tested by the CC-1-7 test case which was successful.
Result	This user requirement is considered addressed. It is mainly tested by the Smart Environment scenario where a lot of effort was spent trying to ensure that the application will function even after periods of local loss of connectivity. Also the performance of all other platform and application services was satisfying. From the questionnaire results (2.6) we observed positive feedback.

Table 64: RRS1 - Multi-Cultural Description of the Real Estate Properties

RRS1	**Multi-Cultural Description of the Real Estate Properties**
Severity	**Low**
Matching on high-level design	-
Strategy	-
Test Cases	**-**
Result	This requirement was not tested by a test case in the scope of the EPIC project. It was decided to be of lowest priority and no pilot

	scenario adopted it. Therefore this requirement was not addressed however cross border customization is offered by the project. No issue regarding this requirement was raised from the questionnaire participants.

Table 65: RRS2 - GIS/Map for showing points of interest

RRS2	**GIS/Map for showing points of interest, real estate properties, etc.**
Severity	**High**
Matching on high-level design	Portal and Forms Server Pilot services
Strategy	Properties and surrounding points-of-interest are shown on a Google Maps plugin, interchangeable for another map plugin should the need arise.
Test Cases	This requirement was tested by the FE-3-1 test case which was successful.
Result	This user requirement is considered addressed. It is shown at the relocation application. No reference on this issue from the questionnaire participants.

Table 66: RRS3 - Reach as many smart phone platforms as possible

RRS3	**Reach as many smart phone platforms as possible and minimize software development effort**
Severity	**Low**
Matching on high-level design	Pilot Services
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.
Test Cases	This requirement was tested by the CC-1-8, FE-3-1 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. The mobile relocation application has been developed using frameworks

	compatible with iOS, Android and Blackberry devices. No reference on this issue from the questionnaire participants.

Table 67: RUP1 - GIS

RUP1	**GIS**
Severity	**High**
Matching on high-level design	Portal and Forms Server
Strategy	The platform should make use of common standards.
Test Cases	This requirement was tested by the FE-3-1 test case, which was successful.
Result	This user requirement is considered addressed. It has been proved at the Urban Planning scenario. No reference on this requirement from the questionnaire participants.

Table 68: RUP2 - Performance of architecture

RUP2	**Performance of architecture**
Severity	**High**
Matching on high-level design	EPIC Platform
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.
Test Cases	This requirement was tested by the CC-1-7 test case. All aforementioned use cases were successful.
Result	This user requirement is considered addressed. The mobile relocation application makes especially use of REST/JSON technologies to minimize the communication overhead so as to achieve minimal delays. Moreover, the Smart Environment scenario makes use of huge amount of continuous data, coming from the sensors and being aggregated into the pilot application. One important remark from the questionnaire participants (question 2.6) was that the workload depends largely on the type of

	application and its use by end-users.

Table 69: RSE1 - Domestic Energy Monitoring

RSE1	**Domestic Energy Monitoring**
Matching on high-level design	EPIC Platform Pilot Services
Strategy	The pilot will provide that respective services that will be deployed on the platform.
Test Cases	There is no specific test case for this requirement. This requirement is close related to the Smart Environment application. Their final definition was delayed due to the withdrawal of Hildebrand from the project. Due to this, no test case was defined at the time when the D8.1 document was delivered.
Result	This requirement is considered addressed. The Smart Environment scenario managed to monitor domestic energy data feeds, being able to use data feeds coming from sensors provided by a variety of technology providers due to a common firmware. No reference on this requirement from the questionnaire participants.

Table 70: RSE3 - Examine overall household energy usage

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.
Test Cases	There is no specific test case for this requirement. This requirement is close related to the Smart Environment application. Their final definition was delayed due to the withdrawal of Hildebrand from the project. Due to this, no test case was defined at the time when the D8.1 document was delivered.
Result	This requirement is considered addressed. The Smart Environment scenario managed to aggregate data feeds coming from different data providers (end users) and presents them in a graphical dashboard. The main objective of this scenario is to examine and understand the energy consumption in order to identify ways to reduce it, rather

	than find ways to bill it. No reference on this requirement from the questionnaire participants.

Table 71: DE1 - Application Development

DE1	**Application Development**
Severity	**Low**
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.
Test Cases	This requirement was tested by the CC-1-1, DE-1-1 test cases. All aforementioned test cases were successful.
Result	This user requirement is considered addressed.

Table 72: DE4 - Application Adapters

DE4	**Application Adapters**
Severity	**Low**
Matching on high-level design	-
Strategy	External adapters must cover the majority of external applications that are needed in average application (i.e. databases).
Test Cases	This requirement was tested by the DE-1-2 test case. All aforementioned test cases were successful.
Result	This user requirement is considered addressed. This was also highlighted in the questionnaire responses (question 2.1, 2.2) as one of the project advantages in cases where access to external data resources is required.

7.2 Requirements Traceability Results

Following the analysis of each requirement in the previous section we summarize our findings in the following requirements traceability matrix. In the 'y' axis, the full list of the user requirements is presented, as defined in the relevant D2.4 document. Then, the 'x' axis presents the correlation between them and the i) the outcomes of the test cases as described in section 4, ii) the outcomes of the questionnaires as described in section 2, and iii) the relevant pilot application scenarios that make use and validates each requirement. The purpled coloured lines indicate requirements that were finally addressed by the EPIC platform, while the blue coloured lines indicate requirements that were partially addressed by the platform.

Table 73: Requirements Traceability Matrix

Requirement		Test Cases		Questionnaire	Pilot Testing Results		
ID	Name	Successful	Failed		Relocation	Urban Planning	Smart Environment
FR1	Common role-based portal server	CC-1-1, CC-1-5, CC-5-2, FE-2-2		1.7, 2.1, 2.4	X	X	X
FR2	Registration of a service	CC-1-1, CC-1-2, FE-2-1		2.4	X		
FR3	Registration of a stakeholder	CC-1-3, CC-1-5		2.3	X	X	X
FR4	Subscription to a web service	CC-1-2, FE-1-23		2.9	X		
FR5	Federated single sign	CC-1-5, CC-5-3, FE-1-1		1.3, 1.7, 2.3	X	X	X
FR6	Search for a web service	CC-1-3			X	X	
FR7	Manage user access rights	CC-1-5, CC-5-2, FE-2-2		2.7	X	X	X
FR8	Possibility to negotiate SLAs when needed			1.8, 1.9			
FR9	Web service enablers	CC-2-2		2.2	X	X	
FR10	Time zone and multicurrency support		CC-3-1, CC-3-2	2.8			
FR11	Role-based user interface	CC-1-5, CC-5-2		1.3, 1.6, 1.7	X	X	X
FR12	Administration interface	CC-1-2, CC-1-5, CC-5-2, FE-1-1,		2.1			

		FE-1-2, FE-2-2					
FR13	Registration Page	CC-1-5, CC-5-2, FE-1-1, FE-1-2		1.2, 1.7, 2.3			
FR14	Service registration screen	CC-1-2, FE-1-2		2.1, 2.4			
FR15	Personal Space	CC-1-5, FE-1-2					X
FR16	Advanced search for services	CC-1-3					
FR17	Notification List	CC-1-5	FE-4-2				
FR18	Promoted/Latest services area	CC-1-3					
FR20	Interoperability	CC-1-5, CC-1-6		1.9, 2.2, 2.9	X	X	X
FR21	Multilanguage support	CC-1-6, CC-3-3		2.8	X		X
FR22	Semantic annotation for WS	CC-1-5			X		
FR23	Feedback	CC-4-1	FE-4-1	1.4			X
FR24	Statistics & Analytics	CC-1-5			X		X
FR25	Clean up all user history	CC-1-5					
FR26	Database supporting different pilot application needs	CC-2-1, FE-2-3		2.2, 2.4, 2.8, 2.9	X		X
NF1	Usability	CC-1-8		1.3, 1.6, 2.3, 2.4		X	
NF2	Privacy Protection	CC-5-1			X		X
NF3	Security	CC-5-1, CC-5-2		2.7	X		
NF4	Support for mobile devices	CC-1-8			X	X	
NF5	Attractive design of EPIC web portal and pilot applications	CC-1-8		1.3, 1.6	X	X	X
NF6	High availability	CC-1-7		2.6	X		X
RRS1	Multi-Cultural Description				X		
RRS2	GIS/Map for showing points of interest	FE-3-1			X	X	
RRS3	Reach as many smart phone platforms as possible	CC-1-8, FE-3-1			X	X	

RUP1	GIS	FE-3-1				X	
RUP2	Performance of architecture	CC-1-7		2.6	X		X
RSE1	Domestic Energy Monitoring						X
RSE3	Examine overall household energy usage						X
DE1	Application Development	CC-1-1, DE-1-1					X
DE4	Application Adapters	DE-1-2		2.1, 2.2			X

From the above traceability matrix, the EPIC platform can be considered as a success one, as it has covered all main user requirements. In the following diagram we highlight the percentage of all succeed requirements compared to the ones that was partially succeed and not addressed at all.

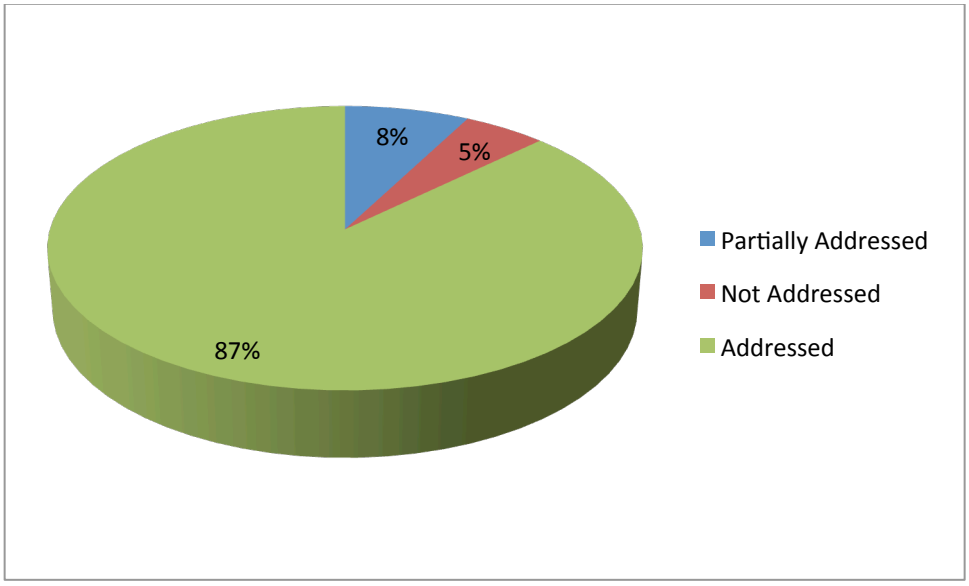


Figure 8: EPIC Project Requirements Results

Requirements Partially Addressed (FR17, FR18, FR23)

As it is mentioned from the previous diagram, there are some minor requirements that were partially addressed. The core functionalities however of the EPIC are already implemented and the platform effectively provides them. This was also validated by the feedback that was received from the internal questionnaires as no blocking issues were identified. The partially addressed requirement FR17 and FR18 (promoted services and notifications on service use) had no value for the experimental use of the platform within the project and the consortium focused on the fundamental aspects. However, it should be noted that the underlying and supporting platform services for these requirements are in place as part of the EPIC Catalogue, since they are also used to fulfil other requirements. Regarding FR23 for a feedback system, we decided to follow the well-established processes and tools of the living labs instead of implementing features whose value for the project would be questionable.

