The Infinity Project
Infrastructures for the Future Internet Community
FI-PPP

Contract Number 285192

D3.3 METHODOLOGY AND TOOLS FOR THE DETECTION OF COMMON ENABLERS AND INTEROPERABILITY CONSTRAINTS

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Document Reference

Project Acronym	Infinity					
ICT Project Number	FP7-285192					
Project URL	www.fi-infinity.eu					
EU Project Officer	Mr.GiorgiosTselentis					
Project Coordinator	**Name**	Federico Alvarez		**Affiliation**	UPM	
	Email	fag@gatv.ssr.upm.es	**Phone**	+34-91 336-7344	**Fax**	+34-91 336-7350
Deliverable Name	D3.3 Methodology and tools for the detection of Common Enablers and Interoperability constraints					
Code name						
Nature			**Distribution Type**			
Responsible Author(s)	**Name**	Stefano Modafferi		**Affiliation**	IT Innovation	
	Email	sm@it-innovation.soton.ac.uk	**Phone**		**Fax**	
Abstract (for dissemination)	This report comprises Deliverable D3.3 of the Infinity project. The aim of this deliverable is to provide a methodology to be used in other work packages to develop an understanding of the relationship between exiting infrastructures and the proposed architecture of the FI-WARE project					
Keywords	Methodology, Interoperability Constraints, Common Enablers, Analysis, Common Description Framework,					
Contractual Date of Delivery	30/03/2012					
Status	Final					
Quality assurance readers	Dai Davies			Mazurek Cezary		
result	OK			OK		

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Table of Contents

Contents

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Table of Figures

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

1 Disclaimer

This document contains material, which is the copyright of certain Infinity contractors, and may not be reproduced or copied without permission. All Infinity consortium partners have agreed to the full publication of this document. The commercial use of any information contained in this document may require a license from the proprietor of that information.

The Infinity Consortium consists of the following companies:

Beneficiary Number	Beneficiary name	Beneficiary short name	Country
1(coordinator)	Universidad Politécnica de Madrid	UPM	Spain
2	FraunhoferGesellschaftzurFoerderug der angewandten Forschunge.V.	FhG	Germany
3	University of Southampton IT Innovation Centre	IT Innovation	UK
4	Waterford Institute of Technology	WIT	Ireland
5	Center for Research and Telecommunication Experimentation for Networked Communities	CREATE-NET	Italy
6	INTERINNOV SAS	INTERINNOV (IS)	France
7	European Regional Information Society Association	ERISA	Belgium
8	Martel GmbH	Martel	Switzerland
9	Telefónica Investigacion Y Desarrollo SA	TID	Spain
10	Thales Services SAS	Thales	France
11	Ericsson GmbH	Ericsson	Germany
12	InstytutChemiiBioorganicznej Pan	ICBP	Poland
13	Delivery of Advanced Network Technology to Europe Limited	DANTE	UK

Table 1 - Partners list

The information in this document is provided “as is” and no guarantee or warranty is given that the information is fit for any particular purpose.

The user thereof uses the information at their sole risk and liability.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

2 Glossary

Name	Meaning
Survey	The survey schema submitted to the owners for getting the data describing their infrastructures.
CDF [1]	The model for describing infrastructures inside the Infinity project
FI-WARE documents [2], [3], [4]	The FI-WARE pages[1], the FI-WARE deliverable on testbed and the document about FI-WARE vision.
Common Enabler	A common enabler is a module present in the FI-WARE architecture that is an identical or equivalent solution to a module present in the architecture of an infrastructure
Generic Enabler	A module developed inside FI-WARE providing specific features.
Interoperability Constraint	An interoperability constraint is a relationship between FI-WARE architecture and the infrastructures
Web Repository [1]	The Web site developed and maintained by the Infinity project where data about infrastructures can be updated by infrastructures owners and can be shown to UC projects
FI-PPP Pilots	The pilot application experiences to be developed in the framework of FI-PPP by Use Case projects
Operational constraints	An operational constraint is related to the way the infrastructure is run and managed and arises typically where the infrastructure operators impose conditions on use which are not acceptable in FI-PPP pilots.

3 Introduction

This report comprises Deliverable D3.3 of the Infinity project. The aim of this deliverable is to provide a methodology to be used in other work packages to develop an understanding of the relationship between exiting infrastructures and the proposed architecture of the FI-WARE project as it is possible to derive from the three sources [2], [3], [4].

The Description of Work for Task 3.4 calls for a methodology for analysing existing infrastructures in WP5. This should allow WP5 to identify common functionalities (enablers), check interoperability and compare with the FI-PPP Core Platform (FI-WARE) to determine if FI-WARE is compatible and whether any new enablers should be added to FI-WARE. At this early stage of the project, no data from existing infrastructure is available (the survey to collect this began during the work described here). To define a methodology for infrastructure interoperability in terms of the WP3 schema alone is too demanding (one would need to compare arbitrary pairs of possible values). This deliverable therefore defines a methodology suitable for a first analysis of the infrastructure survey data based on the comparison of each single infrastructure with the FI-WARE architecture. By using FI-WARE as a common reference, we reduce the complexity, and address directly the requirements of WP5. Applying this

[1] A snapshot of the FI-WARE wiki pages has been taken on 15/03/2012 and the analysis is based on the version available on that date.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

methodology should provide experts on other Work Packages to derive information about the relationship with FI-WARE. This will provide a consistent basis for further analysis with respect to the possible use of infrastructure in the FI-PPP (e.g. regarding interoperability, etc). Moreover it is worth noticing that this approach does not prevent the possibility of finding something totally new and not necessarily already related with FI-WARE.

In addition to this methodology, the deliverable also provides recommendations to other WPs in Infinity regarding the representation and analysis of infrastructure, and to FI-WARE covering specific topics in order to boost the effective adoption by the existing infrastructures of the solution proposed for the future internet environment by FI-WARE.

The proposed methodology has to be validated against the actual data collected using the survey and it has also to be updated according to any feedback coming from the 'matching' process that has been designed with this document. This work is expected to take place in May 2012, and the lessons learned will be fed into a refined and possibly expanded methodology, which will be described in the next update (Deliverable 3.5, due Sep 2012).

This deliverable is divided in four main sections. Section 4 explains the position of this deliverable inside the work carried out in the WP3. Section 5 draws an outline of the approach. Section 6 is used for presenting the methodology and Section 7 describes how the inputs of such methodology are generated. The data needed to apply the methodology (which in some sense characterises FI-WARE with respect to the infrastructure survey data schema) is given in an Appendix.

4 Status of the task

As is shown in Figure 1, the aim of Task 3.3 (*Methodologies for Requirements Deductions*) and T 3.4 (*Methodologies for Detection of Common Enablers and interoperability Constraints*) is to define a methodology to match the information coming from the FI-PPP projects (i.e. the usage area projects and FI-WARE) with the information coming from the analysis of the existing infrastructures to be collected using The survey of Infrastructures being carried out in the Infinity project. This survey is based on a model named Common Description Framework (CDF) [1] and is used for describing infrastructure capabilities.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

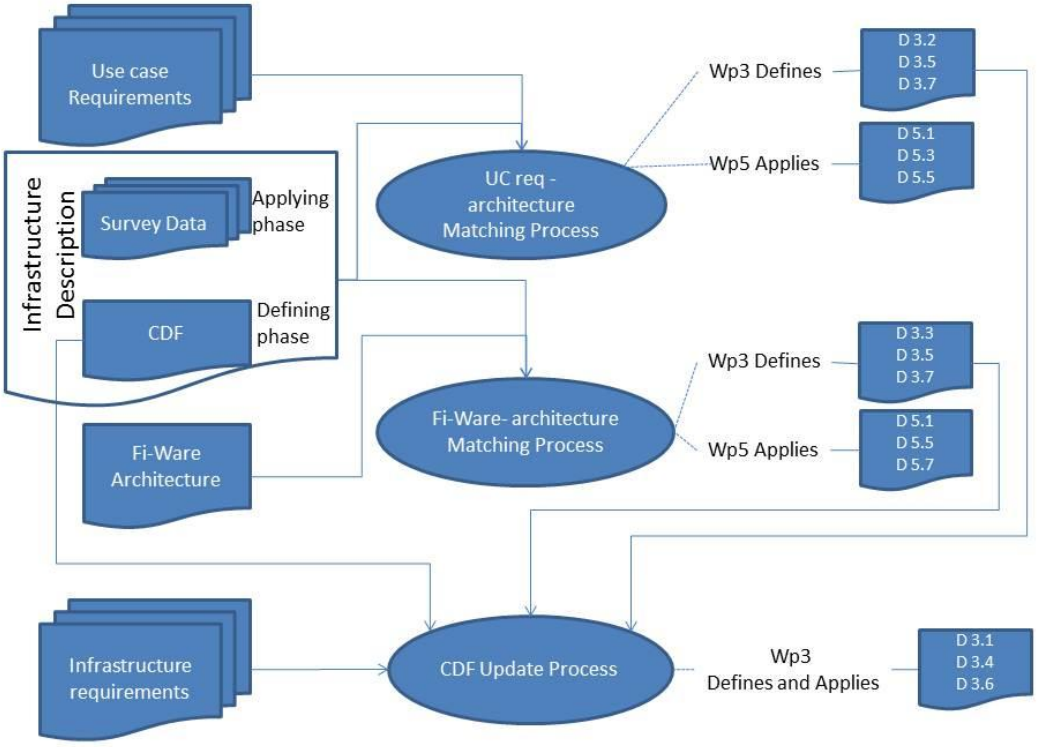

Figure 1 I/O diagram for Processes in WP3

The figure highlights the three processes charachterizing WP3 activities and the documents to be used as input for them. The first two processes in the figure are related to the relationship between the exiting infrastructure and respectively the requirements coming from the Use Case projects and the FI-WARE architecture, while the third one is related to the continuous process of prioritizing new requirements and attributes integrating them inside the CDF.

The first two processes are defined by Wp3 and then applied by WP5 that is in charge of analyze the actual data describing the exiting infrastructures, while the third process is totally in charge of WP3 that, for its application, uses the best practice of the Change Management Board. The process of matching the Fi-Ware architecure with the exiting architecture is addressed in this deliverable.

Such defined work is, with respect to this deliverable, strongly related to the definition of the FI-WARE architecture that is the reference to be taken into account when trying to understand potential, limits, constraints, and interoperability issues of an exiting infrastructure with the respect of the Future internet action. Information about the FI-WARE architecture emerged while the work reported here was being carried out, and some information (e.g. the FI-WARE API specifications) is still not available or in an early version. However, it was possible to create a useful mapping between FI-WARE and the infrastructure survey schema, and define a comparison methodology for infrastructure data that can provide useful results.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

but the proposed methodology still needs validation and refinement to be performed in the next iteration that will also consider possible refinements of the algorithms used in the methodology basing on feedback received by WP5.

5 Outline of the Approach

The main purpose of this analysis is to help ensure that the FI-PPP programme is successful, by facilitating effective interactions between infrastructure owners who could support FI-PPP pilots, and FI-PPP participants.

As already pointed out in the introduction, the approach at this stage has been to focus on aspects of the infrastructures really related to what FI-WARE is going to provide, and also to provide information about what is already in and what is out of the current FI-WARE architecture. The methodology for supporting the mutual analysis of the surveyed infrastructures is therefore postponed until the next deliverable. At this stage, it must be covered by supporting (ad hoc) analysis from the experts. Note also that the meaning of term "Generic Enabler", as presented in the above Glossary, is borrowed from the related definition in FI-WARE.

The proposed methodology is described in Section 6 and the idea is to examine the features and facilities provided by the surveyed infrastructures and see if there are any that are not supported by FI-WARE.

