D1.4 Gap analysis and final requirements

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Executive Summary

Because the Fiware4Water project aims to develop a socially and business relevant architecture for heterogeneous entities based on FIWARE Technology, it is necessary that, in addition to developer know-how, external inputs are acquired to shape the architecture design. The main objectives of WP1 are:

1) the collection of the opinion and potential interest of different actors from the ICT and water sectors, in the development of an open source platform able to transform physical data into digital smart applications, answering water management needs and issues.
2) the collection of the minimum technical requirements to develop Fiware4Water Reference Architecture (F4W-RA) to ensure that it can be interoperable and deployable in any legacy system throughout Europe and also to ensure that it can be used by any SME to develop new services and products, hence boosting innovation.

The problem of acquiring external inputs were addressed by contacting Use Case stakeholders, the Fiware4Water Demo Cases (Task 1.1), possible End-Users of the platform through water utilities and municipalities (Task 1.2) and contacts responsible of the innovation activities inside water sector companies around the world, both individuals and companies, (T1.3) with an interest in or concerns about the realization of the F4W-RA. The inputs were acquired via face to face interviews and online questionnaires. Once collected, all these information (being very technical or not depending on the targeted audience) have been analysed to produce a list of minimum technical requirements as well as a gaps analysis over the water utilities, municipalities, and responsible of innovation activities inside water sector companies. They are not a specific list well suited to each F4W Demo Cases, but on the contrary, a general one allowing the development of a F4W-RA (Task 2.1).

The present report provides this list of unified requirements extracted from the stakeholder workshops material as well as a gap analysis of the end-users and innovation requirements. The final result is the identification of the required components as well as the implementation strategies to be executed during the execution of the project to adress the identified gaps. Additionally, it was identified a set of Data Models that are needed to be defined for the correct implementation of the different F4W Demo Cases (Task 2.3). Hence the added value of WP1 is double:

1) by contacting different actors throughout Europe and beyond, we started to inform stakeholders that such a platform will be soon available, and
2) by contacting actors outside our consortium, we ensured that the developed F4W platform will be interoperable and deployable anywhere in Europe and beyond, in any legacy system.

Future work will involve disseminating these requirements and gaps in the different work packages, which will serve as inputs in designing the architecture reference model and developing harmonized data models for the architecture (WP2), as well as planning implementation actions to carry out the implementation strategies (WP3, WP4, and WP6) identified in this report.

Related Deliverables

D1.1: Requirements from Demo Cases
D1.2: Requirements from end-users
D1.3: Requirements for innovation
D2.1: Specification of system architecture for water management, cybersecurity and quality monitoring

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List of Acronyms/Glossary

AI	Artificial Intelligence
CIM	Context Information Management
ETSI	The European Telecommunications Standards Institute
F4W	Fiware4Water
F4W-RA	Fiware4Water - Reference Architecture
GE or FIWARE GE	FIWARE Generic Enabler, each of the functional components of the FIWARE Catalogue.
ID	Identification
IT	Information technology
ML	Machine Learning
NGSI	New Generation Software Interface
NGSI-LD	New Generation Software Interface – Linked Data
OGC	The Open Geospatial Consortium
SAREF	Smart Appliances REFerence (SAREF) ontology
SME	Small and Medium Enterprise

I. Introduction

I.1. Background

The objective of the Fiware4Water (F4W) project is to provide an architectural reference model for the interoperability of Water sector applications based on FIWARE architecture, outlining principles and guidelines for the technical interfaces based on NGSI-LD and algorithms for Artificial Intelligence (AI) and Machine Learning (ML) purposes taking into account the F4W data models specified and standardised in the project. Thus, F4W aims to provide the architecture that would let water entities exchange information and interact with one another, within the context of being socially and business relevant.

To explain the context of this report, it is necessary to explain how the above overall objective is broken down into concrete work within the F4W project. This work is divided into several work packages (WP) which cover different areas in the resolution of these objectives. The results of this report are relevant for the following WPs:

- WP2: a reference architecture based on FIWARE will be developed (F4W-RA).
- WP3: implementation of smart applications and smart sensors following the specified requirements.
- WP4: implementation of the different use cases and the integration with F4W-RA.
- WP5: creation of the corresponding end-user requirements to be adopted in the F4W-RA.
- WP6: community building information regarding the SME Ecosystem building and definition of proper communication protocol to disseminate the project results.

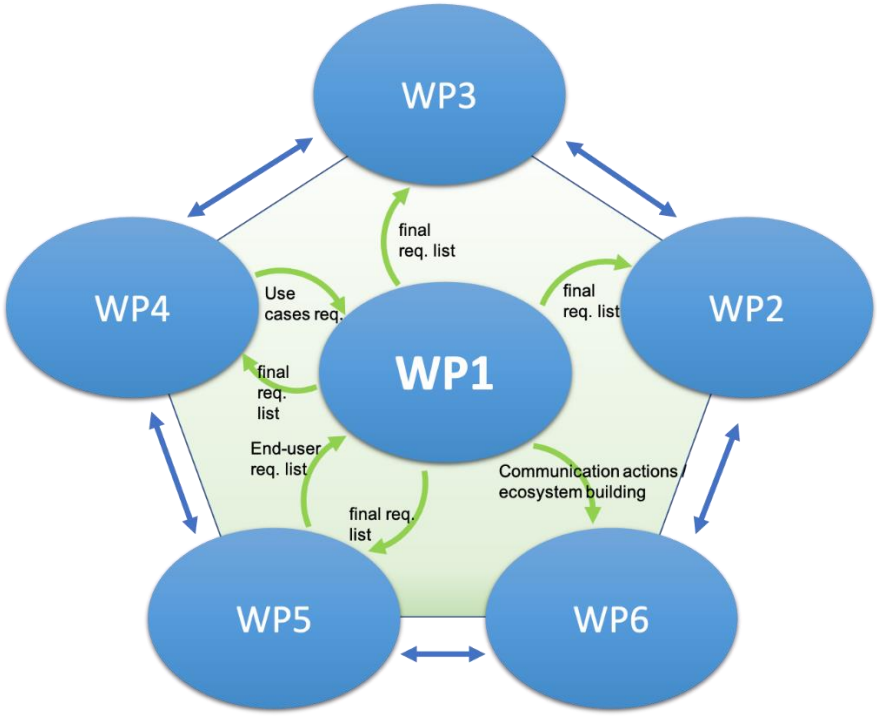

Figure 1: Relationships between WP1 and the rest of WPs

The development of the aforementioned reference architecture (WP2) shall be facilitated through the collection of both functional, non-functional, and data requirements from a diverse set of actors analysed in the WP1. These results shall be transferred to the WP2 in order to help refine the F4W-RA.

