FIT4REUSE

Safe and sustainable solutions for the integrated use of non-conventional water resources in the Mediterranean agricultural sector

Deliverable: D8.4
Work Package: WP8

Due date of deliverable: 30 September 2019
Actual submission date: 30 September 2019
<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Number</th>
<th>Title:</th>
<th>Due date of</th>
<th>Version number</th>
<th>Format</th>
<th>Creation date</th>
<th>Version date</th>
<th>Type</th>
<th>Dissemination Level</th>
<th>Target groups (if public)</th>
<th>Responsible authors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Guidelines for the development of a Multi-Stakeholder and Multi-level Platform</td>
<td>Contractual</td>
<td>30/09/2019</td>
<td>01</td>
<td>02/08/2019</td>
<td>30/09/2019</td>
<td>R</td>
<td>PU Public</td>
<td>Scientific Community (higher education, Research)</td>
<td>Giuseppina Monacelli, Carlo Cipolloni, Anna Di Noi, Maria Chiara Sole</td>
</tr>
</tbody>
</table>
| Work Package| 8      | Exploitation activities and multi-stakeholder platforms for policy and market analysis and public acceptance | Contractual | 30/09/2019 |        |               |               |      | PU Public           | General Public | giuseppina.monacelli@isprambiente.it  
carlo.cipolloni@isprambiente.it  
anna.dinoi@isprambiente.it  
mariachiara.sole@isprambiente.it |
|             |        |        | Actual      | 30/09/2019   |        |               |               |      | CO Confidential     | Industry            | ISPRA |
|             |        |        |             |               |        |               |               |      |                      | Civil Society       |                      |
|             |        |        |             |               |        |               |               |      |                      | General Public      |                      |
|             |        |        |             |               |        |               |               |      |                      | Policy makers       |                      |
|             |        |        |             |               |        |               |               |      |                      | Medias               |                      |
|             |        |        |             |               |        |               |               |      |                      | Other                |                      |
Rights | Copyright “FIT4REUSE Consortium”.
During the drafting process, access is generally limited to the FIT4REUSE Partners.

Brief Description | First set of system specifications for the development of a multi-level and multi-stakeholder platform within the project FIT4REUSE. This includes the identification of macro-components such as the various software components to be considered in the context of the technical activities for the platform development as well as specifications of the final client interface.

Keywords | Platform, stakeholders, networking

Version log Revision history

<table>
<thead>
<tr>
<th>Rev. No.</th>
<th>Issue Date</th>
<th>Modified by</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16/09/2019</td>
<td>Giuseppina Monacelli, Carlo Cipolloni, Anna Di Noi, Maria Chiara Sole (ISPRA)</td>
<td>The first draft preparation</td>
</tr>
<tr>
<td>2</td>
<td>26/09/2019</td>
<td>Antonia Lorenzo (BIOAZUL)</td>
<td>Comments and revisions of the content</td>
</tr>
<tr>
<td>3</td>
<td>29/09/2019</td>
<td>Matteo Vittuari, Laura García Herrero (UNIBO)</td>
<td>Comments and revisions of the content</td>
</tr>
<tr>
<td>4</td>
<td>30/09/2019</td>
<td>Carlo Cipolloni, Anna Di Noi (ISPRA)</td>
<td>Revision following latest comments from the partners</td>
</tr>
</tbody>
</table>