Technological constraints are those that arise from the technologies used by the available infrastructures in relation to the FI-PPP programme. These constraints include the inability of an infrastructure to use FI-WARE technology, e.g. due to architectural inconsistencies or a lack of interoperability, and also the inability to federate infrastructures so they can be used together, due to incompatibilities between the infrastructures.

One interesting aspect to consider is that technological constraints may also represent opportunities for the FI-PPP. For example, if an infrastructure lacks a feature considered important by FI-WARE, it may represent an opportunity to install FI-WARE generic enablers in that infrastructure. If infrastructures cannot be federated due to incompatible technologies, this may also represent an opportunity to adopt FI-WARE as a means to reduce incompatibilities. However, one must also recognise that infrastructures that are already operating cannot easily change their existing technology, so detailed analysis is likely to be needed to decide if a mismatch is an opportunity rather than a constraint.

The level of compatibility may signify that the infrastructure has compatible technology or a compatible architecture (with different implementations that may or may not interoperate), or a gap in functionality that may signify an opportunity or a constraint (depending on whether it can be filled).

This level of compatibility can be defined as a compliance statement giving information on the relationship between an infrastructure and FI-WARE as well between two different infrastructures.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Thus a compliance statement doesn't just say if an infrastructure is or is not compatible with FI-WARE (or another infrastructure) – it provides a range of compliance levels and indicates what actions may be considered to address incompatibilities.

Operational constraints arise not ONLY from the technologies used in an infrastructure, but by the way the infrastructure is run and managed. Operational constraints are most likely to arise where the infrastructure works in a way not acceptable in FI-PPP pilots. The way to identify these is to perform a similar comparison between compliance statements and survey results. However these operational compliance statements will be based on compatibility between infrastructures and use case project requirements as analysed in D 3.2. In these cases, compliance statements may also be quantitative, e.g. where a pilot requires a particular number of users, or has to cover a minimum set of member states. In such cases, it may be appropriate to rank compliant infrastructures based on how easily they can meet the requirement, and how far beyond they can go.

6 Description of the Methodology for the Detection of Common Enablers and Interoperability Constraints

In this Section the inputs, the way for applying the defined methodology and the outputs of the methodology are presented.

6.1 Inputs

This Section gives a high level description of the inputs. When a specific process for generating them is necessary, it is presented separately in Section 7 because it is not part of the methodology itself.

The required inputs are:

1) **Actual data** coming from the filled survey used for describing the infrastructures.
2) **Definition of "Common Enabler" and "Interoperability constraints"**. In this report we state that
    a. "A common enabler is a module present in the FI-WARE architecture that is an identical or equivalent solution to a module present in the architecture of an infrastructure".
    b. "An interoperability constraint is a lack of relationship between FI-WARE architecture and the infrastructures' capabilities". A wide meaning is given to the word constraint because it is interesting to find potential constraints, even if they are not actual ones.
3) **Set of labels** to provide a finer grained table of relationship(s) between the survey data and the FI-WARE architecture. A label is defined as a pair of list of values and text:

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Label = List<Value>; [Text]
The available values and their way of using can be found in the following table:

Values	Specification	Comment
S	Identical or Equivalent solution	A module in FI-WARE is replaceable by a module of the infrastructure.
I	Interoperability	An infrastructure (module) can interact with a module of FI-WARE and vice versa.
P	Partially Compatible/Interoperable	An infrastructure (module) and a FI-WARE module can interoperate or be interchangeable only partially or only under specific conditions
NC	Not Compatible	It is not possible, as they are, to have interoperability between an infrastructure and a module of FI-WARE
OF	Not covered by FI-WARE (out of FI-WARE)	This information coming from the survey is not present in the information provided by FI-WARE
F	Further Investigation Needed	Even if the information required in the survey can be interesting for determining the relationship with FI-WARE, currently it is not possible to take a decision and further investigation are needed.

4) **Set of concepts** upon which to perform the analysis. Both FI-WARE and the survey schema cover different aspects of many infrastructures. To make the analysis effective, a set of concepts are defined and the matching is performed for each one of these concepts. The concepts are:
    a. Cloud Computing
    b. Data and context management
    c. Internet of Things
    d. Application Service Delivery
    e. Interface to Network Device

   The choice of using as concepts the FI-WARE chapters has been taken because, using this approach, it is possible use the same categorization for both the parts upon which the matching is performed (i.e. the infrastructure and the FI-WARE architecture). The security chapter present in FI-WARE is not explicitly defined as concept because it is covered inside the others.
5) **Artefact representing the CDF/survey key questions/answers** grouped by concepts. This is the set of questions to look at to get information about constraints and common enablers. Using this artefact is possible to apply the methodology on two consistent schemas (the set of questions in the artefact and the actual data are both defined on the survey schema) because it provides a translation of the FI-WARE architecture in the common model chosen for describing architecture (i.e. CDF, of which the survey is a subset).
6) **Simple Decision Schema**. This simple schema has to be applied to understand what can be defined as common enabler and what is an interoperability constraint. It is worth noticing that this schema is an

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

early proposal and has to be validated and improved in the next iteration basing on the feedback of Wp5. The decision schema takes into account the generic enablers defined in the FI-WARE documents and considers the related attributes in the survey.

a. Each module defined as generic enabler in FI-WARE can be considered a common enabler for the architecture if all the related attributes in the survey are labelled "S" (see point 3 above).
b. Each attribute in the survey labelled as 'NC', 'I', and 'P' can be considered a potential interoperability constraint.

7) **Global Decision Schema**. This schema is a table stating how to interpret the set of results of the matching phase. It is again worth noticing that this is an early proposal and has to be validated and improved in the next iteration basing on the feedback of WP5.
The decision schema takes into account labels as defined in 3 above and their number of occurrences. It is defined according to the following rules written with a pseudo code. An example of its application can be found in Section 6.4.

Let Rset be the final result set of labels.
Let {'S','I','P','NC','OF','F'} be the set of available labels.

All 'S' → Rset.add('S');
All 'NC' → Rset.add('NC');
At least 1 'S' → Rset.add('P');
At least 1 'F' → Rset.add('F');
'NC' not present & !All 'S' → Rset.add('I'), Rset.add('P')

8) **Key concepts** coming from the analysis of FI-WARE. The proposed methodology is semi-automatic . It requires the expert(s) to complete it considering also other unstructured information made available from an ad hoc analysis of the FI-WARE documents.

6.2 Applying the Methodology

The proposed methodology is shown in Figure 2.

The first two steps are used to identify and group the data coming from the survey that are important with respect to a given concept.

Then the methodology splits between a step able to provide information about potential enablers and interoperability constraints, and another one in charge of a global analysis of the data related to a specific concept.

The first step has as input the simple decision schema and provides a list of potential enablers and interoperability constraints, while the second uses the global decision schema and its output is a global, even if not final, result; the more accurate the decision schemas, the more reliable will be the outputs.

In any case, a further step is designed to be carried out by human experts. This last step is useful for

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

- validating the previous results,
- trying to identify if other unstructured information can be inferred from the analysis
- performing or at least triggering the further analysis that could be required in the automatic output (label 'F').

These steps have to be applied for each concept. Finally, the methodology is concluded by a last step not shown in the figure where experts are required to build a global vision of the relationship of a given architecture with FI-WARE across the different concepts.

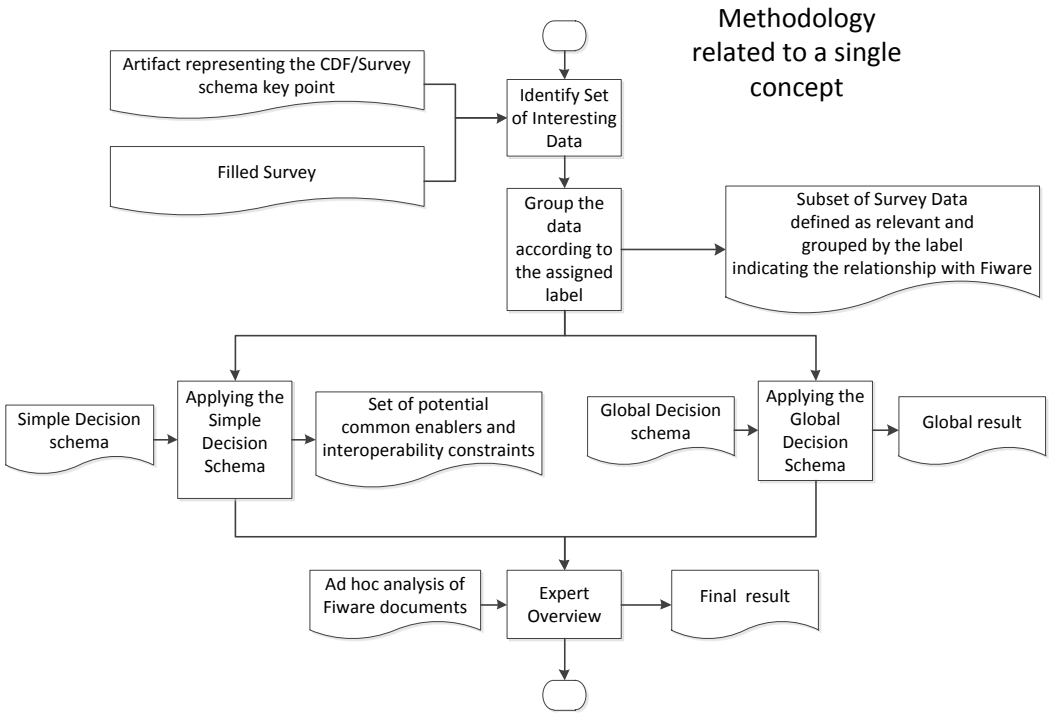

Figure 2 Overview of the methodology

6.3 Outputs

The outputs of the proposed methodology are:

- For each concept a set of potential common enablers and interoperability constraints
- For each concept a set of information about the relationship of an infrastructure with FI-WARE
- A global vision across the concepts of the relationship between the infrastructures and FI-WARE.
- Optionally, several feedbacks to be provided to WP3 for the description of the infrastructures, as well as to FI-WARE for the implementation of its architecture. These potential feedbacks come from the open questions present in the survey and also from answer labelled as 'OF' in the matching phase. (see 6.1 above)

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

6.4 Example of methodology application

This Section shows an example of the methodology, assuming an infrastructure has filled in the survey questions about Cloud as reported in the following table[2]:

Id	Question	Your Response	
I.1	**Please provide the date of initial operation (or planned launch) of this infrastructure**	01/01/2011	
I.5	**How would you best describe the operation of the cloud services?** ***Select One***		• Public Cloud
			• Private Cloud
			• Community Cloud
		X	• Hybrid Cloud
I.6	**Please select all the Cloud Computing services that are provided through your Infrastructure** ***Place an X against all that apply***	X	• SAAS
		X	• PAAS
		X	• IAAS
I.10	**Please select all the APIs supported by your cloud service to manage computing (C) and/or storage (S) resources.** ***Place an X against all that apply***		• Amazon EC2 (C)
			• Eucalyptus (C)
		. . .	. . .
		X	• OpenStack (C)
		. . .	. . .
			• Other
I.12	**Please select the platform over which virtualization is achieved in this Cloud Service** ***Select one***	X	• Vmware
			• Citrix
		. . .	. . .
			• Planned but not yet
I.15	**Please select all the security services/features offered by your infrastructure** ***Place an X against all that apply***	X	• Support for TLS/SSL for communication with cloud resources
		X	• Security monitoring in the cloud
		X	• Security compliance of the cloud
		X	• Identity management (authentication) of cloud users
		X	• Privacy for cloud users (e.g. to prevent their actions being monitored by cloud operators)
		X	• Access control over who can use cloud resources.
			• Other (please specify)

[2] This is a theoretical example and it is based on a subset of questions and answers in the survey.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Then in the following table a part of the artefact for analysing the Cloud aspects is shown[3]:

Survey Question-ID / CDF reference	Question	Answer	Fiware generic Enabler name	Fiware architectural component	Fiware Version	Relationship	Operational / Architectural Issue	Notes
I6	Please select all the Cloud Computing services that are provided through your Infrastructure	SAAS		Cloud Hosting Architecture.Preliminary	Current	S	Arch.	
		PAAS		Cloud Hosting Architecture.Preliminary	Future	S	Arch.	
		IAAS		Cloud Hosting Architecture.Preliminary	Current	OF	Arch.	
I10	Please select all the APIs supported by your cloud service to manage computing (C) and/or storage (S) resources	OpenStack	Service management GE	Cloud Hosting Architecture.SM	Current	S	Arch.	Api compliant with OpenStack
		OpenStack	Data Center Resource Management GE	Cloud Hosting Architecture.DCRM	Current	P	Arch.	Openstack partially implements OCCI that is used in Fiware
		OpenStack	ObjectStorage GE	Cloud Hosting Architecture.ObjectStorage	Current	P	Arch.	several initiatives are investigating how to implement a CDMI interface
I15	Please select all the security services/features offered by your infrastructure	Security monitoring in the cloud	Security Monitoring GE	Security.SecurityMonitoring	Current	S, F	Arch.	Too generic question. Labelled S, but a F is also put to raise further investigations.
		Security compliance of the cloud			Current	S, F	Arch.	Too generic question. Labelled S, but a F is also put to raise further investigations.
		Identity management (authentication) of cloud users	Identity Management GE	Security.IdentityManagement	Current	S, F	Arch.	Too generic question. Labelled S, but a F is also put to raise further investigations.