This deliverable, "D1.4 Gap Analysis and Final Requirements ", documents the resulting requirements coming from the three major interactions between partners and stakeholders through the different questionnaires and workshops during the execution of the WP1. It provides the final results in the form of ordered requirements sorted by stakeholders. These requirements have been analysed, generalized, abstracted, and landed to each of the FIWARE Generic Enablers (GE) in order to provide inputs to WP2. Additionally, a gap analysis of the different sources has been provided in order to facilitate the final synthesis of the activity of the WP1.

Last but not least, an exhaustive conclusion is produced regarding this activity with the future activity to be taken in this process.

I.2. Overview of the document

The present document is structured as follows:

- **Terms. definition** – This section defines the terms which are used in WP1 in the requirements engineering process.
- **Gaps from the requirements for Demo** – This section includes the unified requirement list corresponding to the analysis of the requirements obtained for each Demo Case together with the list of identified FIWARE Generic Enablers (GE) that can be applied to tackle with those requirements.
- **Gaps from the requirements for End-Users** – This section includes the list of final requirements obtained from the End-Users survey and the identified actions to be developed during the execution of the project to resolve them.
- **Gaps from the requirements for Innovation** – This section includes the list of final requirements obtained from the Innovation survey as well as the corresponding actions to be implemented in the different WPs to resolve them.
- **Conclusions** – This section includes the final conclusion related to the generation of corresponding requirements.

The reader should also be aware of complementing documents, D1.1, D1.2 and D1.3, which also cover the results of this content, but avoid any content on requirements in favour of focusing on getting the gap analysis, generate the synthesis and finally provide the conclusions. On the other side, D1.4 will produce the complete list of requirements and the conclusion about the overall activity.

II. Definition of Terms

It is important that the requirements engineering process is defined with an unambiguous understanding of the terminology in order to get effective and precise results to be used in the WP2. This section defines that terminologies which are used in this document in the overall process.

The following is the list of terms in these requirements engineering process and can be applied in the different WP of the F4W project.

- **Actor / User**, something with behaviour (able to execute an if statement). It might be a mechanical system, person, computer service, organization, or some combination of them.
- **System**, Schneider describes the system as "everything you plan to create" [4]. The system is the boundary of the application.
- **Use Cases**, the behavioural portion of a contract between the stakeholders of a system [3].
- **Interaction**, a message, a sequence of interactions, or a set of interaction sequences [3].
- **Scenario**, sequence of actions and interactions, or a set of interactions sequences.
- **Requirements**, a requirement describes a system property in conjunction (if it is applicable) with a measure to clarify if the developed system satisfies that property. We can talk about different types of requirements:
    - Functional requirements detail capabilities, behaviour, and any other information that the solution will need (e.g. formatting text, numeric calculation, applied/demanded standard …).
    - Non-functional requirements detail conditions statements that the solution have to fulfil to keep effective, what are the qualities that have to be defined, or the restrictions under which the solution must operate [5].
    - Data constraints indicate the limits of the data requirements especially regarding further use of it (e.g. maximum size and number of files, records, and data elements).
- **Use Case ID**, a unique identification that represents unambiguously each of the Use Cases.
- **Unique ID**, a unique identification that represents unambiguously the requirements for each Use Case ID. It is formed with the Use Case ID plus a Requirement ID. This requirement ID is formed following the next criteria:
    - Functional requirements, represented by the code "**Fnxxx**", where xxx is a digital number between 001 and 999.
    - Non-functional requirements, represented by the code "**Nfnxxx**", where xxx is a digital number between 001 and 999.
    - Data requirements, represented by the code "**Dfnxxx**", where xxx is a digital number between 001 and 999.
- **Originator,** it corresponds to the acronym of the partner that was responsible to collect the specific requirement from the Use Case (EYDAP, 3S, SWW, EGM, FF, KWR, WNT).

- **FIWARE Generic Enabler (GE),** a fully Restful open source service inside the FIWARE Architecture based on open APIs and classified in subgroups depending on the functionality offered. You can get an overview of the current FIWARE GEs in the FIWARE Catalogue [2].

III. Methodology

Basically, a gap analysis is a process that can help businesses or IT departments identify where they are not living up to their potential and the blind point in the corresponding current scenario, and then use that information to schedule steps to improve the current situation with the purpose to resolve the difference between the current situation and the expected one.

There are two different approaches to follow in the gap analysis of requirements in WP1 depending on the source of these requirements. It conditions the adoption of the corresponding methodology described below.

- In terms of Task 1.1 we made an analysis of requirements from the different use cases of the Project resulting in a complete list of requirements that can be analysed in the corresponding D1.1.
- In terms of Task 1.2 and Task 1.3, we made an analysis of the current situation based on a set of questionnaires, from which we provide a statistical analysis to extract the conclusions. The results of these statistical analysis are reflected in the corresponding D1.2 and D1.3.

Therefore, the methodology to follow depends on the source of these requirements. The main purpose of both approaches is to extract a set of actions points to be implemented during the execution of the project by different WPs. In the next subsections we describe the methodology applied for each of the cases.

III.1. Methodology applied in the requirements for Demo

In this case, a **three-step approach** has been followed; the process consisted in:

1. Join all requirements in a unique list, assign a unique ID and during several iterations identify possible redundant or duplicated requirements that can be dismissed.
2. Refine the subsequent list of unified requirements with the purpose to identify univocally the corresponding component in the F4W-RA that should cover it (the FIWARE GE) during several iterations of refinement. This step identifies new duplicated requirements as well as User Interfaces / User Experiences requirements that are out of the scope of the F4W-RA.
3. Complete the list of unique requirements with the refinement descriptions and identification of the possible component in the F4W-RA that covers that functionality.

It is important to mention that the identification of the corresponding component does not mean that this component fully offers the functionality required in the unique requirements list. In several cases, a concrete implementation has to be developed inside the WP2 in order to cover the integration with NGSI-LD as well as the corresponding integration with the southbound (sensors/actuators and third-parties' applications) and northbound (Use Case UIs and Third-parties' applications).

III.2. Methodology applied in the requirements for End-Users and Innovation

In this case, a **four-step approach** has been followed; the process consisted in:

1. Identifying the current status (AS-IS situation).
2. Setting out the targeted situation expected by each envisaged service tool (TO-BE situation).
3. Assessing the existing gap between the AS-IS and TO-BE stage.
4. Providing recommendations to overcome the existing gap.

The GAP analysis aims to bridge the AS-IS and TO-BE situations by identifying specific actions along with recommendations that should be considered for implementation. The AS-IS situation has been assessed through the two questionnaires disseminated in Task 1.2 and Task 1.3.

IV. Gaps from the requirements for Demo

In D.1.1 in total 213 requirements were identified and classified into three major classes:

- Functional requirements
- Non-functional requirements
- Data requirements

All of those requirements have to be implemented in WP3 and WP4. The purpose of the T1.4 is to provide a unification of these requirements, generated for the four Demo Cases, in a concrete requirements list with the purpose to resolve inconsistencies in the description and eliminate duplicities. It means that an abstraction operation has been developed to get this unique list asking the owners of the original requirements more detailed information in some cases. In that way, this information will be useful for the WP2 to create a common architecture for all the Demo Cases.