This document reflects only the authors’ view and the PRIMA Foundation is not responsible for any use that may be made of the information it contains.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT INFORMATION</td>
<td>1</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>3</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>4</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>4</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>4</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>6</td>
</tr>
<tr>
<td>1. IT ELEMENTS</td>
<td>6</td>
</tr>
<tr>
<td>1.1. ARCHITECTURE OF THE PLATFORM</td>
<td>6</td>
</tr>
<tr>
<td>1.2. IT INFRASTRUCTURE</td>
<td>8</td>
</tr>
<tr>
<td>1.2.1 STORAGE LAYER – DATA ARCHIVING</td>
<td>8</td>
</tr>
<tr>
<td>1.2.2 APPLICATION SERVICE LAYER – MIDDLEWARE LEVEL</td>
<td>9</td>
</tr>
<tr>
<td>1.2.3 USER INTERFACE LAYER – CLIENT LEVEL</td>
<td>11</td>
</tr>
<tr>
<td>2. THE MULTI-LEVEL AND MULTI-STAKEHOLDER PLATFORM</td>
<td>11</td>
</tr>
<tr>
<td>2.1 INTRANET FOR THE STAKEHOLDERS</td>
<td>12</td>
</tr>
<tr>
<td>2.2 SOCIAL COLLABORATION PLATFORM</td>
<td>13</td>
</tr>
<tr>
<td>2.3 KNOWLEDGE MANAGEMENT SYSTEM</td>
<td>14</td>
</tr>
<tr>
<td>2.4 LEARNING MANAGEMENT SYSTEM</td>
<td>15</td>
</tr>
<tr>
<td>3. STEPS FOR THE DEVELOPMENT OF THE PLATFORM</td>
<td>15</td>
</tr>
<tr>
<td>3.1 BUILDING BLOCKS</td>
<td>15</td>
</tr>
<tr>
<td>3.1.1 PEOPLE</td>
<td>15</td>
</tr>
<tr>
<td>3.1.2 STRUCTURE</td>
<td>16</td>
</tr>
<tr>
<td>3.1.3 PERMISSIONS</td>
<td>16</td>
</tr>
<tr>
<td>3.2 CUSTOMISE THE PLATFORM</td>
<td>17</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 1 - General platform architecture pillars ...................................................................................... 7
Figure 2 - Intranet ........................................................................................................................................ 13
Figure 3 - Social collaboration platform .................................................................................................. 14
Figure 4 - Knowledge Management System (KMS) ................................................................................ 14
Figure 5 - Learning Management System (LMS) ...................................................................................... 15
Figure 6 - People ....................................................................................................................................... 16
Figure 7 - Structure ................................................................................................................................... 16
Figure 8 - Permissions ............................................................................................................................... 17

EXECUTIVE SUMMARY

The main objective of FIT4REUSE is to provide safe, locally sustainable and accepted ways of water supply for the Mediterranean agricultural sector by exploiting non-conventional water resources, namely treated wastewater and desalted water. The Guidelines for the development of a Multi-Stakeholder and Multi-level Platform (Deliverable D8.4) provide some suggestions and recommendation for the development of the platform that will support operational networking among project partners and relevant stakeholders. Based on pre-existing IT open source tools (i.e. Groupware, OwnCloud, NextCloud, Geonode, Geoserver, Elastic search, Kibana), the platform is intended as a supporting service that will establish mechanisms for knowledge co-production and a participatory vision building process. The platform will take into account possible connections and collaborations with other platforms/portals (such as Water JPI open data and Copernicus), in line with different International standards as INSPIRE, WMS, WFS, WCS, dialoguing with several data formats (e.g. csv, excel, xml, rdf, json, geojson), and will take into due consideration the progress and results coming from the other Work Packages of the FIT4REUSE project. Customised interfaces will be developed in order to reach the wider range of stakeholders, including users and citizens. Furthermore, the platform will be organised to guarantee access to users with different cultural backgrounds.

LIST OF ABBREVIATIONS

Angular.js - JavaScript-based open-source front-end web framework mainly maintained by Google and by a community of individuals and corporations to address many of the...
challenges encountered in developing single-page applications.

**API** - Application Programming Interface. Interface or communication protocol between a client and a server intended to simplify the building of client-side software.

**Clients** - A piece of computer hardware or software that accesses a service made available by a server. The server is often (but not always) on another computer system, and in that case the client accesses the service through a network.

**CPU** - Central Processing Unit.

**Ember.js** - Open-source JavaScript web framework, based on the Model–View–View-Model (MVVM) pattern. It allows developers to create scalable single-page web applications by incorporating common idioms and best practices into the framework.

**FTP** - File Transfer Protocol is a standard network protocol used for the transfer of computer files between a client and server on a computer network.

**iCalendar** - Internet Calendaring and Scheduling Core Object Specification.

**HTTP** - The Hypertext Transfer Protocol is an application protocol for distributed, collaborative, hypermedia information systems.

**KMS** - Knowledge Management System is a software application for the administration, documentation, tracking, reporting, and delivery of scientific and technical material.

**LDAP** - The Lightweight Directory Access Protocol is an open, vendor-neutral, industry standard application protocol for accessing and maintaining distributed directory information services over an Internet Protocol (IP) network.

**LMS** - Learning Management System is a software application for the administration, documentation, tracking, reporting, and delivery of educational courses, training programmes, or learning and development programmes.

**NFS** - Network File System is a distributed file system protocol that allows a user on a client computer to access files over a computer network, much like local storage is accessed.

**RAM** - Random Access Memory is a form of computer memory.

**React.js** - A JavaScript library for building user interfaces. It is maintained by Facebook and a community of individual developers and companies.