[3] The complete artefact is shown in Section 10.1.5 while its construction is shown in Section 7.1

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

		Privacy for cloud users (e.g. to prevent their actions being monitored by cloud operators)	Privacy GE	Security.Privacy	Current	S, F	Arch.	Too generic question. Labelled S, but a F is also put to raise further investigations.
		Access control over who can use cloud resources.	Security Monitoring GE	Security.SecurityMonitoring	Current	S, F	Arch.	Too generic question. Labelled S, but a F is also put to raise further investigations.

The following lists are generated by applying the *Simple Decision Schema* (it considers only the current version of FI-WARE):

Common Enablers:

- Saas Architecture
- Service management
- SecurityMonitoring GE
- IdentityManagement GE
- Privacy GE

Interoperability Constraint:

- Data Center Resource Management GE
- ObjectStorage GE

Further Investigation needed:

- SecurityMonitoring GE
- IdentityManagement GE
- Privacy GE

Then applying the *Global Decision Schema* we have as global result for the Cloud Computing:

Matching	Output
Survey XYZ ←→ FI-WARE	'P', 'F'

This result is an automatic output that comes from the presence of several "full compatibility", several "partial compatibility" and several "further investigations".

Now it is up to an expert to validate these automatic results considering also the documents about FI-WARE provided as input and described in Section 7.2 below.

The expert can try to further investigate the analysis and update the results. The output can be used to determine the priorities for these deeper investigations in WP5.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

7 Processes for preparing the Input

Many inputs are used in the methodology and this section is devoted to give details about the processes used for preparing them.

A prerequisite for applying the methodology is to have both FI-WARE and the infrastructures described with a model that is as common as possible. This task has required a significant effort. The CDF model has been adopted as a common model.

7.1 Identifying the CDF/survey key points.

The aim of this process is to identify the set of survey questions/answers that characterise the relationship between the infrastructure and FI-WARE considering both the operational and the architectural constraints. This is the process that allows us to express the FI-WARE capability using the CDF that is the same model used for defining the infrastructures.

Table 1 shows the structure of the schema for analysing FI-WARE with respect to the CDF/survey schema attribute. The real interest is often in the answer, rather than in the question, and therefore also each possible answer to a given question is considered[4].

Finally, to ensure a global approach, we consider both the schema of the survey already submitted to the infrastructure owners and the global model (CDF) of which the survey is a subset. The source of the information is stated in a specific column. The information describing the FI-WARE capabilities are mainly derived from FI-WARE wiki pages, but sometimes they were inferred from the FI-WARE Deliverable 10.1 [3] that is about FI-WARE test bed developing and from the document about the FI-WARE vision [4] .

Question-ID	Question	Answer	FI-WARE generic Enabler name	FI-WARE architectural component	FI-WARE Version	Relationship	Upgradability	Operational / Architectural Issue	Source of decision	Notes	Source of Question

Table 1 Schema of the artefact representing the survey/schema key points

Each column in the above table has this meaning:

Question-ID → this is the unique number identifying the attribute in the question in the survey and the attribute in the CDF.

Question → the Text of the question

Answer → Indicates the answer of the question that implies the relationship

[4] In this iteration, the open answers that are actual part of the survey are not considered, because their nature to be a-priori not known requires a specific approach that will be potentially developed in the next iteration.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

FI-WARE generic Enabler name → indicates the generic enabler related to the question/answer. This information is retrieved from the FI-WARE wiki pages [2].

FI-WARE architectural component → indicates the FI-WARE architectural component related to the question/answer.

FI-WARE Version → this attribute states if the considered relationship is related to current or Future Version of FI-WARE according to the FI-WARE wiki pages [2].

Relationship → Indicates the implication raised by the answer (use the agreed labels)

Upgradability → Indicates the possibility of changing the label by means of an upgrade (use a Easy/Medium/Hard scale). Leave blank in doubt

Operational / Architectural Issue → states if it is an operational or an architectural constraint.

Source of decision → States if the analysis considers also the D10.1 of FI-WARE [3]

Notes → Free text description to be used for explaining the chosen label.

Source of Question → this attribute distinguish between attributes present only in the CDF and attributes present in both of them.

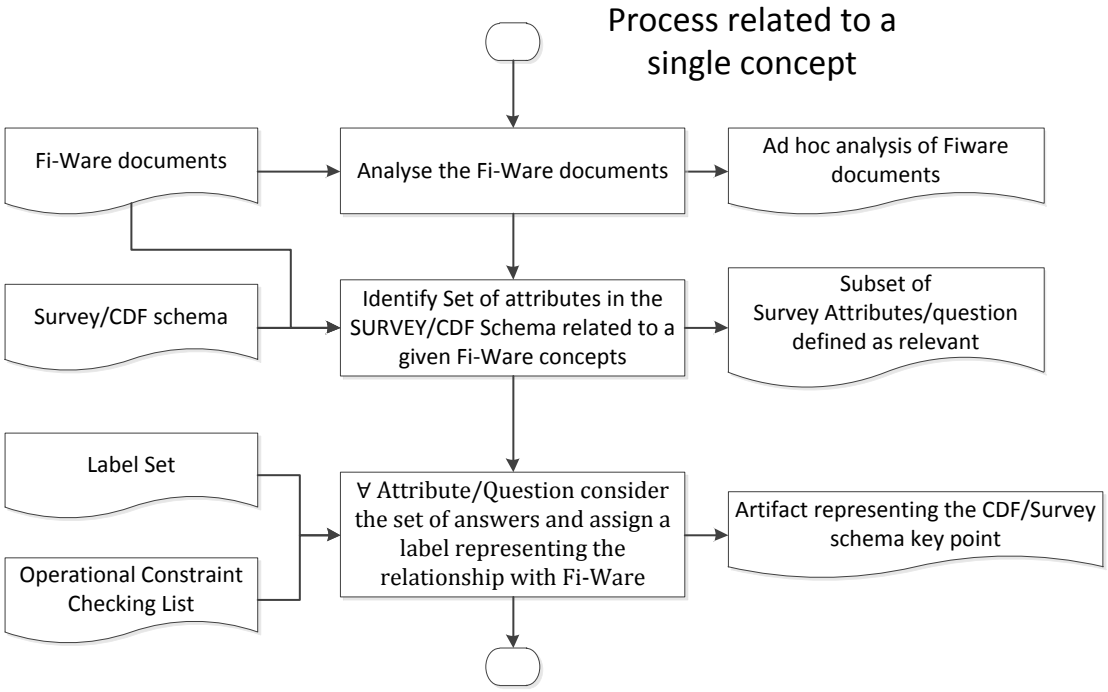

Figure 3 Process for defining the artefact representing the CDF/Survey key points

Figure 3 show the process for building the artefact described above representing the CDF/Survey key points to be considered for performing the match between the FI-WARE architecture and the infrastructure data. The produced artefact is reported in Section 10 .

7.1.1 Identifying the Operational Constraints

In order to identify Operational Constraints the list showed in Table 2 has been produced. Operational constraints arise not from the technologies used in an infrastructure, but from the way in which the infrastructure is operated. The list was defined based on the CDF, the initial survey results, and the full survey question/answer set. It was not validated with respect to FI-WARE specifications since FI-WARE documents [2, 3, 4] address the technical and

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

architectural issues. In the next iteration of the list we will carry out an analysis based on FI-PPP Use Case projects requirements and revise the results so that infrastructure compliance with these requirements can be determined.

The current list of operational constraints is based on the data obtained mostly through the pilot survey and the corresponding CDF, and addresses interoperability among infrastructures.

The list was derived in two steps:

- Step 1 involved analysis of the initial survey questions [5] and the corresponding CDF attributes, in order to select all attributes that defined some rule or requirement related to the operational aspects of an infrastructure use. The analysis covered Socio-economic and Operational sections of the survey (CDF) and their attribute groups: Purpose, Process, Stakeholders and Services. The Technical section, by its nature, did not contain any relevant questions. Next, each of the selected survey questions was classified by determining which of the following categories it applied to:
    - participation rules (who)
    - time limits (when),
    - space limits (where),
    - usage rules (how)
        - business-related
        - legal
        - ethical
- Step 2 involved analysis of the initial survey results, i.e., answers obtained mostly for the questions selected in Step 1 but not only. This step was performed to determine how the questions were interpreted by the survey participants and what additional information that could define operation constraints, was provided. The results were used to verify and complete the operational constraints category list.

In general, the elements included in the list can be divided into two groups. Elements in the first group refer to basic questions of when, where, by whom and for what purpose an infrastructure can be used. The second group of elements refer to more in-depth characteristics related to legal, ethical and business aspects of an infrastructure use.

In the scope of infrastructure interoperability three labels defined in Section 6.1 apply, i.e., Interoperability, Partially Compatible/Interoperable and Not Compatible. The non-compatibility case occurs when infrastructures have conflicting characteristics such as membership criteria for example, while partial interoperability occurs when characteristics allow for limited interoperability, e.g., user sets intersect but are not identical. The full interoperability takes place, if the all users of one infrastructure can potentially become users of another, using the membership example.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

In the Infinity survey version 1.4 the operational constraints as included in the list are addressed by several questions in the Core Questions group, namely 2.7, 2.8, 2.10 and 2 .11.

- where the infrastructure can be used
  - limitations on geographical region (non-technical e.g. not related to connectivity)
  - limitations on jurisdictional boundaries – legal issues
- when the infrastructure can be used –
  - time availability – when the infrastructure becomes available, until when it will be available
- who can use the infrastructure
  - criteria for participation such as nationality, business sector,
  - user commercial status
  - condition that the user must satisfy to use infrastructure such as resource contribution for example
- rules for infrastructure use
  - limit on the number of users
  - limit on the length of continuous time of infrastructure use
  - providing access/services to third parties - is it f allowed and under what conditions
  - resource allocation process and priorities (non-technical aspects)
- for what purpose can the infrastructure be used
  - commercial gain allowed or not
  - purpose - exclusion of certain purposes (e.g.weapon development)
- how to gain access to infrastructure
  - subscription procedure
- business model
  - how are costs of operation covered, if and how users are charged – payment model
  - distribution of royalties/profit if allowed
- legal requirements for the use of infrastructure
  - data protection - what regulations are used (national, EU, other)
  - privacy - requirements for maintaining and availability of activity logs
- ethical issues for the infrastructure use

Table 2 List of topics to be considered evaluating potential operational constraint

7.2 FI-WARE documents ad hoc analysis

This Section reports the analysis of the FI-WARE documents as has been carried out from the Infinity Project. It is intended to be used by the experts for completing the detection of Common Enablers and Interoperability Constraints. The information are taken from the sources [2], [3], [4].