Moreover, it is possible to make a traceability of the Unique requirements and the original Demo Cases requirements. The Unique Id that it is generated contains the corresponding Demo Case requirement ID. For example, the Id FR.3S.SA2.US01.UC01.Dfn003 in the unique list is related with the Demo Case Id FR.3S.SA2.US01.UC01 which makes reference to the French Demo Case (FR), provided by SUEZ Smart Solutions (3S), related to the Smart Application 2 (SA2) and Use Case included in the high-level Use Case (UC01).

From the methodology explained in Section III.1, we made a classification of the requirements in the following way:

- **UI requirements**, many of the requirements (**43 in total**) are from the application point of view and are related to user interface issues (e.g., selecting a sensor for purpose of visualization of water quality with a defined time period). User interface requirements are general requirements and not FIWARE specific.
- **Duplicated requirements**, during the process to unify the complete list of requirements and assign a unique ID, we have identified some duplicates requirements (**28 in total**). In the next iteration,

in which we want to analyse the corresponding requirements to obtain the component in the architecture, we have identified other set of duplicated requirements (**45 in total**).

- **Unclear or unprecise**, there are some requirements (**12 in total**) with not clear and/or not precise description and it is not possible to analyse them to extract the corresponding component in the architecture.
- **Clear requirements**, from the rest of requirements we could identify the corresponding components (FIWARE GEs) in the architecture that should take care about the functionality defined on those requirements. Sometimes, from the original requirement, we have identified and therefore extracted several unified requirements depending on the granularity of the detailed information obtained from the Use Cases. The final list of unified requirements consists of a total of **90 requirements** that are shown in *Table 1*.

Additionally, we have identified general requirements from the list applied to the complete F4W-RA, which are:

- Scalability in the case of data with high temporal and spatial resolution (Smart Meter UK Demo Case).
- Interfaces to legacy systems.

Furthermore, an initial activity was developed to try to identify the corresponding data models to be used in the project. It is a very preliminary activity, and we could not extract relevant information in order to identify them. This is an activity on going and will depend on the different status of the implementation of the Use Cases.

Last but not least, we have analysed the final list of unified requirements to extract the complete list of FIWARE GEs, third-party applications and data models identified, they can be seen in *Table 2*

Table 1: Unified list of requirements, identified F4W-RA components and preliminary data models

Unique ID	Requirement Details	Originator	Note	FIWARE GE
FR.3S.SA2.US01.UC01.Dfn003	The system shall be able to automatically store collected measurements (see Dfn.002) in the AQUADVANCED® Water Networks database.	3S	Unprecise: which database is used to store collected measurements	Cygnus, AQUADVANCED® Water Networks database
FR.3S.SA2.US02.UC01.Dfn005	The system shall be able to automatically store collected water quality measurements (see Dfn.004) in the AQUADVANCED® Water Networks database.	3S		Draco - Cygnus
FR.3S.SA2.US02.UC02.Fn021	The system shall be able to automatically calculate abnormal water quality events detection in the drinking water distribution network based on water quality sensors and/or multi-parameter probes. Calculations are performed in accordance with the calculation context defined in Fn.020.	3S		Perseo

Unique ID	Requirement Details	Originator	Note	FIWARE GE
FR.3S.SA2.US01.UC01.Dfn002	The system shall be able to automatically collect measurements from two data sources stored on clouds and import them in AQUADVANCED® Water Networks: (i) ORTOMAT acoustic sensors / noise loggers (manufacturer: VON ROLL) and (ii) InflowSens™ high-frequency pressure sensors (manufacturer: Inflowmatix).	3S	Unprecise: Do we get real-time data from a cloud? How can we access to that cloud?	IoT Agents, Orion-LD, Cygnus-LD, Draco
FR.3S.SA2.US01.UC02.Fn011	The system shall be able to automatically calculate water leaks events detection in the drinking water distribution network based on different hydraulic sensors (e.g. acoustic sensors, sectorization flow meters, automated meter reading, and high-frequency pressure sensors). Calculations are performed in accordance with the calculation context defined in Fn.010.	3S	Unprecise: in order to get the data from sensors, it is needed to know which kind of transport protocol and payload format are in use on those sensors in order to use the proper IoT Agent.	Perseo, Cosmos
FR.3S.SA2.US01.UC04.Fn018	The system shall be able to locate the cause of the fast hydraulic transient event detected by several sensors.	3S	Unprecise, it is something in real-time or based on historical information.	Perseo, Cosmos
FR.3S.SA2.US02.UC01.Dfn004a	The system shall collect measurements from the water quality sensors and/or multi-parameter probes installed in the distribution network.	3S	Unprecise, we need to know the transport protocol and payload format to determine the corresponding IoT Agents to be used.	IoT Agent, Orion-LD
FR.3S.SA2.US02.UC01.Dfn004b	The system shall notify the measurements in AQUADVANCED® Water Networks.	3S	Unprecise, we need to know the transport protocol and payload format to determine the corresponding IoT Agents to be used.	Orion-LD, Cygnus, Draco
GR.EYDAP.SA1.US01.UC01.Dfn001	The system shall obtain real-time flow data from the local database.	EYDAP		Orion
GR.EYDAP.SA1.US01.UC01.Dfn003	The system shall obtain historical flow measurements from the local database.	EYDAP		Cygnus
GR.EYDAP.SA1.US01.UC01.Fn001	The user shall be able to log on his personal profile using a password and a username.	EYDAP		Keyrock
GR.EYDAP.SA1.US01.UC01.Fn002	The user shall be able to request real-time water flow data from the sensors in the conveyance system.	EYDAP		IoT Agent + Orion
GR.EYDAP.SA1.US01.UC01.Fn003	The user shall be able to select the point (sensor) of interest in the conveyance system.	EYDAP		Orion (GeoQuery) or QuantumLeap (GeoQuery)
GR.EYDAP.SA1.US01.UC02.Fn011	The user shall be able to request access to historical flow data.	EYDAP		PEP Proxy + Keyrock
GR.EYDAP.SA1.US01.UC02.Fn012	The user shall be able to specify the time period of interest for the presented information.	EYDAP		either QuantumLeap or Cygnus