Requirements Not Addressed (FR10, RRS1)

These were defined at the very initial phase of the project development, when the EPIC consortium was not clear about the scope of the platform and the definition of the pilot use cases hadn't started yet. One of those requirements was related with

the need from the platform to support multicurrency and different time zones (FR10) as well as with the multicultural description of the real estate properties (RRS1). It proved that there is no need for EPIC to address the different time zones, as this can be successfully done in pilot level. Moreover, there is no pilot scenario that could benefit from handling different currencies. So these requirements were considered as out of scope and the technical team of EPIC decided to omit them from the final platform delivery. In all cases, these requirements were considered from the beginning as of lowest priority that would not affect the project's initial objectives.

8 Conclusions

In this document we described the WP8 activities for the effective evaluation and validation of the project outcomes. These activities, which focused on the EPIC platform elements and the pilot services and scenarios, run in parallel with the proof of concept and roadmap evaluation that is being reported in D8.3. As part of this validation process a) the results of WP7 end-user testing results have been analysed from the WP8 perspective, b) internal questionnaires regarding the perceived experience working with the EPIC Platform have been circulated and the feedback was associated with the requirements, c) specific test cases on the key platform features were implemented and finally d) performance tests and analysis of the system logs have been conducted. All outcomes of both end-user testing and platform testing have been analysed independently and combined in order to validate that all requirements identified in WP2 and presented in the traceability matrix are effectively addressed and the strategy that has been followed for each one of them is aligned with the testing results. The feedback and the analysis outcomes have been very positive however, weaknesses in 5 of the identified requirements were also identified. The severity of these requirements though was considered as low and by no means could limit the value of EPIC as a unique "smart" city platform for delivering services in a pan-European level. As a conclusion, WP8 validated that the EPIC platform and the various pilot elements fulfil their purpose and are capable to realize the vision of a city to become "smart" and offer advanced services to citizens and visitors.