7.2.1 Interface to Network and Device

Our current pool of resources, i.e. FI-WARE specifications and documentation of the Interfaces to Network and Devices (I2ND) working group mainly focus on software components and modules, APIs, interfaces to networks and devices. In contrast, the CDF and even more the survey, focusses on high-level questions related to the specific environment (cloud, sensor, wireless, etc.).

These differing perspectives lead to a very difficult matching and suggests both revising the CDF adding more detailed requests and to pointing out to FI-WARE the possibility of also considering domain related issues and being more specific about the required hardware and domain-specific interoperability/interworking requirements with existing systems (e.g. core network-elements/nodes in fixed and mobile networks that GEs need to be interoperable/interworking with).

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

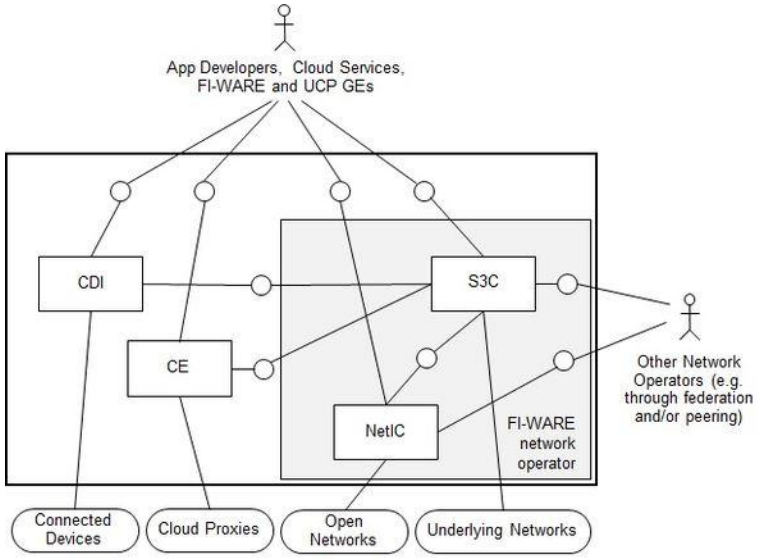

Figure 4 Interface to Networks and Devices (I2ND) Architecture

The I2ND components and Generic Enablers (GEs) are very important for realizing the infrastructural requirements that must be fulfilled in order to deploy FI-WARE Core Platform instances, FI-PPP Core Platform Generic Enablers (GEs) respectively on different infrastructures, providing FI-PPP services and applications to different end-devices. This is due to the fact that especially at this point in the FI-PPP architecture, software is interfacing with specific hardware and specific networks (e.g. access networks) and interworking with specific end-devices.

Figure 4 depicts the main four GEs of the I2ND environment[5]:

- Connected Device Interface (CDI) towards the Connected Devices. These devices include, but are not limited to, mobile terminals, tablets, set top boxes and media phones, and will have features such as remote access from a control environment, exposure of own functionality (device status, sensors, etc).
- Cloud Edge (CE) towards the Cloud Proxies. Cloud Proxies are gateways, which will connect and control a set-up of nodes towards the Internet or/and an operator network. The nodes might be either accessible or not accessible from the outside networks.
- Network Information & Control (NETIC) towards Open Networks. Open Networks provide flow based networking control also known as Software Defined Networking (SDN) which allows for dynamic and flexible virtualisation and provisioning of network resources
- Service, Capability, Connectivity, and Control (S3C) towards Underlying Networks. The underlying networks follow standards such as Next Generation Networks (NGNs) or Next Generation Mobile Networks (NGMNs). In the case of the S3C specified in I2ND the baseline underlying

[5] Mainly taken from the snapshotted version of the FIware Web Wiki: http://forge.fi-ware.eu/plugins/mediawiki/wiki/fiware/index.php/Interface_to_Networks_and_Devices_%28I2ND%29_Architecture

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

network will be the Evolved Packet Core (EPC) by the 3rd Generation Partnership Project 3GPP.

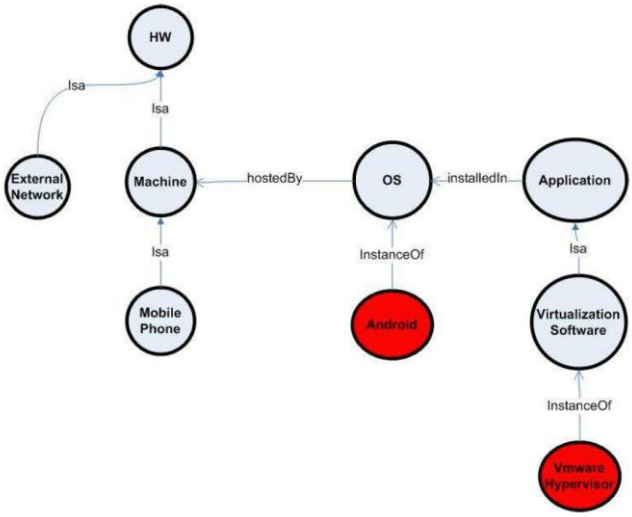

Figure 5 Interface to the Networks and Devices resource categories

In terms of resource categories, the I2ND specification seems quite straight-forward, as shown in Figure 5. Nevertheless only limited information can be found (at least from the documents currently made available to Infinity) on the specific hardware, software OS versions, supported mobile phones (including their capabilities), virtualization software versions as well as supported access networks / interworking access network components like, for instance: Gateway GPRS (General Packet Radio Service) Service Node (GGSN), Access Network Gateways (ANGWs), Enhanced Packet Data Gateways (ePDGs) etc. If the requirements in this regard were more fine-grained and specific, Infinity's CDF and survey could be adapted and updated accordingly; appropriate infrastructures and devices could be matched more efficiently.

7.2.1.1 *I2ND - Connected Device Interface GE*

The I2ND Connected Device Interface (CDI) GE, as the following Figure 6 shows, is mainly focussed on the components and modules on the end-device (mobile terminals, tablets, set top boxes and media phones) with which the network elements have to interwork. Since it was felt that enabling a trial by providing appropriate end-devices, even by shipping those end-devices is rather a small effort, the "upgradability" in order to meet the requirements of this section was evaluated to be "easy".

In fact the CDI chapter focuses on specifying the components and modules that need to be deployed on end-devices in order to enable a broad range of functionalities (low level functionalities like mobility / connectivity related, QoS related, management related as well as service related functionalities).

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

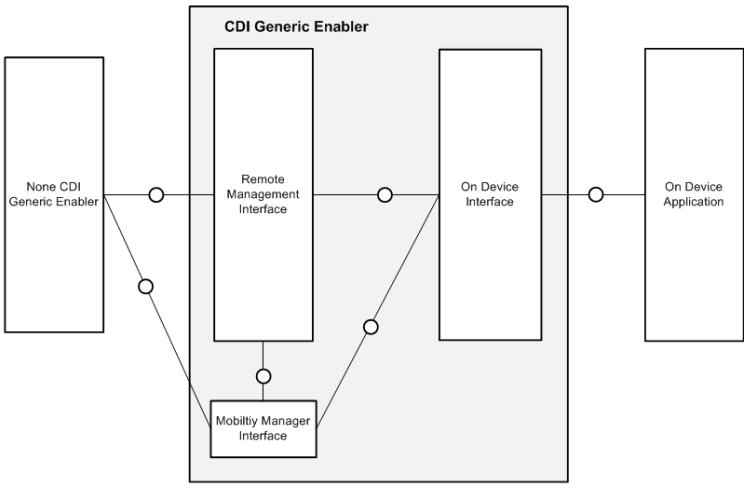

Figure 6 Connected Device Interface Diagram

The analysis of this concept (i.e. also a FI-WARE chapter) revealed that very specific information about the end-devices actually utilized is required, ranging from specific device capabilities (e.g. video, microphone, accelerometer, GPS / location) to connectivity support (e.g. WiFi, Bluetooth, 2G/3G) and available storage, input methods and display resolution is required. This to some extent needs to be taken into account for refining the current CDF and survey.

7.2.1.2 *I2ND - Cloud Edge GE*

The current specification of the Cloud Edge (CE) GE of the I2ND specifies the internal components and modules of a gateways that connect and control the set-up of nodes towards the Internet or/and an operator network. As no further information about utilized standards for the internal components is provided, it seems that there is no added value in deconstructing the CE enabler in the hope of finding a broader range of eligible infrastructures.

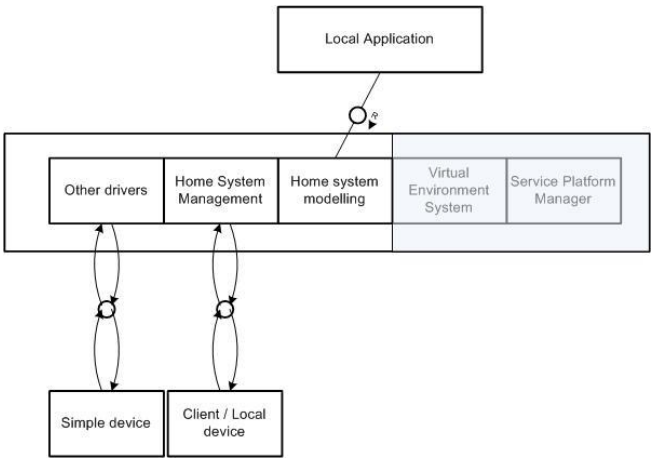

Figure 7 Cloud Proxy general Architecture

Furthermore there remains an uncertainty from analysing the current testbed documents [3]. There are issues of consistency eg it says that the component is 100% dependent on the hardware that will be provided by a partner of FI-

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

WARE, whereas on the current Wiki [2] it is stated that at least for the first release, the component will be realized on a "PC-like platform, equipped with a classical Linux distribution (Ubuntu for instance)".

7.2.1.3 *I2ND – Network Information & Control GE*

The I2ND Network Information & Control (NIC) GE enables Open Networks, which allows flow-based controlled networking mechanisms that can be used for virtualisation of networks.