Unique ID	Requirement Details	Originator	Note	FIWARE GE
GR.EYDAP.SA1.US01.UC02.Fn013	The system shall execute the appropriate calculations for the statistics and information to be displayed.	EYDAP		Cosmos
GR.EYDAP.SA1.US02.UC01.Dfn004	The system shall obtain information on the technical specifications of sensors.	EYDAP		Orion
GR.EYDAP.SA1.US02.UC01.Fn016	The user shall be able to request manually information on the accuracy of measurements.	EYDAP		metadata attribute - Orion
GR.EYDAP.SA1.US02.UC02.Fn020	The system shall execute the appropriate calculations for the detection of unusual flow conditions.	EYDAP		CEP - Perseo? - possibly Cosmos, possibly external
GR.EYDAP.SA1.US02.UC03.Fn023	The user shall be able to specify the temporal level of analysis (daily, monthly, annually).	EYDAP		QuantumLeap
GR.EYDAP.SA1.US02.UC03.Fn026	The user shall be able to request estimations for the future water demand volumes.	EYDAP		Cosmos, corresponding data model for water demand
GR.EYDAP.SA1.US03.UC01.Fn031	The user shall be able to specify the point of interest (where the target flow is to be established).	EYDAP		Orion holds POIs. GIS or Dashboard displays it?
GR.EYDAP.SA2.US01.UC01.Dfn002	The system shall obtain information on the location of quality sensors.	EYDAP	The system shall obtain information of sensors (location, status, battery level, signal strength, technical specs.).	Orion
GR.EYDAP.SA2.US01.UC01.Fn002	The user shall be able to request real-time water quality data from the sensors in the conveyance system.	EYDAP		Orion
GR.EYDAP.SA2.US01.UC01.Fn004	The user shall be able to select the quality parameter to be presented (e.g., turbidity / conductivity / temperature).	EYDAP	The user shall be able to select an attribute from an entity.	Orion
GR.EYDAP.SA2.US01.UC02.Fn011	The user shall be able to request access to historical quality data.	EYDAP	The user shall be able to request access to historical information of an entity.	Cygnus
GR.EYDAP.SA2.US02.UC03.Dfn009	The system shall obtain information on the location of flow sensors and the topology of the conveyance system.		The system shall obtain information about the topology of the conveyance system.	Orion
GR.EYDAP.SA1.US01.UC01.Fn005	The user shall be able to specify a past time point until the last available information (time period of interest).	EYDAP	The user shall be able to request time series of flow measurements through API specifying from-to dates (e.g. from 21/2/2020 to 27/2/2020).	QuantumLeap
GR.EYDAP.SA1.US01.UC01.Fn006	The user shall be able to select multiple points (sensors) for a parallel real-time monitoring.	EYDAP	The user shall be able to request the flow measurements of several sensors identified by their Entity Id.	Orion-LD

Unique ID	Requirement Details	Originator	Note	FIWARE GE
GR.EYDAP.SA1.US02.UC01.Dfn005	The system shall obtain flows from the simulation model.	EYDAP	The system shall be able to integrate third party's simulation tools (e.g. EPANET) and provide the corresponding result of the simulation as a new entity to be queried or notify to Context Information consumer.	EPANET, Orion-LD, Cygnus, Draco
GR.EYDAP.SA1.US02.UC01.Fn015	The user shall be able to request information on the status of sensors.	EYDAP	It is assumed that the status of the sensor is provided by the sensor. Therefore, is a query to get the attribute of the sensor through the Orion-LD (NGSI-LD). Second option, the system will inference the status of the sensor through a clearly defined procedure based on the sensor information and the environmental data of the sensor. Therefore, it is a Complex Event Processing Activity for Perseo component.	Orion-LD or Perseo
GR.EYDAP.SA1.US02.UC01.Fn017	The system shall execute the appropriate calculations for the detection of systematic or accidental faults in measurements.	EYDAP	A tool for the detection of faulty measurements will be developed (by NTUA). This tool will blend real-time measurements and historical data and will search for faults.	Cosmos
GR.EYDAP.SA1.US02.UC02.Dfn006	The system shall obtain information on the operating conditions of the conveyance system.	EYDAP	It is assumed that this information is part of the data model corresponding to those entities. Therefore, the information is provided in the corresponding attribute values of the NGSI-LD and provided via query to the Orion-LD.	Orion-LD
GR.EYDAP.SA1.US02.UC04.Fn027	The system shall execute the appropriate calculations for the estimation of future water demand volumes.	EYDAP	The system should be able to calculate estimation of future water demand volumes based on historical information of water consumption.	Cosmos
GR.EYDAP.SA1.US03.UC01.Fn029	The user shall be able to request suggestions on sluice gate settings.	EYDAP	The system will be able to request the result of the simulation process registered in an Entity.	Orion-LD, Sluice Gate data model
GR.EYDAP.SA2.US02.UC02.Fn021	The system shall raise and display warnings for unusual quality events.	EYDAP	The system should generate new unusual quality events based on the information that it is managing in real-time.	Perseo
GR.EYDAP.SA1.US02.UC02.Dfn007	The system shall obtain thresholds and reference values for the flows.	EYDAP	Further clarifications will be needed on this requirement.	Orion-LD, CEP, Cosmos, QuantumLeap
GR.EYDAP.SA1.US02.UC03.Fn022	The user shall be able to request information on the water losses in the conveyance system.	EYDAP	GUI will enable the user to ask information on water losses - next an external system (developed by NTUA) will run the simulation,	Orion, Cosmos

Unique ID	Requirement Details	Originator	Note	FIWARE GE
			make the required calculation and will display the results to the user.	
GR.EYDAP.SA1.US02.UC03.Fn024	The system shall execute the appropriate calculations for the calculations of water losses in the conveyance system.	EYDAP	Need to know the corresponding data model in order to manage the proper integration of the third-party solution with the F4W-RA.	Orion, Cosmos
GR.EYDAP.SA1.US03.UC01.Dfn009	The system shall obtain information on the characteristics of the sluice gates.	EYDAP	Need to define the corresponding data model and how we can get the information from the sluice dates in real time together with the status of it.	Sluice Data model, IoT Agent, Orion-LD
GR.EYDAP.SA1.US03.UC01.Dfn010	The system shall obtain information on the status of the sluice gates (initial conditions).	EYDAP	Need to define the corresponding data model and how we can get the information from the sluice gates in real time together with the status of it.	Sluice Data model, IoT Agent, Orion-LD
GR.EYDAP.SA1.US03.UC01.Dfn011	The system shall obtain information on the target flow.	EYDAP	It is needed the corresponding definition of the data model in order to pass the proper information in the Entity. Afterwards, it is needed to know from where the data is taken to make the simulation.	Orion-LD, Sluice Gate data model, IoT Agents, Cosmos
GR.EYDAP.SA1.US03.UC01.Dfn012	The system shall execute the simulation to estimate the flow and the sluice gate settings.	EYDAP	Need clarification about the Data model. How is connected that simulations tool with the current F4W architecture.	Orion-LD, Cosmos, Sluice Gate data model
GR.EYDAP.SA1.US03.UC01.Fn030	The user shall be able to specify the target flow.	EYDAP	It is needed the corresponding definition of the data model in order to pass the proper information in the Entity. Afterwards, it is needed to know from where the data is taken to make the simulation.	Orion-LD, Sluice Gate data model, IoT Agents? Cosmos
GR.EYDAP.SA2.US02.UC02.Fn020	The system shall execute the appropriate calculations for the detection of unusual quality events.	EYDAP	The system shall raise notifications based on automated calculated events.	Perseo, Cosmos, Orion-LD
GR.EYDAP.SA2.US02.UC03.Dfn010	The system shall obtain information for detected unusual quality events.	EYDAP	Some sensors have their own system to raise warnings if an unusual event is detected. These warnings should be also presented via GUI through a notification.	IoT Agents, Orion-LD, Sensor data models
NL.WNT.SA1.US01.UC01.Dfn001	The user shall be able to view validated and corrected measurement data, and the raw, possible sampled data.	WNT / KWR	The user shall be able to view attribute data and processed data based on the previous one.	Orion, Perseo
NL.WNT.SA1.US01.UC01.Fn002	The user shall be able to request near real-time sensor or actuator data from the WWTP research lane.	WNT / KWR	The user shall be able to obtain near real-time sensor or actuator data from the WWTP research lane.	IoT Agents