Annex A: Screenshots from Test Cases

Test Case CC-1-1

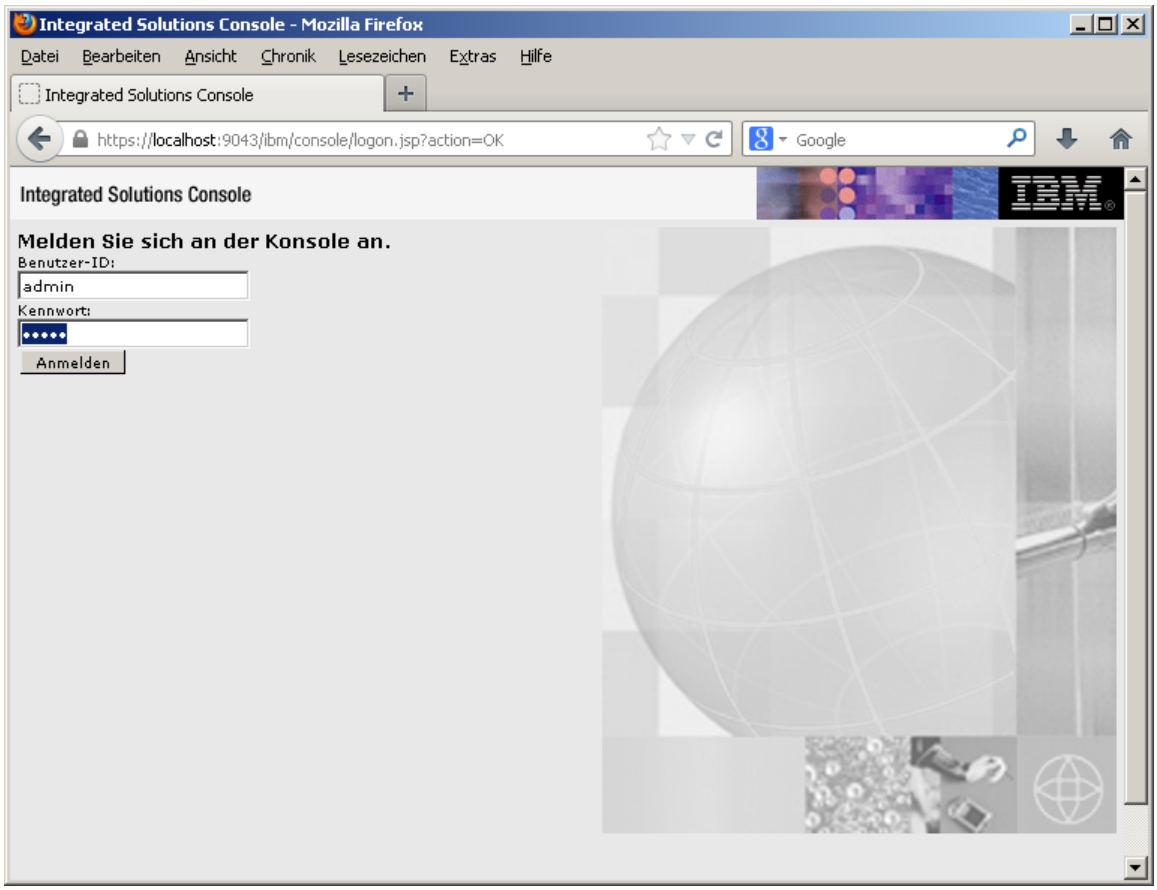


Figure 9: Test Case CC-1-1 – Step1

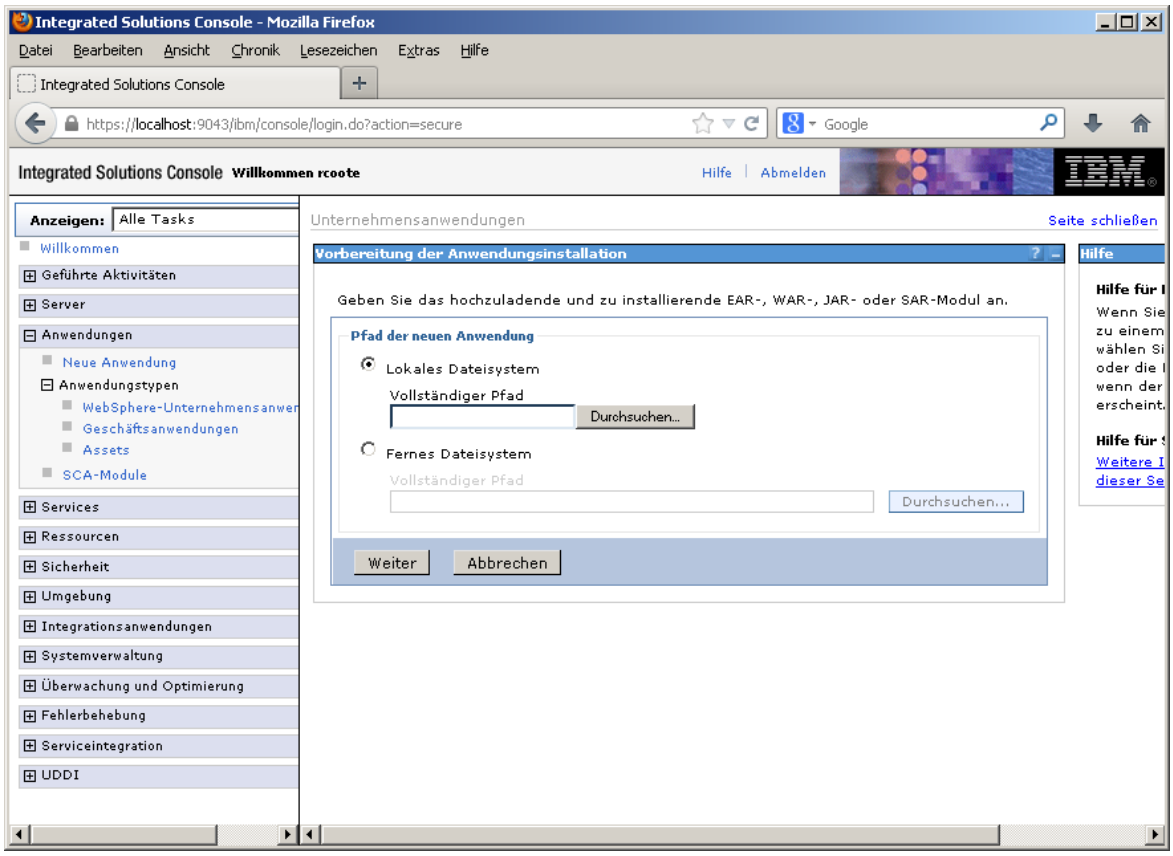


Figure 10: Test Case CC-1-1 – Step2

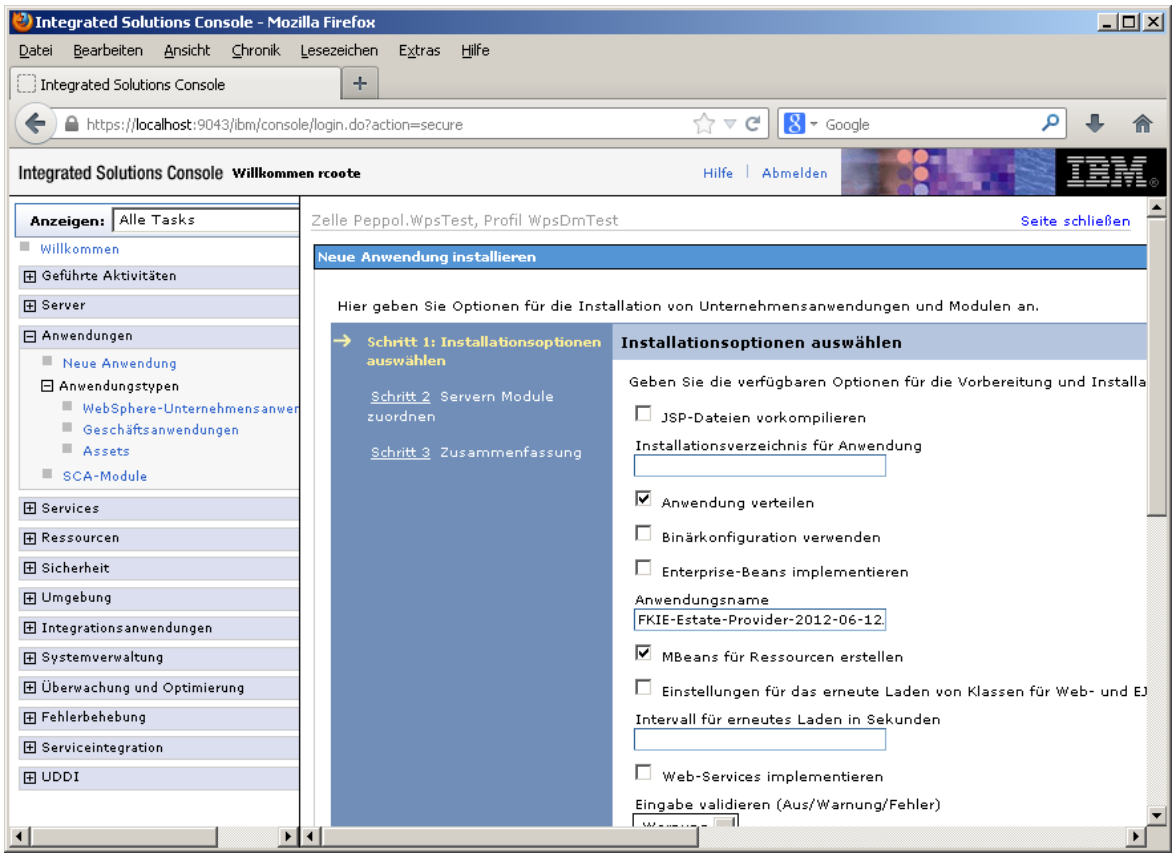


Figure 11: Test Case CC-1-1 – Step3

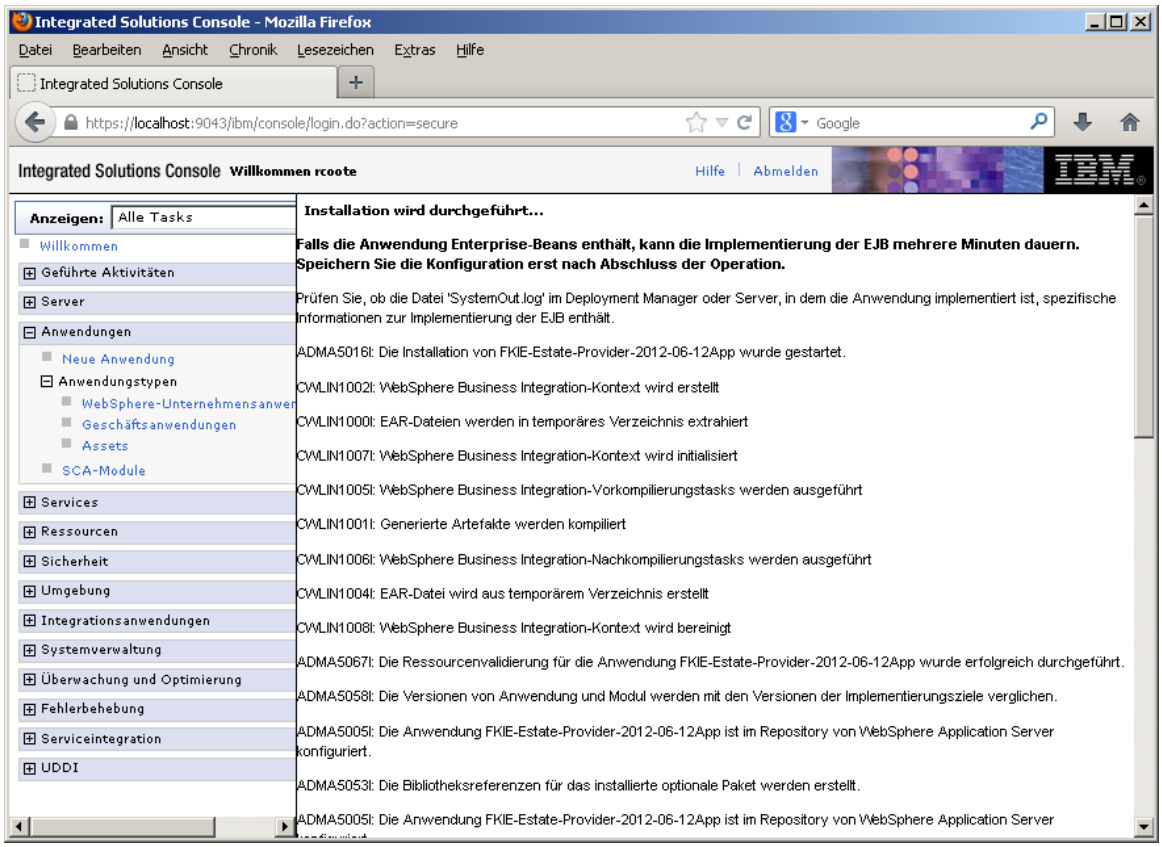