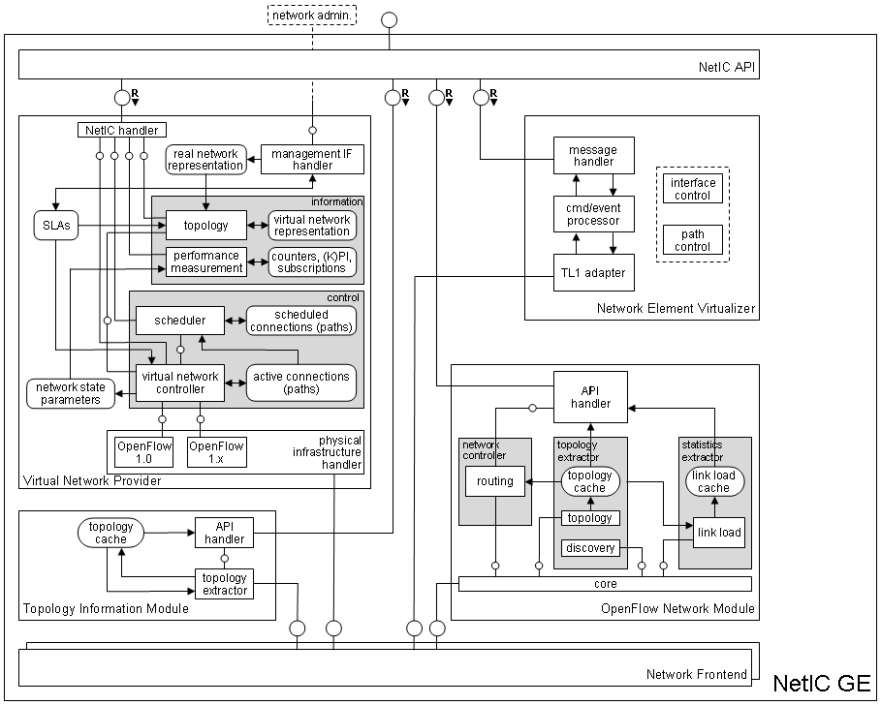

Figure 8 Network Information & Control GE Functional Block Diagram

By analysing the current documentations it was realized that an update of the CDF might make sense in order to analyse the support of specific OpenFlow versions of a particular infrastructure. Furthermore a break-down of the NIC GE into its modules, as depicted in Figure 8 might allow for integration of existing OpenFlow network management systems and existing infrastructures. This however needs further investigation and analysis of the I2ND GE OpenFlow network module.

7.2.1.4 *I2ND - Service, Capability, Connectivity, and Control GE*

The Service, Capability, Connectivity, and Control (S3C) is one of the most complex GEs of FI-WARE, as several components and modules are required to interwork and since several protocols (e.g. SIP, Diameter, HTTP) are used for the interworking of these components as well as for service / application invocation.

As shown in Figure 9 the I2ND S3C is comprised of several components, of which only a few have direct access to the network. As these components are of higher importance when judging whether a specific infrastructure / access network is applicable / suitable for interworking with FI-WARE, special focus was put on

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

those elements. One of the most important elements here is the OpenEPC which, amongst other mechanisms, provides Core Network Mobility Management, Policy and Charging Control, Policy and Charging Control and Client Mobility Management for a broad range of underlying access networks (e.g. 2G, 3G, LTE, WiFi, DSL, FTTx), as described in [5]. The current version of the survey adequately asks for these network capabilities. However, the current documents of FI-WARE's I2ND S3C do not adequately address these requirements towards the underlying access networks. It is not fully clear which access networks will be supported. The specification "Plain Legacy Operator Network" on the bottom of Figure 9 is not sufficient for judging whether mobile (e.g. 2G, 3G, HSDPA, LTE) or fixed (e.g. DSL, Cable, WiMax, WiFi) network is enabled, nor which components of the access network (e.g. GGSN, SGW, ePDG, ANGW) are required for interworking, especially when it comes to mobility and QoS support. Here further investigations and descriptions would be helpful.

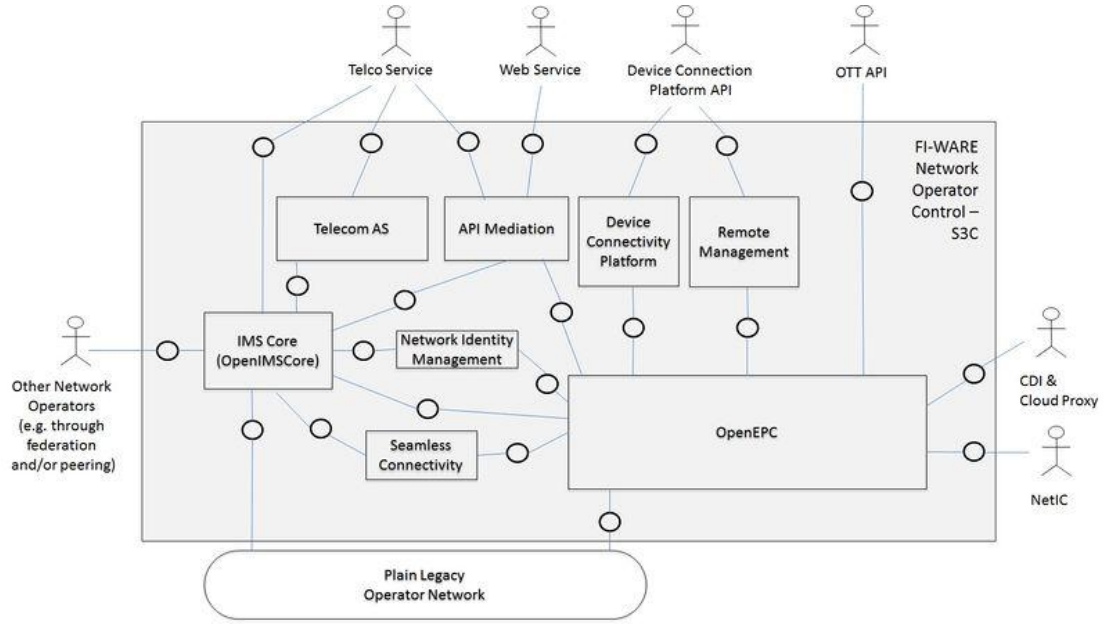

Figure 9 Service, Capability, Connectivity, and Control Interfaces and APIs

The other component interfacing with the operator network is the OpenIMS platform [6], which seems to have less strong requirements (apart from IP access) regarding the underlying operator network elements compared to the OpenEPC.

By analysing the current documents [2], [3], [4], it seems that the current plan / setup only allows remote access to S3C GE, which is planned to be hosted and deployed at a specific operator site on top of a virtualized environment (6 virtual machines, not further specified), deployed on a specific hardware. Therefore remote access to the specific instantiation of the S3C infrastructure is mandatory.

7.2.2 Data and Context management

Figure 10 shows the main components (Generic Enablers) that comprise the first release of FI-WARE Data/Context chapter architecture.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

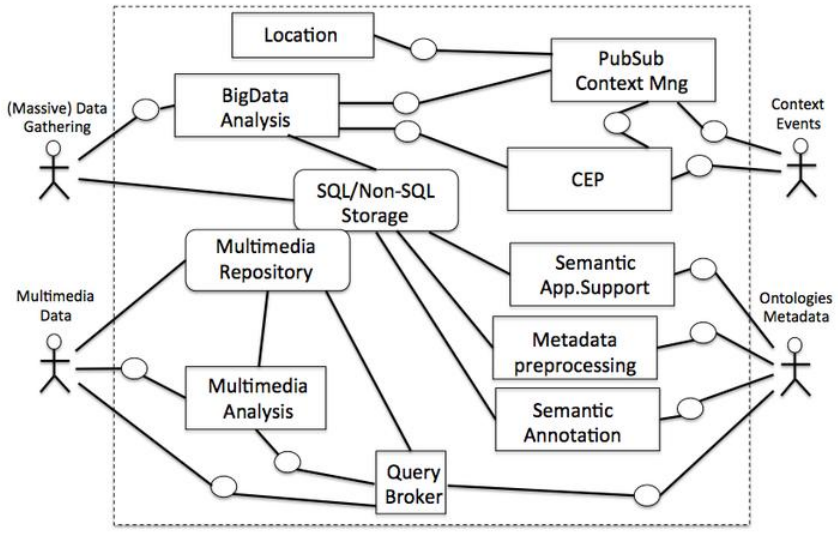

Figure 10 Data and Context Management Architecture

FI-WARE focus on the modelling part and consider the semantic aspect as well as the functionalities to be provided by the Data and Context Management Architecture .While the CDF and even more the provided survey focus on high level question considering also the domain to which the data are related.

This different perspective leads to a very difficult matching and suggests both to revise the CDF adding more detailed requests and to point out to FI-WARE the possibility of considering also domain related issues.

7.2.3 Internet of Things

Internet of Things is not a component per se in CDF/Survey as it is in FI-WARE architecture; however, we can relate several of its high level functionalities with some attributes/questions associated with the sensor network and customer devices components of the CDF and First Full Survey questionnaire.

Both the sensor network and customer device components are considered very briefly in the questionnaire so is also required to take into account the attributes associated with both components in the CDF.

The perspectives applied by the CFD/Survey and FI-WARE for the profiling of an infrastructure are very different, so the matching process between them will necessarily have some limitations.
First, this Fi-Ware chapter describe the architecture of the IoT Service Enablement, that comprises those Generic Enablers in FI-WARE enabling a large number of distributed and heterogeneous things and associated IoT resources to become available, searchable, accessible and usable by Future Internet Applications and Services. It is typically distributed across a large number of Devices, several Gateways and the BackEnd, and makes an in-depth analysis about most of the respective Generic Enablers and their subcomponents. The BackEnd is the component that provides management functionalities for the

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

devices and IoT domain specific support for the applications. The structure is shown in

Figure 11 below:

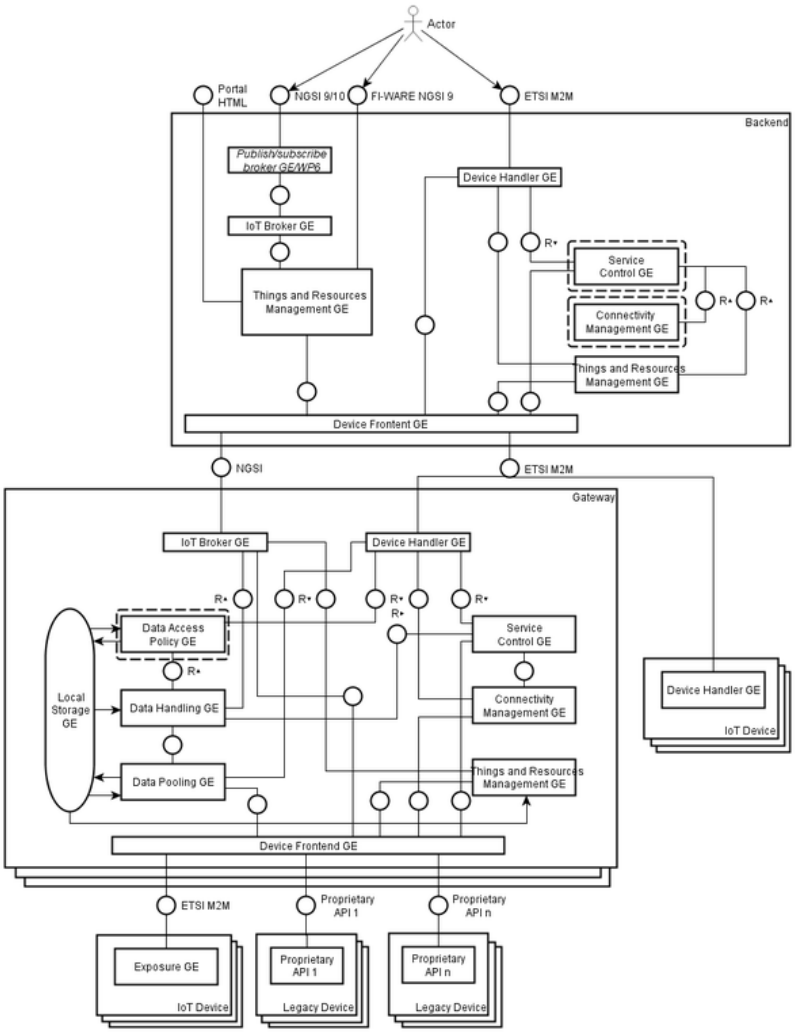

Figure 11 IoT architecture

The chapter explains in detail the relationships between the components of the BackEnd module, how the communications between the application and the core of the infrastructure are carried out and how the data model is used. The interfaces and their associated protocols are also mentioned, together with the functionalities performed by some of the components (the components analysed by FI-WARE until now). The standards used for each of the stated internal interfaces are also specified.