**REST** - Representational State Transfer is a software architectural style that defines a set of constraints to be used for creating Web services.

**S3** - Simple Storage Service is a service offered by Amazon Web Services (AWS) that provides
object storage through a web service interface.

SSL - Secure Sockets Layer is a cryptographic protocol designed to provide communications security over a computer network.

Swift - A highly available, distributed, eventually consistent object/blob store. Organisations can use Swift to store lots of data efficiently, safely, and cheaply.

TLS - Transport Layer Security is an old cryptographic protocol.

WebRTC - Web Real-Time Communication is a free, open-source project that provides web browsers and mobile applications with Real-Time Communication (RTC) via simple application programming interfaces.

INTRODUCTION

The aim of this document is to identify the first set of system specifications for the development of a multi-level and multi-stakeholder platform within the project FIT4REUSE. This includes the identification of macro-components, such as the software modules to be considered in the context of the technical activities for the development of the platform, as well as the specifications of the final client interface.

The definition of the system architecture of the multi-level and multi-stakeholder platform will ensure support for the networking activities among project partners and relevant stakeholders, as well as for the other activities as webinars and trainings.

The functioning of the platform might be revised during the duration of the project based on the needs that emerged in the performance of the various activities.

This document consists of three sections: section one is dedicated to IT architecture and infrastructure; section two describes the main features of the platform to support FIT4REUSE activities; section three is dedicated to the necessary steps for the development of the platform.

1. IT ELEMENTS

1.1. ARCHITECTURE OF THE PLATFORM

The software architecture will be designed as a classical web service-based flexible
architecture to manage, distribute, navigate and interact with data and allow to the user (if authorised) to store data in a secure distributed repository for collaboration use.

The platform architecture will be composed of three main tiers (Figure 1.1): **user interface**, **application service** and **storage-load balancing**.

![General platform architecture pillars](image)

Figure 1 - General platform architecture pillars

More specifically the designing activity will define the details of a service-based open infrastructure to ensure proper distribution of all different data made available to the project. This will be achieved by developing a federated information system, with a main characteristic of being constructed as an integrating layer over existing legacy applications and databases. The interface layer allows the user to share data and documents in a unique co-working environment, where security is ensured in relation to the value and sensitivity of the data stored in the Cloud.

Platform requirements will be divided in two main branches: **Data protection** and **Functional requirements**.

“Data protection” requirements regard the user support in "data management" and "access level management". They offer the possibility to describe the contents using the metadata available for all users and to limit access with different levels of accessibility. Limited access is based on the user profiling system, which is directly connected to the univocal authentication system of the platform.
“Functional requirements” represent the possibilities offered by the platform to the partners and stakeholders. They will be described more in details in the following section (1.2) and next chapters (2 and 3).

In general way, the architecture of the FIT4REUSE platform should follow the SFERA (Scalable, Flexible, Extensible, Robust and Adaptable) requirements, therefore it should be:

- **Scalable**: it should use a technology independent of the server application where it is deployed on, with a storage space based on a distributed and/or federated system (i.e. interconnected);
- **Flexible** for easy addition, modification and replacement of the modules. The system should provide the modules interoperability, such that they have a flexible way to interact with each other without introducing hard dependencies;
- **easily Extensible** for the system components. A specific use case should be able for the developer to easily include and use a third-party dependency inside of Visual Application;
- **Robust** in runtime not to affect the state of other components;
- **Adaptable** using the components that should be reusable across various activities.

### 1.2. IT INFRASTRUCTURE

#### 1.2.1 STORAGE LAYER – DATA ARCHIVING

The lowest level is represented by the “**Storage Layer**” or “**Data archiving**”. Here a set of software is located, which allows the storage of user files in different formats and the geographical information by the use of a **PostgreSQL Database** with the **PostGIS plug-in** installed. “Data archiving” can be mounted on a server or on a distributed server-house. It can be performed on or through a platform interface that supports **Geographical relation database**, but also **Swift** and **S3** object stores, or compliant systems as **FTP**, **NFS** and others.

Storage using **REST API** can be used to either replace the storage, with **Swift** and **S3** as examples of **HTTP-based** storage back-ends (BE). Once a primary storage is configured, the platform will generate a directory for each user with versions, folders and files stored in it. **Object Storage** flattens the file path in the database. These performance characteristics make it most suitable for archival or streaming of large files. To optimise “object storage”
performance, the platform will assign a single bucket to each user. In addition to the “Storage Layer” in the “Application Service Layer”, a full-text search function based on the Apache Solr Java servlet will run, indexing the storage systems and providing instant-search in Office documents and images for the users. In order to improve the integration with personal data repository, an additional module could be the integration with other external storage repository like Google Drive or Dropbox.