Unique ID	Requirement Details	Originator	Note	FIWARE GE
NL.WNT.SA1.US01.UC01.Fn009	The system shall provide (meta) information about data anomalies, the detected sensor failures and information regarding the pre-processing of the presented data.	WNT / KWR		Orion holds metadata - created via Cosmos?
NL.WNT.SA1.US01.UC01.Fn006	The user shall be able to download the near real-time information.	WNT / KWR	The system should be able to integrate the historical data stored in QuantumLeap and generate a CSV file format with Draco.	QuantumLeap, Draco
NL.WNT.SA1.US01.UC02.Dfn002	The user shall be able to view the information.	WNT / KWR	The system shall be able to request the historical information of a sensor (or actuator) during a period of time (horizon). There is a possibility to introduce a type of entity and provide filter about it. Other filters should be evaluated.	QuantumLeap
NL.WNT.SA1.US01.UC01.Dfn002	The system shall obtain near real-time measurement data, pre-processed measurement data and metadata from the local database.	WNT / KWR	We propose the following scheme for obtaining data: sensor/actuator --> legacy system (PIMS DB) ==> route 1: query DB to (case specific) model in Azure cloud (via JSON). Model outputs processed data back to PIMS DB. parallel route 2: connection from PIMS DB to FIWARE. There is also a FIWARE component that requests processed data from the model (via JSON). The model in the Azure cloud puts new (pre-processed) data back to PIMS DB. FIWARE is used for dashboarding and could, if the functionalities exist, also be used to act as a platform for virtual sensors and data validation and anomaly detection. The system wastewater treatment model (WWTP) and control model are put in the Azure cloud, as well as the virtual sensors and data validation algorithms (if it's not implemented in FIWARE). For data validation, timeseries are needed which typically span at least a few days. For dashboarding, a user typically wants to evaluate a time series starting from (say) 1 year back to the e.g. the last hour.	IoT Agents, Draco
NL.WNT.SA1.US01.UC01.Fn002	The user shall be able to request near real-time sensor or actuator data from the WWTP research lane.	WNT / KWR	Our proposal is to get context information via the PIMS DB route - so in that case no IoT agents are needed. See also the clarification in NL.WNT.SA1.US01.UC01.Dfn002.	IoT Agents, Draco
NL.WNT.SA1.US01.UC02.Fn002	The user shall be able to request process (variables) and (key) performance indicator data from the WWTP research lane.	WNT / KWR	Process variable: a modelled or measured quantity, e.g. a temperature, volumetric flow or concentration of a substance (e.g.	IoT Agents, Draco, Data model, Orion-LD

Unique ID	Requirement Details	Originator	Note	FIWARE GE
			nitrate). Data flows between PIMS and the WWTP model and/or PIMS and FIWARE are in JSON. The legacy system consists of: the PIMS Oracle DB, a database with meta data from the sensors and actuators (description, unit of measurements etc.) and the models running in an Azure cloud environment. Data flows may comprise meta data, sensor/actuator time series (temperature, flow rates, concentrations of different substances), valve settings and events.	
UK.SWW.SA1.US01.UC01.Dfn009	The system shall retrieve data for all households which have been tagged with the area (e.g. Great Torrington).	SWW	The system shall retrieve entity data for all tagged entities.	Orion
UK.SWW.SA1.US01.UC01.Dfn010	The system shall retrieve consumption data for any customer.	SWW		Orion
UK.SWW.SA1.US01.UC01.Fn001	The user shall be able to log into the application using their Microsoft AD account (or an application specific username and password).	SWW		Keyrock, Wilma, AuthZForce
UK.SWW.SA1.US02.UC03.Dfn011	The user shall be able to view rainfall data for the smart meter area (e.g. great Torrington, Cranbrook).	SWW	The user shall be able to view entity data for a specific smart meter area.	Orion
UK.SWW.SA2.US01.UC01.Fn014	The system shall retrieve the users' consumption for the previous day.	SWW	The system shall retrieve the average of an entity attribute for the previous days from the historical database.	Orion, Cygnus, Cosmos
UK.SWW.SA2.US02.UC01.Dfn015	The system shall retrieve users' consumption for chosen date range.	SWW	The system shall retrieve entities data for a specific data range.	QuantumLeap
UK.SWW.SA2.US02.UC01.Fn021	The user shall be able to can switch off notifications via the app.	SWW	The system shall be able to unsubscribe entities.	Orion
UK.SWW.SA2.US02.UC01.Fn024	The system shall generate notifications for the user (e.g. for consumption higher than target), unless they have turned them off.	SWW		Perseo
UK.SWW.SA2.US02.UC01.Fn025	The system shall calculate the percentage difference between yesterday's consumption and the user's target.	SWW	The system shall calculate the percentage difference between yesterday measure of an entity attribute and the target defined for that entity.	Cosmos

Unique ID	Requirement Details	Originator	Note	FIWARE GE
UK.SWW.SA1.US01.UC01.Dfn007	The user shall be presented with a map showing all smart metered customers in the area. Households are coloured by their consumption (low, medium, high).	SWW	The system should be able to request geo-queries based in a defined area through a polygon. The GUI should be able to differentiate values of the different areas based on a specified threshold (low - below 120 litres/person/day, med - between 120 and 150 litres/person/day, high - greater than 150 litres/person/day).	Wirecloud, Orion-LD
UK.SWW.SA1.US01.UC01.Dfn001	The user shall be presented an 'average consumption' graph for Smart Meter (AMI) / Temetra.	SWW	There is no difference between getting values from AMI or AMR meters. Both are specific Entities, and the request will be the same to access to the Context Information. Nevertheless, the way in which these sensors can send the information is relevant to know which technology we can use.	Wirecloud, IoT Agent, Orion-LD
UK.SWW.SA1.US01.UC01.Dfn002	The user shall be presented with an 'average consumption' graph for AMR meter.	SWW	The system should provide average consumption data from different entities.	Wirecloud, IoT Agent, Orion-LD
UK.SWW.SA1.US01.UC01.Fn002a	The system shall calculate an average consumption for the current month and previous 5 months of an entity using Smart meter data (e.g. from Great Torrington).	SWW		Cosmos
UK.SWW.SA1.US01.UC01.Fn002b	The system shall obtain information from Smart Meter and translate into NGSI-LD.	SWW	SWW will provide a snapshot of historical data from AMI Meters. We would expect this to be stored in a historical database. Water consumption by customers with AMI meters should be calculated using this data.	IoT Agent
UK.SWW.SA1.US01.UC01.Fn003	The system shall obtain information from AMR Meters and translate into NGSI-LD.	SWW	SWW will provide a snapshot of historical data from AMR Meters. We would expect this to be stored in a historical database. Water consumption by customers with AMR meters should be calculated using this data.	IoT Agent
UK.SWW.SA1.US01.UC01.Fn004	The system shall obtain information from Standard Meter and translate into NGSI-LD.	SWW	SWW will provide a snapshot of historical data from standard Meters. We would expect this to be stored in a historical database. Water consumption by customers with standard meters should be calculated using this data.	IoT Agent
UK.SWW.SA1.US01.UC01.Fn004a	Data should hold in billing system: RAPID (unprecise, need clarification).	SWW	Need further clarification about the integration of RAPID system and FIWARE Components.	Cygnus-LD, Draco, RAPID