Second, both the CDF and the First Full Survey questionnaire are more functionality oriented and do not include a level of detail similar to FI-WARE. Thus, the analysis should be limited to take into account high level questions in

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

the questionnaire / attributes in the CDF. As a consequence, low level considerations about components are out of the scope of the current deliverable.

The first premise of the IoT chapter is that an IoT device may be categorized as IoT compliant if the standard ETSI M2M interface is supported and non-compliant if it is a legacy device based on proprietary protocols.

IoT compliant devices are interoperable with the core of the FI-WARE platform and, as both sensors and actuators are devices explicitly considered by FI-WARE, a match can be made with the two Sensor Network questions included in the table.

The rest of relationships are based on the CDF:

The FI-WARE document specifies that IoT compliant devices must use the TCP/IP stack to communicate. That includes the following values included in the current CDF:

- HTTP value as application layer protocol compliant relates to the ETSI M2M interface required by FI-WARE (row 3 of the table)
- Web Services that includes RESTful compliant relates to the ETSI M2M interface required by FI-WARE (row 4 of the table)

Device Level APIs support several functions (e.g. registration and discovery of devices, discovery of device capabilities, support of trigger events, etc.), but some of the functions are not addressed in the current version of the CDF. The ones considered at the moment are the followings:

- Manual configuration of devices through a Portal Application (row 6 of the table)
- Device management functionalities as, e.g. firmware updating (row 8 of the table)

In addition, it is a future objective that the Device Level API will be able to gather device data for further analysis and management of QoS purposes. This is an aspect considered in the CDF (row 5 of the current table).

Authorization functionalities are part of the security services considered in the Sensor Network component of the CDF. Thus, given that FI-WARE describes the interaction between the Service Execution Layer and the Access Policy Control component (to enforce the authorization decisions) both statements can be considered as partially compatible (row 7 of the table).

The CDF is being subjected to an updating process and, also, some components and generic enablers of FI-WARE have not been defined yet. Therefore, the analysis performed in the current deliverable should be considered as an early one and some of the identified relationships may be subjected to modifications and / or extension in later revisions and iterations of this document.

7.2.4 Application Service Ecosystem

The Application and Services Ecosystem and Delivery FI-WARE chapter covers both the technical and business aspects of the application and service delivery.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

The two main FI-WARE documents analysed were the High-level Description [4] and the preliminary architecture description [3]. The first document provides a broader view of the FI-WARE framework including current and planned generic enablers, while the second document provides more detailed information and design principles for a subset of GEs. The analysis followed framework structure suggested in [4], where GEs are grouped into:

- Business Framework comprising the basic (Broker) functionality GEs,
- Composition and Mashup infrastructure (Aggregator and Gateway) with functionality related to composite services/applications and interoperability issues,
- Channel Maker group offering functionality related to various access channels and device based service adaptation.

Figure 12 presents high level architecture with the above-mentioned GE groups and their relations to external elements such as Provider, Consumer and Hoster.
The user authentication and security related aspects were not taken into account since they are not specific to this FI-WARE chapter.
Since the business framework offers the core functionality for the ecosystem and comprises a number of GEs, it is recommended that the survey question and the corresponding CDF attribute refer to specific business framework elements, rather than use the collective concept of a Broker. Moreover, a more specific question should be asked regarding service composition in general and composite service execution mechanisms in particular as an important part of the ecosystem.

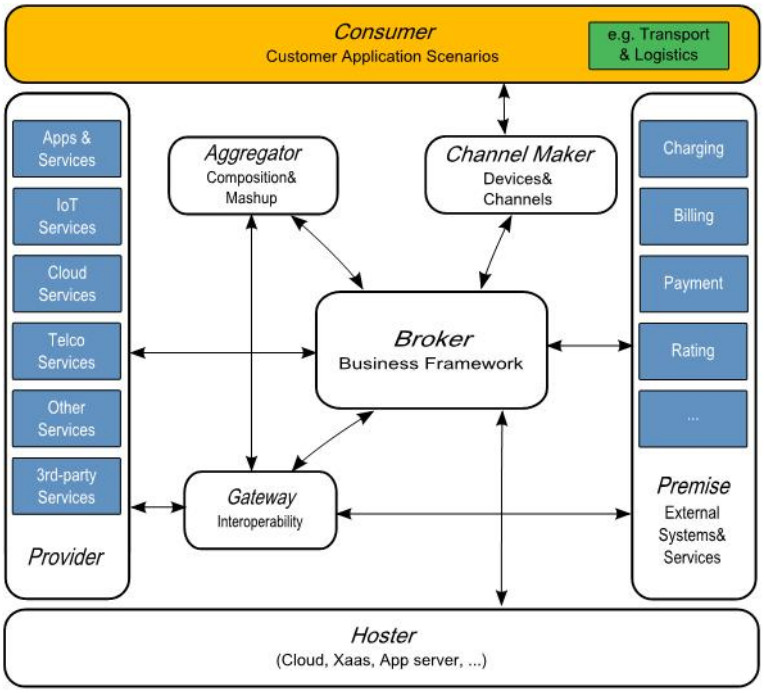

Figure 12 FI-WARE Applications/Services Ecosystem & Delivery High-level Architecture [4]

An extension should also be considered for CDF standard compliancy attribute. The set of possible answers should be extended to include Unified Service

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

Description Language (USDL) as a language for service description central to the ecosystem, and other service description languages used by the GEs, such as Gadget Description Language (GDL)and Mashup Description Language (MDL).
Most of the extensions proposed to CDF/survey key questions/answers set are based on the GEs description provided in FI-WARE documents. Therefore, they are labelled with S, meaning that if an infrastructure implements a given component, it is compatible with FI-WARE. Given a small number of survey questions regarding Application Service Delivery and consequently a small amount of data acquired by the survey, there are not many elements that are included with different labels. These elements should represent a set of potential questions and more importantly answers that can be provided for an infrastructure. They would provide more information on an infrastructure and would allow us to evaluate compatibility with FI-WARE and infrastructure interoperability on a more detailed level. Such an extension should be considered for the next version of the interoperability evaluation methodology.
For most of the GEs and their architectural components, the design principle is that the APIs are independent from the implementation technology and that the technical interfaces comply with or can be mapped to FI-WARE reference implementation. Hence, no specific implementation questions should be asked.

7.2.5 Cloud

Figure 13 shows the FI-WARE cloud general architecture [7]. Each one representing a different module made available from FI-WARE.

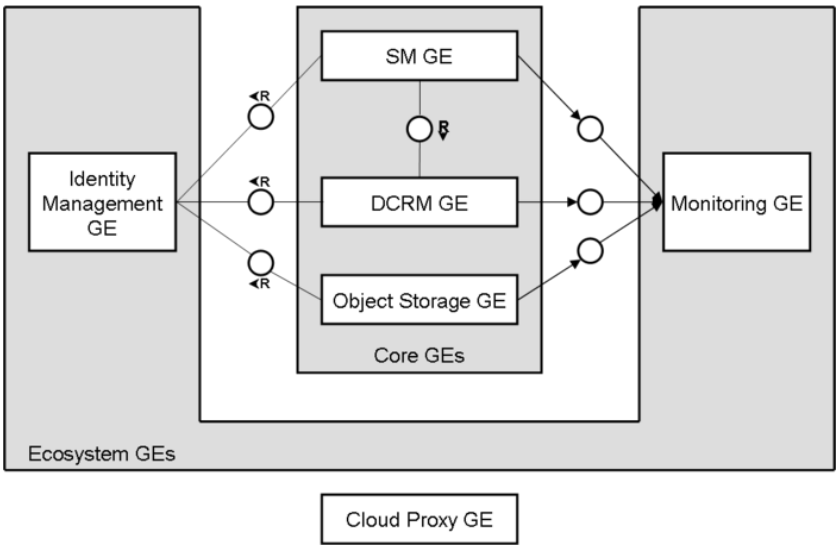

Figure 13 FI-WARE cloud general architecture

The architecture is composed of several modules each one representing a Generic Enabler:

- **Data Center Resource Mangement (DCRM) GE**, offering provisioning and life cycle management of virtualized resources (compute, storage, and network) associated with virtual machines. This enabler has an interface that implements the OCCI standard [8].

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

- **Object Storage GE**, offering provisioning and life cycle management of object-based storage containers and elements. It has an interface compliant with the Cloud Data Management Interface (CDMI) [9].
- **Service Management GE**, offering provisioning and life cycle management of composite services comprising several resources provided by on of the above GEs. In the first release of FI-WARE, Service Management GE will consume resources provided by Data Center Resource Management GE, via the corresponding APIs. This module has a Openstack Compute API compliant interface [10]
- **Cloud Edge Resource Management GE** (available in future releases of FI-WARE), enabling end-to-end provisioning and life cycle management of cloud applications which comprise run-time components designed to run on Cloud Edge devices.
- **PaaS Management GE** (available in future releases of FI-WARE), offering provisioning and life cycle management of middleware-level containers, such as Web, Database, etc.
- **Monitoring GE** (shared with the other FI-WARE chapters), collecting metrics associated with each of the Core GEs, and offering them to GEs which are interested to consume such metrics.
- **Identity Management GE** (shared with the other FI-WARE chapters), providing a unified management of users, roles and tokens, that can be used by other GEs for authentication and authorization purposes.

The Infinity perspective focuses on support for interoperability and on the possibility of using a subset of the FI-WARE enablers together with the existing infrastructure. A prerequisite is therefore the assumption that FI-WARE will support the use of a subset of its enablers in such a way.

To understand the degree of interoperability and possibility of substituting a module (i.e. a piece of software running on a given hardware and providing a set of functionalities) with another coming from the infrastructures, the focus of this analysis is what features each module is going to offer and what its APIs are.

For the security, monitoring and identity management aspects the FI-WARE Cloud system relies on the modules commonly developed for coping with these features across the different FI-WARE chapters, and, in the same way it is possible to notice that the CDF/survey does not cover with sufficient depth this topic.

The APIs for the cloud environment are quickly evolving and the current comparison does not consider different version of the APIs. This kind of information should be required from the infrastructure owners through the survey.

It is also worth noticing the fact that at this stage FI-WARE is providing a IaaS cloud while Paas will be available in future version and SaaS is not cited at all in the FI-WARE document on the cloud topic.

7.2.6 Lesson learned applying the process

Applying the process, it became evident that the different perspectives – the CDF and initial survey being high-level, the FI-WARE documentation focusing on very detailed requirements – make the matching process difficult. In order to be able to better bring together requirements and enablers, the CDF has to be extended with more detailed attributes.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

On the other hand, the input received from FI-WARE sometimes is too domain-specific to be considered at all in the CDF. It is also clear that the selection process of attributes to be included in the CDF requires expert knowledge in the various fields.

However, we believe that the approach followed proves to be very useful. The continued real life checks, analysing the requirements documents and the survey feedback provides valuable input and contributes to the development and evolution of the CDF, thereby increasing its quality.

8 Conclusion

This deliverable shows the first formalization of a process for detecting of Common Enablers and Interoperability Constraints between exiting infrastructures and the FI-WARE architecture.

The methodology is semi-automatic and a specific final step requires involving experts to take the final decision.

While developing the proposed methodology, the working group had to face the early stage of the FI-WARE documentation as well as the lack of a preliminary analysis on a significant amount of collected data from the infrastructures. Therefore it has still to be validated against them.

As side effect of developing the methodology, a specific analysis useful for providing feedback about mutual alignment and completeness both for the survey and for FI-WARE has been carried out.

The second iteration of this deliverable will be developed together with T.3.3 and will consider any received feedback, richer decision schemas to provide more precise automatic outputs, and a specific methodology for taking into account the open questions present in the survey.