1.2.2 APPLICATION SERVICE LAYER – MIDDLEWARE LEVEL

The “Middleware level” is composed by a set of application services, based on different software components and additional modules that allow the users to interact in collaborative way with data and documents.

The “Middleware level” is composed by a set of different applications able to handle data and documents (i.e. modules or functionalities) in a secure way.

The first component is represented by the authentication and security modules, which means that the platform will be able to integrate different methods of authentication. The most suitable method of authentication is LDAP, that provides account provisioning, integration and quota management, but other methods can be selected during the deployment phase. The authentication and security modules will provision users according to the settings in the user directory and, thanks to the possible user and membership profiling, it will be possible to set different levels of security and access.

Through “File Access Control” and “Files Automated Tagging”, the platform gives administrators control over data access by enabling them to define strict rules requests. If users in certain groups or geographic regions should not be given access to certain file types, or if data with a specific tag should not be shared outside the FIT4REUSE consortium, administrators can make sure that their platform instance enforces these rules. In this way, data transfer is protected by using industry standard TLS encryption, by using the facilities provided by the web server on the server side and open-SSL on the clients. With third party application modules, client-side encryption can be implemented.

The security module is an active anti-virus system to scan the data and document stored in the system, in order to prevent internet attacking and a backup system to ensure the data
persistence.

In order to support a **Flexible** and **Scalable** management of data in the uploading and downloading process, a **load balancer component** is implemented as a module. It runs once per service as dedicated machine and monitors the **storage usage**, **CPU** and **RAM** load, network utilization and up time of all nodes. It can mark nodes as online or offline and can initiate the migration of user accounts to different nodes, based on user **QoS settings** and **Lookup Server data**.

The third component is represented by a set of modules that allow the user to interact with data and documents and to share a set of tools and features that enforce the collaborative aspect of the platform.

A first module is the **groupware functionalities** that integrate in the platform the possibility to share between user **planning functions** like contacts, calendars, notification system, web-mail, where it’s possible to integrate or synchronise user enterprise or private native email system (i.e. **Outlook**, **Thunderbird**, **iOS**, etc.). In this module the feature to manage task and project planning is not directly included, but it can be done with an open-source extension module.

A very innovative module is the **communication tools functionalities**, in which self-hosting communication features as chat (like **Slack**), video and audio-conferencing using **WebRTC** system (like **Skype**), polls (like **Doodle**) and forms (like **Google** form) are included.

By relying on existing, vetted infrastructure, the current European legislation compliance and security processes defined will be applied to the platform functions.

The last package of functions is included in the **collaboration modules**, in which some feature are available natively in the platform to share, among users, files and documents in different formats, real-time notifications or comments on web or mobile devices.

The most efficient **extension modules** included in the platform will be the **collaborative editing** and **excellent office share system**. This is a powerful online **office suite** that supports all major documents, spreadsheet and presentation file formats, that can be integrated in different infrastructures. Similarly, the **interactive maps tool** will allow the user to create a share using open-source library (like leaflet or open-layer) interactive geographic map where is possible to share photo, documents, or geographic features.

The **website content management module** is also included in the “Middleware level” and it
guarantees the possibility to host and deploy different web pages for different sub-project managed by a group of users. With this tool, the user can build website pages (Blog, project pages, notes, etc.) in a folder or sub-folder and can make the pages viewable for everyone or only for users or groups of the platform.

### 1.2.3 USER INTERFACE LAYER – CLIENT LEVEL

The “Client level” represents the interaction aspect of the platform. Here there are the protocols that allow the users to access the platform via internet. The platform server provides a powerful web interface for configuring, managing and monitoring the system for the administrator. It can manage users and settings, configure, enable or disable features and modules, set the access control permissions. For end users, the **web interface** allows them to access their files and folders, initiate and control sharing, monitor who is doing what with their files, search for, comment on, edit, view and download files. Files can be deleted and restored from the trash, so that the users can view older versions of files and restore them if they wish. The web interface is responsive and works on all major browsers and on Windows, MacOS, Linux and Android operating systems.

In order to facilitate the use, the integration and the files synchronization between “**data repository**” and “**user’s desktop**” or “**devices specific applications**” (i.e. mobile applications) will be available for multiple operating systems.