Figure 12: Test Case CC-1-1 – Step4

Test Case CC-1-2

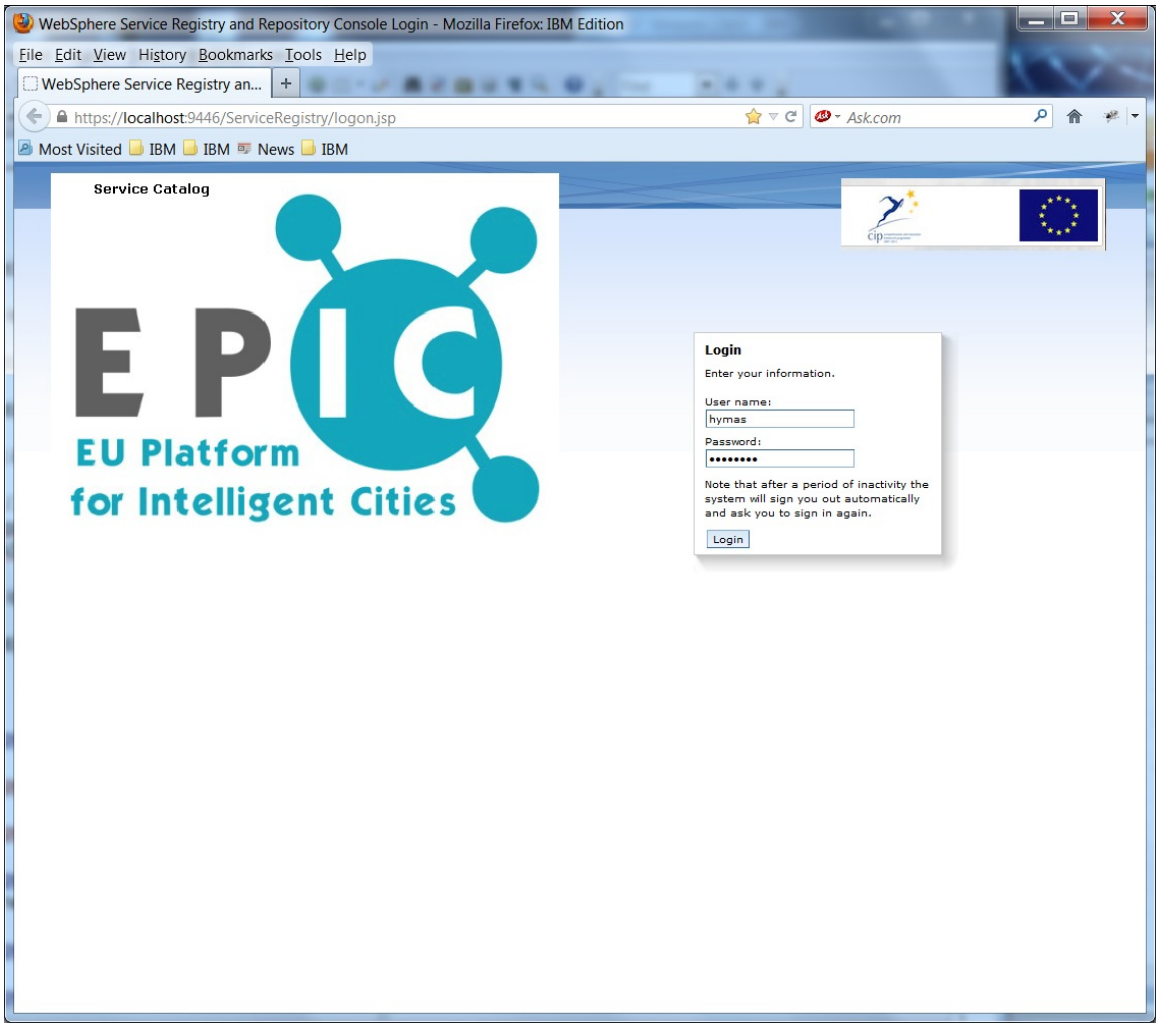


Figure 13: Test Case CC-1-2 – Step1

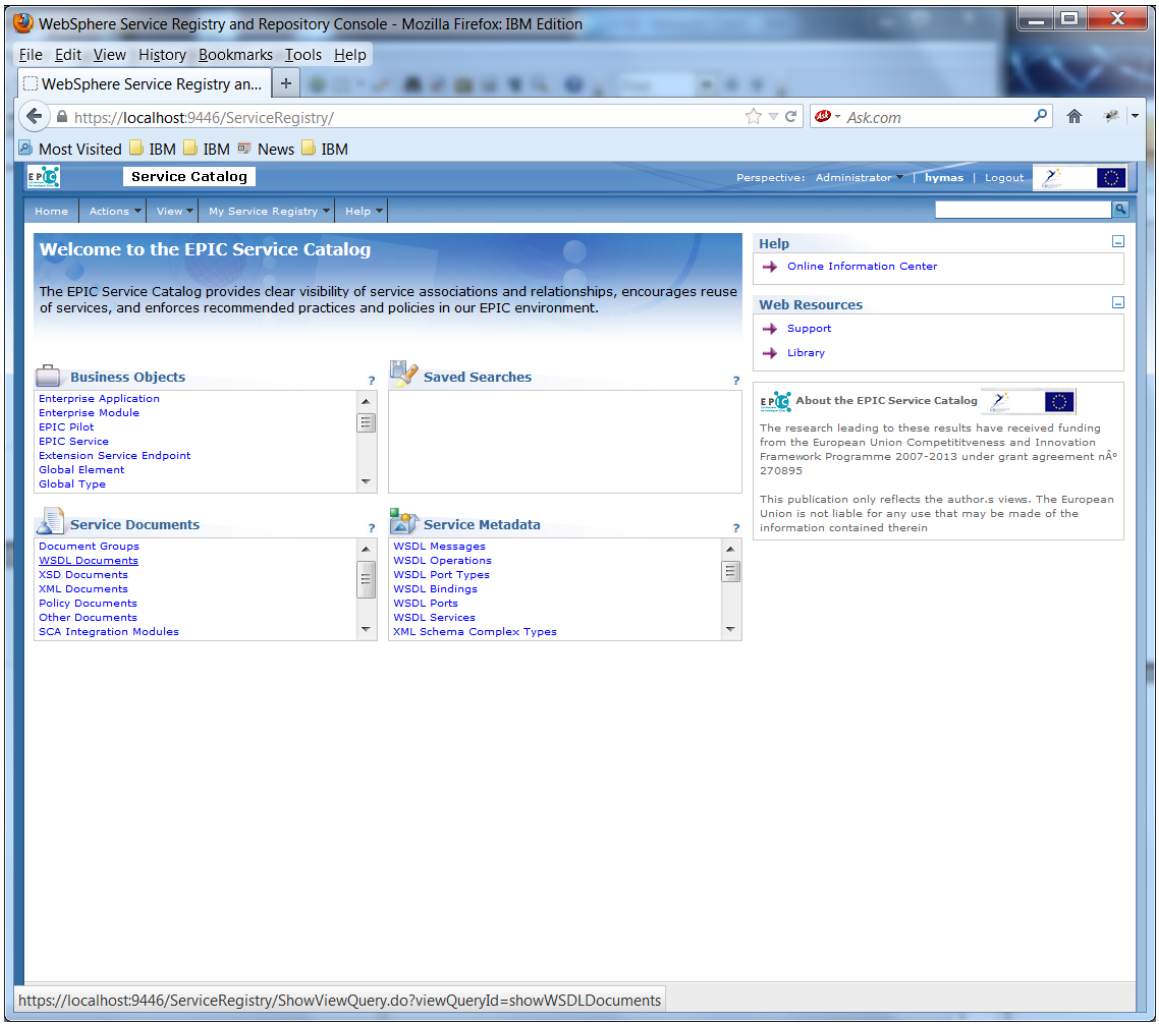


Figure 14: Test Case CC-1-2 – Step2

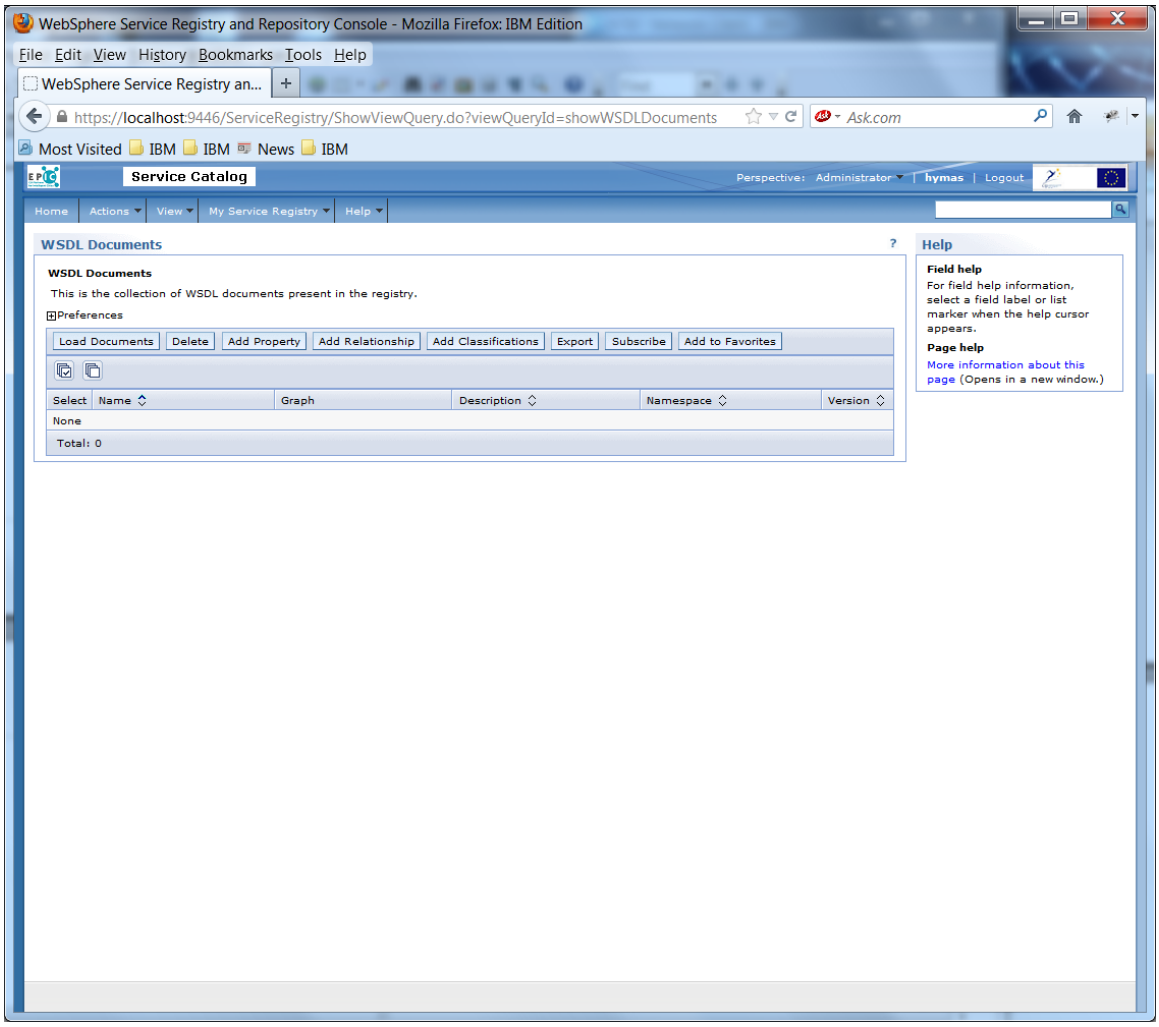


Figure 15: Test Case CC-1-2 – Step3

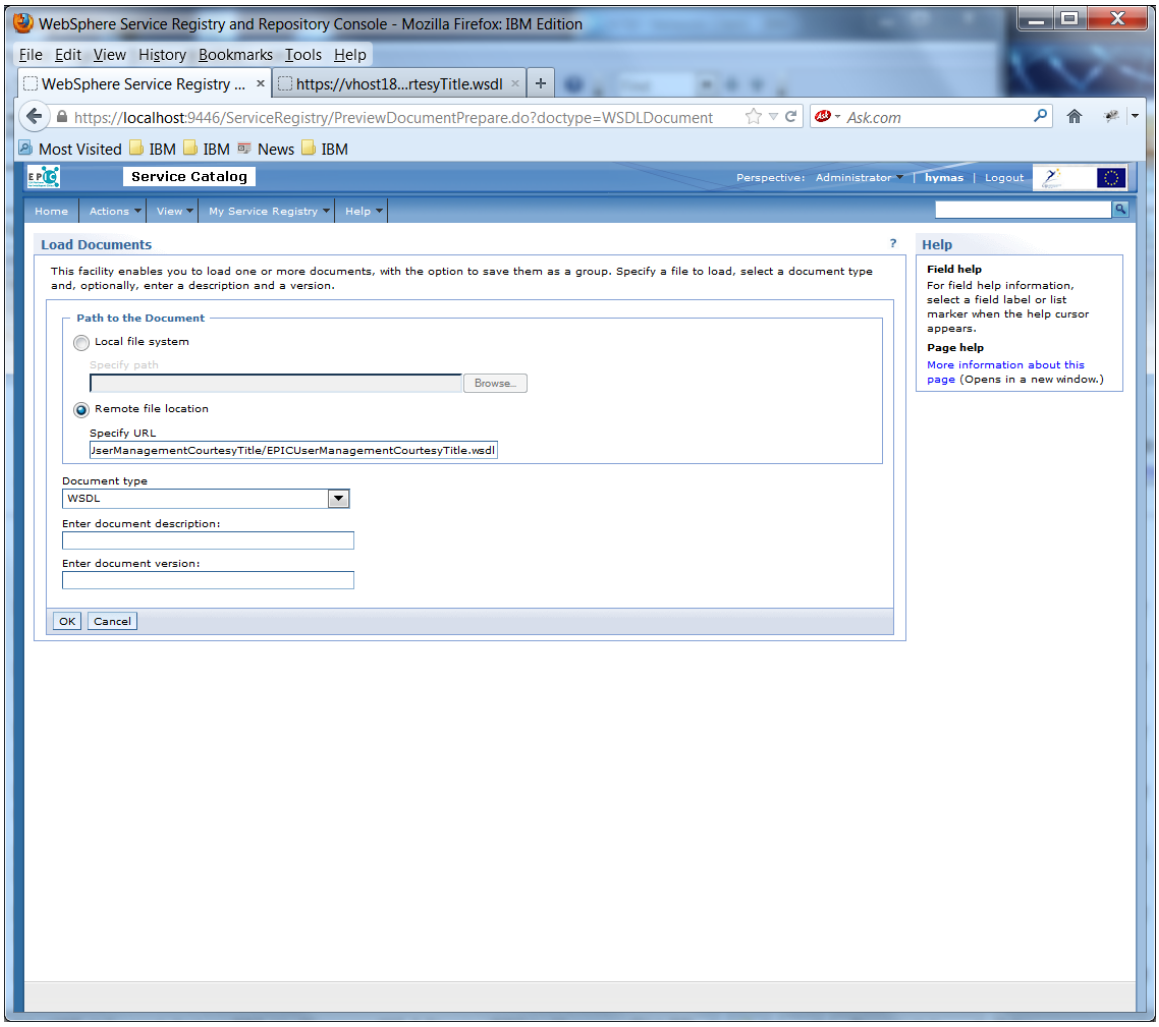