The matching among exiting infrastructures will be also considered for extending the analysis considering subset of them all together, for identifying potential new generic enablers and constraints to be reported to FI-WARE.

9 References

[1] Infinity_Project, “D.3.1 Comon Description Framework for Infrastructure Profiling 1st Release,” 2012.

[2] FIWARE_Project, “FiWare wiki pages,” [Online]. Available: http://forge.FI-WARE.eu/plugins/mediawiki/wiki/fiware/index.php/FI-WARE_Architecture_%28PRELIMINARY%29.

[3] FIWARE_Project, “D.10.1a FI-WARE Testbed Design PP,” 2012.

[4] FIWARE_Project, “High-level Description (Product Vision),” 2011.

[5] T. O. E. P. Core, “"OpenEPC",” [Online]. Available:

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

http://www.openepc.net/_docs/Produktblatt-OpenEPC-Rel3_2011-11.pdf.

[6] OpenIMS, "OpenIMS Platform," [Online]. Available: http://www.openimscore.org.

[7] FIWARE_Project, "Cloud Hosting Architecture," 2012. [Online].

[8] OCCI, "OCCI Specification," [Online]. Available: http://occi-wg.org/about/specification/.

[9] SNIA, "Information Technology - Cloud Data Management Interface (CDMI™) Version 1.0.1," 2011.

[10] Openstack, "Openstack API," [Online]. Available: http://docs.openstack.org/api/openstack-compute/1.1/content/.

[11] FIWARE_Project, "IoT architecture," 2002. [Online]. Available: https://forge.FI-WARE.eu/scmrepos/svn/iot/trunk/documents/FMC/IoT-Overview.graphml.

10 APPENDIX: Artefact for identifying key points in matching FI-WARE architecture and Data coming from the survey

The following tables are to be used for analysing the data coming from the survey as described in Section 6.2.

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

10.1.1 Interface to network and devices (I2ND)

Survey Question-ID / CDF reference	Question	Answer	Fiware generic Enabler name	Fiware architectural component	Fiware Version	Relationship	Upgradability	Operational / Architectural Issue	Source of decision	Notes	Source of Question
B1	Which type of customer devices do you have at your disposal ?	Smart Phone	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S	Easy	**Arch.**		Matches I2ND.CDI supported end-devices: "Handsets (cellular phones, smart phones)"	SURVEY
		Laptop	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		Not menetioned explicitly in I2ND.CDI supported end-devices, but should naturally be supported	SURVEY
		Game Console	Connected Device Interface (CDI) GE	I2ND.CDI	Current	OF	Easy	**Arch.**		Not mentioned in current FIWARE I2ND documents (wiki, testbed description)	SURVEY
		Tablet	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S	Easy	**Arch.**		Matches I2ND.CDI supported end-devices: "Tablets"	SURVEY
		Wearable Sensors	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S	Easy	**Arch.**		Not mentioned in current FIWARE I2ND documents (wiki, testbed description)	SURVEY
		Others	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S	Easy	**Arch.**		Possible feedback to CDF: UPDATE and INCLUDE: Smart TVs, Set-Top-Boxes, In-Vehicle Infotainment, Information kiosks	SURVEY
A11	Please select al the types of nodes in use in your sensor network	Video camera	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		Matches sensor types specified for I2ND.CDI: "Camera" HOWEVER: the I2ND.CDI Sensor Types seem to be linkes to mobile end-device capabilities Recommendation: Check if Camera is part of B1 capabilitites Possibly needs update of CDF to be more specific on customer devices capabilities	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

A13	Please select all of the data that it is possible to collect through the sensor nodes in your network	Video	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, OF	Easy	**Arch.**		Matches sensor types specified for I2ND.CDI: "Camera" HOWEVER: the I2ND.CDI Sensor Types seem to be linkes to mobile end-device capabilities Recommendation: Check if Camera is part of B1 capabilitites Possibly needs update of CDF to be more specific on customer devices capabilities	SURVEY
		Audio	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		Matches sensor types specified for I2ND.CDI: Microphone HOWEVER: the I2ND.CDI Sensor Types seem to be linkes to mobile end-device capabilities Recommendation: Check if Microphone is part of B1 capabilitites Possibly needs update of CDF to be more specific on customer devices capabilities	SURVEY
A14	Please select all of the data that it is possible to collect through the sensor nodes in your network	Others	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		No matches for sensor types specified for I2ND.CDI: Geo-Location Device Orientation & Accelerometer HOWEVER: the I2ND.CDI Sensor Types seem to be linkes to mobile end-device capabilities Recommendation: Check if GPS/Geo-Location is part of B1 capabilitites Possibly needs update of CDF to be more specific on customer devices capabilities	SURVEY
A15	Please select all of the data that it is possible to collect through the sensor nodes in your network	Others	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		Matches sensor types specified for Device Orientation & Accelerometer HOWEVER: the I2ND.CDI Sensor Types seem to be linkes to mobile end-device capabilities Recommendation: Check if Device Orientation & Accelerometer is part of B1 capabilitites Possibly needs update of CDF to be more specific on customer devices capabilities	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

B1	Which type of customer devices do you have at your disposal ?	Smart Phone, Laptop, Game Console, Tablet, Wearable Sensors, Other	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		I2ND supports devices with different form factors. phones (phone like - supports calling), tablet, PCs, a Set top boxes, in-car systems Possibly needs update of CDF, in order to explicitly include: PCs, Set top boxes, in-car systems	SURVEY
		Smart Phone, Laptop, Game Console, Tablet, Wearable Sensors, Other	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		I2ND requires specification of screen sizes. The screen is described using numeric values indicating the screen size (width x height), the colour depth (bit depth), the DPI of the device (pixels per inch) Possibly needs update of the CDF B1 - to be more specific on customer devices capabilities	SURVEY
		Smart Phone, Laptop, Game Console, Tablet, Wearable Sensors, Other	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		I2ND requires specification of available Inputs. The available input methods are described by (boolean) values indicating Touch screen support, Hardware QWERTY keyboard, On screen keyboard, Numeric keypad (T9), Stylus support. In many cases it is clear which kind of input a certain devices supports, however thi possibly needs update of the CDF B1 - to be more specific on customer devices capabilities	SURVEY
		Smart Phone, Laptop, Game Console, Tablet, Wearable Sensors, Other	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		I2ND requires specification of Processor Types. Details about the processor are provided to the application. This includes an enumerated value indicating the processor family (e.g. X86, ARM, Other), an enumerated value indicating machine word size (e.g. 32bit or 64bit), an integer value representing the number of cores. In many cases it is clear which kind of processor type a certain devices is using, however this possibly needs update of the CDF B1 - to be more specific on customer devices capabilities	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

		Smart Phone, Laptop, Game Console, Tablet, Wearable Sensors, Other	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		I2ND requires specification of Available Disk (Storage) Space . During the lifetime of almost any application the need will arise to utilise disk space, either for downloading of content from the cloud / internet or the storage or locally produced content. Storage will be described by integer values representing the total size of the disk in bytes, the total number of bytes consumed,the total number of bytes available. In many cases it is (at least roughly) clear what kind of storage certain devices provide, however this possibly needs update of the CDF B1 - to be more specific on customer devices capabilities	SURVEY
		Smart Phone, Laptop, Game Console, Tablet, Wearable Sensors, Other	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S, F	Easy	**Arch.**		I2ND requires specification of Device Connectivity . The network connectivity of the connected device is provided to the developer. This is expressed in two forms, firstly as the available connectivity options, and secondly the currently connected (if any) connectivity options.Available - Multiple boolean values indicate the presence of the following technologies: Wi-Fi, Bluetooth, Cellular In many cases it is clear what kind of Connectivity certain devices provide, however this possibly needs update of the CDF B1 - to be more specific on customer devices capabilities	SURVEY
B4	Please select all the operating systems of your customer devices.	Android	Connected Device Interface (CDI) GE	I2ND.CDI	Current	S	Easy	**Arch.**		Current I2ND testbed supoprts / requires android devices	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

D4	Please select all the Application Service Delivery services that are provided through your Infrastructure	Gateway for applications/services interoperability	Cloud Edge (CE) GE	I2ND.CE	Current	S, F	Medium	**Arch.**		I2ND.CE specification states: "Our GE is the "cloud proxy", sort of super gateway. The SW is 100% dependant on the HW we will provide. Our plans right now are to provide the 1st release running on a more or less standard small PC, the 2nd and 3rd releases might be more "industrial" being released on a specifically manufactured HW(tbc). The cloud proxy needs an internet connection and nothing more (xDSL).Preliminary version pc-based" BUT (from Wiki): Cloud Proxy is realized on a PC-like platform, equipped with a classical Linux distribution (Ubuntu for instance) Therefore at least for the 1st release it seems that the I2ND.CE could be deployed on commodity Hardware running Ubuntu Linux Needs further investigation / clarification, possibly also update of the CDF (deployable OS, and Connectivity for Gateway)	SURVEY
G7	Please select all the Backbone Network services that are provided through this Infrastructure	Other	Network Information & Control (NETIC) GE	I2ND.NETIC	Current	F	Hard	**Arch.**		In FIWARE I2ND.NETIC Wiki it is stated: The possible instances for open network are OpenFlow 1.0, 1.1, 1.2, 1.x OpenFlow support, including supported Versions should be included in the CDF	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

I11	Please select the platform over which virtualization is achieved in this Cloud Service	Vmware	Network Information & Control (NETIC) GE	I2ND.NETIC	Current	S		**Arch.**		The FIWARE testbed description specifies the follwoing requirements of 3 components (which cannot be mapped to the I2ND.NETIC architectural modules withouth further investigation at the current moment): 1) pc based (may be virtualized), needs IP link to external network information source 2) Java/C, on a dedicated workstation and vmware hypervisor on private IP 3) preliminary pc-based, a specific hw not yet available With I11 in the questionaire answered with "VMWare" 2) can be satisfied	SURVEY
H7	Please select the platform over which virtualization is achieved in this Cloud Service	Access to the Internet	Network Information & Control (NETIC) GE	I2ND.NETIC	Current	S		**Arch.**		The FIWARE testbed description specifies the follwoing requirements of 3 components (which cannot be mapped to the I2ND.NETIC architectural modules withouth further investigation at the current moment): 1) pc based (may be virtualized), needs IP link to external network information source 2) Java/C, on a dedicated workstation and vmware hypervisor on private IP 3) preliminary pc-based, a specific hw not yet available With H7 in the questionaire answered with "Access to the Internet"1) can be satisfied	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

H7	Please select all the Wired Access Network services you can access through your Infrastructure	Access to the Internet	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Medium	**Arch.**		The following specification only allows remote access to an infrastrucutre which is hosted and deployed at DT Preliminary virtualized environment (6 virtual machines) deployed on a specific hardware at DT premises in conjunction with Fraunhofer Therefore an access to the infrastrucutre at DT is mandatory	SURVEY
E9	Please select all the communications protocols / technologies that can be used to access services offered	GSM/GPRS	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If E9 is answered with "GSM/GPRS", 1) is supported	SURVEY
		3G (UMTS)	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If E9 is answered with "3G", 2) is supported	SURVEY
		HSPA/HSPA+	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If E9 is answered with "HSPA/HSPA", 2) is supported	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

		LTE	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If E9 is answered with "GSM/GPRS", 3) is supported	SURVEY
		WIMAX	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If E9 is answered with "GSM/GPRS", 5) is supported	SURVEY
		GSM/GPRS	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If E9 is answered with "GSM/GPRS", 1) is supported	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