Unique ID	Requirement Details	Originator	Note	FIWARE GE
UK.SWW.SA1.US01.UC01.Fn008a	The system shall calculate whether households are low, medium or high users based on the cohort (e.g. through clustering) OR based against company defined threshold (e.g. 400L per day = medium user).	SWW	Threshold (low - below 120 litres/person/day, med - between 120 and 150 litres/person/day, high - greater than 150 litres/person/day).	Cosmos
UK.SWW.SA1.US01.UC01.Fn008b	The system shall calculate whether households are based against company defined threshold (e.g. 400L per day = medium user).	SWW	Threshold (low - below 120 litres/person/day, med - between 120 and 150 litres/person/day, high - greater than 150 litres/person/day).	Cosmos
UK.SWW.SA1.US02.UC01.Dfn005a	The user shall be presented with a tabular leak alarms from smart meters.	SWW	Smart meters send a "leak alarm" back in their payload.	Wirecloud
UK.SWW.SA1.US02.UC01.Dfn005b	The user shall be presented with a map presentation of leak alarms from smart meters.	SWW	Smart meters send a "leak alarm" back in their payload.	Wirecloud
UK.SWW.SA1.US02.UC01.Dfn005c	The system shall detect leak alarms using 'leak alarm' data provided by the smart meters.	SWW	Smart meters send a "leak alarm" back in their payload.	Perseo, IoT Agents, Orion-LD
UK.SWW.SA1.US02.UC02.Fn007	The system shall detect leak alarms by analysing the data to detect constant low flows.	SWW	The system should use smart meter data to diagnose if a customer has a leak. This is different from 'leak alarms' which are generated by the meter itself (e.g. an algorithm might check the data for constant low flow).	Cosmos
UK.SWW.SA1.US02.UC03.Fn011	The system shall query an open source API e.g. https://environment.data.gov.uk/flood-monitoring/doc/rainfall to retrieve rainfall data.	SWW	SWW anticipated that the system will get data via an API on a daily basis.	IoT Agent, Orion-LD
UK.SWW.SA2.US01.UC01.Dfn013	The user shall be presented with 3 figures; yesterdays' consumption, average consumption, and the average daily cost.	SWW		Wirecloud
UK.SWW.SA2.US01.UC01.Fn016	The system shall calculate an estimated daily cost based on company water tariff.	SWW	The system shall calculate an estimated value based on the average of an entity attribute from the historical database.	Orion Cygnus, Cosmos
UK.SWW.SA2.US02.UC01.Fn018	The system shall calculate the lowest and highest (or range of) consumption for the users' region (e.g. Great Torrington).	SWW	The system shall calculate the lowest and highest entity attribute for a specific location.	Perseo
UK.SWW.SA1.US01.UC01.Dfn009	The user shall be presented with a three-dimensional graph showing the output of a clustering algorithm (e.g. K-means) which partitions customers into groups based on similar consumption behaviour. For example, one group may be users which use a lot of water in the summer week because they have very large gardens. Graph also highlights customers which cannot be grouped (e.g. because their consumption is much higher than any other group).	SWW	This requirement is unprecise and should be more detailed afterwards.	Knowage

Unique ID	Requirement Details	Originator	Note	FIWARE GE
UK.SWW.SA1.US01.UC01.Fn005	The system shall calculate a modelled consumption for unmetered customers which reflects seasonality.	SWW	It is needed to know: - Where is the data of those customers? - How we can get that data? - What is the data model? - Is the modelled consumption calculated in real time or from historical data?	Perseo, Cosmos
UK.SWW.SA1.US01.UC01.Nfn004	The systems shall have a user interface which must be available in Microsoft Edge and Chrome (at the least).	SWW	Wirecloud is compatible with the following browsers: * Firefox 52+ * Chrome 57+ * Safari 10.1+ * Opera 43+"	Wirecloud
UK.SWW.SA2.US02.UC01.Dfn014	The user shall be presented with a graph showing their historic consumption.	SWW	Need details about the type of graphics.	Wirecloud
UK.SWW.SA2.US02.UC01.Fn023	The system shall provide a mechanism for user to add, update and remove daily consumption targets.	SWW	The system shall provide a filter query in order to allow filtering daily consumption targets based on a value. The add, update, and remove targets is part of the functionality of the UI.	Orion-LD
UK.SWW.SA3.US01.UC01.Fn026	The system shall be able to connect and use EPANET (Version 2.2 or later) with real time and historical data.	SWW / EGM / FF	The system should be able to provide the corresponding data models of the simulations of the EPANET Toolkit.	Orion-LD, QuantumLeap, Draco, EPANET, EPANET Data Models
UK.SWW.SA3.US01.UC01.Fn027	The system shall be able to connect and use EPANET (Version 2.2 or later) with real time and historical data.	SWW / EGM / FF	The EPANET Toolkit has to be subscribed to the F4W-RA in order to receive the real-time measurements through the corresponding Draco module.	Orion-LD, QuantumLeap, Draco, EPANET, EPANET Data Models
UK.SWW.SA3.US01.UC01.Fn028	The system shall be able to connect and use EPANET (Version 2.2 or later) with real time and historical data.	SWW / EGM / FF	The EPANET Toolkit has to be subscribed to the F4W-RA through the integration of QuantumLeap - Draco to receive historical data to make hydraulic simulations of the network.	Orion-LD, QuantumLeap, Draco, EPANET, EPANET Data Models
UK.SWW.SA3.US01.UC01.Fn029	The system shall be able to connect and use EPANET (Version 2.2 or later) with real time and historical data.	SWW / EGM / FF	The EPANET Toolkit will produce a simulation result that should be integrated in the F4W RA as a new Entity with its corresponding data model.	Orion-LD, QuantumLeap, Draco, EPANET, EPANET Data Models

Table 2: List of FIWARE GEs, data models, and third-party software identified

FINAL LIST FIWARE GEs identified	FINAL LIST identified datamodels	FINAL LIST identified Third Parties
Cygnus-LD	Sluice Data model	EPANET
Draco	Metadata attribute – Data models	AQUADVANCED® Water Networks
Perseo	Corresponding data model for water demand	Third-party applications
IoT Agents with NGSI-LD	Sluice Gate data model	RAPID
Orion-LD	Sensor data models	
Keyrock	Data model	
QuantumLeap	EPANET Data models	
Cosmos		
Wirecloud		
Knowage		
Wilma		
AuthZForce		

V. Gaps from the requirements for End-Users

Referring to the previous Deliverable D1.2, reporting the analyses of the requirements for End-Users from the feedback gathered through the corresponding questionnaire defined in the Task 1.2 the following table draw recommendations on how to improve the Fiware4Water service offerings.