Figure 16: Test Case CC-1-2 – Step4-5

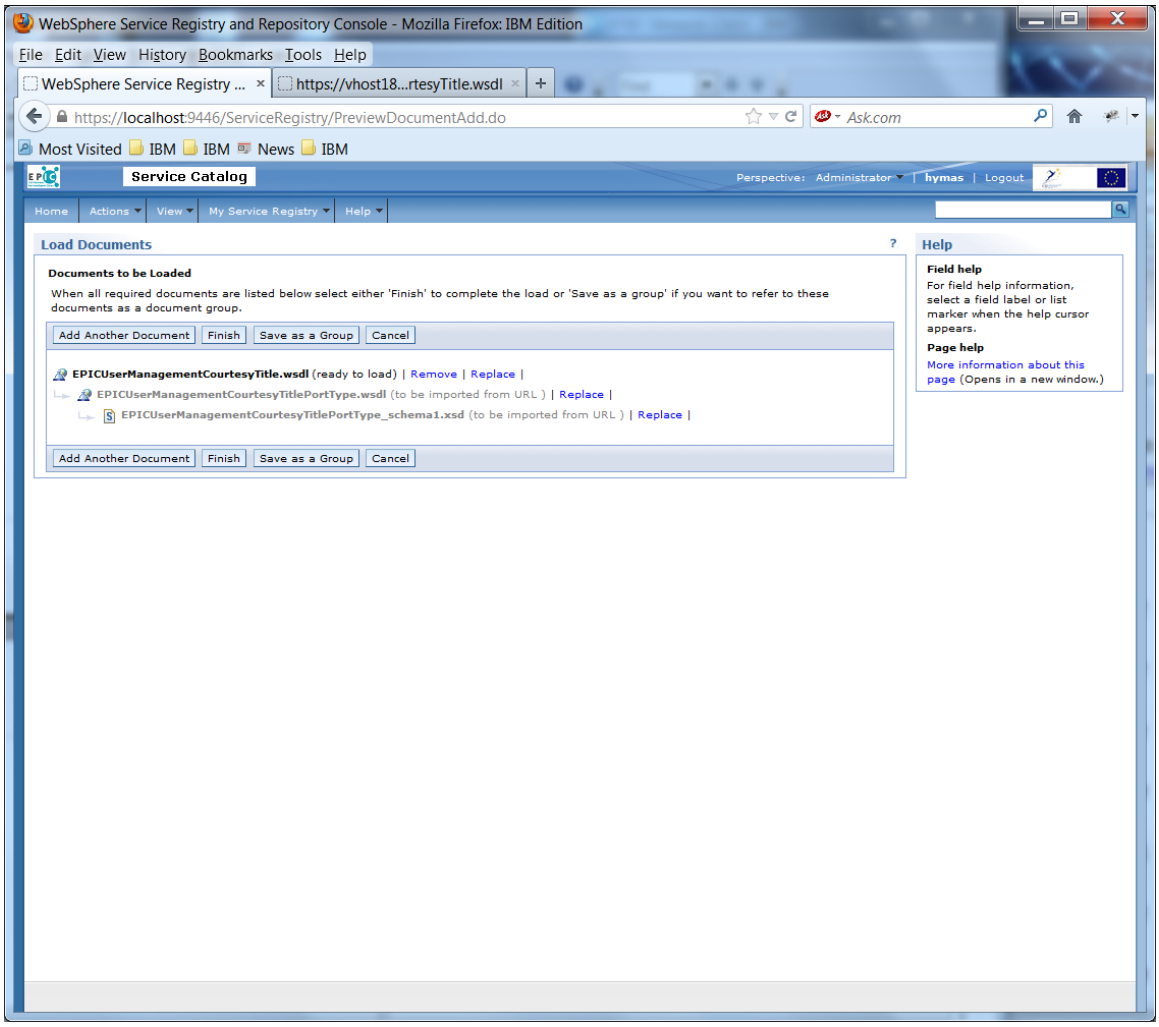


Figure 17: Test Case CC-1-2 – Step6

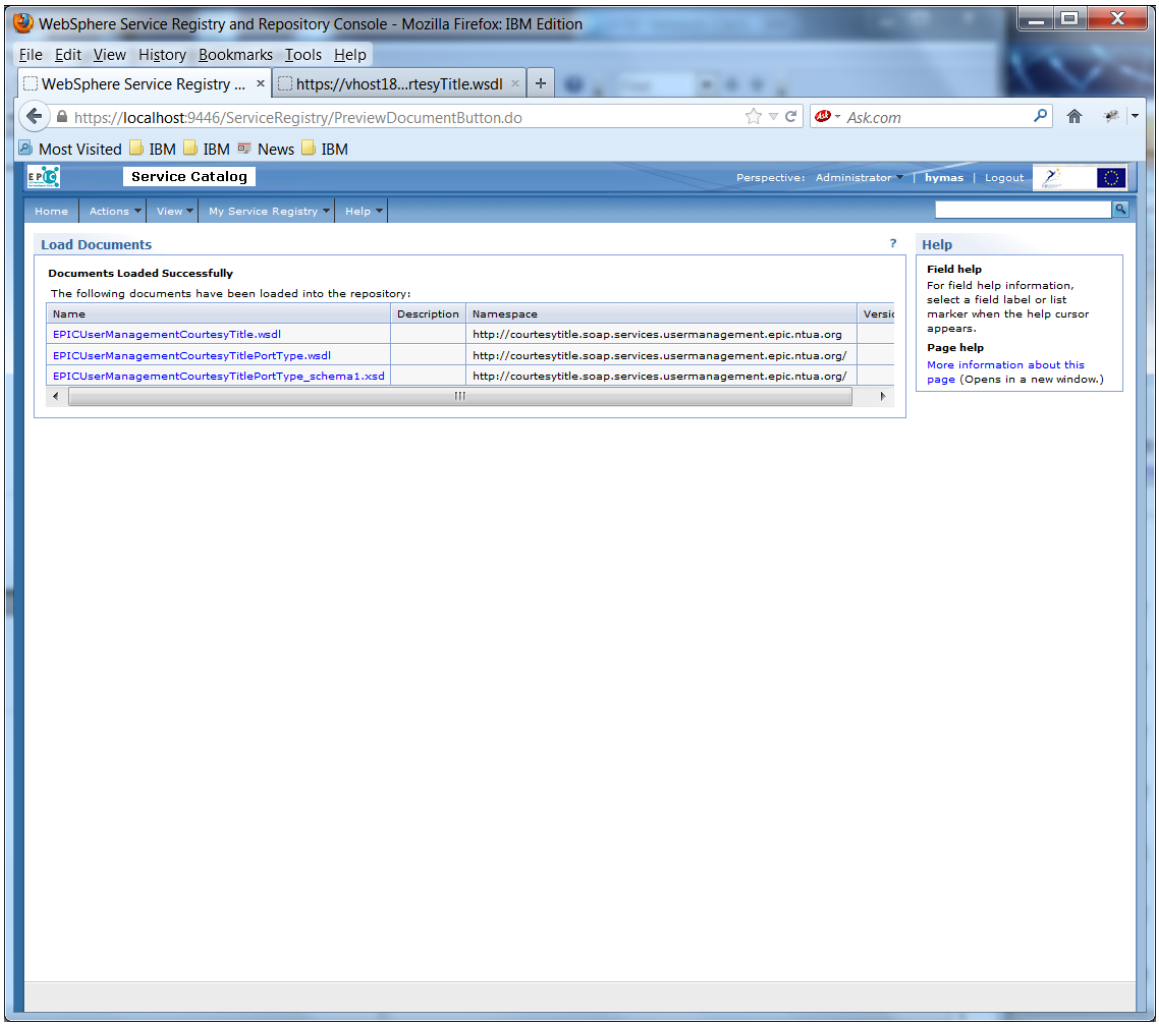


Figure 18: Test Case CC-1-2 – Step7

Test Case CC-1-3

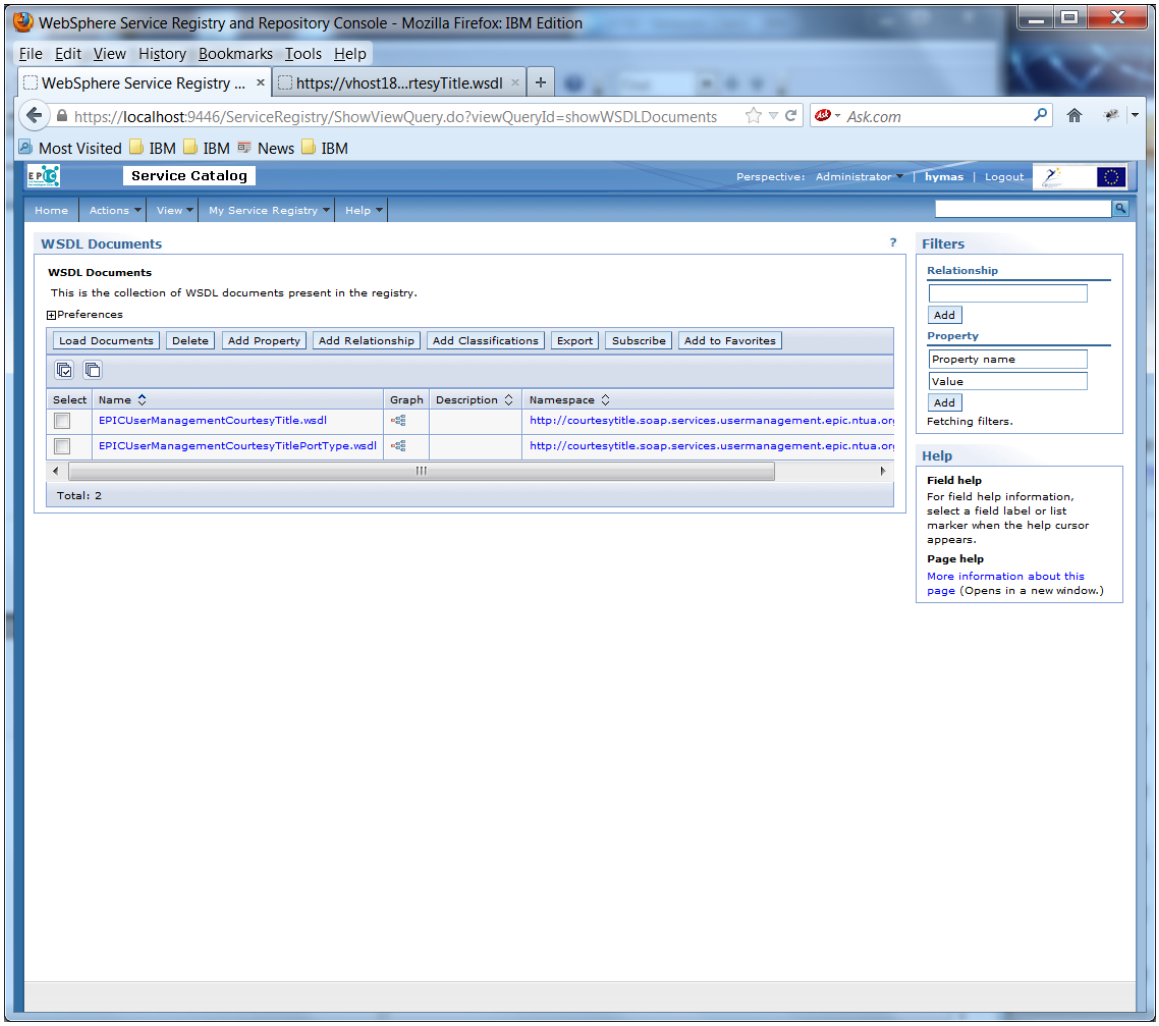


Figure 19: Test Case CC-1-3

Test Case CC-1-4

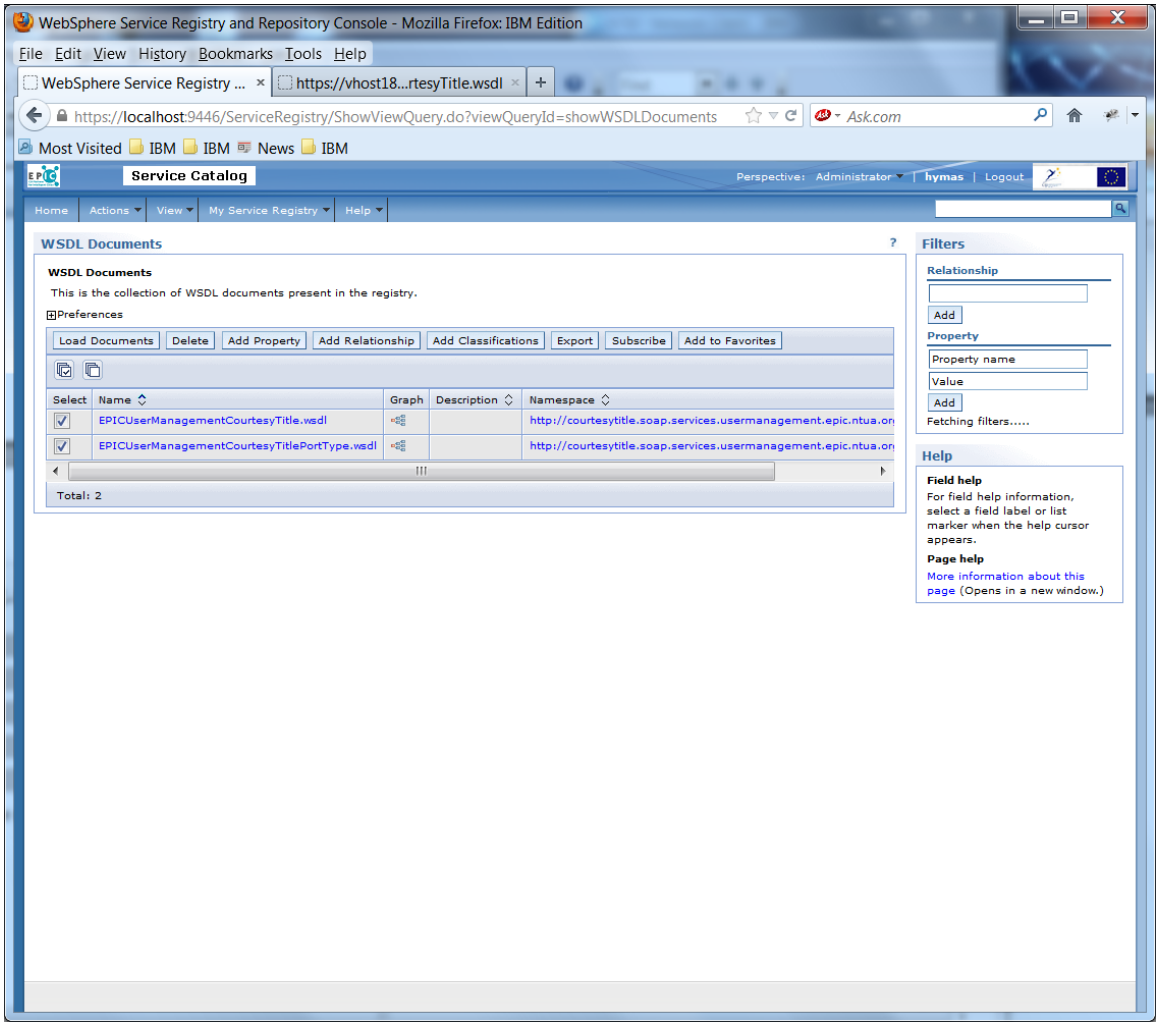


Figure 20: Test Case CC-1-4