### 2. THE MULTI-LEVEL AND MULTI-STAKEHOLDER PLATFORM

After a wide and comparative analysis among the software available for **data sharing** and **project team management**, taking into consideration the main package available (among others Drupal, Open Atrium, OwnCloud, LinShare, NextCloud, Ceph, Pimcore), the software chosen for the development of the platform has been individuated in the new version of **NextCloud**. The technical elements offered by NextCloud trend toward more diverse architectural solutions. Since it was designed to operate as a complete content management system in itself, it pulls content together from various sources and includes features which allow both to control, manipulate, customise and display content, and to manage users and
permissions. NextCloud acts as the centralised place to assemble content, organise it and send it out. Moreover, the distributed or centralised infrastructure is not visible by the users, but it guarantees a secure and sustainable process to share and store data.

The website visitor will not interact with software platform directly. Instead, the visitor will see pages created with **JavaScript** frameworks like **Angular.js**, **React.js** or **Ember** rather than a traditional web site theme. It works natively in a multi-lingual and localised world with distributed cloud infrastructure. This approach supports the so-called "**customised** model of content management", that allows inserting slight variations depending on readers’ geographic location, device type, or a number of other indicators. Moreover, it gives management the ability to both customise and centralise content.

All the features described above meet the objectives of the FIT4REUSE platform, which, if developed in this way, could count on a series of features such as the intranet, the social collaboration platform, the knowledge management system and the learning management system.

## 2.1 INTRANET FOR THE STAKEHOLDERS

The platform will have an “**Intranet section**” to enable the FIT4REUSE stakeholders to share information and documents with restricted access.

The “Intranet section” can be designed to provide repositories of several documents shared only among a group of selected users. The FIT4REUSE-dedicated “Intranet section” could have several document repositories shared among partners including agendas, minutes of meetings, working papers, databases, contact lists, deliverables produced, etc. Usually, the “Intranet section” consists of a drop-down menu from which it is possible to access a series of elements which, in the case of FIT4REUSE, could be the following:

- Participants;
- General documents;
- Meeting documents;
- Thematic folders;
- National Forums;
- Water Reuse Days
- etc.
An individual user personal login and password will be required to access the FIT4REUSE-dedicated “Intranet section”. The password provides access to pages where it is possible to create folders, upload and download documents.

2.2 SOCIAL COLLABORATION PLATFORM

Considering that one of the main objectives of the platform is to support “operational networking among project partners and relevant stakeholders”, the FIT4REUSE multi-level and multi-stakeholder will be developed as a social collaboration platform.
2.3 KNOWLEDGE MANAGEMENT SYSTEM

The platform will make it possible to deposit, save and manage important contents for the sharing of knowledge between partners and interested parties.
2.4 LEARNING MANAGEMENT SYSTEM

The platform will also make it possible to host *trainings* and *webinars*, when needed, following the timeline of the project. The *learning material* will be saved on the platform and be always accessible for consultation.

![File picker]

*Figure 5 - Learning Management System (LMS)*

3. STEPS FOR THE DEVELOPMENT OF THE PLATFORM

3.1 BUILDING BLOCKS

3.1.1 PEOPLE

The platform will be *multi-stakeholder* and will be customised accordingly. It will be possible to create different groups of users.
FIT4REUSE Guidelines for the development of a Multi-Stakeholder and Multi-level Platform

3.1.2 STRUCTURE

Figure 7 - Structure

3.1.3 PERMISSIONS

The platform will be multi-level allowing the creation of different “level of access” according to the characteristics of the people involved (partners, experts, policy maker, citizens, etc.) and their related interests.
3.1.4 CONTENTS

Generally, the contents of the platform can be classified as follows:

- **Documents** - document pages, wiki pages, articles, document management
- **Events** - calendaring with iCalendar integration and geo-location
- **Discussion** - forums, discussion posts and media attachments to conversations
- **Work tracker** - monitor projects, milestones, and deliverables.

3.2 CUSTOMISE THE PLATFORM

With the aim of contributing to transforming the knowledge produced within the FIT4REUSE project into practical solutions, especially in the MED area but not only, the multi-stakeholder and multi-level platform will be developed taking into account all the possible groups of interest (e.g. water consortia, industries, policy makers, general public).

Selected stakeholder groups include water users, environmental organisations, water and agri-food industries (including innovation hubs, technology platforms, SMEs), R&I performers, sectoral and RDI policy makers, National Governments, International Bodies (such as UN
Water, Food and Agriculture Organisation of the United Nations), in addition to farmers’ associations, other actors in the agricultural sector, other programmes outside Europe, educational communities, investors, standardization networks, and finally, consumers and society at large.