One finding from the survey is that the drinking water sector is, at an operational level, more advanced with regards to digitalisation along the length of the value chain (water demand, management and treatment) whilst wastewater operators, for obvious reasons, show a special interest in the digitalisation of treatment and energy optimisation.

It was found out that leading companies in the drinking water sector are applying many smart services and have the capacity to serve as an example to more traditional utilities. Nevertheless, as has been noted above, the water sector is not famed for its capacity to share and learn from one another and the process will be slow. This should not constitute a deterrent but rather a challenge to be overcome. Moreover, it is clear that water utilities must place more emphasis on digitalisation, not only in Eastern Europe but also in many areas where the level of employment of such technology is still relatively low compared to the transport or energy sector.

In the opinion of F4W there exists too many self-developed solutions which leads one to ask whether or not the same challenges are being repeatedly addressed and whether or not there exists an open source solution. The consortium advocates the establishment of standardised, interoperable and open source software for water management whether it be concerned with water quality, leakage or energy consumption together with less perceived priorities such as demand forecasting and customer relations.

Since the survey had more of a strategical character than technical character, no technical requirements can be derived from 1.2. The following general facts were identified. The demand for smart applications is sector-specific. For example, the wastewater sector is interested in energy optimization while the drinking water sector wants applications for water resources management.

Currently on the software side third-party products and open source solutions are used in addition to self-developed solutions (22 %). This shows that there is a potential for FIWARE. Both in-house servers and cloud services are used for data storage and the provision of services.

In conclusion, it can be said that Water supply is part of the critical infrastructure and must therefore meet certain security requirements. For FIWARE this means that FIWARE services must also run locally on the servers of the companies.

The water market is very heterogeneous. There are private companies, public/municipal utilities and private-public partnerships (PPPs). In addition, the size of the companies varies, in some cases quite considerably. This has an impact on the potential target group of FIWARE:

- Small municipal companies are less interested in smart applications, they are more focused on day-to-day business and have too little manpower.
- Large, private companies often use their own solutions thus being less interested in new applications.
- Medium sized enterprises (e.g. municipal utilities and interconnected companies that provide gas and electricity in addition to water) are therefore the most likely target group for F4W.

Another important constraint that has to be kept in mind is that there is no free market in water supply. Consumers are not free to choose between different suppliers (as is the case with for example electricity), but can only purchase water from the local supplier. This causes a certain inertia in the establishment and implementation of innovations in the water industry. Drivers for digitalisation are therefore less market economy constraints, but rather legal requirements, shortage of skilled workers (replacement of expert knowledge by smart applications in the course of the shortage of skilled workers), demographic transition (change in consumption behaviour) and climate change (increase in situations of water stress, i.e. high demand and low water availability).

Utilities already rely on open source solutions. In this context, FIWARE must credibly communicate that it also fulfils requirements for critical infrastructures (based on various national standards within the EU; e.g. KRITIS[1] in Germany). In addition, the appearance of F4W in national associations needs to be developed to increase their visibility in the industry.

[1] KRITIS is a common initiative of Federal Office of Civil Protection and Disaster Assistance (BBK) and Federal Office for Information Security (BSI).

Table 3: Gaps from the requirements for End-Users

Requirement	New / Improvement	Comment	Implementation Strategy
Development of sector specific applications	New	Depending on the companies' sector in the water value chain different problems need to be addressed	**WP3:** • Develop sector specific applications. • Drinking water– Water demand, management and treatment. • Wastewater– digitalisation of treatment and energy optimisation.
Possibility of multiple implementation strategies	Communication	Currently companies use different options for data management.	**WP2:** • FIWARE needs to provide the necessary implementation methods. **WP6:** • Communicate the existence of the necessary implementations.
Ensure the implementation of national safety guidelines	Communication	For companies to be allowed to use F4W, the implementation of national standards concerning critical infrastructure must be ensured.	**WP2:** • Technical implementation of the requirements of national standards. **WP6:** • Communicate the compliance to national standards.
Ensure attractiveness for companies	Communication	Especially large companies already use smart services while small companies are often occupied with day-to-day business. The potential for F4W therefore lies with the medium sized companies.	**WP6:** • Prioritize information and involvement of medium sized companies in F4W.

VI. Gaps from the requirements for Innovation

Referring to the previous Deliverable D1.3, reporting the analyses of the requirements for innovation from the feedback gathered through the corresponding questionnaire defined in Task 1.3 the following tables draw recommendations on how to improve the Fiware4Water service offerings.

The recommendations are about the improvements to the services and to the technology itself. Besides, the recommendations are commented and grouped according to priority to allow the planning for further actions inside the corresponding work packages.

VI.1. Recommendations about Open Source concerns

The three major concerns in using open source platforms are maintenance, technical support and lack of IT security.

Table 4: Recommendations about Open Source concerns

Requirement	New / Improvement	Comment	Implementation Strategy
High feasibility			
Maintenance	New service	The open source components are not properly maintained, or they are discontinued.	**WP2:** • Publish the overall daily analysed information over the FIWARE Components in order to evaluate the proper status of them.
Technical support	Improve communication activities	Lack of support in the resolution of the daily issues in the platform is an important aspect that has to be resolved.	**WP6:** • Publish the QA platforms (Stack Overflow) as well as the ticketing system (JIRA) in the Fiware4Water Community.
Lack of IT security	Improve communication activities	People think because data model or source code are available online it's easier to hack it. It's generally false for widespread open source solution and when security updates are regularly made; additionally, security updates are regularly made, and the national guidelines are applied.	**WP6:** • Publish the security activities that we are following in the FIWARE Community.
Medium feasibility			
Maintenance and technical support	New service	Fear the platform will be discontinued in the future and a lack of support in the resolution of the daily issues in the platform are important aspects that have to be resolved.	Use contracts for hosting tools on governmental infrastructure.

VI.2. Recommendations about the use of open source platforms

Factors that trigger utilities to use open source platforms: integration of different data sources, self-hosting, interfaces to existing analysis and visualization tools.