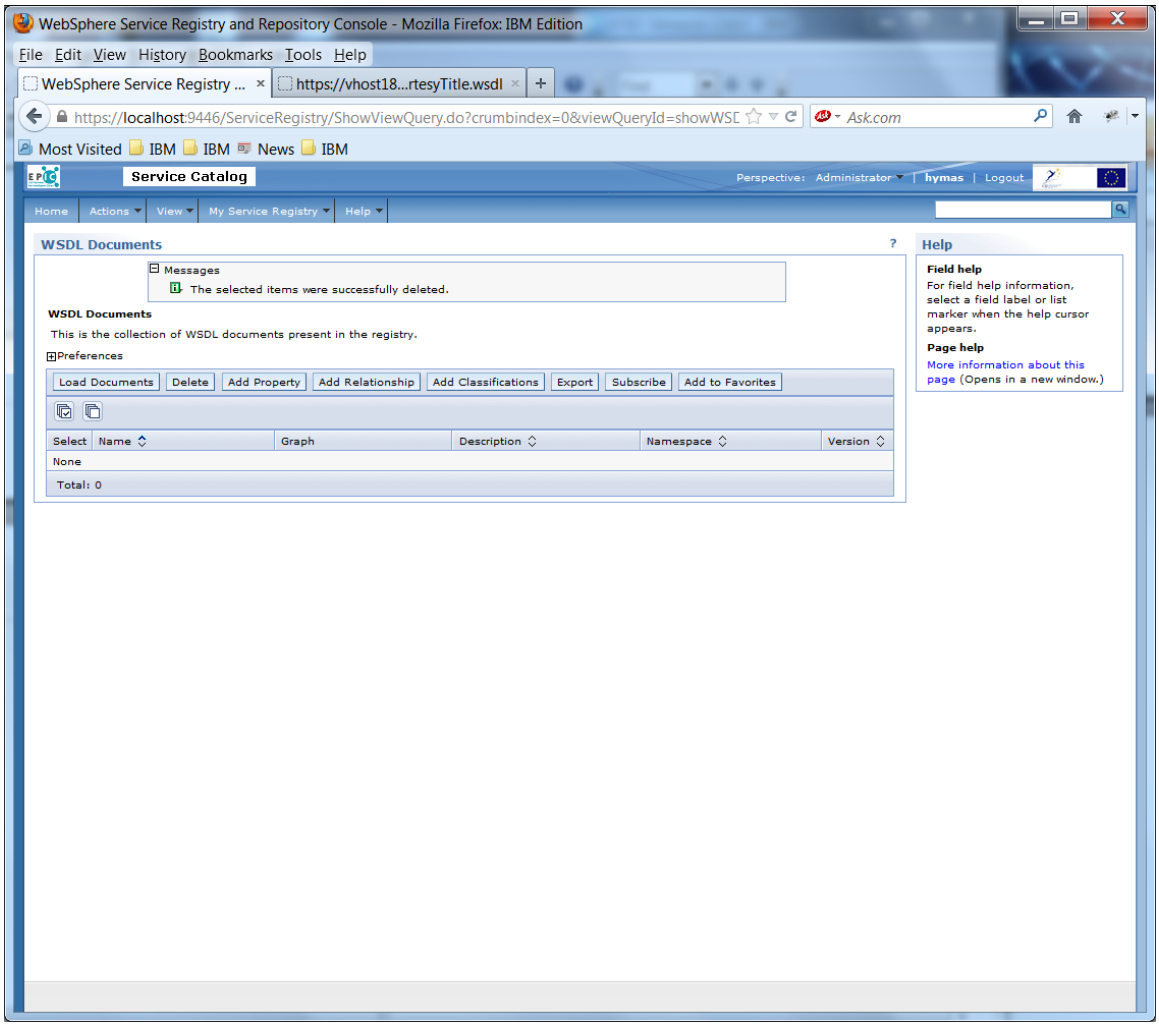


Figure 21: Test Case CC-1-4

Test Case CC-1-6

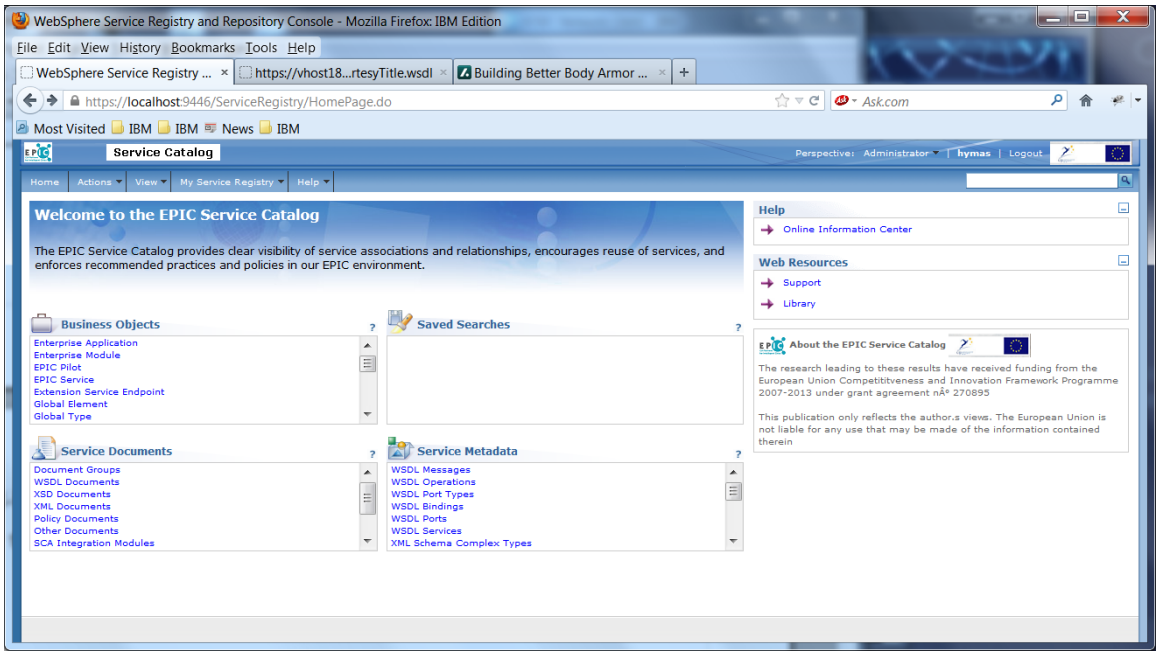


Figure 22: Test Case CC-1-6 – Step1

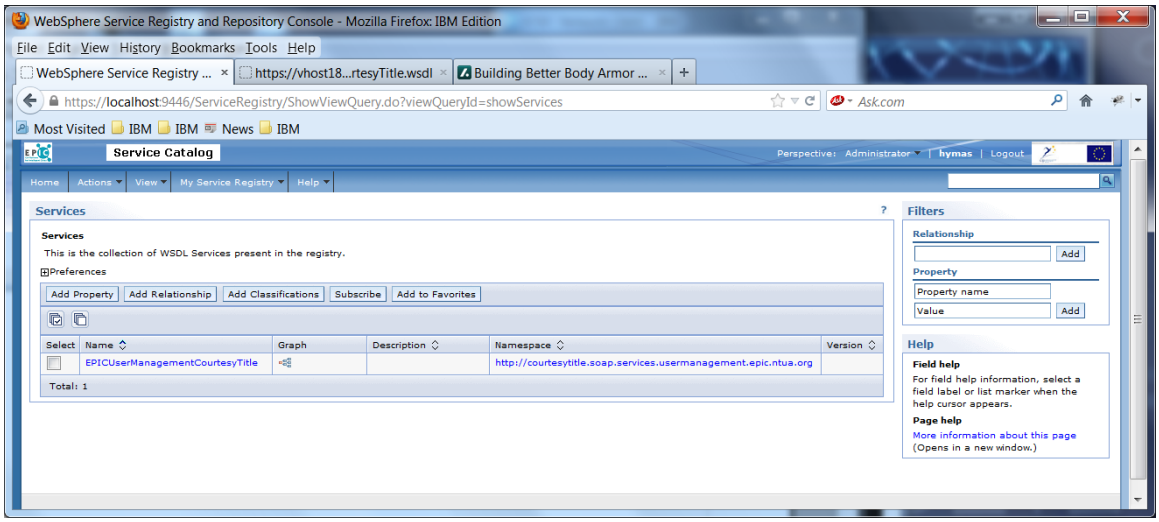


Figure 23: Test Case CC-1-6 – Step2

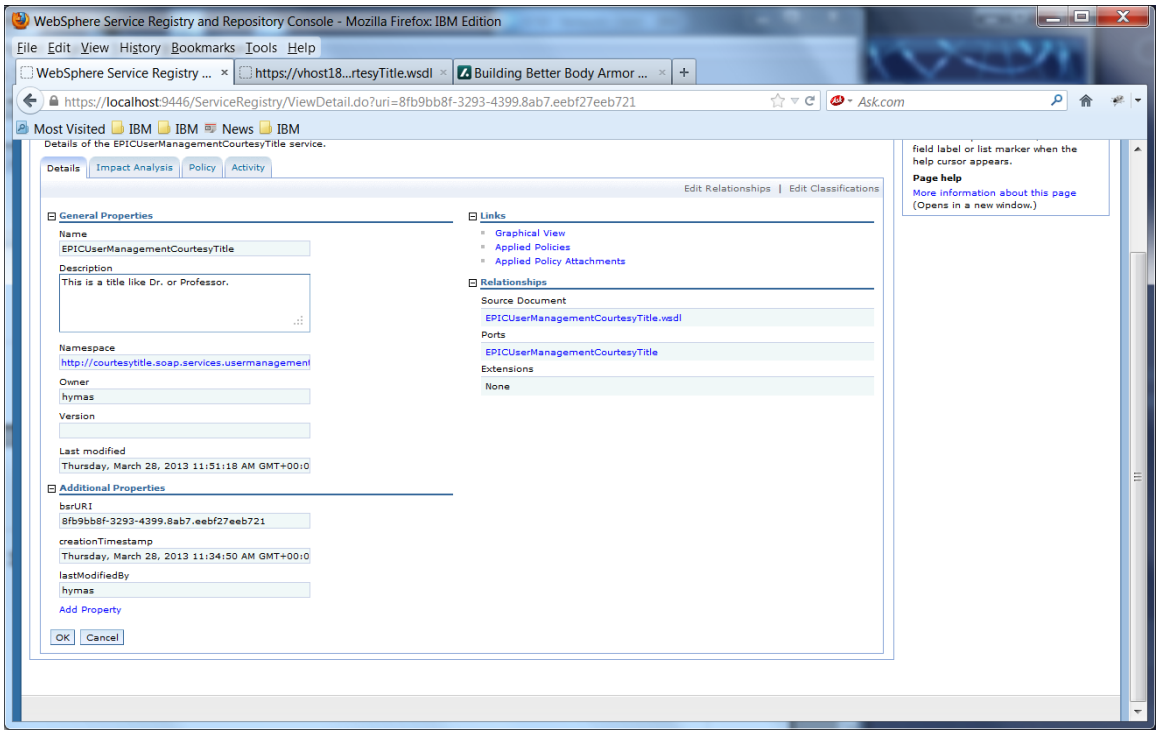
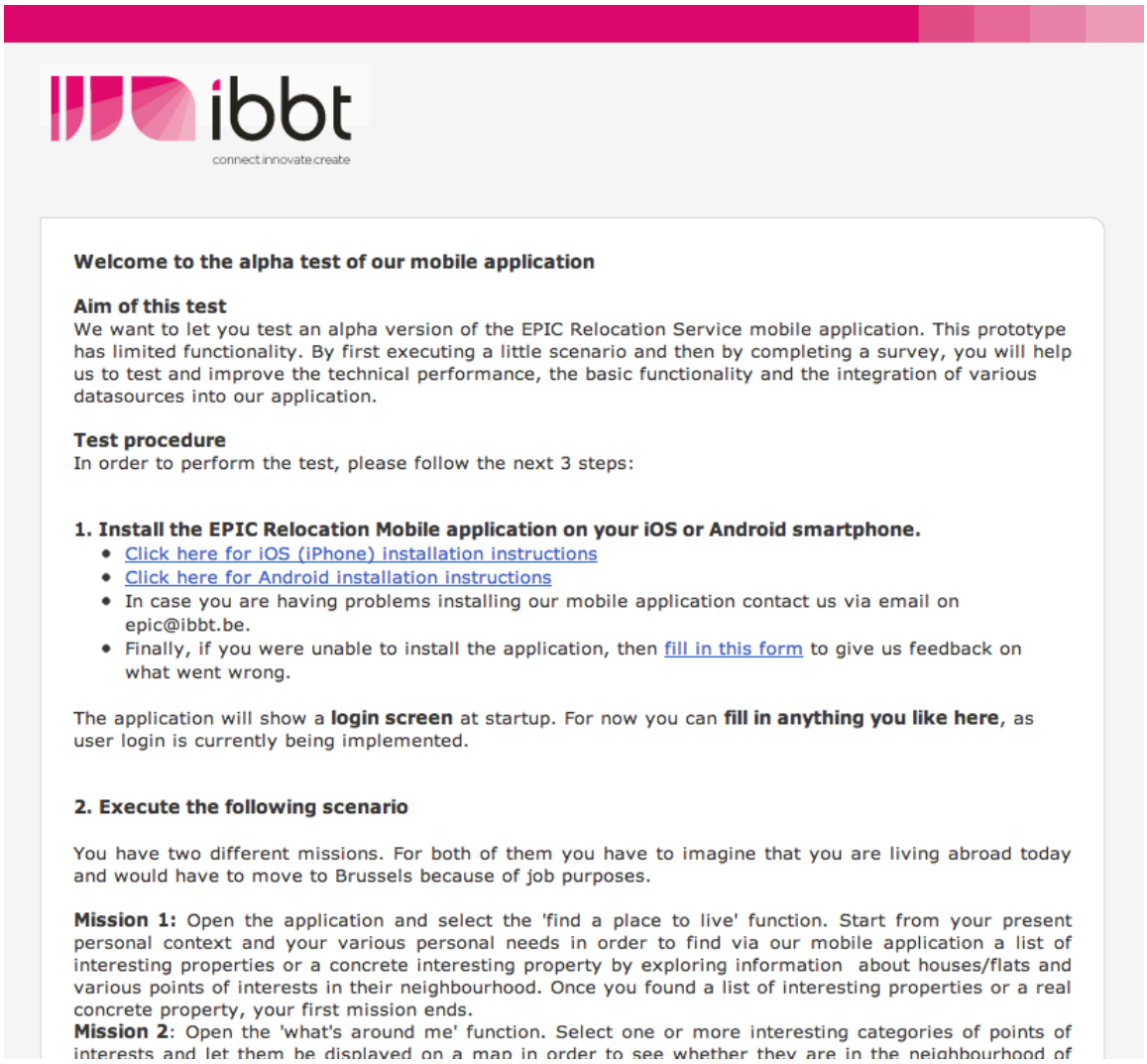