F9	Please select all the communications protocols that can be used to access services offered	802.11 (x / any)	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If F9 is answered with any "802.11x", 5) is supported	SURVEY
H13	Please describe the type of access network in operation	GSM/GPRS	Service, Capability, Connectivity, and Control (S3C) GE	I2ND.S3C	Current	S	Hard	**Arch.**		The OpenEPC as an integral part of the I2ND.S3C GE supports multiple access networks: 1) 2G 2) 3G 3) LTE 4) WiFi 5) Fixed DSL/FTTx/WiMax If H13 is answered with any of " - ADSL - FTTH/FTTB -FTTH/FTTC - FTTH/PON" , 5) is supported	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

10.1.2 Data and Context Management

Survey Question-ID / CDF reference	Question	Answer	Fiware generic Enabler name	Fiware architectural component	Fiware Version	Relationship	Upgradability	Operational / Architectural Issue	Source of decision	Notes	Source of Question
C4	**Please select all the data / context management services that are provided through your Infrastructure**	Data storing	BigData Analysis	Data.BigData		**S,F**		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Data analysis	BigData Analysis	Data.BigData		S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Event Analysis	CEP	Data.CEP		S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Data query	Query broker	Data.QueryBroker		S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Large data management	BigData Analysis	Data.BigData		S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

		Data interoperability	Query broker	Data.QueryBroker		S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
C6	Please select all the security services/features offered by your infrastructure	Support for TLS/SSL for communications with storage devices			Current	OF		**Arch.**			SURVEY
		Security monitoring of storage devices and networks	SecurityMonitoring GE	Security.SecurityMonitoring	Current	S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Identity management (authentication) for data sources	IdentityManagement GE	Security.IdentityManagement	Current	S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Privacy for data subjects (e.g. identity redaction)	Privacy GE	Security.Privacy	Current	S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY
		Access control and/or digital rights management.			Current	S, F		**Arch.**		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	SURVEY

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

10.1.3 Internet of Things

Survey Question-ID / CDF reference	Question	Answer	Fiware generic Enabler name	Fiware architectural component	Fiware Version	Relationship	Upgradability	Operational / Architectural Issue	Source of decision	Notes	Source of Question
Question A.5	Please describe the interoperability capability (if any) of this infrastructure with other infrastructures?	(open answer)	Device Handler	Internet of Things	Current	F		Arch.	IoT Chapter	IoT devices compliant (implementing ETSI M2M interface) will interoperable with the other FI-WARE modules	Survey
Question A.10	Please select al the types of nodes in use in your sensor network? *Place an X against all that apply*	• Sensor • Actuator • Video camera • Other (see below)	Device Handler	Internet of Things	Current	P		Arch.	IoT Chapter	All IoT devices compliant must implement ETSI M2M interface. Sensors and actuators are explicitly consider as devices by FI-WARE.	Survey
CDF	Sensor Network: Protocol for accessing services	- http - telnet - ssh - other (please specify)	Device Frontend	Internet of Things	Current	P	Hard	Arch.	IoT Chapter	IoT compliant devices communicate using the TCP/IP stack. That includes CoAP or HTTP as application layer protocols compliant to the ETSI M2M interface required by FI-WARE	CDF
CDF	Sensor Network: Open interfaces (API)	- Web Services - Restfull API	Device Frontend	Internet of Things	Current	P	Hard	Arch.	IoT Chapter	IoT compliant devices communicate using Web Services that includes RESTful compliant to the ETSI M2M interface required by FI-WARE	CDF

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

CDF	QoS/SLA Management	(open answer)	Device Frontend	Internet of Things	Future	P		Arch.	IoT Chapter	The Device Level API will be able to gather data for analysis and QoS purposes	CDF
CDF	Customer Devices: Configuration of devices	- remotely - local - manual - other (please specify)	Device Frontend	Internet of Things	Current	P	Hard	Arch.	IoT Chapter	Device Level API of ETSI M2M interface used by FI-WARE allows the manual configuration of devices through a Portal Application	CDF
CDF	Sensor Network and Customer Device: Security services	- Support for TLS/SSL in sensor network communications - Security monitoring in the sensor network - Identity Management (authentication) of sensor devices - Privacy for subjects observed by the sensor network - Access control to prevent unauthorized	Service Control	Internet of Things	Future	P	Easy	Operat.	IoT Chapter	FI-WARE will implement an interaction between the Service Execution Layer and the Access Policy Control component to enforcing the last one's authorization decisions	CDF
CDF	Customer Devices: Upgrading of firmware	- remote - local - manual - automatic - no upgrading - other (please specify)	Device Frontend	Internet of Things	Current	P		Arch.	IoT Chapter	Device Level API is used to perform device management functionalities as firmware update	CDF

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

10.1.4 Application Service Ecosystem

Survey Question-ID / CDF reference	Question	Answer	Fiware generic Enabler name	Fiware architectural component	Fiware Version	Relationship	Upgradability	Operational / Architectural Issue	Source of decision	Notes	Source of Question
D.4	Please select all the Application Service Delivery services that are provided through your Infrastructure	Service Repository	Repository GE		Current	S		Arch	No		SURVEY
			Registry GE		Current	S		Arch	No		SURVEY
		Marketplace	Marketplace GE		Current	S		Arch	No		SURVEY
		Monetization and Revenue Management	BEMP GE		Future	S		Arch	No		SURVEY
			Revenue Sharing GE		Current	S		Arch	No		SURVEY
		SLA Management	SLA Management GE		Future	S		Arch	No		SURVEY
		Service Composition & Mashup	Composition Editor GE		Current	S		Arch	No		SURVEY
			Composition Execution GE		Current	S		Arch	No		SURVEY
		Channel for apps/services exploitation	Multi-channel/Multi-device Access System GE		Future	S		Arch	No		SURVEY
		Portal *(Web based GUI)*	Composition Editor GE	Composition Editor	Current	S		Arch	No		SURVEY
				Mashup Editor	Current	S		Arch	No		SURVEY
			Revenue Sharing GE		Current	S		Arch	No		SURVEY
			Mediator GE		Current	S		Arch	No		SURVEY
Sugeested addition	Please select the Application Service	Mashup	Composition Editor GE	Mashup Editor	Current	S		Arch	No		
			Composition Execution GE	Mashup execution engine	Current	S		Arch	No		

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

	Compositon services that are provided through your Infrastructure	Service Orchestration (BPMN, BPEL)	Composition Editor GE	Composition Editor	Current	S		Arch	No		
			Composition Execution GE	Service Orchestration Engine	Current	S		Arch	No		
		Event-based Service Composition	Composition Editor GE	Composition Editor	Current	S		Arch	No		
			Composition Execution GE	Service Composition Engine	Current	S		Arch	No		
CDF: Deliveries. open interfaces	List programmable interface (if any)	API	Repository GE		Current	S		Arch	No		CDF
			Marketplace GE		Current	S		Arch	No		CDF
			Composition Editor GE		Current	S		Arch	No		CDF
			Composition Execution GE		Current	S		Arch	No		CDF
		RESTful API	Mediator GE		Current	S		Arch	No		CDF
		WebService	Revenue Sharing GE		Current	S		Arch	No		CDF
		SOAP	Mediator GE		Current	S		Arch	No		CDF
CDF: Deliveries. standard compliancy	List the standards implemented in this infrastructure	BPMN	Composition Editor GE	Composition Editor	Current	S		Arch	No		CDF
			Composition Execution GE	Service Composition Execution	Current	S		Arch	No		CDF
		WSDL			Current	P	Medium	Arch	No		CDF
		EMML			Current	OF		Arch	No		CDF
	OTHER standards implemented in this infrastructure	USDL	Repository GE	Repository	Current	S		Arch	No		
				Registry	Current	S		Arch	No		
			Marketplace GE		Current	S		Arch	No		
			Composition Editor GE	Composition Editor	Current	S		Arch	No		
			Composition Execution GE	Composition Execution	Current	S		Arch	No		
		MDL	Composition Editor GE	Mashup Editor	Current	S		Arch	No		
			Composition Execution GE	Mashup Execution Engine	Current	S		Arch	No		
		GDL	Composition Editor GE	Mashup Editor	Current	S		Arch	No		
			Composition Execution GE	Mashup Execution Engine	Current	S		Arch	No		
		BPEL	Composition Editor GE	Composition Editor	Current	S		Arch	No		

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

			Composition Execution GE	Service Composition Execution	Current	S		Arch	No		
CDF: Deliveirs. extensibility of services	Are services extensible by the user?	yes				OF		Arch	No		CDF
		no						Arch	No		CDF
CDF: Deliveries.configurability of service	Are services configurable by the user(yes/no) how?	no				OF		Arch	No		CDF
		yes with configurable file (XML)						Arch	No		CDF
		yes with web interface						Arch	No		CDF

10.1.5 Cloud Computing

Survey Question-ID / CDF reference	Question	Answer	Fiware generic Enabler name	Fiware architectural component	Fiware Version	Relationship	Upgradability	Operational / Architectural Issue	Source of decision	Notes	Source of Question
I6	Please select all the Cloud Computing services that are provided through your Infrastructure	SAAS		Cloud Hosting Architecture.Preliminary	Current	S		Arch.			Survey
		PAAS		Cloud Hosting Architecture.Preliminary	Future	S		Arch.			Survey
		IAAS		Cloud Hosting Architecture.Preliminary	Current	OF		Arch.			Survey
I10	Please select all the APIs supported by	OpenNebula	Service management GE	Cloud Hosting Architecture.SM	Current	P		Arch.		Openstack, used in Fiware, partially implements OCCI that is used in OpenNebula	Survey

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

	your cloud service to manage computing (C) and/or storage (S) resources.	OpenNebula	Data Center Resource Management GE	Cloud Hosting Architecture.DCRM	Current	S		Arch.		Same Api (OCCI)	Survey
		OpenNebula	ObjectStorage GE	Cloud Hosting Architecture.ObjectStorage	Current	P		Arch.		OpenNebula claims to be an ongoing work for implementing CDMI interface	Survey
		OpenStack	Service management GE	Cloud Hosting Architecture.SM	Current	S		Arch.		Api compliant with OpenStack	Survey
		OpenStack	Data Center Resource Management GE	Cloud Hosting Architecture.DCRM	Current	P		Arch.		Openstack partially implements OCCI that is used in Fiware	Survey
		OpenStack	ObjectStorage GE	Cloud Hosting Architecture.ObjectStorage	Current	P		Arch.		several initiatives are investigating how to implement a CDMI interface	Survey
		Amazon EC2	Service management GE	Cloud Hosting Architecture.SM	Current	P		Arch.		Openstack partially support EC2 API	Survey
		Rackspace	Service management GE	Cloud Hosting Architecture.SM	Current	P		Arch.		Openstack partially support RackSpace API	Survey
I12	Please select the platform over which virtualization is achieved in this Cloud Service				Current	OF		Arch.			Survey
I15	Please select all the security services/features offered by your infrastructure	Support for TLS/SSL for communication with cloud resources			Current	OF		Arch.			Survey
		Security monitoring in the cloud	SecurityMonitoring GE	Security.SecurityMonitoring	Current	S, F		Arch.		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	Survey

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium

		Security compliance of the cloud			Current	S, F		Arch.		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	Survey
		Identity management (authentication) of cloud users	IdentityManagement GE	Security.IdentityManagement	Current	S, F		Arch.		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	Survey
		Privacy for cloud users (e.g. to prevent their actions being monitored by cloud operators)	Privacy GE	Security.Privacy	Current	S, F		Arch.		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	Survey
		Access control over who can use cloud resources.	SecurityMonitoring GE	Security.SecurityMonitoring	Current	S, F		Arch.		Too generic question to do a reasonable matching. Probably S, but a F is also put to say that further investigations are needed (possible feedback to CDF)	Survey

This document is produced under the EC contract FP7 ICT-285192.
This document is property of the Infinity consortium and shall not be distributed or reproduced without the written approval of the Infinity consortium