Table 5: Recommendations about the use of Open Source platforms

Requirement	New / Improvement	Comment	Implementation Strategy
High feasibility			
Integration with current open source platforms	Improvement of an existing service	Companies currently using open source solutions are taking the benefit from visualisation, information searching and processing, and GIS solutions.	**WP2:** • Develop an architecture in which the integration with Visualisation, Information Searching and Processing are available. These functionalities currently are covered by FIWARE Components. • NGSI-LD, by default, provide geo-location information about the Entity data. The integration with GIS is a matter to translate NGSI-LD into the corresponding format using Cygnus and/or Draco FIWARE Components.
Self-hosted	New service	The most important triggers to use open source platforms are the ability of the platform to be self-hosted	**WP2:** • All the FIWARE Components are deployable on-premises. • Any new component will follow the same approach.
Integration with sensors and other data sources	Improvement of an existing service	Existence of interfaces for integrating sensors and other data sources. There already are specialised data models per domain from different sources (Standardisation bodies, Smart Cities Initiatives, FIWARE Community). Probably such remarkable efforts shall be better advertised within the F4W community. Further developments in data models is advised for those areas	**WP2:** • Review and comment existing data models. • Create a specific service and related page in the Project web site as well as in the FIWARE portal. • Develop new interfaces (IoT Agents) to not covered transport protocols and/or payload formats. • Develop new Connectors (Cygnus, Draco) to cover the

Requirement	New / Improvement	Comment	Implementation Strategy
		considered not well covered by the users.	integration with other Open Source solutions. **WP6:** • Dissemination activities about the F4W data models. • Prepare a series of webinars on data models with the aim to describe them, understand if they are fitting the user needs, and explain how they shall be used/adapted with practical/real case examples.
Dependency on third-parties	Improve communication activities	The minimized dependency on third-parties for daily operation is expected.	**WP2:** • Definition of the F4W RA based on FIWARE will resolve the dependency on third-parties. **WP6:** • Dissemination of the F4W RA.

VI.3. Recommendations about sharing data

Companies have the will to share data with Fiware4Water.

Table 6: Recommendations about sharing data

Requirement	New / Improvement	Comment	Implementation Strategy
High feasibility			
Standard data models	New data models	Companies have expressed their willingness to share data with us.	**WP2:** • Definition of standardized data model/format. **WP6:** • Contact the interviewees to see a future collaboration in the Fiware4Water Challenges.
Datasets	New service	In order to use the corresponding datasets from interviewees, it is needed to define a mechanism to manage the data that it is provided by them in the platform.	**WP2:** • Depending on the scenario, we define a simulated sensor to provide NGSI-LD data or the corresponding Cosmos connector to load the data. **WP6:** • Contact the interviewees to explain how to share the data with us.

VI.4. Recommendations about data formats

Most relevant data formats are: JSON, CSV, XML; additionally, standard data models are not widely used.

Table 7: Recommendations about data formats

Requirement	New / Improvement	Comment	Implementation Strategy
High feasibility			
Data formats	Integration of legacy data formats	We detect several data formats being used, most important are XML, JSON and CSV (including Excel files).	**WP2:** • Generic information exchange data format. F4W provides NGSI-LD data format, a JSON-LD representation of the Entity information. • Depending on the use case, we implement a corresponding IoT Agent to get the data or basically use a parser inside Cosmos to load the data and process them. **WP6:** • Disseminate through the corresponding communication channels the use of NGSI-LD and standard data models defined in F4W.
Standard data models	Improvement of the existing data models	Some of them use data models but the diversity of the information requires a large diversity of them.	**WP2:** • Through the TM-Forum and ETSI CIM as well as the ETSI SAREF we plan to integrate all of these data models.
Standard data models	New data model	There is not currently a widespread standard for sensor use for (near) real time in water monitoring.	**WP2:** • Develop the corresponding data model for water monitoring.

VII. Future Steps and Outlook

For the discussion of the future steps, the process diagram for WP1 with respect to WP2, WP3, WP4, WP5 and WP6 was shown in the *Figure 1*. Our stakeholders were a rich source of possible business scenarios and applications from which we have extracted a set of application demo cases requirements as well as important information to be translated to the communication channels. These future actions are associated to the Implementation Strategies and the Unique Requirements list shown in the previous tables. The purpose of the project is to put in practice the corresponding Implementation Plan to provide answers to the identified points on each of the involved work packages (WP2, WP3, WP4, WP5, and WP6). We need to remind, that the purpose of this task from the beginning, is to obtain a general outlook and not a specific one, precisely for ensuring EU added value of the F4W-RA developed (i.e. interoperable and deployable anywhere in Europe). The future work can be described in the following steps:

1. Future analysis of the general requirements extracted from the Task 1.1 results together with the unique list of requirements described in section IV will be passed onto the WP2 as input, which involves developing Fiware4Water Reference Architecture (F4W-RA).

2. The requirements about data models and format representation in Task 1.3 will be translated to the corresponding definition of connectors in the Fiware4Water Architecture in WP2 (Task 2.2) as well as to the WP3 to get information about what is expected from Smart Applications and Devices. Moreover, the information about the data models will be the base to create new Smart Data Models inside Task 2.3.

3. Additionally, the requirements in Task 1.1 will be passed onto the WP3/WP4 as input, which involves the validation process in the execution of the different Demo Cases as well as the validation of the corresponding F4W-RA produced in the WP2 and if it could be necessary provide feedback to the WP2 to generate new release of it.

4. In parallel, the requirements extracted in Task 1.2 need to be validated from a socio-political impact, end-user engagement and economic consequences of Fiware4Water. This falls internally within the domain of WP5.

5. The information extracted in Task 1.2 and Task 1.3 regarding the questionnaires will be further used as a basis to define proper communication channels in WP6 with stakeholders who manifest interest in the project results.

6. The information extracted in Task 1.3 will help to organise the corresponding Fiware4Water Challenge in WP6. Some of those stakeholders have manifested their interest in the execution of the Fiware4Water Challenges, either through the definition of requirements or the delivery of datasets that can be used during the process.

Last but not least, the Implementation Strategies identified in this document is translated to each work package (WP2, WP3, WP4, and WP6) in order to define the appropriate Implementation actions to response and/or resolve the identified gaps. A periodic coordination meetings will be scheduled every month to evaluate the status of the planned Implementation Actions. Finally, a follow-up document will be produced to evaluate the resolution of the various Implementation Actions and published at the end of the project.

References

[1] Internet platform on Critical Infrastructure Protection (Internetplattform zum Schutz Kritischer Infrastrukturen), https://www.kritis.bund.de/SubSites/Kritis/EN/Home/home_node.html

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[3] Writing Effective Use Cases, Alistair Cockburn, Addison-Wesley Professional, 2000.

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[5] Ralph, P., and Wand, Y. A Proposal for a Formal Definition of the Design Concept. In, Lyytinen, K., Loucopoulos, P., Mylopoulos, J., and Robinson, W., (eds.), Design Requirements Engineering: A Ten-Year Perspective: Springer-Verlag, 2009, pp. 103-136