Figure 24: Test Case CC-1-6 – Step3

Test Case CC-1-8



connect.innovate.create

Welcome to the alpha test of our mobile application

Aim of this test
We want to let you test an alpha version of the EPIC Relocation Service mobile application. This prototype has limited functionality. By first executing a little scenario and then by completing a survey, you will help us to test and improve the technical performance, the basic functionality and the integration of various datasources into our application.

Test procedure
In order to perform the test, please follow the next 3 steps:

1. Install the EPIC Relocation Mobile application on your iOS or Android smartphone.

- Click here for iOS (iPhone) installation instructions
- Click here for Android installation instructions
- In case you are having problems installing our mobile application contact us via email on epic@ibbt.be.
- Finally, if you were unable to install the application, then fill in this form to give us feedback on what went wrong.

The application will show a **login screen** at startup. For now you can **fill in anything you like here**, as user login is currently being implemented.

2. Execute the following scenario

You have two different missions. For both of them you have to imagine that you are living abroad today and would have to move to Brussels because of job purposes.

Mission 1: Open the application and select the 'find a place to live' function. Start from your present personal context and your various personal needs in order to find via our mobile application a list of interesting properties or a concrete interesting property by exploring information about houses/flats and various points of interests in their neighbourhood. Once you found a list of interesting properties or a real concrete property, your first mission ends.
Mission 2: Open the 'what's around me' function. Select one or more interesting categories of points of interests and let them be displayed on a map in order to see whether they are in the neighbourhood of

Figure 25: Test Case CC-1-8

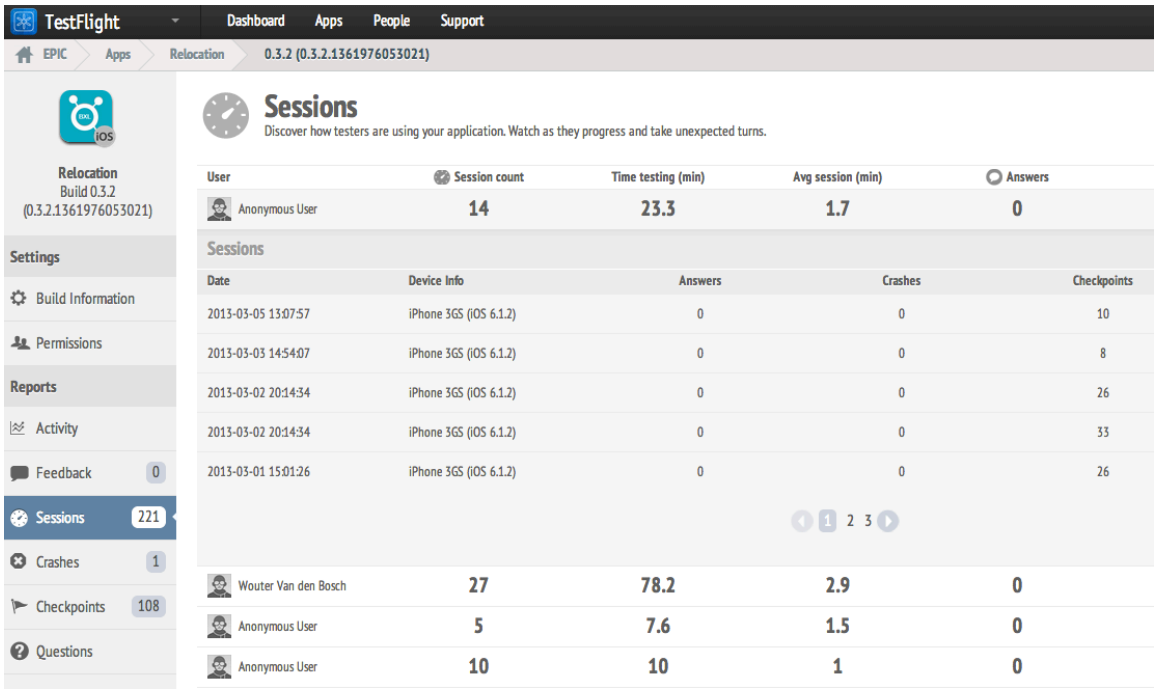


Figure 26: Test Case CC-1-8 – Mobile App Sessions

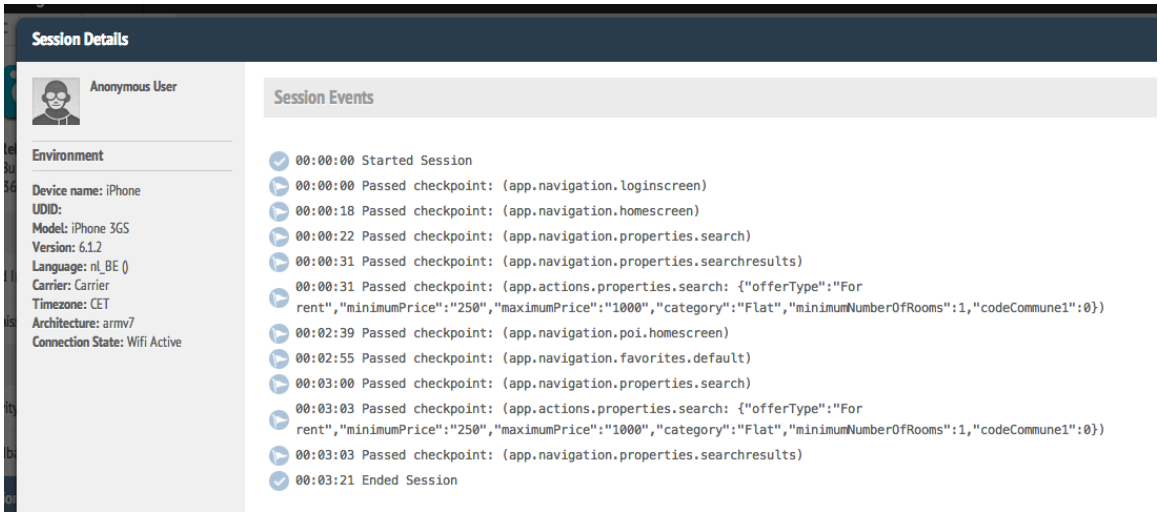


Figure 27: Test Case CC-1-8 – Mobile App Session Log

Test Case 2-1

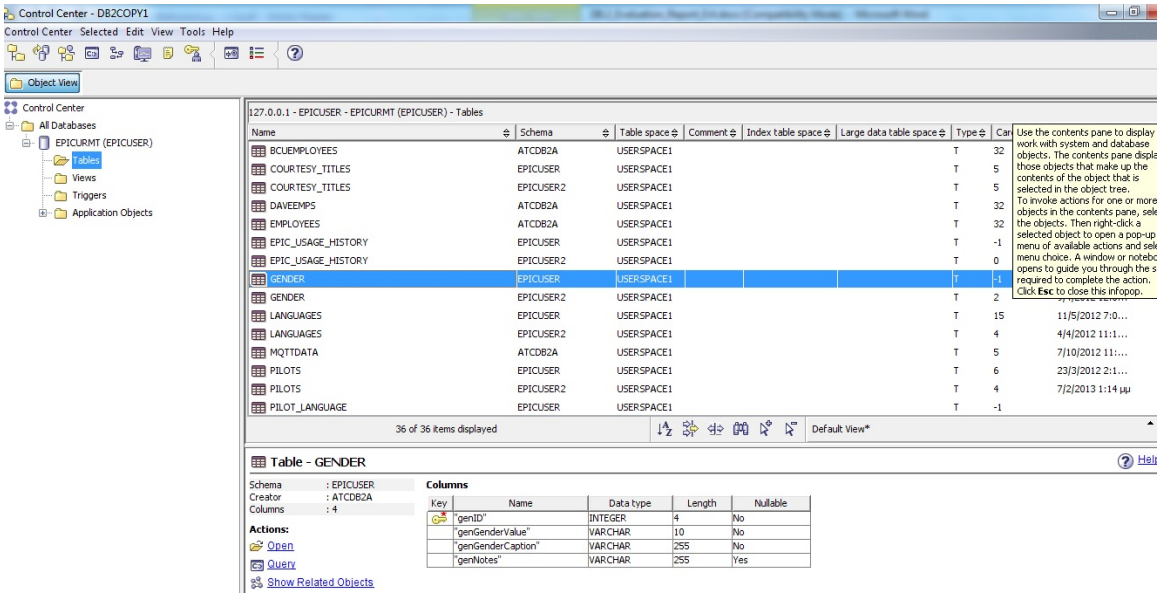


Figure 28: Test Case CC-2-1 – DB2cc control panel

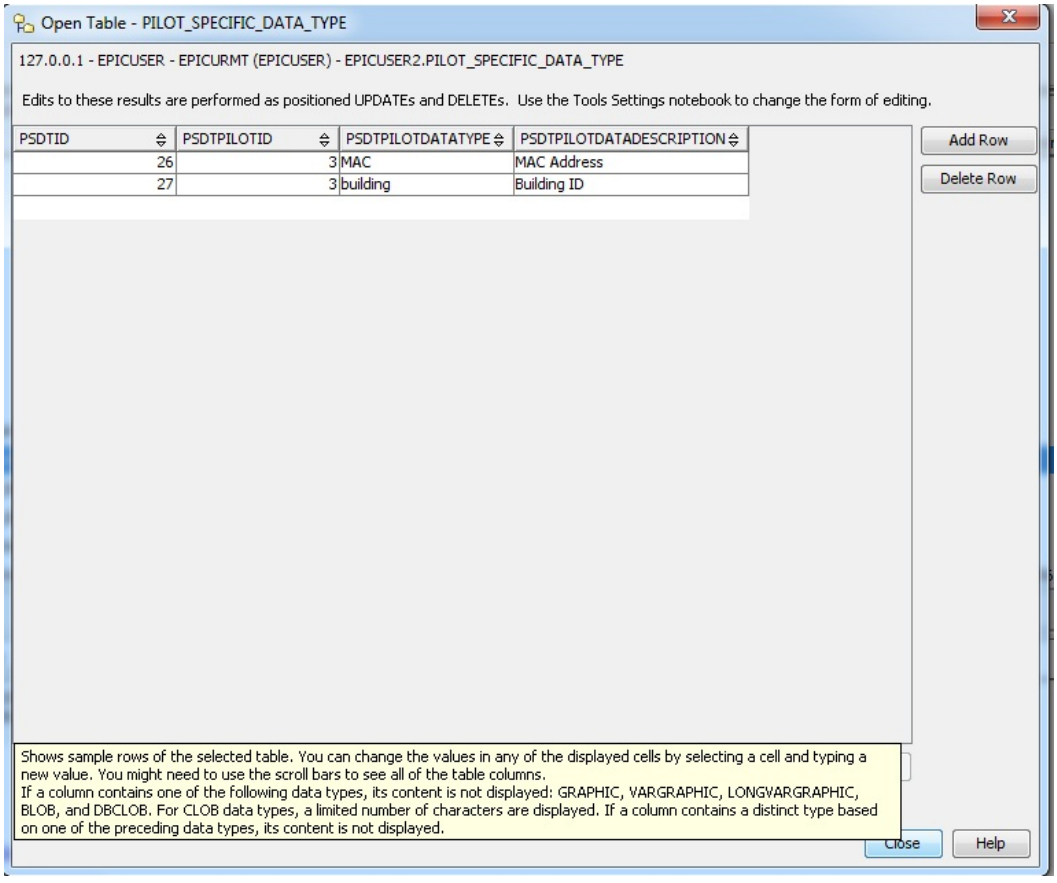


Figure 29: Test Case CC-2-1 – Adding application data

Test Case CC-3-3



Welcome page in Romanian



Figure 30: Test Case CC-3-3 – Welcome page in Hungarian

Test Case 4-1

PUILID	PUILPILOTID	PUILEPICUSERID	PUILPILOTINTERACTIONTYPE	PUILPILOTINTERACTIONVALUE	PUILUSERCOMMENT	PUILTIMESTAMP	PUILUSERIPADDRESS	PUILUSERBROWSERTYPE
9036	1	323	Page Load	Welcome page loads		23 Mai 2012 8:07:51 ...		Mozilla/5.0
9399	1	323	Page Load	Welcome page loads		23 Mai 2012 11:59:2...		Mozilla/5.0
9400	1	323	Page Load	Favorites page loads		23 Mai 2012 11:59:3...		Mozilla/5.0
9401	1	323	Page Load	Selected House Details page loads		23 Mai 2012 11:59:5...		Mozilla/5.0
9402	1	323	Form Submitted	House Details: <housing><Hous...		23 Mai 2012 11:59:5...		Mozilla/5.0
9403	1	323	Page Load	Find a place page loads		23 Mai 2012 12:00:0...		Mozilla/5.0
9404	1	323	Button Clicked	Search button clicked		23 Mai 2012 12:01:1...		Mozilla/5.0
9405	1	323	Form Submitted	<HousingCriteria><minimumPric...		23 Mai 2012 12:01:1...		Mozilla/5.0
9406	1	323	Button Clicked	Add to favorites button clicked		23 Mai 2012 12:01:2...		Mozilla/5.0
9407	1	323	Form Submitted	Add: <favoriteHouses><HouseI...		23 Mai 2012 12:01:2...		Mozilla/5.0
9408	1	323	Page Load	Favorites page loads		23 Mai 2012 12:01:3...		Mozilla/5.0
9409	1	323	Page Load	Find a place page loads		23 Mai 2012 12:01:4...		Mozilla/5.0
9410	1	323	Button Clicked	Search button clicked		23 Mai 2012 12:02:0...		Mozilla/5.0
9411	1	323	Form Submitted	<HousingCriteria><minimumPric...		23 Mai 2012 12:02:0...		Mozilla/5.0
9412	1	323	Button Clicked	Add to favorites button clicked		23 Mai 2012 12:02:2...		Mozilla/5.0
9413	1	323	Form Submitted	Add: <favoriteHouses><HouseI...		23 Mai 2012 12:02:3...		Mozilla/5.0
9414	1	323	Page Load	Favorites page loads		23 Mai 2012 12:02:3...		Mozilla/5.0
9416	1	323	Page Load	Favorite Selected House page lo...		23 Mai 2012 12:04:3...		Mozilla/5.0
9417	1	323	Form Submitted	Favorite Details: <favoriteHouse...		23 Mai 2012 12:04:3...		Mozilla/5.0

Figure 31: Test Case CC-4-1 – Logging data

Test Case CC-5-2



Figure 32: Test Case CC-5-2 – Tirgu Mures Test User

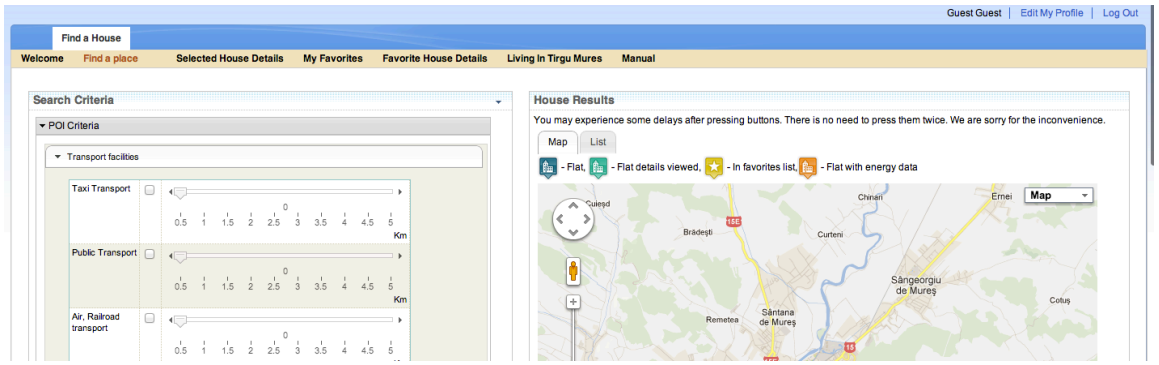


Figure 33: Test Case CC-5-2 – Brussels Relocation Test User

Test Case FE-1-1

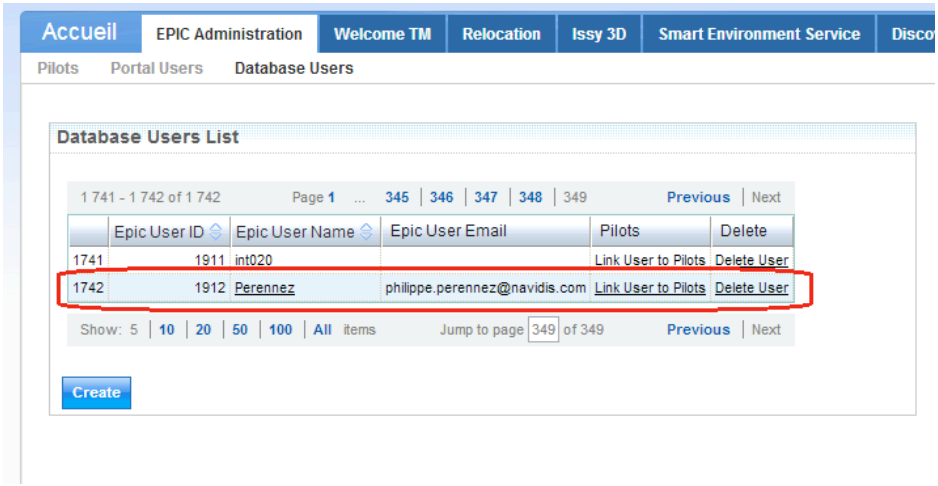


Figure 34: Test Case FE-1-1 – Register a new user

Test Case FE-1-2

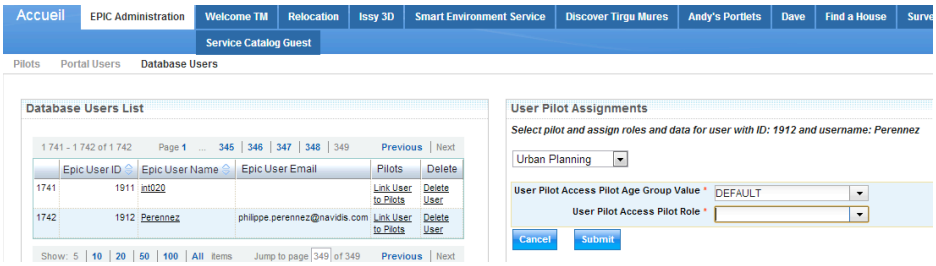


Figure 35: Test Case FE-1-2 – Assign a pilot role to a user – Step1

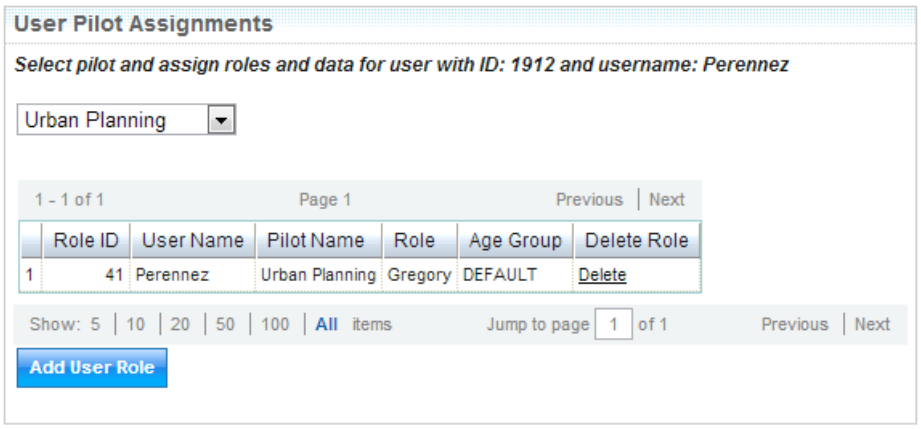


Figure 36: Test Case FE-1-2 – Assign a pilot role to a user – Step2

Test Case FE-2-2

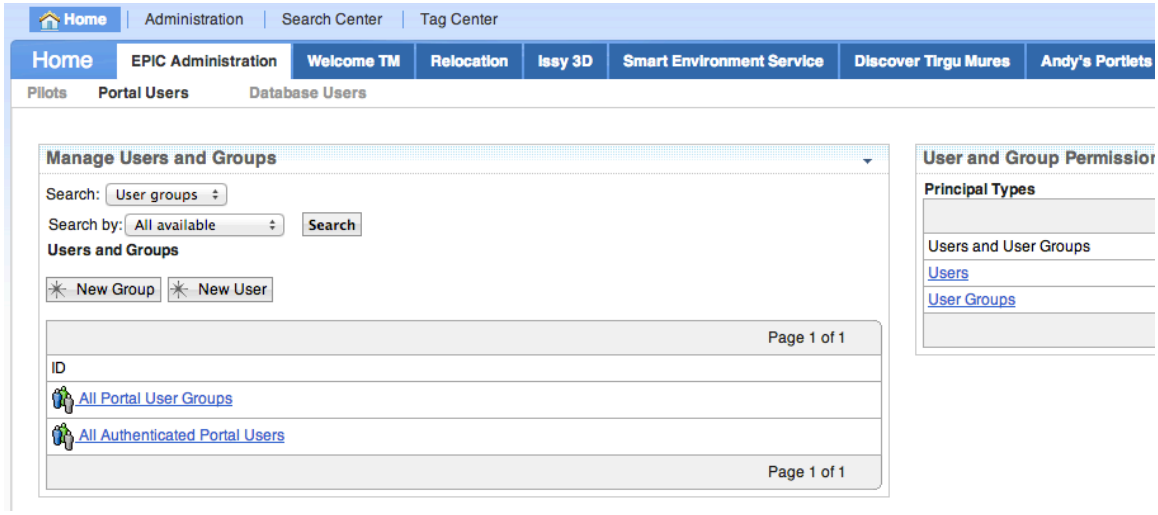


Figure 37: Test Case FE-2-2 – Adding new User Groups (roles)